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**DOCTOR OF PHILOSOPHY**

**Three Essays on Financial Inclusion**

Allam, Almutasembilla

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***Three Essays on Financial Inclusion***

**Almutasembilla Allam – 500188492**

**Ph.D. Thesis**



**June 2020**

## **Abstract**

This thesis focuses on financial inclusion (FI) across countries. FI is defined by the Consultative Group to Assist the Poor (CGAP) as the procedure of providing all entities (households and businesses) with access to an affordable and high-quality range of financial products and services, which should be provided responsibly and sustainably in a well-regulated environment. The thesis can be divided into three papers (Chapters 2, 3 and 4). The Chapter 2 examines measures of FI that include both the indexes and some simpler indicators derived from the World Bank's global financial inclusion (FINDEX) database and the IMF's Financial Access Survey (FAS) database. Indexes of financial inclusion (IFI) are constructed (where the data permitted) for around 183 countries between 2011 and 2017. The six consistency conditions suggested by Bauer et al (1998) are applied to compare IFIs.

The findings show that only two indexes fulfil the consistency conditions, namely, the Sarma (2012) index and a new index (NI) suggested in chapter 2 of this thesis. Moreover, using various approaches (two-step system Generalized Method of Moments (GMM) dynamic panel estimation, fixed effect two stage least squares (2SLS) with instrumental variables (IV), and fixed effect estimates) the study confirms that FI reduces income inequality, improves human development, and boosts economic growth. In addition, the Sarma (2012) index and the NI have performed better than FAS and FINDEX indicators with macroeconomic factors.

Chapter 3 studies the determinants of FI using a wide selection of possible determinants from the literature. FI is measured using the index of Sarma (2012) and NI; simpler indicators derived from the FAS and FINDEX database are also included. The study covers 80 countries from 2011 to 2017. The analysis carried out includes fixed effect panel estimators, and fixed effect 2SLS with an IV. The findings reveal that income, human development, rule of law, and banks' credit to banks' deposit ratio are the main determinants of the level of FI at macro-economic level.

Chapter 4 examines whether countries with considerable Muslim populations (CCMPs) have a lower level of FI compared to the rest of the world (RW). FI is measured by the index of

Sarma (2012) and the NI; simpler indicators derived from the FAS and the FINDEX database are also included. The study covers 80 countries (22 CCMPs and 58 from the RW) between 2011 and 2017. The results demonstrate that the difference in the overall level of FI between CCMPs and the RW is insignificant. Looking at each aspect of FI show that the difference in level of FI is insignificant in financial demographical and geographical coverage as well as in firms' level of FI. However, there is a significant difference at the percentage of population participating in the financial system.

Chapter 4 examines whether the introduction of Islamic banks can raise the level of FI in CCMPs. However, the result turned out to be insignificant. This is because the IBs have a negative relationship with some aspects of FI cancel off the positive relationship with other aspects. There are five reasons behind the negative relationship that IBs have with some of the aspects of FI. First, the limited number of Islamic financial products and services. Second, the low ratio of credits to deposits in IBs, which considered one of the main determinant of FI. Third, the risk and cost of financial services in IBs. Fourth, previous studies that suggested introducing IBs to enhance the level of FI in CCMPs have not directly measured the relationship between IBs and FI. Fifth, financial awareness and financial literacy. Therefore, regulators and policymakers should evaluate the business model applied by IBs and modify it in a way that enhance the level of FI.

## **Acknowledgements**

First, I would like to express my sincere gratitude to my supervisors, Professor Philip Molyneux and Professor Aziz Jaafar, for their continuous support of my Ph.D. study and for their patience, power to motivate, knowledge and guidance, which have helped me in researching and writing the thesis. I would also like to thank the chairman of the annual review committee, Professor John Ashton, for his insightful comments and valuable questions which have improved my research in many different ways.

I gratefully acknowledge the scholarship provided by the Government of Saudi Arabia and King Abdul-Aziz University, which covered not only my course but also the living expenses for my family and myself. This Ph.D. study would not have been possible without their support. I am indebted to my Ph.D. colleagues: Mr. Sergio Castellanos Gamboa, Ms. Marybeth Rouse, Mrs. Wei Kang, Dr. Yang Wang and Dr. Alessio Reghezza. Their advice has helped me to choose the most suitable methodological approaches to investigate the complexities of FI and the broad topic under study.

My deep appreciation goes to my family, especially my parents Zaki Allam and Lamya Yousef and my wife Alyaa Alarabi for their support in every way, for always believing in me and for inspiring me to follow my dreams. I would also like to say thank you to my children (AL-Zahraa and Zaki) for being such good children and making it possible for me to complete my study.

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## **Acronyms and Abbreviations**

2SLS	Two Stage Least Squares
AMM	Index of Amidžić, Massara, and Mialou (2014)
CCMPs	Countries with a Considerable Muslim Populations
CGAP	Consultative Group to Assist the Poor
CP	The Index of Chakravarty and Pal (2013)
CT	The Index of Cáamara and Tuesta (2014)
DEA	Data Envelopment Analysis
FAS	Financial Access Survey
FDH	Free Disposal Hull
FFIs	Formal Financial Institutions
FI	Financial Inclusion
FINDEX	Global Financial Inclusion
G20	Group of Twenty
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GMM	Generalized Method of Moments
IBs	Islamic Banks
IBF	Islamic Banking and Finance
IFI	Indexes of Financial Inclusion
IMF	International Monetary Fund
ISFIs	Islamic financial institutions
MSEs	Micro and Small Enterprises
NI	New Index
OIC	Organization of Islamic Cooperation
PCA	Principal Components Analysis
ROSCA	Rotating Savings and Credit Associations
RW	Rest of the World
SA	Index of Sankaramuthukumar and Alamelu (2012)
SP	Index of Sarma and Pais (2011)
UNDP	United Nations Development Program

VAR	Vector Auto-Regressive Model
PLS	Profit and Loss Sharing



# **Chapter 1: Introduction**

## **1.1. Historical Background**

### **1.1.1. Introduction**

During the 1990s, a growing body of literature regarding access to banking services emerged. Leyshon and Thrift (1993) are among the first to use the term “financial exclusion” (the opposite of financial inclusion) with reference to individuals who had limited physical access to the financial system. Then Kempson and Whyley (1999) used the term in a broader context to mean individuals who faced difficulty in accessing mainstream financial services. According to the European Commission (2008, p. 9) financial exclusion is “a process whereby individuals experience difficulties in accessing and/or using financial products and services in mainstream finance, which are suitable to their needs and enable them to live a normal social life in their society”.

Note that financial exclusion boosts inequality because it prevents the talented poor from making profitable investments in physical and human capital, which in turn prevents the economy from growing to its full potential (Galor and Zeira, 1993; Banerjee and Newman, 1993). Benhabib (2003) lists recent researchers who have stated that inequality harms economic growth in that it increases the redistributive pressure from median voters to permit redistributive taxes (Tabellini and Persson, 1993), or generates social conflict, rent seeking behavior and expropriation (Alesina and Rodrik, 1994; Benhabib and Rustichini, 1996; Benabou, 1996; Perotti, 1996; Acemoglu and Robinson, 2000). Such activities reduce the return on investment and lead to a low growth rate.

### **1.1.2. The Reason behind Financial Exclusion (obstacles to achieving financial inclusion)**

Financial exclusion can take on number of features. One aspect relates to access being limited by risk management procedures that may exclude individuals. Price can also lead to some individuals being excluded from the financial system, lest that they become unable to re-pay loans or fees. Moreover, targeted marketing that focuses only on higher income customers can also effectively lead financial institutions to exclude low income customers. The deregulation, globalization and the shift towards more market orientated financial systems have also aggravated inclusion issues (Carbó et al, 2005). The lack of collateral has

led many small enterprises as well as low income individuals to be financially excluded. Another possible reason for financial exclusion is the lack of documentation. Some individuals may also decide against participating in the financial system because of their experience, beliefs and perceptions.

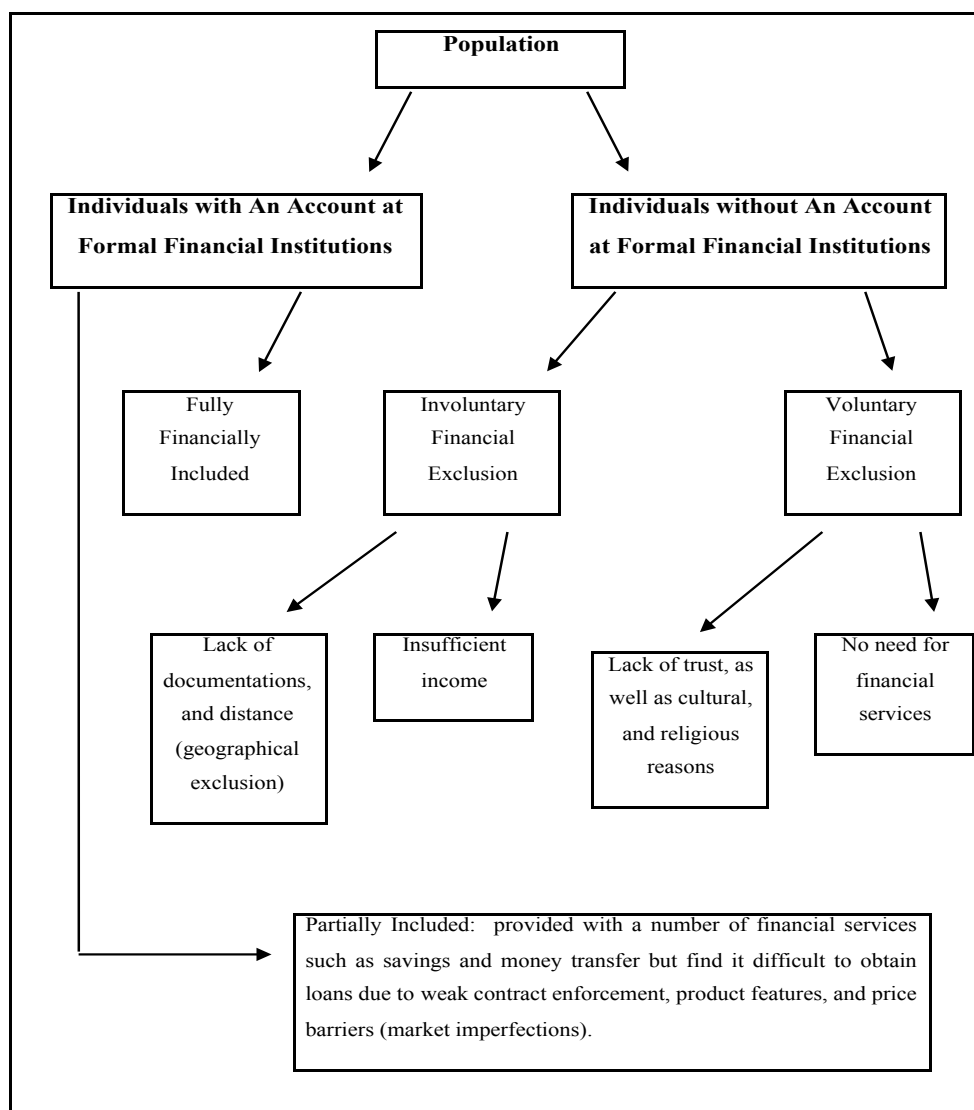
Another reason behind the financial exclusion of poor people as well as micro and small enterprises (MSEs) is credit rationing. Banks may restrict the credit supply to borrowers who demand funds, even when they are prepared to pay higher interest rates (Stiglitz and Weiss, 1981). This is because banks are concerned about the risks of lending money. Besides, the interest rate charged might itself affect the survival of the loans pool by leading to adverse selection or moral hazard, since banks do not have complete information about borrowers (Demirguc-Kunt et al, 2008). Banks' expected rate of return – in an imperfect market and with high information cost – increases more slowly than the interest rate until it reaches a point ( $r^*$ ) after which it starts to decrease (Appendix 1.1). The interest rate at point  $r^*$  is called the optimal rate because the banks' expected rate of return is maximized, which makes banks unwilling to raise their interest rates further.

### 1.1.3. Financial Inclusion (Definition, Current level, and Improvement)

CGAP defines FI as **“the procedure of providing all entities (households and businesses) – especially micro and small enterprises MSEs and low-income segments of the economy – with access to an affordable range of high-quality financial products and services, which should be provided responsibly and sustainably in a well-regulated environment”**. This definition of FI will be carried throughout the thesis. The reason behind using this definition is because it includes not only bank account and geographical coverage but also financial services. The more positive sounding term FI has generally replaced the negative term financial exclusion in the policy debate and literature.

Based on the Global Financial Inclusion Database (FINDEX), the percentage of adult population with an account at formal financial institutions FFIs 69%, which means that about one-third of the adult population in the world are financially excluded. Note that not all individuals with an account at a FFIs are fully financially included, since a considerable

number of them will be unable to receive loans for various reasons – such as risk management and a limited supply of funds. The percentage of adults who have saved at or borrowed from FFIs is much lower, only 26.7% and 10.8%, respectively. These results show that most individuals are not provided with a full range of financial products and services, which is somewhat shocking.



**Figure 1.1: Use of and Access to Financial Services**

This figure is adapted from the World Bank report on Global Financial Inclusion (2014) page 8.

Researchers have highlighted number of solutions to the issue of financial exclusion. The development of postal financial services and postal offices has substantially extended

financial service outreach, mainly in rural areas. Postal office networks in many countries already have many clients and branches than commercial banks, which give them a comparative advantage, given that they operate at lower cost. The financial services offered by postal offices include current accounts, savings accounts, payment accounts, credit services (through partnership with a financial service provider), insurance, transfer services, and remittances. Based on the Universal Postal Union, postal systems financially include roughly one billion people in more than 50 countries<sup>1</sup>.

The introduction of Mobile Banking has also helped to overcome the issues of limited financial infrastructure (by ATMs and bank branches). This is because of the popularity of cell phones, which are owned by a high percentage of adults around the globe. Mobile banking has effectively helped large numbers of unbanked people to be included, especially in areas with low bank penetration such as sub-Saharan Africa (Andrianaivo and Kpodar, 2011). Services provided by mobile banking include money accounts, transactions, payments and information and support services.

Having a bank account does not enable all poor and MSEs to have full access to financial services. Governments and central banks in various countries have allowed the expansion of non-bank financial institutions that provide micro-credit to tackle the issue of financial exclusion, for example credit unions, community banks, institutions of Rotating Savings and Credit Associations (ROSCA), and other financial cooperative institutions mainly in poor and rural areas (McKillop et al., 2007; Fuller and Mellor, 2008; Yusuf et al., 2009). This is because credit unions, community banks and ROSCA provide funds at a lower interest rate than that of commercial banks which helps low income segments of society to be included.

In addition, policymakers in many regions of the world have been supporting micro-financial institutions to focus mainly on MSEs who are usually less able to get loans and other financial services from commercial banks, because they present a higher risk of default than large corporations do – and have less collaterals. Moreover, governments, not-for-profit

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<sup>1</sup> Global Panorama on Postal Financial Inclusion: Key Issues and Business Models, Universal Postal Union (2013)

organizations and several voluntary institutions in middle- and high-income countries have started to provide the poor and MSEs with interest-free short-term loans.

There has been a strong movement in the last two decades toward the development of an overall financial market that includes poor and MSEs. This acknowledgement is reflected in the position taken by the Consultative Group to Assist the Poor (CGAP), the Group of Twenty (G20), the World Bank and the International Monetary Fund (IMF). Therefore, the concept of Financial Inclusion (FI) has become an object of interest to a wide array of governments, politicians and economists because of its economic and social dimensions.

This chapter is structured in seven sections, of which the present introduction is considered the first. The second section includes the theoretical background of the study. The third and fourth section highlights the motivation (reasons why FI is important) and the main research questions. The fifth section summarizes the main findings of the thesis. The sixth section presents the main contributions of the thesis. The seventh section presents the structure of the thesis.

## **1.2. Theoretical Background**

Kumar (2011) argue that the free market theory since the time of Adam Smith emphasis that a deregulated economy tends to move closer to “Pareto Optimum” where all resources are well spread out to ensures maximum potential wealth creation. However, this view does not envisage economic agents from being deteriorated by the improvement of the gain of others. Kumar (2011) stated that competition released by the policy of “laissez faire” will shower the advantages of eradicating all issues facing an economy. Intervention by government’s policies will deviate the economies from the path of reaching growth accompanied by the elimination of all type of imbalances. Nowadays, financial institutions indulge in financial market operations to collect fund for their fundamental functions. Thus, financial institutions aim to be highly rated by the rating agencies to make these institutions worth of investing, which in fact forced these institutions to abstain from risky lending (Kumar, 2011).

Banks focus more on certain groups to reduce risk in lending which leads to financially exclude non-valuable customers and more strategically include valuable customers. Banks generally believe that including more valuable customers at the cost of marginalizing non-valuable customers will add value to the shareholder wealth maximization model (Boyce, 2000). For instance, some banks require minimum cash balance on deposit accounts. In addition, even low-income customers appear to have less information about the products being launched by the banks, and they are not heavily targeted for new products innovated by banks. In short deregulation accelerate the process of financial exclusion.

The Free Market suggests that deregulation of the financial sector driven by the motive of profit and market signals give a message that if uncontrolled it might exacerbate the issue of financial exclusion further, leading to a larger gap between the rich and the poor. Therefore, government can play a role in directing banks to develop the regions where they operate and include further low-income customer. Note that institutions pursuing this way have also scripted successful stories of more profit and greater efficiency in their financial operations such as Grameen bank.

Another theory that can explain financial exclusion is the theory of Asymmetric information. Transaction or exchange in the credit market is complicated because most of the financial transactions are future contracts in nature such as mortgage. Therefore, information on the personal characteristics of the borrower is essential in such a transaction. Thus, financial institutions spend a considerable time in locating moral borrowers and worthy projects as they are concern about what the borrowers will do with the loans and whether they will abide by the terms and conditions of the contract (Clemenzen, 1986).

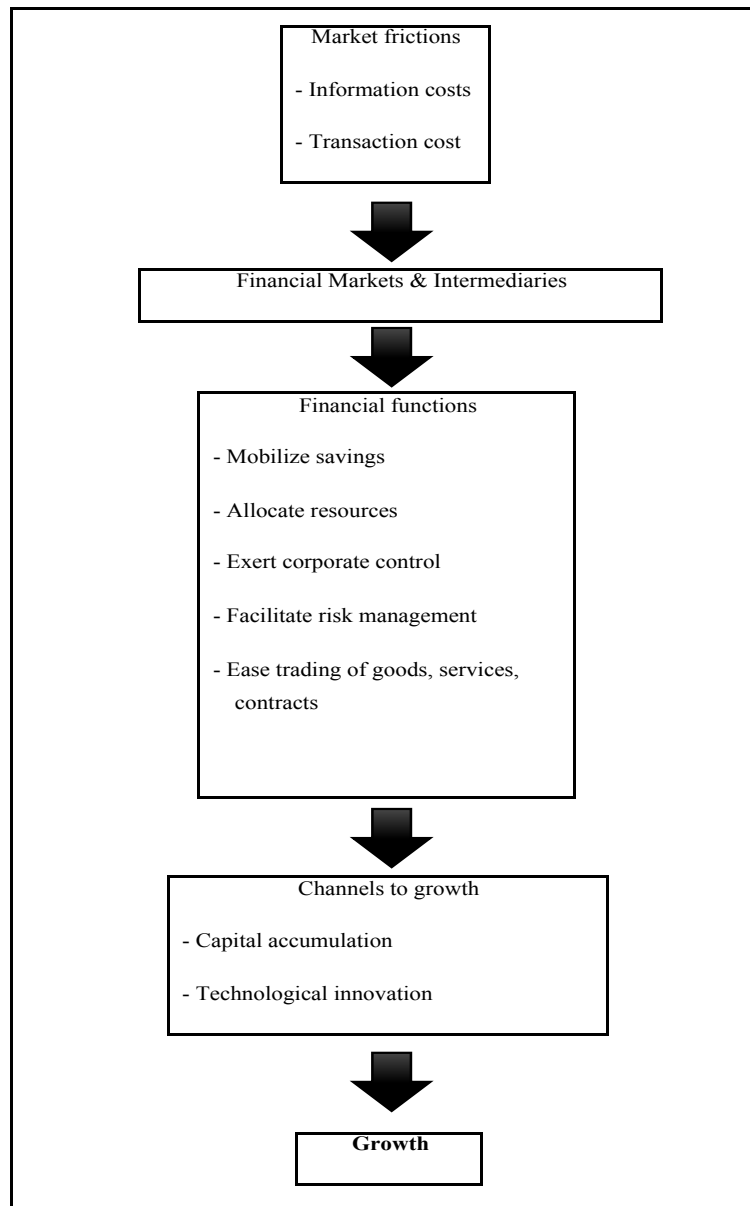
Lenders provides loans without complete certainty of loans' repayment. As the borrowers know themselves better than the lenders, they can gain from understating the information they have and exaggerating positive qualities, which raise the issue of moral hazards and incentive problems. To address this issue, the financial institutions use screening techniques to reduce the risk of default. The asymmetric information drives financial institutions to exclude some entities from having effective access to loans.

The theory of financial development and economic growth are considered very important for the topic of FI. The relationship between financial development and economic growth was first highlighted by Bagehot (1873) and Schumpeter (1911). Schumpeter (1911) argued that a well-functioning financial sector is important in order to accelerate economic growth. Arrow (1964) and Debreu (1959) state that the motivation behind the emergence of financial markets and institutions is market frictions (information and transactions costs). A financial system – under the theories of financial development – exists to: mobilize savings, allocate capital, monitor investments and corporate governance, facilitate dealing with risk and the trading of goods, services, and financial contracts (Cole and Slade, 1991; Merton and Bodie, 1995; Levine, 2004).

Financial institutions protect investors from liquidity and efficiency risks through the investment tools they develop. The risk-spreading ability of financial markets shift portfolio investments to projects with higher expected returns, which enhances economic growth (Obstfeld, 1994). It is worth mentioning that financial deepening through providing more loans to MSEs will enable them to invest and being involved in more economic activities which leads to growth. In addition, financial development through financial innovation and financial technologies can lead to expand access to main stream finance and consequently enable poor and underprivileged to invest in real and human capital. This also boosts the income for these segments of society and leads to economic growth.

Levine (1997) highlight two channels through which financial functions can affect economic growth. The first channel is through capital accumulation where financial functions can affect growth through their impact on the rate of capital formation. The second channel is through technological innovation where financial functions can affect growth through changing the rate of technological innovation (Figure 1.2). The importance of this relationship is that it provides insight regarding the priority required to be given to the financial sector reforms in developing countries, mainly where financial market and institutions are not sufficiently developed, which partly clarifies why countries grow at different rates.



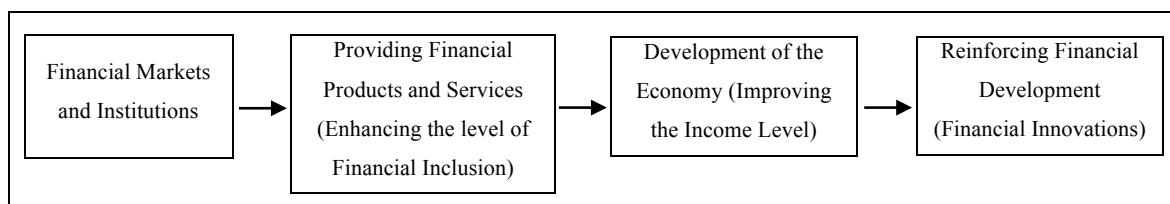


**Figure 1.2: A Theoretical Approach to Finance and Growth**

Source: Levine (1997) page 691

There are three hypotheses that explain the relationship between financial development and economic growth in the literature. First is the hypothesis of supply leading financial development – also called active financial development – that is pioneered by Schumpeter (1911). The hypothesis states that financial intermediation increases the effectiveness of capital accumulation, savings and, accordingly, investment rates which contributes to

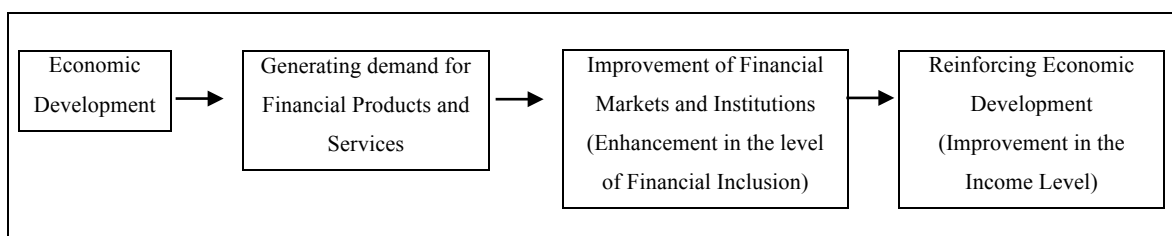
economic growth. Mckinnon (1973) and Shaw (1973) argue that a well-developed financial sector reduces (and monitors) transaction costs and asymmetric information, which consequently improves financial intermediation, enhances the creation of financial products and services, and facilitate access to them. Hence, developing the financial sector to provide entities with full range of financial products and services is the key to tackle the problem of financial exclusion (Kumar, 2011). Once acceptable financial needs are met then entities will start building upon wealth and will reinforce financial development (Figure 1.3).



**Figure 1.3: The Theory of Active (Supply Leading) Financial Development**

Source: Kumar (2011) page 10

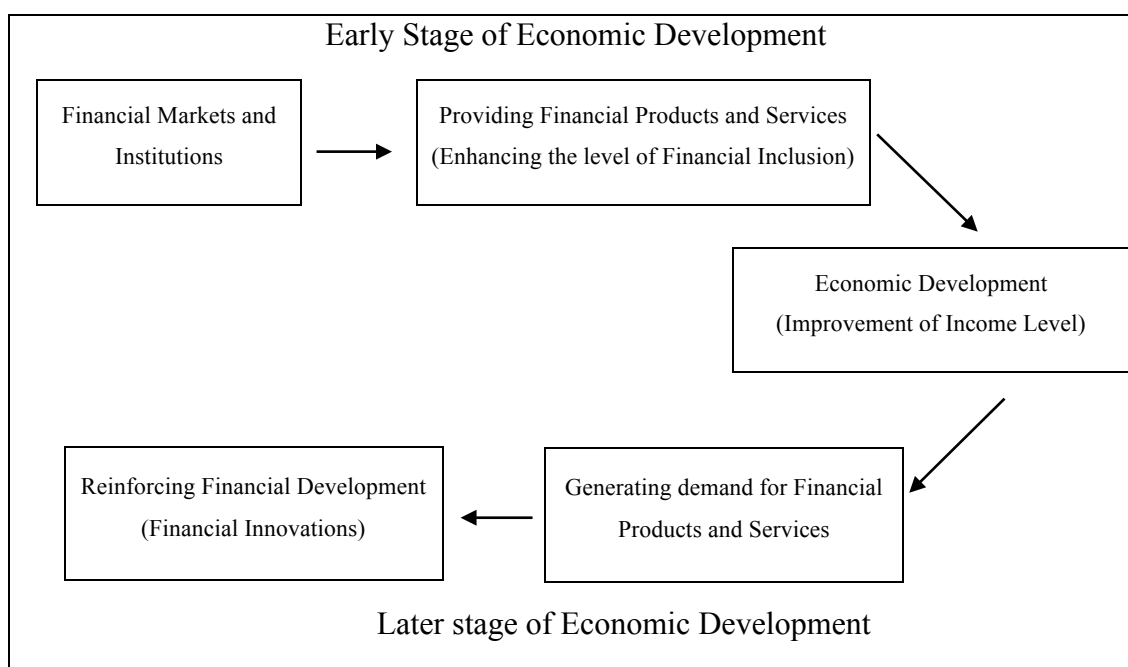
The second hypothesis is the demand following financial development – also named passive financial development – put forward by Robinson (1952). This hypothesis proposes that when an economy expands, there is a rise in macroeconomic activities (entities are involved in more economic activities), that enhance employment and income, which rises the demand for various financial products and services to fit their needs (Singh, 1999) (figure 2). The generated demand for financial products and services is considered as incentives for the financial development (Calderón and Liu, 2002). Kumar (2011) argue that this hypothesis of financial development is sustainable in nature when compared to the hypothesis of supply leading financial development.



**Figure 1.4: The Theory of Passive (Demand Following) Financial Development**

Source: Kumar (2011) page 10

The third hypothesis is the stage of financial development hypothesis that has been suggested by Patrick (1966). The hypothesis proposes that during early stage of economic development (underdeveloped countries), financial development leads to economic growth (supply-leading). Whereas in later stage of economic development (developed countries), financial development shifts towards demand-leading.



**Figure 1.5: The Theory of Stage of Financial Development**

The recent interest in FI is a result of the importance of financial development and its role in enhancing economic growth. Therefore, this thesis is based on the theory financial development and its effect on growth. FI helps poor and MSEs to enhance their capacity to overcome the issue of financial market imperfections such as transaction costs and information asymmetries. The inclusion of these segment will promote economic growth and enable it to grow at full potential. However, without increasing FI, these parties are always limited by their lack of collateral, credit histories, and connections, and will only be able to develop based on their own levels of savings and earnings.

### **1.3. Motivation (Why Financial Inclusion is Important?)**

The motivation to undertake this research originates from many considerations. FI provides substantial benefits at the micro level (for individuals and MSEs) and macro level (for the whole society and economy). First, FI enables the low-income segment of society to generate income, build wealth, smooth consumption, and manage risks by accessing a full range of financial products and services (Mirakhor and Iqbal, 2012). Second, FI promotes economic growth through increasing economic activities. FI can promote the savings portfolio and the efficiency of financial intermediation, boost enterprises and consequently improve economic growth (Hariharan and Marktanner, 2012; Babajide et al, 2015; Sharma, 2016; Hassan et al, 2018).

Third, FI helps to increase the employment rate through its strong positive effect on total factors of production (Bruhn and Love, 2014). Fourth, FI leads to a more equal distribution of income by giving poor individuals and MSEs loans to build on wealth and leads to income growth of the poorest in society. Furthermore, FI is related to a fall in the proportion of people living on less than \$1 a day (Clarke et al, 2006; Beck et al, 2007; and García-Herrero and Turégano, 2015). Fifth, FI leads to poverty reduction through promoting equal distribution of income and giving poor individuals and MSEs loans to build on wealth. Moreover, FI enhancing domestic savings, credit and income can significantly reduce rural poverty (Burgess and Pande, 2005; Swamy, 2010; Bruhn and Love, 2014).

These five points are enough to show why FI is important. Note that including adult population that are financially excluded, which are more than one-third of adult population in the world as discussed earlier, into the financial system will enhance the economic growth of developing and underdeveloped nations. In addition, the inclusion of these segment of society will greatly reduce poverty, income inequality and boosts employment rate.

## 1.4. Research Questions

There is no consensus as to the most appropriate way to measure FI. Several studies, such as Beck and Demirguc-Kunt (2008), Beck et al (2009), Kendall et al (2010), Demirguc-Kunt and Klapper (2013) and Naceur et al (2015), have used simple indicators of FI – such as the number of deposit accounts at banks per 1,000 adults – that focus only on a single dimension of inclusion provided by the IMF’s Financial Access Survey FAS database or the FINDEX database. However, some researchers, for example, Sarma (2008), Sarma and Pais (2011), Chakravarty and Pal (2013), Sinha (2013), Amidžić et al. (2014) and Cáamara and Tuesta (2014) have suggested combining several simple indicators into a single index to summarize the complex nature of FI, since it is multidimensional and no one indicator can give an accurate view of all its aspects. Using broader index measures makes it possible to more accurately study the relationship between FI and a range of micro and macro-economic factors of interest (Cáamara and Tuesta; 2014).

It may be the case that all the different indexes yield similar inferences about FI, even though they are constructed in various ways. But if the results show that the indexes yield different inferences about FI, then choosing a particular index can influence the interpretation of FI. This raises the question of the reliability of studies that examine FI both within and across countries. It is also important to check whether these indexes perform better with micro- and macro-economic factors than the simple indicators provided by FAS and FINDEX database.

Furthermore, it is important to study the determinants of FI at the macro level to understand the variation in the level of FI across countries. In addition, highlighting the main determinants of FI will enable regulators and policymakers to build on strategies to raise the level of FI in a country. Note that several studies, such as Allen et al. (2012), Zins and Weill (2016), Rhine and Greene (2013), Akudugu (2013), Peña et al. (2014), and Tuesta et al. (2015), focus on the determinants of FI only at the micro-level using the FINDEX database. Some studies have concentrated on the FI relationship with only one or a few macro-economic variables, for example Toxopeus and Lensink (2007) Andrianaivo and Kpodar (2011) and Bansal (2014) Park and Mercado (2015) Ali et al. (2016).

Based on the literature of FI, countries with considerable Muslim populations (CCMPs) tend to have a lower level of FI. This is because Global Financial Development Report 2014 highlights that 7% of population with no account at formal financial institutions (FFIs) in member countries of Organization of Islamic Cooperation refer to religious reasons for being financial excluded. Therefore, it is important to examine whether there is a difference in level of FI between CCMPs and the rest of the world (RW). Moreover, it is also important to study if the introduction of Islamic banks (IBs) can raise the level of FI in CCMPs. The main research questions are as follow:

- What is the Most Consistent Measure of the Level of Financial Inclusion?
- What are the Determinants of Financial Inclusion at the Country Level?
- Can Islamic Banks Raise the Level of Financial Inclusion in the Muslim World?

## **1.5. Main Findings**

Chapter 2 focuses on studying the Indexes of Financial Inclusion (IFIs) that have been suggested in the literature. The chapter constructs a variety of IFIs (those of Sarma (2008), Sarma and Pais (2011), Chakravarty and Pal (2013), Sinha (2013), Amidžić et al. (2014) and Cáamara and Tuesta (2014) plus a new index). It is found that no database contains information about the IFIs covered in this chapter. As such, all substantial amount of the data should be collected to construct the IFIs. IFIs are constructed for 183 countries (the number of countries vary from on index to another) from 2011 to 2017. Note that the data used to calculate the IFIs are mainly obtained from the following databases: FAS, FINDEX, Sigma Reinsurance and World Development Indicators (WDIs).

The six consistency conditions suggested by Bauer et al (1998) – that originally used to compare consistency of bank efficiency indicators – are used to compare IFIs. The first three consistency conditions suggested by Bauer et al (1998) infer that IFIs should be consistent with each other in terms of their levels of inclusion, rankings and identification of the highest and lowest FI countries. The latter three consistency conditions check whether the IFIs are consistent: over time, with other (simpler) FI measures and with economic conditions. The

findings confirm that the index of Sarma (2012) and the NI suggested in the second chapter provide the most consistent measure of FI. These indexes have also performed better than simple indicators from the FAS and FINDEX in relation to various selected macroeconomic factors.

Chapter 3 studies the main determinants of FI using a wide selection of possible variables from the literature. FI is captured by the most consistent measures of FI as suggested in the second chapter. Selected simple indicators of FI, from FAS and FINDEX database, are used to offer a deeper understanding of the way in which FI interacts with potential determinants. The analysis is carried out using number of regression approaches (fixed effect panel regression, and fixed effect two stage least squares with instrumental variables). The study covers data on 80 countries (where data permit) from 2011 to 2017. The findings show that income, human development, rule of law, banks' credit to banks' deposit ratio are the main determinants of FI at macro-economic level.

Chapter 4 focuses on analyzing the difference in the level of FI between the CCMPs and the RW using random effect panel estimates. The index of Sarma (2012), the NI and selected simple FI indicators from FAS and FINDEX are used to offer a deeper understanding of the difference in the level of FI between the CCMPs and the RW. The analysis covers 80 countries (22 CCMPs and 58 from the RW) for the period between 2011 and 2017. The result shows that the difference in the overall level of FI, measured by IfIs, between CCMPs and the RW is insignificant. Simple indicators show that there is insignificant difference between the two groups in financial coverage and firms' level, but this difference turned out to be significant for the percentage of population participating in the financial system (indicators from FINDEX).

In Chapter 4, it was found that no database covers all the information about Islamic banking and finance (IBF). Hence, data were collected from three databases: the Islamic Financial Services Board (IFSB) database, the Bank-Focus database, and the 2014 Islamic Banking Database (IBD) from the World Bank. The total number of CCMPs with data about IBs is 33. The data collected is used to measure the following: the percentage of IBs to total number

of banks, the percentage of IBs' assets to total assets, the ratio of Islamic deposits (loans) to total deposits (loans), the number of Islamic branches per 1,000 kilometer squares (and per 100,000 adults) and IBs' return on assets.

A descriptive analysis was carried out in the fourth chapter to highlight the potential of Islamic banking and finance. Then, fixed effect panel estimates carried out to examine whether IBs can raise the level of FI in countries where IBs operate. 80 countries are included in the analysis for the period between 2011 and 2017. The result shows that IBs has insignificant relationship with FI. This is because the IBs have a negative relationship with some aspects of FI cancel off the positive relationship with other aspects of FI.

The Chapter 4 also highlights five reasons behind the negative relationship that IBs have with some of the aspects of FI. First, the limited number of Islamic financial products and services. Second, the low ratio of credits to deposits in IBs, which considered one of the main determinant of FI. Third, the risk and cost of financial services in IBs. Fourth, previous studies that suggested introducing IBs to enhance the level of FI in CCMPs have not directly measured the relationship between IBs and FI. Fifth, financial awareness and financial literacy.

## **1.6. Contributions to the literature**

Chapter 2 focuses on comparing between the IFIs that have been identified in the literature using six consistency conditions suggested by Bauer et al (1998). The derivation of the above IFIs reported in the second chapter is considered a major dataset contribution, since it is the first study (as far as I am aware) to cover such an extensive dataset in the area of FI. Chapter 2 also contributes to the literature by showing that the index of Sarma (2012) and the NI suggested in the second chapter are the most consistent measure of FI. Note that these indexes also performed better than simple indicators from the FAS and FINDEX when compared with selected macroeconomic factors.



It is worth mentioning that finding the most consistent measure of FI is important if researchers are to be able to study FI and the way in which they interact with various macro- and micro- economic factors. The most consistent measure of FI is important because it lets policymakers construct strategies to raise the level of FI and enables policymakers to monitor the level of FI and evaluate the policies that promise to enhance FI.

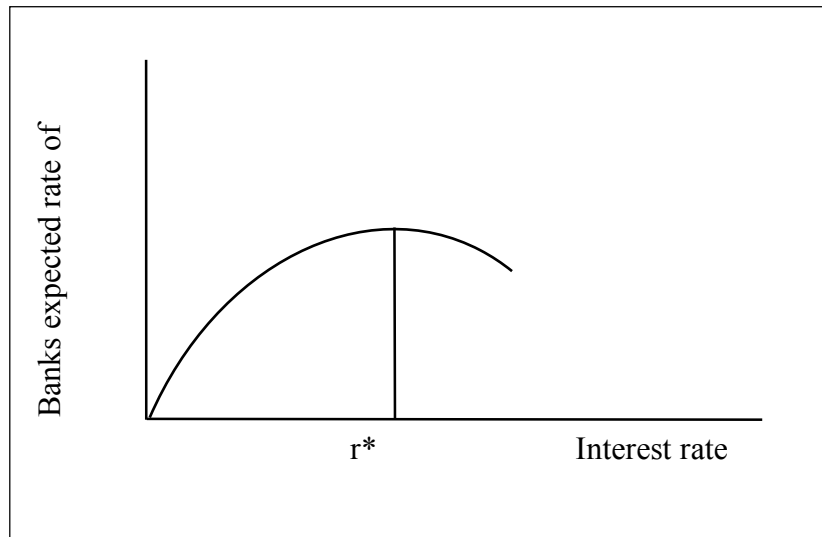
The contribution of the third chapter is that it reveals the main determinants of FI (at country level). These determinants are: income; human development; rule of law; and banks' credit to banks' deposit. Note that the findings enable policymakers to set strategies that raise the level of FI. The fourth chapter has two main contributions. The first contribution is the derivation of the data as it is the first study (as far as I am aware) to cover such an extensive dataset on the topic of Islamic banking and finance. The second contribution is that IBs can raise the level of FI. The findings highlight that policymakers in CCMPs should evaluate IBs' business model and change it in a way that enhance the level of FI.

**Table 1.1: Summary of Contributions**

Chapter	Contribution
Chapter 2: Second chapter	Finding consistent measures of financial inclusion: <ul style="list-style-type: none"> <li>▪ The index of Sarma (2012)</li> <li>▪ The new index suggested in the first paper</li> </ul>
Chapter 3: Second Paper	The determinants of FI at country level: <ul style="list-style-type: none"> <li>▪ Income (GDP per Capita)</li> <li>▪ Human development (Human Development Index HDI)</li> <li>▪ Rule of law</li> <li>▪ Banks' credit to banks' deposit ratio</li> </ul>
Chapter 4: Third Paper	<ul style="list-style-type: none"> <li>▪ Insignificant difference in the overall level of FI between CCMPs and the RW.</li> <li>▪ Islamic banking has insignificant relationship with FI.</li> <li>▪ Regulators have to evaluate IBs' business model and change it in a way that enhance the level of FI.</li> </ul>

## **1.7. Thesis Structure**

The present thesis contains three main studies shown below as Chapters 2, 3 and 4. Thus, with its introduction and conclusion the thesis contains five chapters altogether. The second chapter compares the different measures of FI and examines whether they yield similar or different inferences about FI. The third chapter highlights the main determinants of FI (at the country level) and explains the variation in the level of FI across countries. The fourth chapter studies the effect of IBs on FI. The final chapter contains a summary of the thesis, concluding with policy implications, and covers the limitations of the thesis and suggestions for future research.



### **Appendix 1.1: Credit Rationing & Optimal Rate**

Source: Stiglitz and Weiss (1981) page 394

## **Chapter 2**

**What is the Most Consistent Measure of  
the Level of Financial Inclusion?**

## **Abstract**

This paper examines measures of financial inclusion (FI) that include both indexes and some simpler indicators derived from the World Bank's Global Financial Inclusion (FINDEX) database and IMF's Financial Access Survey (FAS) database. Indexes are constructed (where data permit) for around 183 countries between 2011 and 2017. To compare the indexes of financial inclusion (IFI), the consistency conditions suggested by Bauer et al (1998) are applied. Generally, only two indexes fulfil these consistency conditions, which are the index of Sarma (2012) and the new index suggested in this paper. These indexes also perform better than the selected indicators from FINDEX and FAS as they interact better with the macroeconomic conditions. Moreover, using various estimation approaches the results confirms that FI reduces income inequality, improves human development, and boosts economic growth.

## **2.1. Introduction**

During the 1950s, the dominant view of the relationship between inequality and economic growth was positive. Researchers such as Kaldor (1957) and Kuznets (1955) argue that inequality leads to higher savings since the rich save proportionately more than the poor and this increases the rate of investment and growth (Benhabib, 2003). However, inequality is coupled with borrowing constraints and financial market imperfections which prevent the talented poor from making profitable investments in physical and human capital; consequently, the economy cannot grow to its full potential (Galor and Zeira, 1993; Banerjee and Newman, 1993).

In contrast to the Kaldor view a broader consensus has emerged that inequality harms economic development. Benhabib (2003), for instance, notes that researchers have claimed that inequality harms economic growth in that it increases redistributive pressures by median voters to permit redistributive taxes (Tabellini and Persson, 1993), or generates social conflict, rent seeking behaviour and expropriation (Alesina and Rodrik, 1994; Alesina and Rodrik, 1994; Benhabib and Rustichini, 1996; Benabou, 1996; Perotti, 1996; Acemoglu and Robinson, 2000). Such activities reduce the return on investment and consequently lower the rate of growth.

Stiglitz (1998) argues that market failure is one of the fundamental causes of poverty. Empirical evidence demonstrates that people participating in the financial system receive substantial benefits, being in a better position to establish and expand businesses, build on wealth, deal with financial shocks and manage risk (Mirakhor and Iqbal, 2012). Therefore, economists, politicians and policymakers around the globe have recently become interested in promoting Financial Inclusion (FI). This movement towards FI is also related to the role of financial development in promoting economic growth, which has been extensively studied in the literature.

FI is defined as the procedure of providing all entities (households and businesses) with access to an affordable and quality range of financial products and services, which should be provided responsibly and sustainably in a well-regulated environment. From a macro-

economic perspective, an increase in FI boosts savings leading to a better allocation of funds and enhanced productive investment (Bruhn and Love, 2014). It also supports the expansion of micro and small enterprises (MSEs), which has positive effects on both employment status and income (Karlan and Zinman, 2009: and Cull and Xu, 2013).

The International Monetary Fund (IMF) and the World Bank have taken the lead by reporting on survey data. The IMF has built the Financial Access Survey database (FAS), which contains 47 indicators of FI for more than 183 countries around the globe from 2004 onwards – this is considered supply-side information on FI as information is provided by central banks and financial institutions. To complement this, the World Bank has built the Global Financial Inclusion Database (FINDEX) which provides 100 indicators of FI for more than 140 countries around the globe for three single years (2011, 2014 and 2017) – this is mainly demand-side information based on survey information on FI.

Several studies, such as Beck and Demirguc-Kunt (2008), Beck et al (2008), Beck et al (2009), Kendall et al (2010), Demirguc-Kunt and Klapper (2013) and Naceur et al (2015), rely on these two databases to examine FI. These studies, however, tend to use simple indicators – such as the number of deposit account at banks per 1,000 adults – of FI that focus on only a single dimension of inclusion. Since FI is multidimensional and no one indicator can give an accurate view of the state of financial inclusion, some researchers have suggested combining several indicators into a single index to summarize the complex nature of FI. A single index allows for a more comprehensive (or accurate) study of the relationship between FI and other micro and macro-economic factors of interest (Cáamara and Tuesta; 2014). Besides, it can be useful for policymakers to monitor FI and set and evaluate strategies to enhance the level of FI.

Nine indexes of financial inclusion (IFIs) identified from the literature and included in the study. Additionally, a new index developed in this paper and included in the analysis. These indexes are different in terms of the number of indicators and dimensions that determine the level of FI and the weights used for each indicator and dimension. Although FI can be measured in a variety of ways, there is no consensus as to the most “appropriate” way of

measuring FI. It may be the case that all the different indexes yield similar inferences about FI. But, if the results show that the indexes are different, then choosing a particular index can influence the interpretations of FI in a certain country or region. This raises the question of the reliability of studies that examine FI both within and across countries. It is also important to check whether these indexes perform better than the simple indicators provided by the FAS and FINDEX or not. In case that these indexes are not performing better than the simple indicators then there is no need use them. The research sub-questions are addressed as follow:

1. Do indexes of financial inclusion give similar interpretation regarding the level of financial inclusion?
2. Do indexes of financial inclusion perform better than indicators provided by FAS and FINDEX?

This paper aims to compare all the aforementioned IFIs using cross-country data for 183 countries (where data permit) between 2011 and 2017. The consistency conditions suggested by Bauer et al. (1998) – that originally used to compare between banks' efficiency measures – is applied to compare the different IFI. The first three consistency conditions suggest that IFI should be similar to each other in terms of their levels of inclusion, rankings, and identification of the best and worst case. The other three consistency conditions check whether IFIs are consistent over time, with single measures of FI (simple indicators from FAS and FINDEX database) and with their link to various economic conditions (economic growth, inequality and human development).

The results show that indexes use efficiency measures and those which use empirical maximum and minimum cannot fulfil the condition of consistency over time because they vary significantly over time and with sample size. The only indexes that are consistent over time and do not vary noticeably with different sample sizes is Sarma (2012) and the new index (NI) suggested in the present chapter.



The paper is structured as follows. The first section reviews the literature on the various IFIs. The second section describes the data and methodology. The third section includes the results and analysis. The fourth section highlights the consistent measures of FI. The fifth section summarizes and concludes the main findings of the chapter.

## 2.2. Literature Review of Indexes of Financial Inclusion

This section reviews nine IFIs suggested in the literature. The NI developed in this chapter is also covered in this section. The main points highlighted in the literature review relate to the different methodologies used in building the IFI – including the model approach, the number of indicators and dimensions used to construct the IFI, the weights used for each indicator and dimension; the number of countries (and regions) covered in the study; and the periods covered in the present study.

### 2.2.1. Sarma (2008)

Sarma (2008) was one of the first to suggest an index for FI, designed in a similar manner to the United Nations Development Program (UNDP) indexes – such as the Human Development Index HDI<sup>2</sup>. Sarma (2008) uses a multidimensional approach and includes three dimensions in the index: banking penetration (access); availability of banking services and usage (depth). These dimensions are captured respectively by the number of deposit accounts per 1,000 adults; the number of bank branches per 1,000 adults; and the volume of credit and deposits as a proportion of the country's GDP. Sarma (2008) first calculates the index for each dimension( $d_i$ ) of FI.

$$d_i = \frac{I_{Ai} - I_m}{I_M - I_m}$$

where

$I_{Ai}$ : Actual value of indicator I given to country (region) i,

$I_{Mi}$ : the highest value recorded for the indicator I, which is use as a benchmark (Maximum) for the indicator I,

$I_{mi}$ : the lowest value recorded for the indicator I, which is referred to as Minimum value.

---

<sup>2</sup> The Human Development Index is the geometric mean of normalized indexes for the following dimensions: long and healthy life, education, and a decent standard of living.

The formula ensures that  $d_i$  lies between 0 and 1, where higher values of  $d_i$  indicate greater values in dimension  $i$  of the country. The difference between the Sarma index and the indexes produced by the UNDP is the choice of minimum and maximum values for the dimensions. The indexes constructed by the UNDP use pre-fixed values for the minimum and maximum for each dimension to calculate the dimensional index. For example, the minimum life expectancy is 25 years and maximum is 85 years. In contrast, Sarma (2008) uses an empirically observed minimum and maximum for each  $d_i$ . This is because of the difficulty in determining what should be the minimum and maximum for any dimension of various FI dimensions. The IFI for a country is calculated through “the normalized inverse Euclidean distance of the point  $d_i$  from the ideal point” (Sarma 2008, p.7). Note that all dimensions are given equal weight (that’s why in the equation below the sum of the squared value of dimensions is divided by 3).

$$Sarma (2008) = 1 - \sqrt{\frac{(1 - d_p)^2 + (1 - d_a)^2 + (1 - d_u)^2}{3}}$$

where

$d_p$  represent the dimension of penetration (accessibility),

$d_a$  signify the dimension of availability,

$d_u$  stand for the dimension of usage.

The normalization object is to ensure that the value of the IFI lies between 0 and 1, where higher values of  $d_i$  indicate greater values in the level of FI in a country. The objective of normality is that it makes reading the result easier and help in comparing different countries. Sarma used the index to study the level of FI in 55 countries in 2004. Several articles have used the Sarma index. For example, Chattopadhyay (2011) used it to study the level of FI in west Bengal regions and Yorulmaz (2013) used for the level of FI in regions and provinces of Turkey.

### 2.2.2. Sarma and Pais (2011)

Sarma and Pais (SP) modified the Sarma (2008) index in three ways. First, to exclude outliers, they use the empirical 94th quantile for each dimension to represent the maximum.

Second, they jointly use two indicators to measure the availability dimension (the number of bank branches and ATMs per 100,000 adults) instead of using only the number of bank branches per 100,000 adults. SP give two-thirds the weight of the availability dimension to bank branches per 100,000 adults and one-third the weight to ATMs per 100,000 adults. Third, they give different weights for each dimension of the IFI (the accessibility dimension weight as 1, and both the availability and usage dimension weight as 0.5) because of the lack of adequate data on some important indicators that characterize the dimension of availability and usage, such as the introduction of internet and mobile banking.

$$d_i = \sum w_I * \frac{I_{Ai} - I_m}{I_M - I_m}$$

where

$w_I$ : weight given to indicator I,

$I_{Ai}$ : Actual value of indicator I given to country (region) i,

$I_{Mi}$ : the highest value recorded for the indicator I, which is use as a benchmark (Maximum) for the indicator I,

$I_{mi}$ : the lowest value recorded for the indicator I, which is referred to as Minimum value.

SP refer to Nathan et al (2008) who demonstrate that distance-based methods cover “intuitive properties including normalization, anonymity, monotonicity, proximity, uniformity and signaling (NAMPUS)”<sup>3</sup>. Sarma and Pais (2011) adopt the modified index in their cross-country study that covers 49 countries in 2004.

$$Sarma \text{ and Pais (2011)} = 1 - \sqrt{\frac{(1 - d_p)^2 + (0.5 - [W_a * d_a])^2 + (0.5 - [W_u * d_u])^2}{1.5}}$$

where:

$w_a$ : the weight given to the availability dimension,

$w_u$ : the weight given to the usage dimension,

$d_p$  represent the dimension of penetration (accessibility),

$d_a$  signify the dimension of availability,

$d_u$  stand for the dimension of usage.

---

<sup>3</sup> Sarma and Pais (2011) page 13.

### 2.2.3. Sankaramuthukumar and Alamelu (SA) Index (2012)

Sankaramuthukumar and Alamelu (SA) also modify Sarma's (2008) index. They use only two dimensions (financial access and financial usage) instead of three because information on the availability dimension is not available in several countries. They include commercial bank branches both per 1,000  $Km^2$  and per 100,000 adults to measure financial access and they give equal weight to the two indicators. Commercial bank deposits and loans as a percentage of GDP are used to construct the financial usage dimension and they are given equal weight. The index is measured as the average of the two dimensions. SA use the index to study 32 countries in Africa in 2007.

$$d_i = \frac{\sum \frac{I_{Ai} - I_m}{I_M - I_m}}{2}$$

where

$w_I$ : weight given to indicator I,

$I_{Ai}$ : Actual value of indicator I given to country (region) i,

$I_M$ : the highest value recorded for the indicator I, which is use as a benchmark (Maximum) for the indicator I,

$I_{mi}$ : the lowest value recorded for the indicator I, which is referred to as Minimum value.

$$SA (2012) = \frac{d_A + d_U}{2}$$

where

$d_A$ : Financial Access

$d_U$ : Financial Usage

### 2.2.4. Sarma Index (2012)

In 2012, Sarma modified her early model again. She suggested fixed maximum and minimum values to be able to compare the index with respect to the same benchmarks on various dimensions. Sarma (2012) chose zero as the minimum (lower bound) and selected the following for the maximum (upper bound) dimensions:

- The maximum value of the number of deposit accounts per 1,000 adults is 2,500.
- The maximum value of the number of bank branches per 100,000 adults is 60, about 1,667 clients per bank branch. In addition, the maximum value of the number of ATMs per 100,000 adults is 120, suggesting one ATM per 833 adults.

- The maximum value of the sum of credit and deposit volume as a proportion of GDP – denoting the usage dimension – is 300, indicating the sum of credits and deposits equal to 3 times GDP.

Sarma (2012) measures the level of FI for a country by the simple average of a normalized Euclidean distance of the estimated point from the worst point and the normalized inverse Euclidean distance of the estimated point from the ideal point. She uses this index to measure FI for 94 countries between 2004 and 2010.

$$Sarma (2012) = 0.5 * \left[ \left( \sqrt{\frac{(d_p)^2 + (d_a)^2 + (d_u)^2}{1.5}} \right) + \left( 1 - \sqrt{\frac{(1 - d_p)^2 + (0.5 - d_a)^2 + (0.5 - d_u)^2}{1.5}} \right) \right]$$

where

$d_p$ ,  $d_a$  and  $d_u$  represent the dimension of penetration (accessibility), availability and usage, respectively.

$d_i = w_i * \frac{A_i - m_i}{M_i - m_i}$ ,  $w_i$  represents the weight of the dimension  $i$ .

### 2.2.5. Chakravarty and Pal Index (2013)

Chakravarty and Pal (CP) develop the Sarma (2008) index. They do not use dimensions as Sarma (2008) does, but instead they use six simple indicators to construct their index: the number of bank branches per 1,000 square kilometres; number of bank branches per 100,000 adults; number of deposit accounts per 1,000 adults; number of loans accounts per 1,000 adults; and the ratio of the average size of deposits (and loans) to the per capita net state domestic product. CP modifies Sarma's index (2008) in normalizing the indicators by adding a constant parameter for inclusion sensitivity  $r$ .

$$A_r = \left( \frac{x_i - m_i}{M_i - m_i} \right)^r$$

where

$x_i$ : the actual value of a country in indicator  $A_r$ ,

$m_i$ : the empirical minimum value of indicator  $A_r$ ,

$M_i$ : the empirical maximum value of indicator  $A_r$ ,

$r$ : constant parameter representing inclusion sensitivity and its value is between 0 and 1

Note that the indicator is a decreasing function of  $r$ . CP set four axioms for an arbitrary  $A_r$  of an indicator; these are normalization, monotonicity, homogeneity, and a fourth axiom which applies the law of diminishing marginal utility. The law of diminishing marginal utility means that an increase in the level of  $A_r$  is greater at lower levels than the same increase at higher levels. The last axiom requires  $r$  to be smaller than 1 and larger than zero, which makes Sarma's index (2008) a special case ( $r = 1$ ).

The CP index is constructed by averaging the six indicators. CP uses the four axioms for  $A_r$  and adds a fifth axiom, namely, symmetry (the anonymity condition) which states that the value of the IFI does not change with any reordering of individual indicators. CP use the index to study the level of FI in 17 states in India from 1972 to 2009.

$$\text{CP (2013) Index} = \frac{1}{k} \sum_{i=1}^k \left( \frac{x_i - m_i}{M_i - m_i} \right)^r$$

#### 2.2.6. Sinha (2013) Indexes

Sinha (2013) proposes two ways to construct an IFI using non-parametric approaches. This idea comes from a multi-input multi-output production system where distance functions provide a functional characterization of the production technology structure. The output set is characterized by the output distance function. The two methods used by Sinha (2013) to measure IFI are Data Envelopment Analysis (DEA) using the classic model of Banker, Charnes and Cooper (1984) (the so-called BCC Envelopment) and the Free Disposal Hull FDH Approach. In both approaches Sinha (2013) suggests one input indicator (gross domestic product) and three output indicators – deposits mobilized per capita, credit disbursed per capita and insurance premium mobilized per capita.

$$\text{Output} (DM_i, CD_i, PC_i) = \text{Input}(GDP_i)$$

where

$DM_i$ : Per Capita Deposit Mobilized in a country  $i$ ,

$CD_i$ : Per Capita Credit Disbursed in a country  $i$ ,

$PC_i$ : Per Capita Insurance Premium Collected in a country  $i$ ,

$GDP_i$ : Gross domestic product in a country  $i$ .

Sinha (2013) claims that the non-parametric approaches have two advantages over the Euclidean distance function approach. One advantage is that they do not require prior assumptions about the relationship between inputs and outputs. In addition, they assign weights (optimally) to the inputs and outputs in a way that facilitates the evaluation of decision-making in a more favourable manner. Sinha uses the two IFIs to study the level of FI in 29 states in India between 2005 and 2006.

### 2.2.7. Amidžić, Massara, and Mialou Index (2014)

Amidžić, Massara, and Mialou (AMM) argue that the Sarma (2008) and the CP indexes give equal weights to all factors and dimensions, assuming equal impact on FI from all dimensions. Therefore, AMM create an alternative composite IFI using factor analysis to derive a weighting methodology. AMM's multidimensional method is implemented in a five-step sequence. First, normalization of variables using the distance to a reference method, this being consistent with non-linear aggregators that use logarithmic functions to transform raw variables. 1 represents the leading country.

$$nx_{i,c} = \frac{x_{i,c}}{M_i}$$

where

$nx_{i,c}$ : normalized value

$x_{i,c}$ : the raw value of variable  $i$  for country  $c$

$M_i$ : the maximum value of the variable across countries

Second, introducing a statistical identification of the FI dimensions using factor analysis and showing that the statistical groups that are obtained comply with the theoretical dimensions of outreach and usage. Outreach is measured using branches of other depository corporations<sup>4</sup> (ODCs) per 1,000  $km^2$  and ATMs per 1,000  $km^2$ ; and usage includes the number of household depositors at ODCs per 1,000 adults and number of household borrowers at ODCs per 1,000 adults. Because factor analysis requires the variables to be

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<sup>4</sup> The FAS defines Other depository corporations as all resident financial corporations and quasi-corporations that are mainly engaged in financial intermediation and that issue liabilities included in the national definition of broad money.

correlated, AMM examine the relationships among the variables in their database and select two factors for inclusion.

Next, they obtain the components of each dimension by grouping the variables by their factor loadings. In addition, weights are assigned to individual variables and dimensions through the percentage of the variance explained by the factor corresponding to the total variance. Then they choose a weighted geometric average as a functional form of the aggregator to compute the dimension and composite indexes, respectively. AMM construct their index for 35 countries to study the FI level for the period between 2009 and 2012.

$$AMM = \exp \left( \frac{\sum_{i=1}^N w_i \log(x_i)}{\sum_{i=1}^N w_i} \right)$$

where:

$w_i$ : The weight associated with variable  $i$

$x_i$ : The raw value of variable  $i$

### **2.2.8. Cáamara and Tuesta Index (2014)**

Cáamara and Tuesta (CT) argue that using supply-side data is not enough to assess the level of FI across countries. Focusing on usage and access does not always mean that a financial system is inclusive because usage can be affected by other socio-economic factors, such as GDP per capita and regulations. Similarly, banking infrastructure indicators capture accessibility only in part. Therefore, CT include in their index demand-side data at an individual level. CT construct a multi-dimensional IFI by applying a two-stage principal components analysis (PCA) to estimate the weights of the index endogenously. They argue that PCA is preferred to common factor analysis because it does not require assumptions on the raw data to be made, for example, selecting the underlying number of common factors (Steiger, 1979).

In the first stage of PCA, CT estimate the dimensions that represent FI: namely, usage, access and barriers. The barriers are the set of constraints experienced by un-banked individuals and these measure the involuntary exclusion provided by FINDEX. The dimensions are



estimated directly by picking all the indicators at the same time to overcome the high inter-correlation among the indicators on each dimension.

$$\begin{aligned}
Y_i^u &= \beta_1 \text{account}_i + \beta_2 \text{savings}_i + \beta_3 \text{loan}_i + u_i \\
Y_i^b &= \theta_1 \text{distance}_i + \theta_2 \text{affordability}_i + \theta_3 \text{documents}_i + \theta_4 \text{trust}_i + \epsilon_i \\
Y_i^a &= \gamma_1 \text{ATM}_{pi} + \gamma_2 \text{branch}_{pi} + \gamma_3 \text{ATM}_{ki} + \gamma_4 \text{branch}_{ki} + v_i
\end{aligned}$$

where:

$Y_i^u$ : usage dimension; contains information about the proportion of population with an account at a formal financial institution FFIs (account), who saved with FFIs (savings), or who borrow from FFIs (loan)

$Y_i^b$ : the barriers dimension; contains information about the percentage of unbanked population, referring to long distance (distance), cost (affordability), lack of documentation (documents), and lack of trust (trust)

$Y_i^a$ : the access dimension; contains information about the number of ATMs per 100,000 adults ( $\text{ATM}_{pi}$ ) and per 1,000  $\text{km}^2$  ( $\text{ATM}_{ki}$ ), as well as the number of bank branches per 100,00 adults ( $\text{branch}_{pi}$ ) and per 1,000  $\text{km}^2$  ( $\text{branch}_{ki}$ ).

The aim of the first stage is to estimate the unobserved endogenous variables and the parameters of the three dimensions. The estimator of each dimension is calculated as the weighted averages. Note that the weight of each component is decreasing, which indicates that the greatest variance in each dimension is explained by the first principal component, the second largest variance is explained by the second principal component, and so on. The  $p$ th orthogonal principal component represents a linear combination of the indicators that capture the smallest variance.

$$\begin{aligned}
Y_i^u &= \frac{\sum_{j,k=1}^p \lambda_j^u P_i^u}{\sum_j \lambda_j^u} \\
Y_i^b &= \frac{\sum_{j,k=1}^p \lambda_j^b P_i^b}{\sum_j \lambda_j^b} \\
Y_i^a &= \frac{\sum_{j,k=1}^p \lambda_j^a P_i^a}{\sum_j \lambda_j^a}
\end{aligned}$$

where:

$$P_k = X \lambda_j$$

$\lambda_j$ : the weights

X: indicators matrix

The second stage computes the dimension weights and the overall index by using the dimensions ( $Y_i^u, Y_i^b, Y_i^a$ ) as explanatory variables, as in the first stage procedure. As

mentioned in the first stage, the greatest weight,  $\lambda$ , is linked to the first principal component and so on. Each component of the model represents a linear combination of the three dimensions. CT use the index to study the FI level in 82 countries for 2011. Please note that this index can be calculated for only three single years (2011, 2014 and 2017) since it is part of the indicators unique to the World Bank's FINDEX database.

$$\text{Cáamara and Tuesta (2014)} = w_1 Y_i^u + w_2 Y_i^b + w_3 Y_i^a + e_i$$

where;

$W_k$ : represents the relative weights of each dimension

$e_i$ : the error term

### 2.2.9. New Index (NI)

In the present paper, a new index of FI is suggested. This index includes three dimensions: financial access, financial usage, and financial availability. The dimension of financial access and usage measured by the number of depositors at ODCs to total adult population and the number of borrowers in ODCs to total adult population. The data is collected from the FAS database that provides information about the number of depositors and borrowers per 1,000 adults which then multiplied by 1,000 to make the value between 0 and 1. Note that in case that the value is greater than 1 (which is possible if most of adult population and entities are financially included).

$$\text{Financial Access} = \text{depositors at ODCs per 1,000 Adults}/1,000$$

$$\text{Financial Usage} = \text{borrowers at ODCs per 1,000 Adults}/1,000$$

Since the FAS indicators cover limited number of countries, the number of deposit and loan accounts per 1,000 adults are also used to extend the number of observations. Note that the number of deposit and loan accounts per 1,000 adults are likely to give value greater than that of the number of depositors and borrowers per 1,000 adults because individuals and entities may have more than one deposit account. Therefore, the average ratio of the number of deposit (loan) accounts over the number of depositors (borrowers) across the world is

calculated and used estimate the number of depositors (borrowers) in the countries that does not have information about the number of depositors. The average ratio of the number of deposit (loan) accounts over the number of depositors (borrowers) across the world is 1.3 (1.7).

$$\text{The estimated number of depositors per 1,000 adults} = \frac{\text{deposit accounts per 1,000 adults}}{\text{ARDATD} * 1,000}$$

Where;

*ARDATD*: the average ratio of deposits accounts to depositors

$$\text{The estimated number of borrowers per 1,000 adults} = \frac{\text{loan accounts per 1,000 adults}}{\text{ARLATB} * 1,000}$$

Where;

*ARLATB*: the average ratio of loan accounts to depositors

The financial availability dimension comprises of four indicators: the number of branches and ATMs of ODCs per 100,000 adults; and the number of mobile cellular subscriptions and fixed broadband subscriptions per 100 people. Note that the first two indicators cover the demographical inclusion of adult population. The latest two indicators capture the effect of technology in enhancing the level of financial inclusion. This is because mobile cellular subscriptions and fixed broadband subscriptions become potential platforms to extend the access to financial services. Although SP and AMM have highlighted that geographic and demographic have become less important in recent years because of mobile and internet banking, they have not suggested ways to capture the effect of technology.

The number of mobile cellular subscriptions and fixed broadband subscriptions per 100 people is provided by the World Bank's world development indicators WDI database. Note that these two indicators are not measuring the same thing. WDI defines mobile cellular subscriptions as subscriptions to a public mobile service that provide access to the PSTN using cellular technology and excludes subscriptions through tele-point, data cards or USB modems, private trunked mobile radio, public mobile data services, radio paging and telemetry services.

Whereas WDI defines fixed broadband subscriptions as fixed subscriptions to high-speed access to the public Internet, at downstream speeds equal to 256 kbit or greater, including cable modem, DSL, fiber-to-the-home/building, other fixed broadband subscriptions, and satellite broadband. It excludes subscriptions that have access to data communications (including the Internet) via mobile-cellular networks. It should include fixed WiMAX and any other fixed wireless technologies. Descriptive summary of the two is carried in appendix 2.1 to show how they are statistically different.

In order to normalize the value between 0 and 1, the number of branches and ATMs of ODCs per 100,000 adults are divided by the maximum values suggested by Sarma (2012) that are 60 and 120, respectively. The number of mobile cellular subscriptions per 100 people was also divided by 120 because some individuals may have more than one mobile. The number of fixed broadband subscriptions per 100 people was divided by 25 assuming that every four people are sharing the same broadband (they either have it at home or at work, or some public places near their location). The four indicators of financial availability dimension are given equal weight.

$$Financial\ Availabilty = \frac{M_{i,t}}{120} + \frac{B_{i,t}}{25} + \frac{ATM_{i,t}}{120} + \frac{Branch_{i,t}}{60}$$

where:

$M_{i,t}$ : the number of mobile cellular subscriptions per 100 people for country  $i$  at time  $t$ ,

$B_{i,t}$ : the number of fixed broadband subscriptions per 100 people for country  $i$  at time  $t$ ,

$ATM_{i,t}$ : the number of ATMs of ODCs per 100,000 adults for country  $i$  at time  $t$ ,

$Branch_{i,t}$ : the number of branches of ODCs per 100,000 adults for country  $i$  at time  $t$ .

$$New\ Index\ (NI_{i,t}) = \frac{A_{i,t} + U_{i,t} + V_{i,t}}{3}$$

where

$A_{i,t}$ : financial access dimension in a country  $i$  at time  $t$ ,

$U_{i,t}$ : financial usage dimension in a country  $i$  at time  $t$ ,

$V_{i,t}$ : financial availability dimension in a country  $i$  at time  $t$ .

**Table 2.1: Summary of Financial Inclusion Indexes**

Index	Countries	Period	Dimension	Indicator	Data Source
Sarma (2008)	55	2004	Banking Penetration	Deposit Accounts per 1,000 Adults	IMF's Financial Access Survey
			Availability of Banking Services	Banks' Branches per 100,000 Adults	
			Usage of Banking Services	Domestic credit (% of GDP) Domestic deposit (% of GDP)	
Sarma & Pais (2011)	49	2004	Banking Penetration	Deposit Accounts per 1,000 Adults	IMF's Financial Access Survey
			Availability of Banking Services	Banks' Branches per 100,000 Adults ATM per 100,000 Adults	
			Usage of Banking Services	Domestic credit (% of GDP) Domestic deposit (% of GDP)	
Sankaramut-hukumar & Alamelu (2012)	32	2007	Financial Access	Banks' Branches for 1,000 $Km^2$ Banks' Branches per 100,000 adults	IMF's Financial Access Survey
			Financial Usage	Domestic credit (% of GDP) Domestic deposit (% of GDP)	
Sarma (2012)	94	2004 – 2010	Banking Penetration	Deposit Accounts per 1,000 Adults	IMF's Financial Access Survey
			Availability of Banking Services	Banks' Branches per 100,000 Adults The Number of ATM per 1,000 Adults	
			Usage of Banking Services	Domestic credit (% of GDP) Domestic deposit (% of GDP)	
Chakravarty & Pal (2013)	17 States in India	1972 – 2009	Number of Banks' Branches for 1,000 $Km^2$		IMF's Financial Access Survey
			Banks' Branches per 100,000 Adults		
			Number of Deposit Accounts per 1,000 Adults		
			Number of Loan Account per 1,000 Adults		Reserve Bank of India
			Ratio of Average Size of Deposits to per Capita Net State Domestic Product		
			Ratio of Average Size of Loans to per Capita Net State Domestic Product		
Sinha (2013)	29 States in India	2005 – 2006	Input	Deposit Mobilized per capita Credit Disbursed per capita	IMF's Financial Access Survey
				Insurance Premium mobilized per capita	Sigma Database
			Output	GDP	World Bank Database
Amidžić et al. (2014)	35	2009 – 2012	Banking Outreach	Banks' Branches for 1,000 $Km^2$ Bank ATMs for 1,000 $km^2$	IMF's Financial Access Survey
			Financial Usage	Number of Depositors per 1,000 Adults Number of Borrowers per 1,000 Adults	
Cáamara & Tuesta (2014)	82	2011	Financial Access	Banks' Branches per 100,000 adults Bank ATMs per 100,000 adults Banks' Branches for 1,000 $Km^2$ Bank ATMs for 1,000 $km^2$	IMF's Financial Access Survey
			Financial Usage	% Account % Borrowed % Saved	World Bank Global Financial Inclusion Database
			Financial Barriers	Distance Affordability Documents Trust	
The New Index	114	2004 – 2017	Financial Access	Number of depositors as a percentage of adult population	IMF's Financial Access Survey
			Financial Usage	Number of borrowers as a percentage of adult population	
			Financial Availability	Branches of ODCs per 100,000 adults ATMs of ODCs per 100,000 adults	
				Mobile cellular subscriptions per 100 people Fixed broadband subscriptions per 100 people	World Development Indicators

### 2.3. Data and Methodology

No database contains information on the IFIs discussed in Section 2. Therefore, all the indicators have to be collected and then the IFIs constructed. Note that the raw data used to calculate the IFIs are considered secondary and are mainly been obtained from the following databases: FAS, FINDEX, Sigma Reinsurance, and World Development Indicators WDI. Given these sources, the IFIs are measured for 183 countries (where possible) over the period between 2004 and 2017 (the number of countries provided by each IFI is reported in Table 2.2).

Note that the average deposits (loans) to net GDP per capita, which are used in the index of CP, are not available in any database and hence they were constructed manually. In addition, CP have not mentioned or calculated  $r$ , instead they only gave an example to illustrate the importance of using  $r$ . Therefore, the same number they used in their example is applied, which is (0.75). The deposit mobilized per capita and credit disbursed per capita, which are used in the indexes of Sinha (2013), are calculated manually.

The derivation of the above IFIs (over 14 years) reported in the present paper is considered a major dataset contribution, since it is the first study (as far as I am aware) to cover such an extensive dataset in the area of FI. The process of understanding the methodologies used to derive the IFIs, manually collecting the data, and constructing the IFIs for 14 years took a considerable amount of time. The number of observations in each index varies because of the availability of each indicator of FI. IFIs are not available for all the countries for the whole period<sup>5</sup>. Only a few countries have data available for one index alone, or, in rare cases, for a single year.

The mean value and number of observations measured by each IFI are reported as follow: Appendix 2.2 reports countries of east and south west Asia; Appendix 2.3 covers countries of Middle East, South and Central Asia; Appendix 2.4A and 2.4B contain African countries;

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<sup>5</sup> Please note that most countries have some missing data during the period of the study.

Appendix 2.5 includes countries in Australasia; Appendix 2.6 reports countries in South America; Appendix 2.7 covers countries in North and Central America; Appendix 2.8 contains countries in Eastern Europe; and Appendix 2.9 reports countries in Western Europe. The way to measure FI is varied and no consensus has been reached about the most “appropriate” measure. The main aim of this paper is to analyse whether the different index approaches to measure FI yield similar findings when compared to each other and when they are compared to simple indicators of FI. In addition, it is essential to test whether the indexes perform better than the simple indicators provided by FAS and FINDEX or not. If these indexes do not perform better than the simple indicators, then there is no need use them. The hypothesis test in this chapter are set based on the two sub-questions highlighted in the introduction.

Hypotheses based on the first question:

$H_1$ : Indexes of FI yield similar inference about FI.

Hypotheses based on the second question:

$H_2$ : Indexes of FI perform better than indicators from FAS and FINDEX database.

The six consistency conditions suggested by Bauer et al. (1998) are applied to compare the different IFIs. These consistency conditions were originally used in comparing the frontier efficiency approaches that measure the performance of financial institutions to find the most appropriate/ consistent approach to use to gauge bank efficiency as well as to use for regulatory purposes. The first three consistency conditions suggest that the results from the IFIs should be consistent with each other in terms of deriving estimates of the levels of inclusion, rankings, and the identification of countries with the highest and lowest levels of FI. These conditions can determine the degree to which the different IFIs are mutually consistent. The descriptive statistics and pair-wise correlation are used to examine these three consistency conditions.

The latter three consistency conditions check whether IFIs are consistent over time; with other (simpler) indicators of FI from the FAS and FINDEX database; and as expected given

economic conditions, (including inequality, economic growth and human development). These conditions can determine the degree to which the different IFIs are consistent with the evidence. The consistency over time was examined using descriptive analysis. Pairwise correlations also been used to examine the fifth consistency condition. In addition, three different approaches are used to examine whether the measures of FI are consistent with broad macroeconomic factors for the sixth consistency condition.

The two-step system GMM dynamic estimator is applied to study the FI relationship with human development (captured by the human development index (HDI)) and economic growth (measured by the growth Gross Domestic Products GDP). Nevertheless, since some IFIs and indicators of FI are only available for three single years (2011, 2014, and 2017) two stage least squares (2SLS) with instrumental variables (IV) is applied when the two-step system GMM dynamic estimator is inapplicable. Furthermore, the relationship between FI and inequality of income distribution – estimated by Gini coefficient – is examined using a fixed effect panel estimator. The second hypothesis will be tested based on the fifth and sixth consistency conditions suggested by Bauer et al. (1998). The results are important practically for policy implications and regulators about the most appropriate measure for FI.

## **2.4. Applying Bauer et al (1998) Consistency Conditions**

This section is divided into four sub-sections. The first section contains analysis of the first three consistency conditions suggested by Bauer et al (1998). The second section covers the consistency of IFIs over time. The third section includes the analysis of the relationship between the IFIs and the selected simple FI indicators. The fourth section includes the analysis of FI (IFIs and indicators) effects on the selected economic factors.

### **2.4.1 Comparing Indexes of Financial Inclusion**

Bauer et al's (1998) first consistency condition highlighted that the scores derived from different IFIs should have comparable distributional properties. Table 2.2 reports the descriptive statistics of the ten IFIs. The maximum values of six IFIs are 1, suggesting that various countries have reached full inclusion. Nevertheless, the maximum values of the rest



of the IFIs (Sarma 2008, SA, CP, and AMM) are relatively low. The reason for the low average mean (median) and empirical maximum in these four indexes is the presence of outliers created by small countries classified as financial centres – such as Hong Kong – that usually tend to have more developed banking infrastructure than other countries<sup>6</sup>. The AMM index has another reason, too, for the low average mean, which is the weighted geometric aggregator that includes exponential function and is applied twice – once in the dimensions and once in the overall index. This aggregator makes the empirical maximum small, and this is confirmed when the findings in the AMM paper (pp. 27-31) are viewed.

Most of the IFIs are positively skewed because the tail on the right side of the distribution is longer than the tail on the left side (see Figure 2.1), but that of the NI which is negatively skewed. This is because NI includes mobile cellular subscriptions and fixed broadband subscriptions per 100 people, which boosts the financial availability compared to the rest of the IFIs. The results of the kurtosis test in Table 2.2 show that most of the IFIs (SP, Sarma 2012, CP, CT, NI and the indexes of Sinha 2013) are platykurtic (having less extreme outliers than a normal distribution has). In contrast, the rest of IFIs are leptokurtic (more outliers than a normal distribution has). From Table 2.2 and figure 2.1, it can be seen that IFIs have different distributional properties. The number of observations plays a role in the differences in distributional properties.

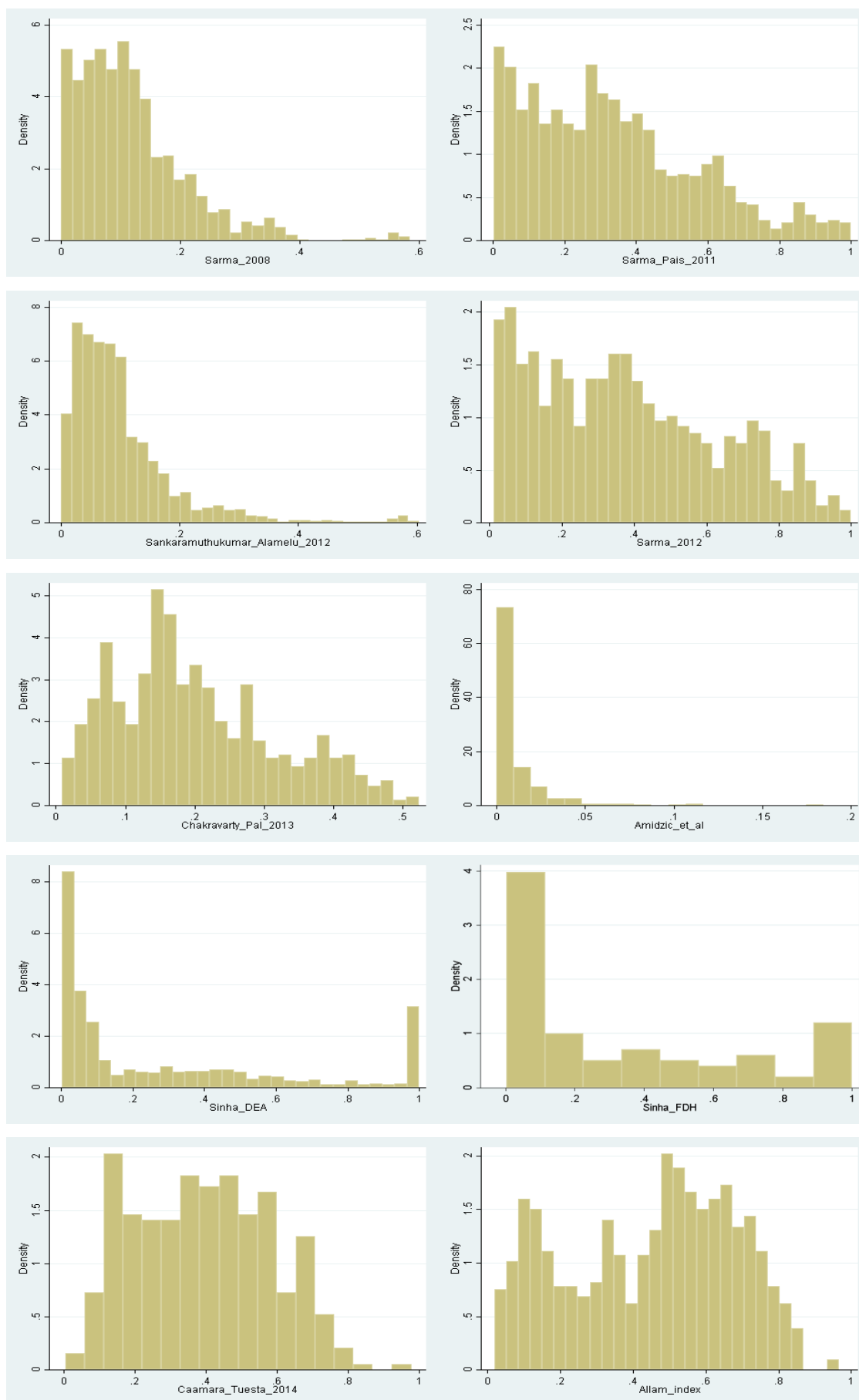
The second consistency condition highlighted by Bauer et al. (1998) suggests that the IFIs should be able to rank countries in approximately the same order. Although each IFI gives a different value for the same country, it is still possible that these IFIs will generate similar rankings for the countries according to their level of FI. Identifying the rough ordering based on the level of FI in a country compared to the world is more important for regulatory policy conclusions than measuring the level of FI per se. If the IFIs do not rank countries similarly, then policy decisions may be “fragile” and reliant on which IFI is employed.

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<sup>6</sup> Some countries such as Macao have data for only one or two dimensions of FI. These data have been used, instead of losing them, to measure the minimum and maximum values of the individual dimensions.

**Table 2.2: Descriptive Statistics of Indexes of Financial Inclusion**

Index of Financial Inclusion	Number of Countries	Years	Number of Observations	Mean	Median	Minimum	Maximum	Standard Deviation	Skewness	Kurtosis
Sarma (2008)	128	2004-2017	1417	0.118	0.102	0.001	0.585	0.092	1.590	6.871
SP	127	2004-2017	1329	0.333	0.300	0.002	1.000	0.237	0.682	2.796
SA (2012)	183	2004-2017	2351	0.101	0.079	0.000	0.604	0.090	2.422	11.257
Sarma (2012)	127	2004-2017	1329	0.376	0.345	0.010	1.000	0.253	0.448	2.199
CP	95	2004-2016	813	0.201	0.177	0.009	0.524	0.116	0.603	2.596
AMM	55	2005-2017	381	0.010	0.004	0.000	0.184	0.018	4.661	34.531
CT	148	2011, 2014, & 2017	355	0.392	0.390	0.005	1.000	0.191	0.194	2.221
DEA Sinha (2013)	91	2006-2017	970	0.287	0.104	0.002	1.000	0.332	1.115	2.888
FDH Sinha (2013)	91	2006-2017	970	0.330	0.142	0.002	1.000	0.352	0.880	2.301
NI	114	2004-2017	941	0.451	0.491	0.020	0.966	0.228	-0.217	1.925



**Figure 2.1: Distribution of Average Value of Indexes of Financial Inclusion**

Spearman rank-order correlation coefficients show how close the rankings of countries are for each of the ten IFIs using the full sample. Table 2.3 shows that Spearman rank-order correlation coefficients for all the IFIs are significant at 1%. The only exceptions are rank-order correlation for AMM index with CT index negative correlation (which is surprising as these IFIs should theoretically be positive) at 10% level. This point will be discussed further in the following section.

The correlation coefficients with values less than (0.5) appear mainly with CT index. AMM correlation with Sinha indexes and FDH correlation with NI have also values less than (0.5). The indexes constructed by SP, SA, Sarma (2012), CP and NI are highly correlated because these were originally developed from Sarma (2008) and use similar FI indicators, methodologies or both. In addition, the Sinha (2013) indexes, for the same reason, have also high pairwise correlation with each other. Overall, IFIs seem to rank countries in a similar fashion.

The third consistency condition suggested by Bauer et al (1998) stresses that IFIs should be consistent with each other in identifying the countries with highest and lowest levels of inclusion. Although IFIs do not always rank countries similarly, they may still be valuable for some regulatory purposes if they turn out to be consistent in identifying which are the countries with the highest and lowest levels of inclusion. Table 2.4 summarizes, for each pair of IFIs, the percentage of countries that are identified in the highest and lowest quarter by the pair of IFIs.

The top triangle of Table 2.4 reports, for each pair of IFIs, the percentage of countries that are identified in the top quarter by the pair of IFIs as having high levels of FI. For instance, 75% of the countries identified in the top quarter by the CP are also identified in the top quarter by SA. It is worth mentioning that the average value of each country in each index is used in Table 2.4 (the average value of countries in the period between 2011 and 2017 are used only when they appear in the paired indexes)<sup>7</sup>. Moreover, the same analysis is carried out with respect to the countries with the lowest level of inclusion; these are shown in the bottom triangle of Table 2.4, which tells essentially the same story as the top triangle of Table 2.4.

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<sup>7</sup> For example, the indexes of CP and CT share 72 countries between 2011 and 2014.

**Table 2.3: Spearman Rank-Order Correlation among the Indexes of Financial Inclusion**

	Sarma (2008)	SP	SA	Sarma (2012)	CP	AMM	DEA Sinha (2013)	FDH Sinha (2013)	CT	NI
Sarma (2008)	1									
SP	0.966 ***	1								
SA	0.916 ***	0.799 ***	1							
Sarma (2012)	0.963 ***	0.995 ***	0.787 ***	1						
CP	0.974 ***	0.943 ***	0.922 ***	0.942 ***	1					
AMM	0.564 ***	0.539 ***	0.507 ***	0.530 ***	0.539 ***	1				
DEA Sinha (2013)	0.687 ***	0.662 ***	0.637 ***	0.662 ***	0.794 ***	0.323 ***	1			
FDH Sinha (2013)	0.675 ***	0.655 ***	0.541 ***	0.652 ***	0.763 ***	0.334 ***	0.974 ***	1		
CT	0.453 ***	0.442 ***	0.415 ***	0.471 ***	0.413 ***	-0.207 *	0.316 ***	0.313 ***	1	
NI	0.851 ***	0.668 ***	0.898 ***	0.905 ***	0.854 ***	0.543 ***	0.511 ***	0.478 ***	0.528 ***	1

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

**Table 2.4: Correspondence of Highest and Lowest Countries Across Indexes of Financial Inclusion**  
(top triangle shows the ratio of highest 25% countries and bottom triangle shows the ratio of lowest 25% countries)

	Sarma (2008)	SP	SA	Sarma (2012)	CP	AMM	DEA Sinha (2013)	FDH Sinha (2013)	CT	NI
Sarma (2008)		93.55%	65.63%	93.55%	83.33%	66.67%	60.00%	53.33%	59.26%	80.77%
SP	93.55%		64.52%	96.77%	79.17%	66.67%	60.00%	53.33%	55.56%	76.92%
SA	87.50%	80.65%		67.74%	75.00%	71.43%	60.87%	52.17%	48.65%	62.96%
Sarma (2012)	90.32%	96.77%	77.42%		83.33%	66.67%	60.00%	53.33%	55.56%	80.77%
CP	91.67%	87.50%	87.50%	87.50%		60.00%	72.73%	72.73%	78.95%	65.38%
AMM	50.00%	50.00%	50.00%	50.00%	50.00%		50.00%	50.00%	50.00%	46.15%
DEA Sinha (2013)	66.67%	73.33%	65.22%	66.67%	72.73%	25.00%		86.96%	25.00%	36.36%
FDH Sinha (2013)	73.33%	80.00%	60.87%	73.33%	72.73%	25.00%	100.00%		30.00%	36.36%
CT	66.67%	66.67%	64.86%	70.37%	84.21%	40.00%	50.00%	45.00%		52.17%
NI	88.46%	88.46%	77.78%	84.62%	73.08%	53.85%	54.55%	54.55%	73.91%	

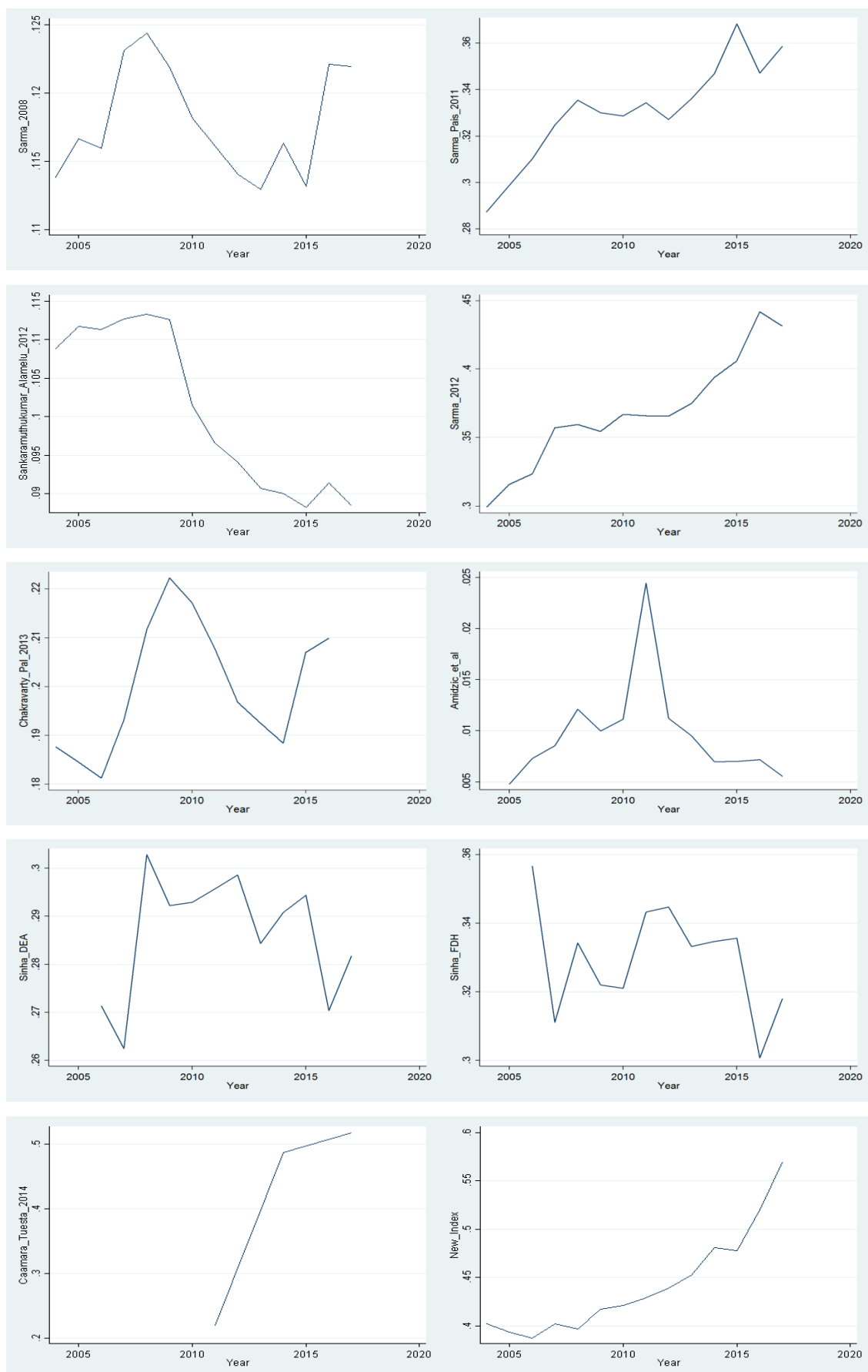
Table 2.4 shows that IFIs generally have good consistency in both identifying the highest and lowest quarter of country FI, the average results being 63.6% and 69.4%, respectively. There are a few exceptions where the percentages of the highest and lowest quarter are below 50%. The exceptions that appear in the top triangle of Table 4 are mainly in NI and CT, and the exceptions that appear in the bottom triangle of Table 4 also mainly relate to AMM.

The indexes that were originally developed from Sarma (2008) have greater consistency with each other in both the top and bottom quarter than with the overall average. On average, countries identified in the top (bottom) quarter of the Sarma (2008) based indexes are 80.3% (88%) consistent. Similarly, Sinha's indexes (2013) have high consistency with each other in both the top and bottom quarters (87% and 100% respectively). Appendix 2.10 summarizes the number of countries shared by the IFIs.

#### **2.4.2. Consistency over Time**

Based on the fourth consistency condition, IFIs should show reasonable stability over time, so that the same countries can be classified as inclined to reaching relatively high or low levels of FI over different years, rather than varying noticeably from one year to the other. Figure 2.2 shows the mean value of each IFI over time. The graphs in Figure 2.2 show that the IFIs have different patterns. The indexes of SP, Sarma (2012), CT and the NI show an increase in the overall level of FI over time.

The only index that shows a decrease in the mean level of FI over time is the SA index. From 2004 until 2009 the mean of the index was increasing because all the countries were moving in the same direction and at similar speeds. Furthermore, the increase in the mean of the index was also a result of the increase in the number of countries reporting to the FAS. However, since the 2008 financial crisis, the countries in general have been increasing at a slower rate than that of the leading countries (the maximum), which tends to make the level of FI in most of the countries look as though it was decreasing. For instance, the mean of the indexes dropped sharply between 2009 and 2010 as a result of the rapid increase in outstanding loans as a percentage of the GDP of Hong Kong (the maximum) from 193% in 2009 to 234.8% in 2010.



**Figure 2.2: Average Value of Financial Inclusion Indexes**



The reason behind the fluctuation in the CP index is similar to that for the SA index. There was a dramatic change in the value of the number of loan accounts per 1,000 adults in 2011 as the value of Belgium increased by 33.87% (from 953 to 1275.8). This happened again in 2012, when the number of loan accounts per 1,000 adults in Brazil increased by 146.9% (from 826 to 2039.6) due to the change in the minimum outstanding amounts of loans that had to be reported to the credit bureau – in 2012 it was lowered from BRL 5,000 to BRL 1,000. Thus, Brazil overtook Belgium as the benchmark (maximum) for the number of loan accounts per 1,000 adults reaching (2039.6), which is double the value for Belgium (1275.8).

Note that the indexes of Sarma (2008) and AMM face similar problem to the indexes of SA and CP. The DEA and FDH indexes constructed by Sinha are efficiency measures, thus the Sinha indexes evaluate countries either by an increase in output given inputs or a decrease in the output given a greater fall in inputs. In this way, they are affected by the input-output level and the indexes will not show an improvement in the level of FI if the input variables (the FI indicators) increase at a time when the output variable (GDP) is not improving. This is especially relevant after the 2008 financial crisis, shown by the stationary graph which fluctuates around a particular level (Figure 2.2).

The index of Sarma (2012) uses fixed minimum and maximum levels that enable researchers and policymakers to compare the index over time or with other countries. Moreover, NI uses depositors and borrowers at ODC as a percentage of the population and fixed maximum for the financial availability dimension, which makes it a stable and useful tool to use in comparing the level of FI over time and across countries. Although Sarma (2010) uses empirical minimum and maximum, the paper does show an increase in inclusion levels over the period of study since it uses the 94<sup>th</sup> quantile and thus removes a large proportion of the outliers resulting from using an empirical maximum.

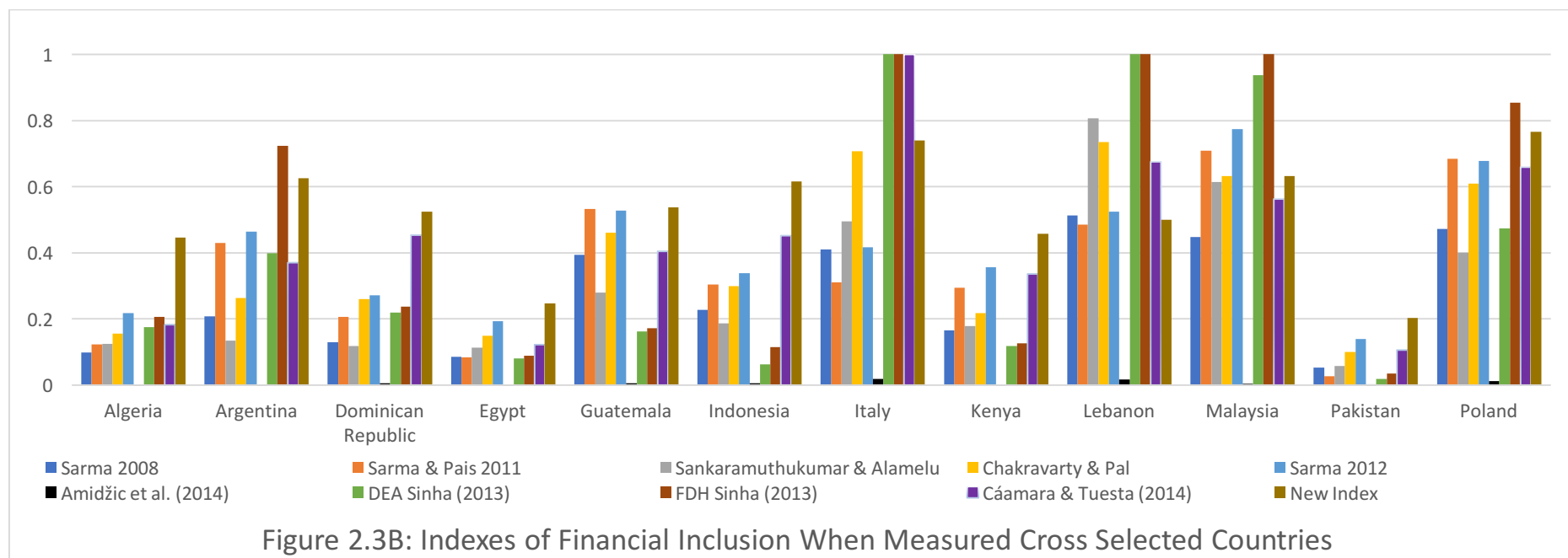
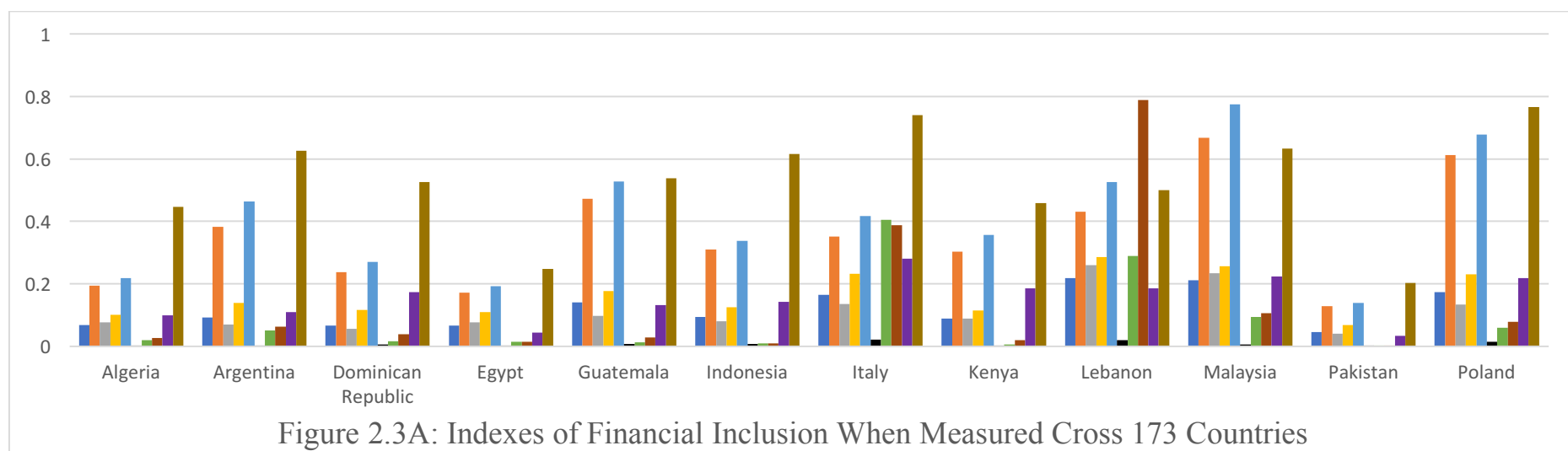
Although the level of FI may slightly increase or decrease for a country over a short period, it is unlikely that a country with a high level of FI in one year would have a low level of inclusion in the following year, only to return to a high inclusion level the year after that. Examining IFIs using this consistency condition reveals that the indexes that use efficiency measures and those that use empirical maximum and minimum do seem

to vary significantly over time, especially when the number of countries changes. This limits their usefulness to policymakers who want to compare FI across countries or over time.

To explain how IFIs vary based on sample size, twelve countries with different level of FI were selected (Figures 2.3A and 2.3B). These countries are Algeria, Argentina, Dominican Republic, Egypt, Guatemala, Indonesia, Italy, Kenya, Lebanon, Malaysia, Pakistan and Poland for the year 2014. Figure 2.3A shows the value of IFIs for the selected countries when they are estimated among a sample of 183 countries. Figure 2.2B, however, shows the value of IFIs for the selected countries when they are measured alone (sample of 12 only). Comparing Figures 2.2A and 2.2B, it can be seen that the value of most of the indexes vary, except for Sarma (2012) and the NI.

Note that when the level of FI in the benchmark country is increasing at a faster rate, the indexes using the empirical minimum and maximum tend to show that the level of FI in the rest of countries as decreasing. Figure 2.4 highlights the issue of consistency over time. IFIs are calculated for a small sample of three countries (Indonesia, Kenya and Pakistan) considered over the period between 2004 and 2017 – some of the IFI have smaller sample.

In this sample, the level of FI in the three countries is increasing but at different growth rate. Indonesia has the highest level of FI among three and Pakistan has the lowest. Note that Kenya has the highest growth rate among the three, whereas Pakistan has the lowest growth rate. Since Pakistan has lower growth rate than the Indonesia – benchmark or called the maximum – most of the indexes with empirical minimum and maximum show as if Pakistan decreasing by time. The only exception is CT, which shows that if Kenya is decreasing and this is because it using FINDEX which is different data. However, CT still show unreal result – as if Kenya is decreasing. Similarly, the indexes made by Sinah are also showing as if Pakistan volatile over the period. The only indexes that show the level of FI is increasing in all the three countries are Sarma (2012) and the NI.





**Figure 2.4: Issue of Consistency Over Time**

### 2.4.3 Consistency with Simple Financial Inclusion Indicators

The fifth consistency condition of Bauer et al (1998) stipulates that the scores generated by the different IFIs should be reasonably consistent with current financial conditions and with standard measures of FI. Examining how close the IFIs are to other FI indicators will help us understand whether the IFIs add more value, in terms of our understanding of financial inclusion, than alternative simple measures do. Here the pairwise correlation is used to compare simple FI measures - that are mainly used in the previous studies – with those from the IFIs. Eleven FI indicators were selected from the FAS and FINDEX databases categorized into 5 groups. Note that some of the simple indicators are already included in some of the IFIs.

- Banked Population: percentage of banked population collected from FINDEX, and the number of depositors at other depositary corporation ODCs per 100,000 adults, and deposit accounts per 1,000 adults provided by the FAS database.
- Financial Services: percentage of the population that saved with and borrowed from FFIs (both from FINDEX) as well as the number of borrowers at other depositary corporation ODCs per 100,000 adults, and loan accounts per 1,000 adults from the FAS database.
- Geographical Inclusion: number of branches of ODCs per 1,000 kilometres squared available from FAS database.
- Demography Inclusion: number of branches of ODCs per 100,000 adults collected from FAS database.
- Financial Usage: deposits and loans as a percentage of GDP offered by FAS database.

Table 2.5 shows the pairwise correlation between IFIs and the simple indicators. The result shows that most of the selected simple indicators have significantly positive relationships with IFIs. There are a few exceptional cases where the correlation appears to be insignificant (branches of ODCs per 1,000 kilometer squares and CP index, the percentage of population borrowed from FFIs with the AMM index, and loan account at banks per 1,000 adults with the CT index). The average value of pairwise correlations in the table is (0.508). The index with the highest average pairwise correlation with the simple indicators is that of Sarma (2008) with an average value of (0.603). The IFI with the lowest average pairwise correlation to the simple indicators was the index of CT, with an average value of (0.399).

**Table 2.5: Pairwise correlation between Indexes of Financial Inclusion and Simple indicators from FAS and FINDEX**

Variables	Sarma (2008)	SP	SA	Sarma (2012)	CP	AMM	DEA Sinha (2013)	FDH Sinha (2013)	CT	NI	Depositors at ODCs per 1,000 adults	Borrowers at ODCs per 1,000 adults	Branches of ODCs per 100,000 adults	Branches of ODCs per 1,000 km <sup>2</sup>	Deposits of GDP	Loans of GDP	Account	Borrowed
Depositors at ODCs per 100,000 Adults	0.678 ***	0.821 ***	0.529 ***	0.846 ***	0.777 ***	0.388 ***	0.307 ***	0.263 ***	0.504 ***	0.882 ***								
Borrowers at ODCs per 100,000 adults	0.646 ***	0.697 ***	0.464 ***	0.698 ***	0.727 ***	0.462 ***	0.282 ***	0.322 ***	0.385 ***	0.837 ***	0.729 ***							
Branches of ODCs per 100,000 Adults	0.606 ***	0.395 ***	0.551 ***	0.410 ***	0.345 ***	0.780 ***	0.291 ***	0.254 ***	0.209 ***	0.451 ***	0.426 ***	0.374 ***						
Branches of ODCs per 1,000 km <sup>2</sup>	0.354 ***	0.134 ***	0.463 ***	0.124 ***	0.017	0.777 ***	0.256 ***	0.231 ***	0.141 **	0.145 ***	0.316 ***	0.468 ***	0.2498 ***					
Deposits in Banks (% GDP)	0.743 ***	0.574 ***	0.842 ***	0.578 ***	0.702 ***	0.553 ***	0.437 ***	0.427 ***	0.411 ***	0.400 ***	0.475 ***	0.412 ***	0.323 ***	0.321 ***				
Loans in Banks (% GDP)	0.813 ***	0.766 ***	0.841 ***	0.765 ***	0.897 ***	0.461 ***	0.557 ***	0.548 ***	0.421 ***	0.651 ***	0.653 ***	0.533 ***	0.357 ***	0.188 ***	0.783 ***			
Account	0.723 ***	0.759 ***	0.546 ***	0.774 ***	0.795 ***	0.208 *	0.668 ***	0.664 ***	0.623 ***	0.810 ***	0.853 ***	0.689 ***	0.434 ***	0.167 ***	0.402 ***	0.573 ***		
Borrowed	0.312 ***	0.320 ***	0.245 ***	0.360 ***	0.343 ***	0.016	0.303 ***	0.287 ***	0.413 ***	0.384 ***	0.508 ***	0.390 ***	0.336 ***	0.026	0.144 ***	0.279 ***	0.565 ***	
Saved	0.552 ***	0.549 ***	0.477 ***	0.548 ***	0.612 ***	0.145 ***	0.731 ***	0.700 ***	0.484 ***	0.564 ***	0.697 ***	0.575 ***	0.335 ***	0.196 ***	0.396 ***	0.515 ***	0.830 ***	0.546 ***

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

In contrast, the simple FI indicator with the highest pairwise correlation with IFIs is that of outstanding loans as a percentage of GDP, with an average value of (0.672). The indicator with the lowest pairwise correlation with IFIs is the number of branches of ODCs per 1,000 kilometer squares, with an average value of (0.264). Table 2.5 also reports the pairwise correlation among the simple indicators. The indicator of depositors at ODCs per 1,000 adults has the highest pairwise correlation of all the simple indicators, with an average value of (0.582).

#### **2.4.4. Consistency with Economic Conditions**

Recalling the sixth consistency condition specified by Bauer et al (1998), the value of all the IFIs should be reasonably consistent with economic conditions. The selected economic conditions are economic growth, inequality of income distribution, and human development. This consistency condition enables us to compare how the IFIs interact with economic conditions as well as to check if IFIs perform better than the selected simple FI indicators from the FAS and FINDEX database. In addition, this section includes a considerable number of FI indicators and indexes for 14 years to examine FI relationship of three macro-economic variables.

##### **2.4.4.1 Indexes of Financial Inclusion and Economic Growth**

From a macro-economic perspective, an increase in FI boosts savings, leading to an improvement in the allocation of funds and more productive investment (Bruhn and Love, 2014). Hariharan and Marktanner (2012) have shown that FI can boost economic growth because FI can generate capital due to its strong positive correlation with total factor productivity. They demonstrate that FI can raise the savings portfolio and the efficiency of financial intermediation, foster entrepreneurship and thus improve economic growth. Babajide et al (2015) find that FI positively impacts total factor productivity and capital per worker, which positively affects the final output of the economy.

Furthermore, Sharma (2016) applied a vector auto-regressive model (VAR) and reveals positive impact on growth using various dimensions of FI: banking penetration and the availability and usage of banking services. She also used Granger causality tests and finds a unidirectional causality between the number of deposits and GDP and a bidirectional causality between geographical penetration and economic development. The

bidirectional causality indicates that a strong economic outlook facilitate access to banking services and increase ATMs coverage. The improvement of banking geographical outreach also fosters economic growth.

Hassan et al (2018) also study the relationship between financial inclusion and economic growth across 55 countries in the Organization of Islamic Cooperation (OIC) countries from 1990 to 2013. They use simple indicators from FAS to represent FI (ATMs per 100,000 adults; banks' branches per 100,000 adults; deposit accounts with commercial banks per 1,000 adults; borrowers from commercial banks per 1,000 adults; and volume of life insurance premiums to GDP). The result demonstrates that FI positively affects economic growth in OIC countries using the Arellano-Bond dynamic panel Generalized GMM estimator and panel VAR analysis. Next, they also use panel Granger causality tests (as suggested by Dumitrescu and Hurlin 2012) to show that financial inclusion and economic growth have mutual causality with each other.

The aim of this section is to study whether all the IFIs have similar or different relationships with economic growth. The data covered in this analysis covers data only from 2011 to 2017 in order to make a good comparison between IFIs (CT index is the only index with less number of years). In addition, six simple FI indicators are selected from the FAS and FINDEX database: the natural logarithm of depositors and borrowers at ODCs per 1,000 adults, the outstanding banks' deposits and loans as a percentage of GDP, and the natural logarithm of branches of ODCs per 1,000 kilometre squares and per 100,000 adults. The purpose of including simple FI indicators is to check if the IFIs perform better than the selected simple indicators.

Economic growth is measured using real GDP growth that is available on a country-by-country basis from World Economic Outlook database provided by the IMF. Government expenditure has been used several times as a control variable to study the relationship between financial development and economic growth, for example, Levine et al (2002), Caporale et al (2009), and Petkovski and Kjosevski (2014). This is because increasing government expenditure is expected to boost aggregate demand, leading economic growth to increase in the short run. Therefore, government expenditure as a percentage of GDP from the World Development Indicators (WDI) database is included in the analysis.



The real interest rate is also included because of its effect on both economic growth and financial development. Note that real interest rate is measured by subtracting inflation rate (consumer price index) from the lending rate (the short and medium-term bank rate to finance the private sector), which is collected from WDI. Central banks influence interest rates by applying expansionary or contractionary monetary policies as a means of controlling the economy.

When interest rates increase, enterprises are discouraged to borrow to finance investment and consumers are encouraged to save rather than spend, which decreases aggregate demand leading to a slowdown in short-term GDP growth. On the other hand, when interest rates decrease enterprises have access to cheap loans and therefore are encouraged to finance investment and consumers are encouraged to spend rather than save, which increases aggregate demand leading to a boost in short-term GDP growth (Brown et al. 2018). The data described earlier are available from the WDI database from the World Bank.

Technological progress is considered an important determinant for long-run economic growth based on Solow (1956) and Swan (1956) growth model. Additionally, technological progress has lead to new inventive way to enhance the level of FI such as internet banking and mobile banking. The growth rate of output per worker is included (measured manually) to control for technological progress. The data described earlier are available from the World Development Indicators (WDI) database from the World Bank.

Property rights proxy is also included in the analysis. Leblang (1996) uses a pooled cross-sectional and time series design on 50 countries between 1960 and 1990 (ten-years intervals) to study the relationship between property rights and economic growth. He found that economies that protect property rights grow faster than those that do not protect property rights.

Besley and Ghatak (2009) highlight that property rights are an essential component of the institutional structure of an economy as it influences the efficiency of resource allocation through promoting investment incentives by limiting expropriation risk, and facilitating market transactions which leads to facilitate trade in assets and credit transactions. The proxy used in this analysis is the property rights index that measures to

which degree laws protect private property rights in a country and to which degree the government of this country enforces those laws. The property rights index is collected from the Heritage Foundation database.

Since countries are at different stage of economic development, countries are categorized into four groups based on the World Bank's classifications (low, lower middle, upper middle, and high). Low income group represents countries with GNI per capita less than \$1025, whereas lower middle class signifies countries with GNI per capita between \$1025 and \$4035. Upper middle class presents countries with GNI per capita between \$4035 and \$12475, and high income class covers countries with GNI per capita more than \$12475. The GNI Income Group gives Low income group the value 1, lower middle income group the value 2, upper middle income group the value 3, and high income group the value 4.

$$Growth_{i,t} = Growth_{i,t-1} + FI_{i,t} + GE_{i,t} + GOW_{i,t} + T_{i,t} + R_{i,t} + PR_{i,t} + IG_{i,t}$$

Where

$Growth_{i,t}$ : real GDP growth for a country  $i$  at time  $t$ ,

$FI_{i,t}$ : financial inclusion index (or indicator) for a country  $i$  at time  $t$ ,

$GE_{i,t}$ : government expenditure as a percentage of GDP in a country  $i$  at time  $t$ ,

$GOW_{i,t}$ : growth rate of output per worker in a country  $i$  at time  $t$ ,

$T_{i,t}$ : trade as a percentage of GDP in a country  $i$  at time  $t$ ,

$R_{i,t}$ : real interest rate in a country  $i$  at time  $t$ ,

$PR_{i,t}$ : property rights level in a country  $i$  at time  $t$ ,

$IG_{i,t}$ : income classification of a country  $i$  at time  $t$  based on GNI per Capita (World-Bank's income Classification).

The descriptive summary of all variables is reported in Appendix 2.11. The pairwise correlation between these variable is also reported in Appendix 2.12. Since several papers highlight the bidirectional relationship between FI and economic growth, the two-step system-GMM dynamic panel estimator is applied. Four stationarity tests (Fisher type unit-root test for panel data using Dickey-Fuller with the first order lag) are selected to check if the dependent and independent variables are stationarity. These tests are the inverse chi-squared, inverse normal, inverse logit, modified inverse chi-squared. The result is shown in Appendix 2.13<sup>8</sup>. Sarma (2008) index and the DEA index made by

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<sup>8</sup> The results of stationary test for property rights index is not reported in the appendix because the Stata command applied to all variables give errors when it is applied on property rights. Therefore, another Stata commands are applied and the results show that property rights are stationary using Fisher type unit-root using augmented Dickey Fuller test and Phillips Perron test.

Sinha are non-stationary, hence the first difference (D1.) is taken to ensure that the index is stationary.

The endogenous instruments are the first lag of real GDP growth, FI, real interest rate and growth rate of output per worker. The exogenous instruments are government expenditures as a percentage of GDP, property rights index, trade as a percentage of GDP and Countries Classifications by GNI per Capita. The collapsed option was applied to make sure that the number of instruments do not exceed the number of countries in the panel (limit instrument proliferation). Note that all variables are winsorized to remove 5% extreme values and replaced them by the next value counting inwards from the extremes. Note that all models contain robust standard errors (heteroscedasticity-robust).

Table 2.6A reported the results of FI (measured by IFIs) relationship with real GDP growth. Surprisingly, only three indexes in Table 2.6A are consistent with the recent literature and show significantly positive effects on real GDP growth at 10% level, which are the index of Sarma (2012) and SP and the NI. An increase in the level of FI measured by Sarma (2012), SP and NI by 0.1 may enhance GDP growth by 0.37, 0.42 and 0.53, respectively. However, the rest of the indexes show an insignificant relationship, which raises the questions as to the reliability of these indexes and whether this is caused by the inconsistencies over time.

Furthermore, Table 2.6B reports the results of FI (measured by simple FI indicators from FAS) relationship with real GDP growth. The result in Table 2.6B shows that banks' outstanding loans as a percentage of GDP has positive relationship with real GDP growth at 10% level, which is consistent with the recent literature. However, the rest of the FI indicators have an insignificant relationship with real GDP growth.

The Hansen test of over-identifying restrictions and the Arellano-Bond test for second-order autocorrelation in the disturbances are used to check the robustness of the models in Tables 2.6A and 2.6B. The result of the Hansen test show that restrictions are not over-identified at the 1% level in all the models in Tables 2.6A and 2.6B. The Arellano-Bond test for second-order autocorrelation in the disturbances in Table 2.6A and 2.6B accept the null hypothesis of no autocorrelation in all the models at the 1% level.

**Table 2.6A: The Relationship between Financial Inclusion Indexes and Real Economic Growth**

Independent Variables		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Control Variables	First Lag of Real GDP Growth	0.405 ***	0.372 ***	0.363 **	0.374 **	0.265 *	0.418 **	0.535 ***	0.409 ***	0.429 ***
	Government Expenditure (%GDP)	-0.112 ***	-0.067	-0.112 **	-0.120 **	-0.105 **	-0.039	-0.040	-0.098	-0.096 **
	Growth Rate of Output per Worker	9.439 ***	7.667 ***	7.593 ***	7.733 ***	5.788 ***	12.626	6.668 ***	5.025 *	6.290 ***
	Trade (%GDP)	0.001	0.003	-0.002	-0.002	-0.006	0.005	0.002	0.006	0.002
	Real Interest Rate	-0.055 ***	-0.026 *	-0.040 *	-0.053 **	-0.073 ***	0.011	0.009	-0.011	-0.036 *
	Property Rights	0.005	0.002	-0.014	-0.010	-0.010	-0.003	-0.001	0.012	0.006
	World-Bank Countries' Income Classifications	-0.673 ***	-0.676	-1.223 ***	-1.195 ***	-1.292 **	0.070	-0.179	0.083	-1.492 **
Variables Under-study	D1. Sarma (2008)	-2.607								
	SA		0.423							
	SP			4.637 *						
	Sarma (2012)				3.688 *					
	CP					8.424				
	AMM						-56.946			
	D1. DEA Sinha (2013)							0.682		
	FDH Sinha (2013)								-2.946	
	NI									5.305 *
Constant		5.086 ***	4.334 ***	6.231 ***	6.088 ***	6.548 ***	2.320	2.316	2.590	4.183 ***
Observations		377	560	376	376	254	117	292	292	305
Number of Countries		84	122	85	85	68	31	63	63	75
Average Period		4.44	4.59	4.42	4.42	3.74	3.77	4.56	4.56	4.07
Number of instruments		31	32	32	32	28	32	32	32	32
F test		17.18 ***	17.6 ***	10.93 ***	11.6 ***	8.87 ***	7.11 ***	17.91 ***	12.67 ***	13.61 ***
Hansen Test of Over-Identifying Restrictions		21.87	26.44	23.39	23.96	12.36	22.43	27.75	30.71	19.21
Arellano-Bond Test for Second-Order Autocorrelation in the Disturbances		-0.59	-0.11	-0.85	-0.79	-1.1	1.24	0.05	-0.21	1.15

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

**Table 2.6B: The Relationship between Selected FAS Indicators and Real Economic Growth**

Independent Variables		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Control Variables	First Lag of Real GDP Growth	0.405 **	0.330 *	0.348 **	0.363 ***	0.495 ***	0.564 ***
	Government Expenditure (%GDP)	-0.057	-0.082	-0.071 **	-0.059	0.005	-0.030
	Growth Rate of Output per Worker	0.014	0.006	0.003	-0.005	0.003	0.003
	Trade (%GDP)	11.190 ***	9.021 ***	7.606 ***	9.567 ***	7.000 ***	7.489 ***
	Real Interest Rate	-0.005	0.011	-0.031 *	-0.052 ***	-0.034 **	-0.027 *
	Property Rights	0.011	0.000	0.007	-0.011	-0.010	0.000
	World-Bank Countries' Income Classifications	-0.332	-0.484	-0.710 **	-1.127 ***	-0.749 **	-0.689
Variables Under-study	Log of Depositors at ODCs per 1,000 Adults	-0.988					
	Log of Borrowers at ODCs per 1,000 Adults		0.109				
	Banks' Outstanding Deposits (%GDP)			-0.004			
	Banks' Outstanding Loans (%GDP)				0.034 *		
	Log of Branches of ODCs per 1,000 km2					0.740	
	Log of Branches of ODCs per 100,000 Adults						0.629
Constant		8.553	3.677	4.578 ***	4.979 ***	1.846	1.465
Observations		190	242	565	563	505	505
Number of Countries		51	59	122	122	117	117
Average Period		3.73	4.1	4.63	4.61	4.32	4.32
Number of instruments		32	32	32	32	32	32
F test		13.3 ***	7.14 ***	18.49 ***	13.42 ***	7.03 ***	15.39 ***
Hansen Test of Over-Identifying Restrictions		18.79	23.94	21.78	22.46	23.47	20.27
Arellano-Bond Test for Second-Order Autocorrelation in the Disturbances		0.82	0.72	-0.05	0.17	0.55	0.625

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively

Note that CT index rely on the FINDEX database which is has a limited number of observations and are not available on a yearly basis. Therefore, it is not included in the GMM dynamic estimator to test their relationship with GDP growth. Hence, fixed effects 2SLS with IV is applied. The IVs used for CT are the percentage of population saved at FFIs. Table 2.7 reports the results of the second stage of 2SLS. The results confirm that CT positively influence GDP growth, which is consistent with the literature. An increase in CT by 0.1 can boosts GDP growth by 0.524 at 10% level.

**Table 2.7: The Effect of Financial Inclusion on Real Economic Growth Using Two Stage Least Squares Fixed Effects Estimation (The Result of Second Stage Only)**

Independent Variables		Stage 2
Control Variables	Government Expenditure (%GDP)	-0.218 *
	Growth Rate of Output per Worker	14.582 ***
	Trade (%GDP)	0.052 **
	Real Interest Rate	-0.111 ***
	Property Rights	-0.008
	World-Bank Countries' Income Classifications	0.049
Variable Understudy	CT	5.236 ***
Observations		187
Number of Countries		76
Average Period (years)		2.5
F test		3.95 ***
Centered R2		0.244
Weak-instrument-robust inference Anderson-Rubin Wald test (chi-sq)		5.52 **
Under-identification test (Kleibergen-Paap rk LM statistic)		30.140 ***
Weak identification test (Cragg-Donald Wald F statistic)		52.258
Kleibergen-Paap rk Wald F statistic		50.059
Stock-Yogo weak ID test critical values:		
10% maximal IV size		16.38
15% maximal IV size		8.96

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

The weak instrument robust inference (the Anderson-Rubin Wald test) rejects the null hypothesis of the joint significance tests of endogenous regressors in the main equation at 1% level. The under-identification test (the Kleibergen-Paap rk LM statistic) is important to use since robust standard errors are used. The result of the under-identification test rejects the null hypothesis of under-identification at 1% level.

Furthermore, the weak identification tests (Cragg-Donald Wald F statistic and Kleibergen-Paap rk wald F statistic) are applied. The null hypothesis (the estimator is weakly identified) are rejected since the test result is above the critical values of the Stock-Yogo weak identification test in all models.

The effect of government as a percentage of GDP on real GDP growth appears to be negative in several models as also found by Caporale et al (2009), and Petkovski and Kjosevski (2014). Real interest rates are confirmed as having a negative relationship with real GDP growth in most of the models as discussed in the literature. The only variable that shows significantly positive effects on real GDP growth is the growth of output per worker, again consistent with the literature. However, property rights index collected from the Heritage Foundation shows insignificant effect on real GDP growth.

#### **2.4.4.2 Financial Inclusion and Income Inequality**

Providing SMEs and the poor with access to financial services supports them in generating income, building assets, smoothing consumption patterns and managing risks, which helps to reduce poverty and income inequality (Mirakhor and Iqbal, 2012). Clarke et al (2006) find a strong negative relationship between financial depth (claims on the private sector by financial institutions as a percentage of GDP) and inequality when they examine a panel data set of 91 countries for the period 1960-1995 after accounting for country characteristics and dealing with potential reverse causality issues. Additionally, financial depth is found to relate to the upturn in the income share of the poor across countries.

Similarly, Beck et al (2007) find that in the period between 1960 and 2005 financial development (using the same variables) boosted the incomes of the poorest quintile to grow faster than the average per capita GDP growth, which reduced income inequality. They also show that financial development is linked to poverty alleviation (the proportion of people living on less than \$ 1 a day), a result that holds even after controlling for average growth.

Furthermore, García-Herrero and Turégano (2015) empirically study the relationship between FI and inequality. They use four indexes out of the ten covered in the present paper: Sarma (2008), Sarma (2012), AMM and CT. In addition, they include simple

indicators, namely, the amount of credit given to SMEs as a percentage of GDP; credit to SMEs as a percentage of loans; and the percentage of adults with a formal bank account, as reported by both FINDEX and Honohan (2007). The analysis covers three single years (2000, 2004, and 2011). García-Herrero and Turégano (2015) show that FI helps to reduce income inequality after controlling for economic development (the natural log of GDP per capita and the squared natural log of GDP per capita) and government expenditure.

This section study whether all the FIs show similar or different relationships with income inequality. Again, the period covered in this analysis are between 2011 and 2017. In addition, selected simple FI indicators are included to see whether the FIs perform in a different manner to the simple indicators or not.

Income inequality is measured using the Gini coefficient, which estimates the level at which the income distribution among persons or households in an economy deviates from a complete equal distribution. The Gini index provides values between 0 and 100, where a value of 0 shows perfect equality and a value of 100 represents perfect inequality. Country level Gini coefficients are collected from the United Nation Development Program UNDP database. The link between income inequality and FI is investigated by running a fixed effects panel estimators. The select control variables are: government expenditure as a percentage of GDP; trade as a percentage of GDP; inflation rate; an index of representative government; and Countries Classifications by GNI per Capita.

Albanesi (2007) uses simple correlation, conditional correlation, and ordinary least squares for 51 developed and developing countries averaged over the period from 1966 to 1990. The author studies the relationship between inflation and inequality of income distribution. Albanesi (2007) finds that inflation has a positive relationship with inequality of income distribution because low income households are relatively more vulnerable to inflationary pressure. The dummy of countries' classifications by GNI per capita is also used in this analysis to control for the different stage of economic development.

Government expenditure usually plays a key part in the process of redistributing wealth within a country. Gregorio and Lee (2002) find that government expenditure as a



percentage of GDP can improve income equality using panel regressions for more than 100 countries between 1960 and 1990 (five-year intervals). García-Herrero and Turégano (2015) use the trade openness (trade over GDP) as a control variable to capture the impact of external developments in income distribution in their study of the effect of FI on income inequality. The authors include 75 countries for 3 single years (2000, 2004 and 2011) and estimate an ordinary least squares model. García-Herrero and Turégano (2015) find that trade openness has a significant negative relationship with inequality.

However, Altunbas and Thornton (2019) use government expenditure as a percentage of GDP and trade as a percentage of GDP in their study of the effect of financial development on income inequality, which covers 121 countries for the period between 1980 and 2015. Using a quantile regression approach, Altunbas and Thornton (2019) find both government spending and trade foster inequality with their influence increasing as incomes become more unequal.

An index of representative government was included as a proxy that gauges contested and inclusive general elections for legislative and directly (or indirectly) voted political executives. This index is provided by the International Institute for Democracy and Electoral Assistance. This index is used by Altunbas and Thornton (2019) in their study of the effect of financial development on income inequality and they found that more representative governments reduces income inequality, mainly at lower levels of income inequality.

$$Gini_{it} = FI_{i,t} + GE_{i,t} + trad_{i,t} + REPGOV_{i,t} + CPI_{i,t} + IG_{i,t}$$

where

$Gini_{i,t}$ : inequality of income distribution in country i at time t,

$FI_i$ : financial inclusion index (or indicator) for a country i at time t,

$GE_{i,t}$ : government expenditure as a percentage of GDP in a country i at time t,

$trad_{i,t}$ : trade as a percentage of GDP in a country i at time t.

$REPGOV_{i,t}$ : index of representative government to capture the impact of voter rights in a country i at time t,

$CPI_{i,t}$ : consumer price index that capture inflation rates in a country i at time t.

$IG_{i,t}$ : income classification of a country i at time t based on GNI per Capita (World-Bank's income Classification).

**Table 2.8A: The Relationship between Financial Inclusion Indexes and Income Inequality Using Fixed Effects**

Independent Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Government Expenditure (%GDP)	-0.165	-0.139	-0.158	-0.146	-0.214 *	-0.274	-0.322	-0.381 *	-0.186	-0.140
Trade (%GDP)	0.030	0.050 ***	0.025	0.024	0.047 **	-0.023	0.084 ***	0.077 ***	0.044 **	0.010
Index of Representative Government	-2.983	-3.125	-3.148	-3.142	-4.577	1.483	-0.494	-0.329	-4.201	-3.628
Inflation rate	0.037 **	0.049 ***	0.069 ***	0.044 **	0.064 **	0.040	0.004	0.013	0.067 ***	0.021
World-Bank Countries' Income Classifications	-1.549 *	-0.324	-1.115	-1.076	-1.319	-0.816 **	1.385	1.037	-0.751	-1.144
D1. Sarma (2008)	-12.204									
SA		-21.818 ***								
SP			-9.369 ***							
Sarma (2012)				-8.473 **						
CP					-18.296					
AMM						64.781 ***				
D1. DEA Sinha (2013)							-1.924 **			
FDH Sinha (2013)								-1.553 **		
CT									-2.212 ***	
NI										-12.449 ***
Constant	25.528 ***	21.918 ***	27.785 ***	28.059 ***	30.605 ***	27.630 ***	9.719 *	12.807 **	23.693 ***	33.952 ***
Observations	463	781	545	545	328	137	372	372	282	381
Number of Countries	95	133	95	95	72	31	74	74	124	77
Average Period (years)	4.9	5.9	5.7	5.7	4.6	4.4	5	5	2.3	4.9
F test	3.29 ***	7.13 ***	5.06 ***	5.07 ***	6.29 ***	3.46 ***	4.53 ***	6.28 ***	10.04 ***	5.25 ***
R-Squared within	0.096	0.116	0.146	0.151	0.180	0.241	0.127	0.141	0.237	0.156
R-Squared between	0.381	0.154	0.543	0.556	0.453	0.243	0.198	0.079	0.163	0.589
R-Squared Overall	0.344	0.125	0.526	0.539	0.429	0.297	0.176	0.059	0.112	0.591
Correlation ( $u_i, X_b$ )	0.389	0.134	0.447	0.467	0.287	0.377	-0.683	-0.533	0.113	0.372
rho	0.971	0.971	0.956	0.956	0.962	0.973	0.976	0.974	0.966	0.934

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

**Table 2.8B: The Relationship between Selected Financial Inclusion Indicators and Income Inequality Using Fixed Effects**

<b>Independent Variable</b>	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>	<b>Model 4</b>	<b>Model 5</b>	<b>Model 6</b>	<b>Model 9</b>	<b>Model 10</b>	<b>Model 11</b>
Government Expenditure (%GDP)	-0.307 **	-0.221	-0.116	-0.078	-0.149	-0.163	-0.222 *	-0.296 **	-0.296 **
Trade (%GDP)	0.001	0.089 ***	0.047 ***	0.044 ***	0.043 ***	0.045 ***	0.009	0.028	0.027
Index of Representative Government	-1.613	1.092	-3.241	-2.763	-2.594	-2.939	-2.957	-5.155	-4.688
Inflation rate	0.068 ***	0.031	0.016	0.039 ***	0.027 *	0.029 *	0.014	0.048 ***	0.049 ***
World-Bank Countries' Income Classifications	-0.183	0.299	-0.232	-0.063	-0.466	-0.478	-0.501	-1.032	-1.118
Log of Depositors at ODCs per 1,000 Adults	-3.009 **								
Log of Borrowers at ODCs per 1,000 Adults		-0.092							
Banks' Outstanding Deposits (%GDP)			-0.069 **						
Banks' Outstanding Loans (%GDP)				-0.070 ***					
Log of Number of Branches of ODCs per 1,000 km <sup>2</sup>					-2.045 **				
Log of Number of Branches of ODCs per 100,000 Adults						-2.064 **			
Account							-0.075 ***		
Saved								-0.039	
Borrowed									-0.100 **
Constant	47.951 ***	14.447 **	23.506 ***	22.269 ***	25.374 ***	27.100 ***	29.227 ***	27.921 ***	28.284 ***
Observations	238	296	791	789	668	668	328	328	328
Number of Countries	51	60	133	133	125	125	130	130	130
Average Period (years)	4.7	4.9	5.9	5.9	5.3	5.3	2.5	2.5	2.5
F test	4.38 ***	3.25 ***	5.69 ***	7.27 ***	8.62 **	9.18 ***	7.93 ***	3.25 ***	4.63 ***
R-Squared within	0.202	0.143	0.150	0.148	0.114	0.057	0.194	0.125	0.139
R-Squared between	0.499	0.124	0.143	0.188	0.223	0.244	0.508	0.353	0.411
R-Squared Overall	0.507	0.180	0.120	0.156	0.187	0.206	0.498	0.342	0.395
Correlation ( $u_i, Xb$ )	0.436	-0.643	0.087	0.153	0.037	0.151	0.439	0.320	0.401
rho	0.959	0.978	0.972	0.971	0.970	0.971	0.938	0.943	0.943

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

The descriptive statistics of the variables included in the analysis is reported in Appendix 2.11 and the pairwise correlation is reposted in Appendix 2.14. Note that the regressions contain the first difference of Sarma (2008) and DEA index, since it is non-stationary (Appendix 2.13). Robust standard errors are also applied in all regressions. The results are reported in Table 2.8A and 2.8B.

Table 2.8A indicates that most of the IFIs show that FI has a significant negative effect on income inequality as suggested in the literature. The only IFIs that show insignificant relationship with income inequality are those of Sarma (2008), and CP. Surprisingly, the index AMM show positive relationship with inequality, which raise the question about the reliability of their index. In addition, all the selected simple indicators of FI in Table 2.6B confirm a significant negative effect on income inequality, but the natural logarithm of borrowers at ODCs per 1,000 adults and the population saved at FFIs.

The average overall R-squared in Table 2.8A is 0.32 whereas the average overall R-squared in Table 2.8B is 0.288. The model that includes the NI explains the highest percentage of variation in income inequality (59.2%). The second highest model is that of Sarma's 2012 index, which explains (53.9%) of variation in income inequality. The F-test that jointly tests whether all individual effects  $u_i$  are zero is significant at 5% level in all regressions in Table 2.8A and 2.8B.

Trade openness and inflation show a significant positive effect on income inequality in half of the model included in the analysis. Whereas, government expenditures as a percentage of GDP shows a significant negative effect on inequality only in half of the models. However, the index of representative government show an insignificant relationship with income inequality in all the models.

Note that the GDP per capita growth or Kuznets curve are not used<sup>9</sup> because of the possible multicollinearity caused by the relationship between government expenditure and growth as well as the relationship between FI and growth. However, growth per capita is added in an additional analysis reported in appendix 2.15 and 2.16. The results of FI indicators and indexes generally remain the same. The only ones that changed is

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<sup>9</sup> A hypothesis suggested by Kuznet (1955) that explains market forces first increase the level of income inequality as an economy develops and then decrease the inequality level.

the coefficient of CP, which show significantly negative sign, and the coefficient of AMM that surprisingly positive relationship with inequality, which raise the question about the reliability of AMM index.

#### **2.4.4.3. Financial Inclusion and Human Development**

Access to financial services can have a positive influence on the lives of individuals (mainly the poor) because it can help to build wealth, leading to improvements in education, health and other features of human development. Sarma and Pais (2011) study the relationship between FI – using their index– and the UNDP’s Human Development Index based on data for 49 countries in 2004 and find a strong positive relationship. Raichoudhury (2016) examine the relationship between FI and human development across 107 countries in 2013. He uses the Sarma (2012) index as well as simple indicators from FAS to capture the level of FI. He finds that human development and FI move closely in step with each other.

This section investigates whether the IFIs have any link to human development (as one would expect). Moreover, to check whether the IFIs perform differently to simple indicators, a number of simple FI indicators are included in the analysis. Human development is measured using the Human Development Index (HDI) provided by UNDP database, which combines information about education, health and income. HDI gives country values over time between 0 and 1, with 0 presenting the lowest level of development and 1 the highest.

Note that a bidirectional relationship may exist between FI and human development because the HDI include information about the level of health, income and education that are correlated with FI. Therefore, a system-GMM dynamic panel estimator is applied to cope with the issue of bidirectional relationships. The control variables included are: government expenditure as a percentage of GDP; the percentage of urban population; World-Bank countries’ income classifications. The data covered in this analysis covers the period from 2011 to 2017.

Government expenditure plays a key role in human development through the improvement of health and education (Gupta et. al., 1998; Doryan, 2001). Additionally, the percentage of urban population is associated with human development (Revision of

World Urbanization Prospects, 2018). It is also expected that people who live in rural areas are less likely to be financially included as discussed in the literature (Leyshon and Thrift, 1993; World Bank Global Financial Inclusion report 2011). In addition, this analysis control for the different stage of economic development using a dummy that classify countries into four categories based on the GNI per capita.

Technological progress is also included as a control variable because, based on Solow (1956) and Swan (1956), technological progress increase efficiency leading to higher output per worker, which increase income per capita and consequently improves economic development. Note that through this channel technological progress enhances human development. To control for technological progress, the growth rate of output per worker is included (measured manually).

The data described earlier are available from the World Development Indicators (WDI) database from the World Bank. The data description is reported in Appendix 2.11 and the stationary tests are reported in Appendix 2.12. The pairwise correlation also reported in Appendix 2.17.

$$HDI_{i,t} = HDI_{i,t-1} + FI_{i,t} + GE_{i,t} + GOW_{i,t} + PUP_{i,t} + IG_{i,t}$$

where

$HDI_{i,t}$ : Human development index in country  $i$  at time  $t$ ,

$FI_{i,t}$ : financial inclusion index (or indicator) for a country  $i$  at time  $t$ ,

$GE_{i,t}$ : government expenditure as a percentage of GDP in a country  $i$  at time  $t$ ,

$GOW_{i,t}$ : growth rate of output per worker in a country  $i$  at time  $t$ ,

$PUP_{i,t}$ : percentage of urban population in a country  $i$  at time  $t$ ,

$IG_{i,t}$ : income classification of a country  $i$  at time  $t$  based on GNI per Capita (World-Bank's income Classification).

The endogenous instruments included in the two-step system GMM dynamic estimator are the first lag of HDI and FI (index / simple FI indicator). The exogenous instrument is government expenditure as a percentage of GDP, percentage of urban population, and growth rate of output per worker. The control variable is the dummy variable of countries' income groups. The collapsed option is applied to make sure that the number of instruments do not exceed the number of group in the panel. Robust standard errors are also used. The results for the system-GMM dynamic panel estimators are summarized in Table 2.9A and 2.9B.

**Table 2.9A: The Relationship between Financial Inclusion Indexes and the Human Development Index**

Independent Variable		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Control Variables	First Lag of HDI	0.879 ***	0.913 ***	0.897 ***	0.881 ***	0.887 ***	0.991 ***	0.960 ***	0.956 ***	0.789 ***
	Government Expenditure (%GDP)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Growth Rate of Output per Worker	0.004 *	0.002	0.004	0.003	0.005	0.005	-0.001	0.000	0.000
	Percentage of Urban Population	0.000 **	0.000 **	0.000 **	0.000 **	0.000 *	0.000	0.000	0.000	3E-4 ***
	World-Bank Countries' Income Classifications	0.012 ***	0.008 **	0.009 **	0.009 **	0.012 **	0.000	0.002	0.002	0.014 ***
Variables Under-study	D1. Sarma (2008)	-0.001								
	SA		0.007							
	SP			0.004						
	Sarma (2012)				0.016 *					
	CP					-0.032				
	AMM						0.061			
	DEA Sinha (2013)							-0.001		
	FDH Sinha (2013)								0.002	
	NI									0.031 *
Constant		0.049 ***	0.007 ***	0.043 ***	0.049 ***	0.024 ***	0.009	0.026 ***	0.029 ***	0.076 ***
Observations		591	861	592	592	351	177	865	462	436
Number of Countries		115	164	116	116	88	44	90	85	98
Average Period		5.14	5.25	5.1	5.1	3.99	4.02	9.61	5.44	4.45
Number of instruments		17	18	18	18	16	18	49	18	18
F test		10969.35 ***	24132.28 ***	11616.6 ***	10335.09 ***	4457.29 ***	28845.52 ***	32849.69 ***	22428.44 ***	9006.84 ***
Hansen Test of Over-Identifying Restrictions		9.43	19.64 *	16.09	13.72	6.87	17.97	18.88 **	13.93	15.16
Arellano-Bond Test for Second-Order Autocorrelation in the Disturbances		1.23	1.22	1.34	1.38	0.96	0.87	1.19	1.19	0.02

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

**Table 2.9B: The Relationship between FAS Indicators and the Human Development Index**

Independent Variable		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Control Variables	First Lag of HDI	0.973 ***	0.924 ***	0.890 ***	0.894 ***	0.906 ***	0.948 ***
	Government Expenditure (%GDP)	0.000	0.000	0.000	0.000	0.000	0.000 *
	Growth Rate of Output per Worker	0.007	0.002	0.003	0.002	0.001	0.001
	Percentage of Urban Population	0.000	0.000	0.000 ***	0.000 ***	0.000	0.000
	World-Bank Countries' Income Classifications	0.003	0.008 *	0.011 ***	0.010 ***	0.008 **	0.000
Variables Under-study	Log of Depositors at ODCs per 1,000 Adults	-0.001					
	Log of Borrowers at ODCs per 1,000 Adults		0.001				
	Banks' Outstanding Deposits (%GDP)			0.000			
	Banks' Outstanding Loans (%GDP)				0.000		
	Log of Number of Branches of ODCs per 1,000 km2					0.003	
	Log of Number of Branches of ODCs per 100,000 Adults						0.013 ***
Constant		0.021	0.032 **	0.046 ***	0.044 ***	0.035 ***	0.003 ***
Observations		271	338	872	870	752	752
Number of Countries		65	75	164	164	154	154
Average Period		4.17	4.51	5.32	5.3	4.88	4.88
Number of instruments		17	18	18	18	18	18
F test		2667.45 ***	8413.29 ***	16663.35 ***	16490.97 ***	2960.71 ***	21825.69 ***
Hansen Test of Over-Identifying Restrictions		12.4	22.81	15.92	15.25	17.16	7.75
Arellano-Bond Test for Second-Order Autocorrelation in the Disturbances		0.86	0.22	1.2	1.21	1.34	1.43



Table 2.9A reports the result of IFIs. Table 2.9A indicates that only five IFIs confirm that FI has a weak positive effect on human development. The indexes with positive effect on human development are Sarma's 2012 index and NI at 10% level. An increase in index of Sarma (2012) and NI by 0.1 leads to an increase in HDI by 0.002 and 0.003, respectively. The result of analysis of the simple FI indicators in Table 2.9B shows that only the natural logarithm of number of branches of ODCs per 100,000 adults at the 1% level. An increase by 10% in number of branches of ODCs per 100,000 adults by 1 boosts level of HDI by (0.001).

The results of the Hansen test show that restrictions are not over-identified in most models in Table 2.9A and 2.9B at the 5% level, but the change in DEA index made by Sinha. The second-order autocorrelation tests accept the null hypothesis of no autocorrelation in all the models in Table 2.9A and 9B at the 1% level.

Since CT index has a limited number of observations, 2SLS with an IV is applied to check the relationship with the HDI. Note that the IV used is exactly the same as in the 2SLS with IV for the relationship between FI and real GDP growth. Tables 2.10 summarizes the results of the second stage of the 2SLS. The results confirm that FI has a significantly positive effect on human development. An increase by 0.1 in CT improve HDI by (0.004).

The result of Anderson-Rubin Wald test rejects the null hypothesis of the joint significance tests of endogenous regressors in the main equations in both models at the 1% level. The test rejects the null hypothesis of under-identification at the 1% level. Furthermore, the weak identification tests show that the null of weak identification is rejected since the tests results are above the critical values of the Stock-Yogo weak identification test. The results of the Hansen test of over-identifying restrictions indicate that restrictions are not over-identified at the 1% level in both models.

**Tables 2.10: The Effect of Financial Inclusion on Human Development Using Two Stage Least Squares Fixed Effects Estimation (The Result of Second Stage Only)**

Independent Variable		Stage
Control Variables	Government Expenditure (%GDP)	0.001 **
	Growth Rate of Output per Worker	-0.014
	Percentage of Urban Population	0.000
	World-Bank Countries' Income Classifications	0.006 **
Variable Under-study	CT	0.043 ***
Observations		314
Number of Countries		122
Average Period (years)		2.6
F test		46.52 ***
Centered R2		0.634
Weak-instrument-robust inference Anderson-Rubin Wald test (chi-sq)		14.4 ***
Under-identification test (Kleibergen-Paap rk LM statistic)		31.501 ***
Weak identification test (Cragg-Donald Wald F statistic)		78.71
Kleibergen-Paap rk Wald F statistic		75.73
Stock-Yogo weak ID test critical values:		
10% maximal IV size		16.38
15% maximal IV size		8.96

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

## 2.5. Preferred Measure of Financial Inclusion

The first three consistency conditions indicate that IFIs should yield similar findings in terms of how they order countries according to the: levels of inclusion; rankings; and identification of the most and least financially included countries. The results show that all IFIs have positive skewness but different means and standard deviations. In general, IFIs are generally consistent in terms of rankings and identification of the highest and lowest financially included countries, as illustrated in Tables 2.2, 2.3 and 2.4.

However, examining the fourth consistency condition, which stipulates that IFIs should show reasonable stability over time, our analysis reveals that the indexes that use efficiency measures and those that include empirical maximum and minimum do seem to vary significantly over time and with sample size. The only indexes that do not have time consistency issues and do not vary noticeably with different sample size are the Sarma (2012) index and the NI.

The fifth consistency condition focuses on whether IFIs are consistent with other (simpler) FI measures. In fact, the pairwise correlation results comparing the IFIs and these simple indicators show significant positive relationships – so the indexes are generally consistent with the simple measures. The sixth consistency condition checks whether IFIs are consistent with various macroeconomic variables. Three macroeconomic variables are selected, namely, economic growth, income inequality and human development. The only indexes that are shown to have a positive effect on economic growth and human development as well as a negative effect on income inequality, as mentioned in the literature, are those of Sarma (2012) and NI.

Hence, the only IFIs that fit all the six consistency conditions suggested by Bauer et al (1998) are those of Sarma (2012) and NI. Based on these findings, the first hypothesis which assumes that IFIs yield similar inference about FI is rejected since only Sarma (2012) and NI pass the six consistency conditions suggested by Bauer et al (1998). The second hypothesis which assumes that IFIs perform better than indicators from FAS and FINDX database is accepted since the index of Sarma (2012) and NI interacts better with the macroeconomic conditions than the selected simple FI indicators.

Please not that though these two indexes are the most consistent measure of FI, NI in the long run is expected to perform better. This is because as technology improves financial institutions become more efficient and need lower number of branches. This will lead the number of branches in developed countries to fall in the long run, which is going to appear in the index of Sarma as if FI is declining. However, in the NI the decrease in the number of branches will be offset by the increase in number of mobile and internet broadband.

## **2.6. Conclusion**

FI is important because of the role of financial development in promoting economic growth, reducing inequality and promoting human development. FI helps to provide low-income segments of society and MSEs with access to an affordable range of quality financial products and services. Finding the appropriate measure of FI is therefore an important task for both policymakers and researchers.

The present paper focuses on studying ten IFIs to examine their comparability / consistency. These indexes are constructed for 183 countries over the period 2004 to 2017. Then, the six consistency conditions suggested by Bauer et al (1998) is applied to compare all the IFIs. The first three consistency conditions suggest that IFIs should be consistent with each other in terms of measuring levels of inclusion, rankings, and identification of the highest and lowest financially included countries. The results show that IFIs are generally consistent in terms of country rankings and identification of the highest and lowest financial included countries, as shown in Tables 2.2, 2.3 and 2.4.

The latter three consistency conditions check whether the IFIs are consistent: over time, with other (simpler) financial inclusion measures; and with economic conditions. IFIs are compared with selected simple FI indicators from the FINDEX and FAS database using pairwise correlation. The results show significant positive correlations. The indexes are then linked to various economic conditions – inequality, human development and economic growth – using the fixed effects and system-GMM dynamic panel estimator approach (2SLS with IVs for CT and NI). The only indexes that show a positive link (as expected) to economic growth and human development as well as a having a negative relationship with income inequality, are Sarma (2012) and NI.

Examining the consistency of IFIs over time reveals that the indexes that use efficiency measures and those that use empirical maximum and minimum do seem to vary significantly over time and with sample size. Inconsistency over time is a serious issue because it limits their usefulness to policymakers in making comparisons. The only indexes that are consistent over time and do not vary noticeably with different sample size are those of Sarma (2012) and the NI suggested in the present chapter.

The indexes fit the six consistency conditions suggested by Bauer et al (1998) are Sarma (2012) and NI. These IFIs also perform better than simple indicators selected from FAS and FINDEX database as they interact better with economic conditions. Since the results suggest that IFIs are different, then choosing a particular index can influence the interpretations of FI in a certain country. Therefore, policymakers are advised to use only the indexes that are generally consistent with the six conditions suggested by Bauer et al (1998).

Sarma' index (2012) covers more aspects of FI compared to the NI. Sarma's (2012) index also cover more years (from 2004 onward), takes into consideration demographic inclusion, and includes information about all entities (individuals and enterprises). NI also comprise most of its data from FAS. However, it includes variables that are more connected to FI than that of Srrama (2012) index, mainly number of depositors and borrowers as a percentage of adult population. In addition, it covers border variables about financial availability than that of Srrama (2012) index, namely access through mobile and internet. Note that Please note that index of Srrama (2012) covers information only about banks whereas NI covers information about ODCs.

Though these two indexes are the most consistent measure of FI, NI in the long run is expected to perform better. This is because as technology improves financial institutions become more efficient and need lower number of branches. This will lead the number of branches in developed countries to fall in the long run, which is going to appear in the index of Sarma as if FI is declining. However, in the NI the decrease in the number of branches will be offset by the increase in number of mobile and internet broadband.

Appendix 2.1: Descriptive Summary of the Number of Mobile Cellular Subscription and Fixed Broadband Subscription per 100 People

Variable	Period	Obs	Mean	Standard Deviation	Minimum	Maximum
Mobile Cellular Subscription per 100 people	2004-2017	2,180	89.675	40.701	7.521	152.335
Fixed Broadband Subscription per 100 people	2004-2017	2,075	9.559	11.128	0.008	33.108

Appendix 2.2: The Mean Value and Number of Observations for East and South East Asian Countries

N	Country		Sarma (2008)	SP	SA	CP	Sarma (2012)	DEA Sinha (2013)	FDH Sinha (2013)	AMM	CT	NI
1	Brunei Darussalam	Mean	0.155	0.555	0.098	0.328	0.636	.	.	0.021	.	0.824
		Obs.	10	10	14	5	10	0	0	10	0	9
2	Cambodia	Mean	0.052	0.102	0.063	0.123	0.125	.	.	.	0.256	0.220
		Obs.	10	10	12	9	10	0	0	0	3	9
3	China: Hong Kong	Mean	.	.	0.581	.	.	0.948	0.997	.	0.704	.
		Obs.	0	0	14	0	0	12	12	0	1	0
4	China: Macao	Mean	.	.	0.433	.	.	0.994	1	.	.	.
		Obs.	0	0	14	0	0	7	7	0	0	0
5	China	Mean	0.102	0.135	0.162	.	0.240	0.084	0.061	.	0.703	.
		Obs.	6	6	6	0	6	11	11	0	2	0
6	Indonesia	Mean	0.080	0.236	0.065	0.159	0.265	0.008	0.009	.	0.368	0.460
		Obs.	14	14	14	13	14	11	11	0	3	10
7	Japan	Mean	0.370	0.937	0.213	0.460	0.876	0.783	0.702	.	0.581	0.646
		Obs.	14	14	14	13	14	12	12	0	2	14
8	South Korea	Mean	0.269	0.856	0.148	.	0.851	0.371	0.368	.	0.586	.
		Obs.	14	13	14	0	13	12	12	0	2	0
9	Lao	Mean	0.057	0.169	0.050	0.143	0.206	.	.	.	0.412	.
		Obs.	5	5	9	3	5	0	0	0	3	0
10	Malaysia	Mean	0.212	0.617	0.189	0.393	0.712	0.085	0.119	.	0.435	0.595
		Obs.	14	14	14	13	14	12	12	0	3	14
11	Mongolia	Mean	0.153	0.387	0.124	0.278	0.466	.	.	0.001	0.510	0.585
		Obs.	13	9	13	1	9	0	0	4	2	9
12	Myanmar	Mean	0.015	0.061	0.013	0.067	0.081	.	.	0.001	0.454	0.208
		Obs.	6	6	14	5	6	0	0	0	3	3
13	Philippines	Mean	0.060	0.165	0.054	.	0.183	0.008	0.012	.	0.218	.
		Obs.	14	14	14	0	14	11	11	0	3	0
14	Singapore	Mean	.	.	0.241	.	.	0.582	0.778	.	0.753	.
		Obs.	0	0	14	0	0	12	12	0	2	0
15	Thailand	Mean	0.145	0.455	0.128	0.263	0.507	0.044	0.058	.	0.590	0.642
		Obs.	14	14	14	13	14	12	12	0	3	11
16	Timor-Leste	Mean	.	.	0.011	.	.	.	.	0.002	.	0.115
		Obs.	0	0	14	0	0	0	0	3	0	3
17	Vietnam	Mean	0.125	0.257	0.162	.	0.338	0.016	0.020	.	0.454	.
		Obs.	8	8	10	0	8	11	11	0	3	0

Appendix 2.3: The Mean Value and Number of Observations for Middle East, Central and South Asian Countries

N	Country		Sarma (2008)	SP	SA	CP	Sarma (2012)	DEA Sinha (2013)	FDH Sinha (2013)	AMM	CT	NI
1	Afghanistan	Mean	0.015	0.042	0.014	0.046	0.061	.	.	2-E4	0.188	0.087
		Obs.	8	8	14	7	8	0	0	10	3	9
2	Bangladesh	Mean	0.073	0.179	0.076	0.152	0.201	0.004	0.005	.	0.428	0.460
		Obs.	14	14	14	13	14	9	9	0	3	10
3	Bhutan	Mean	0.105	0.282	0.090	0.185	0.316	.	.	.	0.497	0.340
		Obs.	13	13	14	12	13	0	0	0	1	9
4	India	Mean	0.111	0.323	0.094	0.193	0.369	0.008	0.008	.	0.417	0.460
		Obs.	14	13	14	13	13	12	12	0	3	7
5	Iran	Mean	.	.	0.084	.	.	0.020	0.023	.	.	.
		Obs.	0	0	14	0	0	11	11	0	0	0
6	Iraq	Mean	.	.	0.018	.	.	.	.	.	0.235	.
		Obs.	0	0	12	0	0	0	0	0	3	0
7	Jordan	Mean	0.152	0.282	0.188	0.266	0.330	0.090	0.243	.	0.443	0.317
		Obs.	14	11	14	13	11	12	12	0	3	10
8	Kazakhstan	Mean	.	.	0.061	.	.	0.032	0.043	.	0.462	.
		Obs.	0	0	14	0	0	12	12	0	3	0
9	Kuwait	Mean	.	.	0.117	.	.	0.240	0.304	0.017	0.541	0.525
		Obs.	0	0	14	0	0	12	12	13	3	14
10	Kyrgyz Republic	Mean	.	.	0.028	.	.	.	.	.	0.332	.
		Obs.	0	0	14	0	0	0	0	0	3	0
11	Lebanon	Mean	0.236	0.452	0.273	0.404	0.549	0.266	0.379	0.033	0.564	0.481
		Obs.	13	13	14	12	13	12	12	13	3	12
12	Maldives	Mean	0.109	0.378	0.085	0.190	0.457	.	.	.	.	0.510
		Obs.	7	7	14	6	7	0	0	0	0	7
13	Nepal	Mean	0.085	0.213	0.083	0.160	0.247	.	.	.	0.362	0.313
		Obs.	6	6	14	5	6	0	0	0	3	5
14	Oman	Mean	0.110	0.344	0.082	.	0.389	0.106	0.109	.	0.255	.
		Obs.	8	8	8	0	8	7	7	0	1	0
15	Pakistan	Mean	0.050	0.113	0.052	0.105	0.125	0.003	0.004	0.004	0.320	0.167
		Obs.	14	14	14	13	14	12	12	12	3	13
16	Qatar	Mean	.	.	0.111	.	.	0.477	0.597	0.015	0.278	0.472
		Obs.	0	0	14	0	0	10	10	13	1	14
17	Saudi Arabia	Mean	0.096	0.314	0.083	0.211	0.357	0.080	0.090	0.003	0.451	0.433
		Obs.	9	9	14	7	9	12	12	13	3	14
18	Sri Lanka	Mean	.	.	0.080	.	.	0.015	0.018	.	0.452	.
		Obs.	0	0	12	0	0	10	10	0	2	0
19	Syria	Mean	.	.	0.094	.	.	.	.	0.004	0.214	0.142
		Obs.	0	0	4	0	0	0	0	5	1	5
20	Tajikistan	Mean	.	.	0.024	.	.	.	.	0.003	0.108	0.346
		Obs.	0	0	10	0	0	0	0	1	1	1
21	Turkey	Mean	0.177	0.597	0.085	.	0.663	0.042	0.046	0.018	0.405	0.764
		Obs.	13	13	13	0	13	12	12	13	3	13
22	United Arab Emirates	Mean	0.151	0.388	0.160	.	0.446	0.293	0.376	.	0.519	0.598
		Obs.	9	9	14	0	9	11	11	0	3	3
23	Uzbekistan	Mean	0.101	0.262	0.071	0.153	0.302	.	.	.	0.369	.
		Obs.	14	14	14	11	14	0	0	0	3	0
24	Palestine	Mean	0.074	0.265	0.032	.	0.334	.	.	0.017	0.430	0.329
		Obs.	10	9	14	0	9	0	0	8	3	6
25	Yemen	Mean	0.017	0.042	0.022	.	0.055	.	.	.	0.279	.
		Obs.	6	6	12	0	6	0	0	0	2	0



### Appendix 2.4A: The Mean Value and Number of Observations for African Countries

N	Country		Sarma (2008)	SP	SA	CP	Sarma (2012)	DEA Sinha (2013)	FDH Sinha (2013)	AMM	CT	NI
1	Algeria	Mean	0.068	0.184	0.063	0.144	0.211	0.018	0.025	.	0.425	0.393
		Obs.	14	14	14	12	14	12	12	0	3	14
2	Angola	Mean	.	.	0.051	.	.	0.016	0.019	.	0.233	.
		Obs.	0	0	14	0	0	9	9	0	2	0
3	Benin	Mean	.	.	0.044	.	.	.	.	.	0.248	.
		Obs.	0	0	14	0	0	0	0	0	3	0
4	Botswana	Mean	0.068	0.229	0.054	0.166	0.275	0.126	0.167	.	0.361	.
		Obs.	6	6	14	5	6	1	1	0	3	0
5	Burkina Faso	Mean	0.034	0.076	0.040	.	0.108	.	.	.	0.323	.
		Obs.	1	1	14	0	1	0	0	0	3	0
6	Burundi	Mean	0.019	0.028	0.028	0.075	0.039	.	.	0.003	0.266	0.094
		Obs.	12	12	13	11	12	0	0	7	2	8
7	Cameroon	Mean	0.016	0.029	0.023	0.054	0.037	.	.	.	0.236	0.081
		Obs.	11	11	11	11	11	0	0	0	2	1
8	Cabo Verde	Mean	.	.	0.142	.	.	.	.	0.014	.	.
		Obs.	0	0	14	0	0	0	0	12	0	0
9	Central African Republic	Mean	0.007	0.013	0.012	0.036	0.026	.	.	0.000	0.107	0.037
		Obs.	13	13	14	11	13	0	0	4	2	3
10	Chad	Mean	0.004	0.007	0.007	0.037	0.027	.	.	.	0.237	0.040
		Obs.	5	5	14	4	5	0	0	0	3	4
11	Comoros	Mean	0.014	0.036	0.016	0.055	0.052	.	.	0.011	0.192	0.299
		Obs.	8	8	14	6	8	0	0	7	1	7
12	Congo, Democratic Republic	Mean	0.006	0.010	0.006	0.033	0.020	.	.	.	0.190	0.048
		Obs.	6	6	11	5	6	0	0	0	2	2
13	Congo, Republic	Mean	0.014	0.031	0.016	.	0.039	.	.	0.000	0.254	0.182
		Obs.	12	12	12	0	12	0	0	2	2	1
14	Cote d'Ivoire	Mean	.	.	0.035	.	.	.	.	.	0.420	.
		Obs.	0	0	14	0	0	0	0	0	1	0
15	Djibouti	Mean	0.060	0.099	0.079	.	0.131	.	.	0.001	0.120	0.081
		Obs.	10	10	14	0	10	0	0	9	1	9
16	Egypt	Mean	0.075	0.159	0.102	0.144	0.181	0.013	0.016	0.004	0.301	0.206
		Obs.	10	10	12	5	10	10	10	5	2	10
17	Equatorial Guinea	Mean	0.015	0.044	0.012	0.070	0.055	.	.	0.001	.	0.075
		Obs.	12	12	12	6	12	0	0	3	0	11
18	Eswatini	Mean	0.045	0.160	0.035	0.108	0.196	.	.	0.004	0.155	0.319
		Obs.	7	7	14	6	7	0	0	12	1	9
19	Ethiopia	Mean	.	.	0.038	.	.	.	.	0.001	.	0.078
		Obs.	0	0	9	0	0	0	0	6	0	6
20	Gabon	Mean	0.026	0.068	0.025	0.090	0.076	.	.	0.001	0.130	0.129
		Obs.	9	9	9	9	9	0	0	6	1	9
21	Gambia, The	Mean	0.048	.	0.045	0.107	.	.	.	.	.	.
		Obs.	14	0	14	12	0	0	0	0	0	0
22	Ghana	Mean	0.044	0.144	0.037	.	0.174	.	.	0.005	0.379	0.227
		Obs.	13	10	14	0	10	0	0	1	3	1
23	Guinea	Mean	0.006	0.015	0.007	0.037	0.026	.	.	0.001	0.227	0.097
		Obs.	14	14	14	12	14	0	0	10	3	7
24	Guinea-Bissau	Mean	.	.	0.016	.	.	.	.	.	.	.
		Obs.	0	0	14	0	0	0	0	0	0	0
25	Kenya	Mean	0.060	0.180	0.048	0.150	0.220	0.007	0.016	.	0.374	0.327
		Obs.	14	14	14	6	14	11	11	0	3	10
26	Lesotho	Mean	0.038	0.113	0.029	0.098	0.133	.	.	.	0.218	0.155
		Obs.	9	9	13	7	9	0	0	0	2	4

**Appendix 2.4B: The Mean Value and Number of Observations for African Countries**

N	Country		Sarma (2008)	SP	SA	CP	Sarma (2012)	DEA Sinha (2013)	FDH Sinha (2013)	AMM	CT	NI
27	Liberia	Mean	0.011	0.040	0.003	0.018	0.057	.	.	.	0.095	0.083
		Obs.	7	7	7	7	7	0	0	0	1	6
28	Libya	Mean	.	.	0.064	.	.	.	.	0.001	0.390	0.373
		Obs.	0	0	9	0	0	0	0	7	1	4
29	Madagascar	Mean	0.015	0.028	0.020	0.052	0.040	.	.	.	0.164	0.117
		Obs.	14	14	14	12	14	0	0	0	3	10
30	Malawi	Mean	0.028	0.082	0.022	0.089	0.100	.	.	.	0.262	0.150
		Obs.	4	4	11	4	4	0	0	0	2	4
31	Mali	Mean	.	.	0.038	.	.	.	.	.	0.296	.
		Obs.	0	0	14	0	0	0	0	0	3	0
32	Mauritania	Mean	0.028	0.063	0.031	0.110	0.076	.	.	.	0.308	0.187
		Obs.	8	6	8	2	6	0	0	0	3	2
33	Mauritius	Mean	0.230	0.654	0.191	0.353	0.734	0.731	0.860	.	0.586	0.619
		Obs.	14	14	14	6	14	8	8	0	3	2
34	Morocco	Mean	0.129	0.281	0.145	0.260	0.307	0.028	0.033	.	0.582	0.474
		Obs.	14	14	14	2	14	12	12	0	1	3
35	Mozambique	Mean	0.036	0.078	0.041	.	0.093	.	.	.	0.295	0.101
		Obs.	13	13	14	0	13	0	0	0	2	12
36	Namibia	Mean	0.097	0.281	0.095	0.194	0.313	0.247	0.494	0.001	0.463	0.525
		Obs.	13	11	13	13	11	10	10	4	1	11
37	Niger	Mean	.	.	0.020	.	.	.	.	.	0.172	.
		Obs.	0	0	13	0	0	0	0	0	3	0
38	Nigeria	Mean	.	.	0.024	.	.	0.003	0.004	.	0.373	.
		Obs.	0	0	13	0	0	11	11	0	3	0
39	Rwanda	Mean	0.024	0.062	0.024	0.061	0.076	.	.	0.007	0.450	0.269
		Obs.	14	14	14	12	14	0	0	10	3	10
40	Sao Tome and Principe	Mean	0.105	0.325	0.079	0.189	0.363	.	.	0.006	.	0.411
		Obs.	9	6	9	3	6	0	0	5	0	5
41	Senegal	Mean	.	.	0.056	.	.	.	.	.	0.277	.
		Obs.	0	0	14	0	0	0	0	0	3	0
42	Seychelles	Mean	0.191	0.563	0.121	0.240	0.638	.	.	.	.	0.592
		Obs.	14	14	14	12	14	0	0	0	0	14
43	Sierra Leone	Mean	.	.	0.016	.	.	.	.	.	0.077	.
		Obs.	0	0	9	0	0	0	0	0	1	0
44	South Africa	Mean	0.113	0.344	0.106	0.241	0.389	0.142	0.157	0.000	0.397	0.575
		Obs.	14	14	14	6	14	12	12	6	3	7
45	South Sudan	Mean	0.013	0.024	.	.	0.043	.	.	.	.	0.034
		Obs.	6	6	0	0	6	0	0	0	0	6
46	Sudan	Mean	.	.	0.011	.	.	.	.	.	0.277	.
		Obs.	0	0	1	0	0	0	0	0	2	0
47	Tanzania	Mean	0.025	0.069	0.026	0.069	0.083	.	.	0.001	0.212	0.130
		Obs.	10	8	10	10	8	0	0	8	2	8
48	Togo	Mean	.	.	0.058	.	.	.	.	.	0.226	.
		Obs.	0	0	14	0	0	0	0	0	2	0
49	Tunisia	Mean	.	.	0.119	.	.	0.034	0.068	.	0.495	.
		Obs.	0	0	13	0	0	11	11	0	1	0
50	Uganda	Mean	0.021	0.055	0.021	0.068	0.070	.	.	0.001	0.267	0.132
		Obs.	14	14	14	6	14	0	0	4	3	9
51	Zambia	Mean	0.025	0.072	0.024	0.077	0.090	.	.	.	0.313	0.145
		Obs.	8	8	14	7	8	0	0	0	3	7
52	Zimbabwe	Mean	0.030	0.068	0.031	.	0.082	.	.	.	0.304	0.263
		Obs.	9	9	9	0	9	0	0	0	3	2

**Appendix 2.5: The Mean Value and Number of Observations for Australasian Countries**

N	Country		Sarma (2008)	SP	SA	CP	Sarma (2012)	DEA Sinha (2013)	FDH Sinha (2013)	AMM	CT	NI
1	Australia	Mean	.	.	0.191	.	.	0.507	0.549	.	0.576	.
		Obs.	0	0	14	0	0	12	12	0	2	0
2	Fiji	Mean	0.112	0.343	0.094	0.191	0.386	.	.	.	.	0.418
		Obs.	14	14	14	13	14	0	0	0	0	13
3	Kiribati	Mean	0.030	0.081	0.027	0.076	0.091	.	.	0.004	.	0.096
		Obs.	3	3	3	3	3	0	0	3	0	3
4	Marshall Islands	Mean	.	.	0.099	.	.	.	.	.	.	.
		Obs.	0	0	12	0	0	0	0	0	0	0
5	Micronesia	Mean	0.077	0.187	0.068	.	0.201	.	.	.	.	0.177
		Obs.	14	14	14	0	14	0	0	0	0	9
6	New Zealand	Mean	.	.	0.227	.	.	0.439	0.598	.	0.458	.
		Obs.	0	0	14	0	0	12	12	0	2	0
7	Samoa	Mean	0.116	0.338	0.092	0.191	0.376	.	.	0.004	.	0.498
		Obs.	14	14	14	13	14	0	0	3	0	3
8	Solomon Islands	Mean	0.043	0.116	0.040	0.110	0.134	.	.	0.001	.	0.149
		Obs.	14	14	14	8	14	0	0	5	0	13
9	Tonga	Mean	0.105	0.284	0.095	0.175	0.309	.	.	0.004	.	363
		Obs.	11	11	14	10	11	0	0	2	0	10
10	Vanuatu	Mean	0.120	0.328	0.137	0.218	0.349	.	.	0.001	.	0.359
		Obs.	2	2	12	1	2	0	0	2	0	2

**Appendix 2.6: The Mean Value and Number of Observations for South America**

N	Country		Sarma (2008)	SP	SA	CP	Sarma (2012)	DEA Sinha (2013)	FDH Sinha (2013)	AMM	CT	NI
1	Argentina	Mean	0.079	0.301	0.032	0.159	0.370	0.043	0.049	0.004	0.347	0.515
		Obs.	14	14	14	13	14	12	12	13	3	14
2	Bolivia	Mean	0.056	0.149	0.061	0.125	0.162	.	.	.	0.346	0.397
		Obs.	13	10	13	8	10	0	0	0	3	9
3	Brazil	Mean	0.103	0.338	0.074	0.264	0.371	0.047	0.046	.	0.417	0.557
		Obs.	9	9	13	7	9	12	12	0	3	7
4	Chile	Mean	0.168	0.577	0.114	0.328	0.651	0.090	0.123	.	0.364	0.630
		Obs.	14	14	14	13	14	12	12	0	3	14
5	Colombia	Mean	0.111	0.384	0.064	0.218	0.451	0.023	0.031	0.007	0.341	0.568
		Obs.	10	10	10	9	10	12	12	9	3	10
6	Ecuador	Mean	0.062	0.201	0.045	0.149	0.230	0.018	0.019	0.011	0.346	0.475
		Obs.	13	13	14	12	13	11	11	8	3	8
7	Guyana	Mean	0.082	0.262	0.055	0.136	0.308	.	.	.	.	0.343
		Obs.	14	14	14	13	14	0	0	0	0	12
8	Paraguay	Mean	0.044	0.115	0.052	.	0.131	.	.	0.002	0.350	0.270
		Obs.	13	9	14	0	9	0	0	8	2	8
9	Peru	Mean	0.072	0.255	0.047	0.146	0.302	0.017	0.021	.	0.274	0.586
		Obs.	14	14	14	13	14	12	12	0	3	10
10	Suriname	Mean	0.120	0.427	0.064	0.224	0.523	.	.	5-E4	.	0.606
		Obs.	3	3	14	2	3	0	0	2	0	2
11	Trinidad and Tobago	Mean	0.119	0.433	0.071	0.268	0.513	0.332	0.602	.	0.458	0.635
		Obs.	14	10	14	12	10	12	12	0	2	10
12	Uruguay	Mean	.	.	0.062	.	.	0.070	0.179	0.005	0.454	0.623
		Obs.	0	0	14	0	0	11	11	9	3	9
13	Venezuela	Mean	.	.	0.057	.	.	0.059	0.077	.	0.385	0.563
		Obs.	0	0	9	0	0	8	8	0	2	11

**Appendix 2.7: The Mean Value and Number of Observations for North and Central American Countries**

N	Country		Sarma (2008)	SP	SA	CP	Sarma (2012)	DEA Sinha (2013)	FDH Sinha (2013)	AMM	CT	NI
1	Antigua and Barbuda	Mean	.	.	0.126	.	.	.	.	.	.	.
		Obs.	0	0	9	0	0	0	0	0	0	0
2	Aruba	Mean	.	.	0.128	.	.	.	.	.	.	.
		Obs.	0	0	1	0	0	0	0	0	0	0
3	Bahamas	Mean	0.171	0.520	0.130	0.346	0.576	1	1	.	.	0.724
		Obs.	11	11	11	10	11	8	8	0	0	11
4	Barbados	Mean	.	.	0.144	.	.	.	.	.	.	.
		Obs.	0	0	11	0	0	0	0	0	0	0
5	Belize	Mean	0.120	0.322	0.130	0.240	0.351	.	.	0.001	0.495	0.535
		Obs.	7	7	14	5	7	0	0	4	1	6
6	Canada	Mean	.	.	0.139	.	.	0.460	0.454	.	0.533	.
		Obs.	0	0	12	0	0	12	12	0	2	0
7	Costa Rica	Mean	0.128	0.411	0.091	0.260	0.459	0.062	0.122	.	0.473	0.602
		Obs.	14	14	14	10	14	12	12	0	3	12
8	Dominica	Mean	.	.	0.122	.	.	.	.	.	.	.
		Obs.	0	0	14	0	0	0	0	0	0	0
9	Dominican Republic	Mean	0.065	0.229	0.041	0.146	0.277	0.018	0.030	0.015	0.453	0.529
		Obs.	6	6	14	5	6	12	12	7	3	7
10	El Salvador	Mean	0.088	0.270	0.070	0.217	0.305	0.034	0.041	.	0.328	0.481
		Obs.	9	9	9	5	9	2	2	0	3	4
11	Grenada	Mean	.	.	0.158	.	.	.	.	.	.	.
		Obs.	0	0	14	0	0	0	0	0	0	0
12	Guatemala	Mean	0.120	0.405	0.077	0.201	0.463	0.013	0.024	.	0.291	0.514
		Obs.	14	10	14	13	10	7	7	0	3	8
13	Haiti	Mean	0.041	0.090	0.039	0.083	0.116	.	.	0.001	0.435	0.135
		Obs.	13	3	13	12	3	0	0	2	2	2
14	Honduras	Mean	0.103	0.271	0.093	0.194	0.293	.	.	.	0.277	0.390
		Obs.	14	14	14	13	14	0	0	0	3	8
15	Jamaica	Mean	0.085	0.300	0.051	0.157	0.361	0.124	0.292	.	0.363	0.516
		Obs.	14	14	14	12	14	11	11	0	2	14
16	Mexico	Mean	0.072	0.257	0.041	.	0.301	0.026	0.026	.	0.282	.
		Obs.	14	14	14	0	14	12	12	0	3	0
17	Nicaragua	Mean	0.048	0.112	0.053	0.136	0.123	.	.	.	0.265	0.248
		Obs.	14	14	14	9	14	0	0	0	3	10
18	Panama	Mean	0.195	0.428	0.222	0.363	0.508	0.195	0.325	.	0.320	0.559
		Obs.	11	11	11	9	11	11	11	0	3	11
19	St. Kitts and Nevis	Mean	.	.	0.182	.	.	.	.	.	.	.
		Obs.	0	0	14	0	0	0	0	0	0	0
20	St. Lucia	Mean	.	.	0.148	.	.	.	.	.	.	.
		Obs.	0	0	14	0	0	0	0	0	0	0
21	St. Vincent and the Grenadines	Mean	.	.	0.100	.	.	.	.	.	.	.
		Obs.	0	0	9	0	0	0	0	0	0	0
22	United States	Mean	.	.	0.117	.	.	1	0.707	.	.	.
		Obs.	0	0	14	0	0	12	12	0	0	0

### Appendix 2.8: The Mean Value and Number of Observations for Eastern European Countries

N	Country		Sarma (2008)	SP	SA	CP	Sarma (2012)	DEA Sinha (2013)	FDH Sinha (2013)	AMM	CT	NI
1	Albania	Mean	0.141	0.442	0.093	0.228	0.542	.	.	0.004	0.352	0.558
		Obs.	2	2	14	1	2	0	0	2	3	2
2	Armenia	Mean	0.082	0.263	0.053	0.178	0.301	.	.	.	0.421	0.507
		Obs.	14	14	14	8	14	0	0	0	3	9
3	Azerbaijan	Mean	0.077	0.282	0.038	.	0.340	.	.	0.008	0.300	0.283
		Obs.	7	7	12	0	7	0	0	10	2	9
4	Belarus	Mean	.	.	0.054	.	.	0.031	0.032	.	0.468	.
		Obs.	0	0	14	0	0	2	2	0	3	0
5	Bosnia and Herzegovina	Mean	0.128	0.355	0.109	0.243	0.386	.	.	.	0.480	0.519
		Obs.	13	12	13	2	12	0	0	0	3	11
6	Bulgaria	Mean	0.234	0.615	0.167	0.317	0.709	0.056	0.095	.	0.464	0.687
		Obs.	13	13	14	12	13	12	12	0	3	13
7	Croatia	Mean	0.149	0.404	0.139	.	0.461	0.105	0.147	.	0.644	.
		Obs.	8	8	14	0	8	11	11	0	3	0
8	Cyprus	Mean	.	.	0.296	.	.	0.935	0.989	.	0.538	.
		Obs.	0	0	13	0	0	10	10	0	3	0
9	Czech	Mean	0.158	0.515	0.104	.	0.576	0.121	0.158	.	0.556	.
		Obs.	14	14	14	0	14	12	12	0	3	0
10	Estonia	Mean	0.195	0.626	0.127	0.343	0.725	.	.	0.012	0.422	0.754
		Obs.	13	7	14	11	7	0	0	10	2	10
11	Finland	Mean	0.132	0.487	0.078	.	0.612	0.750	0.911	.	0.344	.
		Obs.	7	7	14	0	7	12	12	0	2	0
12	Georgia	Mean	0.105	0.336	0.069	0.197	0.383	.	.	.	0.422	.
		Obs.	14	14	14	13	14	0	0	0	3	0
13	Greece	Mean	0.282	0.844	0.183	0.446	0.822	0.207	0.273	.	0.511	0.742
		Obs.	8	8	14	5	8	12	12	0	3	8
14	Hungary	Mean	0.106	0.335	0.084	0.259	0.374	0.083	0.110	.	0.443	0.745
		Obs.	14	14	14	8	14	12	12	0	3	10
15	Kosovo	Mean	0.108	0.339	0.076	.	0.379	.	.	.	0.387	.
		Obs.	14	13	14	0	13	0	0	0	3	0
16	Latvia	Mean	0.182	0.611	0.121	0.337	0.681	0.121	0.157	0.011	0.287	0.687
		Obs.	14	14	14	9	14	3	3	10	1	10
17	Lithuania	Mean	.	.	0.092	.	.	0.063	0.118	.	0.486	.
		Obs.	0	0	14	0	0	4	4	0	3	0
18	Montenegro	Mean	0.180	0.535	0.119	0.262	0.600	.	.	.	0.502	0.629
		Obs.	11	11	14	2	11	0	0	0	3	11
19	Moldova	Mean	0.141	0.426	0.093	0.192	0.477	.	.	.	0.363	.
		Obs.	14	14	14	6	14	0	0	0	3	0
20	North Macedonia	Mean	0.163	0.560	0.091	0.288	0.638	.	.	.	0.477	0.619
		Obs.	11	11	14	8	11	0	0	0	3	11
21	Poland	Mean	0.175	0.602	0.097	0.293	0.674	0.065	0.077	0.032	0.400	0.753
		Obs.	7	5	14	6	5	12	12	8	2	8
22	Romania	Mean	.	.	0.082	.	.	0.029	0.042	.	0.441	.
		Obs.	0	0	10	0	0	12	12	0	3	0
23	Russia	Mean	.	.	0.088	.	.	0.038	0.039	.	0.482	.
		Obs.	0	0	14	0	0	12	12	0	3	0
24	Serbia	Mean	.	.	0.098	.	.	0.042	0.087	.	0.485	.
		Obs.	0	0	14	0	0	12	12	0	3	0
25	Slovak	Mean	.	.	0.094	.	.	0.096	0.103	.	0.511	.
		Obs.	0	0	14	0	0	9	9	0	3	0
26	Slovenia	Mean	.	.	0.141	.	.	0.301	0.846	.	0.399	.
		Obs.	0	0	14	0	0	11	11	0	2	0
27	Ukraine	Mean	0.183	0.594	0.079	.	0.704	0.018	0.024	.	0.373	.
		Obs.	13	13	14	0	13	12	12	0	3	0

### Appendix 2.9: The Mean Value and Number of Observations for Western European Countries

N	Country		Sarma (2008)	SP	SA	CP	Sarma (2012)	DEA Sinha (2013)	FDH Sinha (2013)	AMM	CT	NI
1	Austria	Mean	0.106	0.405	0.065	.	0.466	0.398	0.475	.	0.542	.
		Obs.	14	14	14	0	14	12	12	0	2	0
2	Belgium	Mean	0.247	0.728	0.141	0.428	0.771	0.490	0.572	.	0.543	0.784
		Obs.	10	10	10	9	10	12	12	0	2	10
3	Denmark	Mean	.	.	0.130	.	.	0.869	0.998	.	0.534	.
		Obs.	0	0	14	0	0	12	12	0	2	0
4	France	Mean	.	.	0.094	.	.	0.556	0.541	.	0.567	.
		Obs.	0	0	14	0	0	12	12	0	2	0
5	Germany	Mean	.	.	0.055	.	.	0.418	0.392	.	0.483	.
		Obs.	0	0	14	0	0	12	12	0	2	0
6	Iceland	Mean	0.299	0.779	0.238	.	0.803	1	1	.	.	0.944
		Obs.	2	2	14	0	2	3	3	0	0	2
7	Ireland	Mean	0.220	0.669	0.197	.	0.738	0.872	0.991	.	0.507	.
		Obs.	14	14	14	0	14	12	12	0	2	0
8	Italy	Mean	0.162	0.318	0.168	0.318	0.392	0.367	0.363	0.033	0.442	0.707
		Obs.	14	14	14	13	14	12	12	7	2	14
9	Luxembourg	Mean	.	.	0.243	.	.	1	1	.	0.553	.
		Obs.	0	0	14	0	0	11	11	0	2	0
10	Malta	Mean	0.325	0.874	0.257	.	0.855	0.726	0.735	.	0.544	0.642
		Obs.	14	14	14	0	14	10	10	0	2	14
32	Norway	Mean	0.127	0.377	0.118	.	0.420	0.913	0.949	.	.	.
		Obs.	13	13	13	0	13	11	11	0	0	0
11	Netherlands	Mean	0.199	0.559	0.204	0.385	0.621	0.932	0.931	.	0.565	0.714
		Obs.	13	13	14	12	13	12	12	0	2	6
12	Portugal	Mean	0.277	0.794	0.244	0.434	0.883	0.294	0.403	.	0.450	0.790
		Obs.	11	11	14	8	11	12	12	0	2	9
13	San Marino	Mean	0.543	0.857	0.539	.	0.999	.	.	0.116	.	0.873
		Obs.	14	5	14	0	5	0	0	5	0	5
16	Spain	Mean	0.313	0.676	0.274	0.441	0.827	0.289	0.353	.	0.444	0.797
		Obs.	14	14	14	13	14	12	12	0	2	14
42	Sweden	Mean	0.227	0.665	0.099	.	0.729	0.561	0.669	.	0.572	.
		Obs.	8	8	14	0	8	12	12	0	2	0
17	Switzerland	Mean	0.348	0.940	0.318	.	0.945	0.973	0.982	.	0.553	.
		Obs.	14	14	14	0	14	12	12	0	1	0
18	United Kingdom	Mean	.	.	0.287	.	.	0.721	0.694	.	0.306	.
		Obs.	0	0	10	0	0	12	12	0	1	0

**Appendix 2.10: The number of Countries shared between Indexes of Financial Inclusion**

	Sarma (2008)	SP	SA	Sarma (2012)	CP	AMM	DEA Sinha (2013)	FDH Sinha (2013)	CT	NI
Sarma (2008)	126									
SP	125	125								
SA	126	125	183							
Sarma (2012)	125	125	125	125						
CP	95	94	95	94	95					
AMM	46	46	55	46	38	55				
DEA Sinha (2013)	61	61	91	61	42	17	91			
FDH Sinha (2013)	61	61	91	61	42	17	91	91		
CT	103	103	142	103	72	38	79	79	143	
NI	102	102	109	102	88	51	45	45	91	115

**Appendix 2.11: Descriptive summary of Variables included in Section 2.4.4 (2011 to 2017)**

	Obs.	Mean	Median	Standards Deviation	Minimum	Maximum	Kurtosis	Skewness
Sarma (2008)	817	0.114	0.106	0.075	0.012	0.303	2.995	0.736
SA	1,184	0.087	0.075	0.060	0.014	0.273	4.271	1.221
SP	798	0.342	0.324	0.223	0.027	0.819	2.288	0.422
Sarma (2012)	798	0.394	0.381	0.242	0.037	0.848	1.962	0.241
CP	462	0.200	0.187	0.104	0.044	0.424	2.414	0.474
AMM	251	0.009	0.004	0.011	0.000	0.040	5.046	1.730
DEA Sinha (2013)	566	0.288	0.105	0.330	0.007	1.000	2.915	1.124
FDH Sinha (2013)	566	0.331	0.154	0.351	0.008	1.000	2.327	0.896
CT	355	0.391	0.390	0.183	0.114	0.705	1.903	0.117
NI	598	0.476	0.519	0.229	0.020	0.944	1.955	-0.325
Account at FFI	419	53.820	48.708	30.078	9.005	98.992	1.634	0.127
Saved at FFI	419	21.113	14.537	17.643	1.982	60.422	2.807	1.012
Borrowed from FFI	419	11.127	10.176	6.174	2.065	23.653	2.241	0.401
Log Depositors at ODCs per 1,000 Adults	388	6.188	6.417	0.942	4.164	7.430	2.292	-0.544
Log of Borrowers at ODCs per 1,000 Adults	476	4.989	5.313	1.218	1.832	6.562	3.004	-0.809
Banks' Outstanding Deposits (%GDP)	1,209	53.053	44.581	32.418	12.184	133.902	3.491	1.091
Banks' Outstanding Loans (%GDP)	1,207	47.089	40.484	31.344	6.837	119.963	2.940	0.894
Log of Branches of ODCs per 100,000 Adults	1,072	2.851	2.959	0.859	0.949	4.345	2.703	-0.469
Log of Branches of ODCs per 1,000 km2	1,072	2.245	2.524	1.782	-1.249	5.058	2.086	-0.263
Real GDP Growth	1,280	3.317	3.200	2.962	-3.000	10.000	2.870	0.000
Technological Progress	1,188	0.029	0.034	0.093	-0.147	0.280	3.229	0.112
Real Interest Rates	809	-2.087	-2.634	8.753	-16.651	14.089	1.966	0.056
Government Expenditure (%GDP)	1,129	15.972	15.923	4.765	7.593	25.020	2.235	0.128
Trade (%GDP)	1,199	88.528	83.131	36.005	37.129	165.094	2.491	0.565
Property Rights	1,216	44.536	40.000	23.551	10.000	90.000	2.265	0.566
World-Bank Countries' Income Classifications	1,316	2.742	3.000	1.066	1.000	4.000	1.784	-0.239
Percentage of Urban Population	1,295	56.668	57.104	22.632	18.450	93.734	-0.066	1,295
Inflation	1,165	12.514	13.457	7.104	1.280	24.532	-0.183	1,165
GDP per Capita Growth	1,271	1.956	1.887	2.817	-4.160	8.698	-0.004	1,271
HDI	1,268	0.697	0.722	0.153	0.325	0.953	2.129	-0.333
Gini Coefficient	1,005	20.630	19.800	10.354	3.600	45.900	1.853	0.244
Index of Representative Government	1,043	0.555	0.581	0.217	0.020	0.853	2.726	-0.571



## Appendix 2.12: Pairwise Correlation for Variables Included in Real GDP Growth Regressions

	World-Bank Countries' Income Classifications	Property Rights	Trade (%GDP)	Government Expenditure (%GDP)	Real Interest Rates	Technological Progress	Real GDP Growth
World-Bank Countries' Income Classifications	1.000						
Property Rights	0.653 ***	1.000					
Trade (%GDP)	0.325 ***	0.244 ***	1.000				
Government Expenditure (%GDP)	0.354 ***	0.357 ***	0.164 ***	1.000			
Real Interest Rates	-0.335 ***	-0.327 ***	-0.208 ***	-0.504 ***	1.000		
Technological Progress	-0.123 ***	-0.078 ***	0.003	-0.168 ***	0.133 ***	1.000	
Real GDP Growth	-0.301 ***	-0.185 ***	0.014	-0.254 ***	0.138 ***	0.385 ***	1.000
Sarma (2008)	0.667 ***	0.618 ***	0.274 ***	0.286 ***	-0.351 ***	-0.086 **	-0.258 ***
SA	0.725 ***	0.657 ***	0.282 ***	0.312 ***	-0.369 ***	-0.112 ***	-0.248 ***
SP	0.514 ***	0.511 ***	0.335 ***	0.020	-0.228 ***	-0.049	-0.182 ***
Sarma (2012)	0.735 ***	0.656 ***	0.284 ***	0.315 ***	-0.319 ***	-0.106 ***	-0.256 ***
CP	0.751 ***	0.664 ***	0.259 ***	0.436 ***	-0.436 ***	-0.140 ***	-0.356 ***
AMM	0.319 ***	0.226 ***	0.089	0.088	-0.389 ***	0.186 ***	-0.068
DEA Sinha (2013)	0.601 ***	0.716 ***	0.341 ***	0.206 ***	-0.382 ***	-0.075 *	-0.181 ***
FDH Sinha (2013)	0.608 ***	0.689 ***	0.416 ***	0.232 ***	-0.378 ***	-0.077 *	-0.196 ***
CT	0.433 ***	0.445 ***	0.165 ***	0.222 ***	-0.026	-0.377 ***	-0.188 ***
NI	0.752 ***	0.575 ***	0.203 ***	0.307 ***	-0.257 ***	-0.084 **	-0.267 ***
Log Depositors at ODCs per 1,000 Adults	0.660 ***	0.553 ***	0.337 ***	0.339 ***	-0.149 **	-0.112 **	-0.162 ***
Log of Borrowers at ODCs per 1,000 Adults	0.679 ***	0.592 ***	0.188 ***	0.138 ***	-0.056	-0.114 **	-0.247 ***
Banks' Outstanding Deposits (%GDP)	0.478 ***	0.456 ***	0.318 ***	0.049	-0.215 ***	-0.075 **	-0.138 ***
Banks' Outstanding Loans (%GDP)	0.588 ***	0.602 ***	0.292 ***	0.143 ***	-0.285 ***	-0.117 ***	-0.191 ***
Log of Branches of ODCs per 100,000 Adults	0.530 ***	0.488 ***	0.122 ***	0.220 ***	-0.188 ***	-0.062 *	-0.168 ***
Log of Branches of ODCs per 1,000 km2	0.381 ***	0.404 ***	0.223 ***	0.005	-0.052	-0.035	-0.118 ***
Account at FFI	0.791 ***	0.758 ***	0.307 ***	0.419 ***	-0.269 ***	-0.104 **	-0.255 ***
Saved at FFI	0.662 ***	0.774 ***	0.269 ***	0.345 ***	-0.308 ***	-0.115 **	-0.170 ***
Borrowed from FFI	0.435 ***	0.417 ***	0.132 ***	0.105 **	0.028	-0.075	-0.052

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

### Appendix 2.13: Fisher Unit-root Test for Panel Data Using Dickey-Fuller

Variable	Inverse chi-squared	Inverse Normal	Inverse Logit	Modified Inverse chi-squared	Number of Panels	Average Periods
Sarma (2008)	234.129	3.769	3.054	-0.177	128	6.38
SA	815.521 ***	-4.105 ***	-9.774 ***	18.105 ***	182	6.51
SP	518.179 ***	-1.077	-6.790 ***	13.136 ***	127	6.28
Sarma (2012)	586.704 ***	0.995	-5.842 ***	16.304 ***	127	6.28
CP	513.909 ***	-7.0342 ***	-12.93421 ***	9.7841 ***	95	4.86
AMM	324.236 ***	-11.025 ***	-17.386 ***	21.020 ***	52	4.83
DEA Sinha (2013)	93.195	5.553	5.407	-3.910	86	6.58
FDH Sinha (2013)	279.472 ***	0.1944	-2.539 ***	6.376 ***	86	6.58
NI	684.185 ***	-7.771 ***	-16.926 ***	28.160 ***	112	5.34
Log Depositors at ODCs per 1,000 Adults	213.910 ***	-1.315 *	-4.2193 ***	6.6167 ***	75	5.17
Log of Borrowers at ODCs per 1,000 Adults	406.653 ***	-3.933 ***	-10.932 ***	15.936 ***	88	5.41
Banks' Outstanding Deposits (%GDP)	743.895 ***	0.954	-5.030 ***	15.006 ***	184	6.57
Banks' Outstanding Loans (%GDP)	703.869 ***	-0.2382	-5.605 ***	13.489 ***	184	6.56
Log of Branches of ODCs per 100,000 Adults	754.443 ***	2.134	-5.283 ***	17.576 ***	177	6.06
Log of Branches of ODCs per 1,000 km2	733.122 ***	-0.6778	-6.921 ***	16.725 ***	177	6.06
Real GDP Growth	1321.599 ***	-10.404 ***	-19.597 ***	35.32 ***	183	6.99
Gini Coefficient	701.394 ***	-0.549	-7.178 ***	16.801 ***	162	6.2
HDI	1339.565 ***	-8.1474 ***	-19.992 ***	36.331 ***	182	6.97
Government Expenditure (%GDP)	899.153 ***	-3.374 ***	-11.675 ***	21.724 ***	175	6.45
Inflation	405.050 ***	7.917	5.742	2.664 ***	181	6.44
Trade (%GDP)	624.497 ***	-0.204	-3.848 ***	10.166 ***	182	6.59
Technological Progress	782.693 ***	-6.047 ***	-10.544 ***	16.977 ***	172	6.91
Real Interest Rates	286.190 **	3.406	1.412	1.910 **	139	5.82
Representative Government Index	483.34 ***	1.080	-1.781 **	7.592 ***	149	13.91
Percentage of Urban Population	450.252 ***	10.588	9.721	2.950 ***	185	7
Representative Government Index	993.177 ***	-2.335 ***	-12.072 ***	28.477 ***	149	7

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

### Appendix 2.14: Pairwise Correlation for Variables Included in Gini Coefficient Regressions

	Gini Coefficient	Government Expenditure (%GDP)	Trade (%GDP)	World-Bank Countries' Income Classifications	Inflation	GDP per Capita Growth	Representative Government Index
Gini Coefficient	1.000						
Government Expenditure (%GDP)	-0.400 ***	1.000					
Trade (%GDP)	-0.329 ***	0.164 ***	1.000				
World-Bank Countries' Income Classifications	-0.750 ***	0.354 ***	0.325 ***	1.000			
Inflation	-0.094 ***	0.446 ***	0.079 ***	0.103 ***	1.000		
GDP per Capita Growth	0.041	-0.209 ***	0.064 **	-0.134 ***	-0.128 ***	1.000	
Representative Government Index	-0.480 ***	0.301 ***	0.089 ***	0.409 ***	0.090 ***	-0.024	1.000
Sarma (2008)	-0.709 ***	0.286 ***	0.274 ***	0.667 ***	0.056	-0.055	0.546 ***
SA	-0.545 ***	0.020 ***	0.335 ***	0.514 ***	-0.024	-0.078 ***	0.324 ***
SP	-0.738 ***	0.312 ***	0.282 ***	0.725 ***	0.111 ***	-0.058	0.596 ***
Sarma (2012)	-0.762 ***	0.315 ***	0.284 ***	0.735 ***	0.054	-0.055	0.595 ***
CP	-0.725 ***	0.436 ***	0.259 ***	0.751 ***	0.228 ***	-0.137 ***	0.612 ***
AMM	-0.300 ***	0.088	0.089	0.319 ***	0.109	-0.031	0.211 ***
DEA Sinha (2013)	-0.503 ***	0.206 ***	0.341 ***	0.601 ***	0.091 **	-0.180 ***	0.391 ***
FDH Sinha (2013)	-0.496 ***	0.232 ***	0.416 ***	0.608 ***	0.115 ***	-0.195 ***	0.392 ***
CT	-0.447 ***	0.222 ***	0.165 ***	0.433 ***	-0.193 ***	-0.082	0.163 ***
NI	-0.744 ***	0.307 ***	0.203 ***	0.752 ***	0.013	-0.018	0.598 ***
Log Depositors at ODCs per 1,000 Adults	-0.698 ***	0.339 ***	0.337 ***	0.660 ***	0.001 ***	0.018	0.425 ***
Log of Borrowers at ODCs per 1,000 Adults	-0.652 ***	0.138 ***	0.188 ***	0.679 ***	-0.081 *	-0.016	0.613 ***
Banks' Outstanding Deposits (%GDP)	-0.404 ***	0.049	0.318 ***	0.478 ***	-0.106 ***	-0.061 **	0.170 ***
Banks' Outstanding Loans (%GDP)	-0.563 ***	0.143 ***	0.292 ***	0.588 ***	-0.015	-0.089 ***	0.298 ***
Log of Branches of ODCs per 100,000 Adults	-0.537 ***	0.220 ***	0.122 ***	0.530 ***	0.019	-0.036	0.565 ***
Log of Branches of ODCs per 1,000 km2	-0.392 ***	0.005	0.223 ***	0.381 ***	-0.124 ***	-0.013	0.398 ***
Account at FFI	-0.723 ***	0.419 ***	0.307 ***	0.791 ***	0.004	-0.053	0.509 ***
Saved at FFI	-0.541 ***	0.345 ***	0.269 ***	0.662 ***	0.016	-0.074	0.496 ***
Borrowed from FFI	-0.540 ***	0.105 **	0.132 ***	0.435 ***	-0.090 *	0.057	0.292 ***

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

**Appendix 2.15: The Relationship between Financial Inclusion Indexes and Income Inequality Using Fixed Effects (IFIs)**

Independent Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Growth of GDP per Capita	0.086 ***	0.062	0.101 ***	0.092 **	0.140 ***	0.047	0.038	0.092	0.107	0.146 **
Government Expenditure (%GDP)	-0.146	-0.131	-0.135	-0.127	-0.185 *	-0.266	-0.307	-0.341	-0.167	-0.121
Trade (%GDP)	0.024	0.045 ***	0.019	0.018	0.041 **	-0.024	0.080 ***	0.069 ***	0.038 *	0.005
Index of Representative Government	-3.068	-3.374	-3.232	-3.235	-4.575 ***	1.242	-0.500	-0.447	-4.307	-3.926
Inflation rate	0.040 **	0.050 **	0.071 ***	0.047 **	0.063	0.041	0.006	0.017	0.072 ***	0.028
World-Bank Countries' Income Classifications	-1.593 *	-0.334	-1.130	-1.096	-1.192	-0.927 *	1.325	0.963	-0.595	-1.202
D1. Sarma (2008)	-12.464									
SA		-19.721 **								
SP			-8.959 ***							
Sarma (2012)				-7.977 **						
CP					-17.964 ***					
AMM						63.115 *				
D1. DEA Sinha (2013)							-1.950 **			
FDH Sinha (2013)								-1.465 **		
CT									-2.080 **	
NI										-11.174 ***
Constant	25.700 ***	22.028 ***	27.669 ***	28.897 ***	29.966 ***	27.942 ***	9.887 *	12.881 **	23.177 ***	33.334 ***
Observations	463	781	545	545	328	137	372	372	282	381
Number of Countries	95	133	95	95	72	31	74	74	124	77
Average Period (years)	4.9	5.9	5.7	5.7	4.6	4.4	5	5	2.3	4.9
F test	3.51 ***	7.82 ***	6.32 ***	6.26 ***	8.04 ***	2.83 **	4.47 ***	6.31 ***	9.36 ***	5.89 ***
R-Squared within	0.106	0.121	0.159	0.161	0.205	0.244	0.128	0.149	0.246	0.175
R-Squared between	0.415	0.170	0.555	0.565	0.449	0.293	0.195	0.071	0.147	0.597
R-Squared Overall	0.384	0.141	0.541	0.551	0.427	0.349	0.172	0.051	0.099	0.601
Correlation ( $u_i, Xb$ )	0.428	0.167	0.467	0.486	0.299	0.424	-0.673	-0.501	0.107	0.404
rho	0.971	0.971	0.957	0.957	0.964	0.968	0.976	0.974	0.967	0.935

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

**Appendix 2.16: The Relationship between Selected Financial Inclusion Indicators  
and Income Inequality Using Fixed Effects (Simple FI Indicators)**

Independent Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Growth of GDP per Capita	0.050	0.088	0.062	0.049	0.090 *	0.089 *	0.131 *	0.161 **	0.134 *
Log of Government Expenditure	-0.299 **	-0.204	-0.107	-0.073	-0.128	-0.144	-0.197 *	-0.262 **	-0.268 **
Trade (%GDP)	-0.001	0.083 ***	0.043 ***	0.041 ***	0.037 ***	0.039 ***	0.003	0.020	0.020
Index of Representative Government	-1.889	0.388	-3.428 *	-2.963	-2.934	-3.273	-3.181	-5.326	-4.882
Inflation rate	0.070 ***	0.035	0.019	0.041 ***	0.030 ***	0.032 **	0.018	0.051 **	0.052 ***
World-Bank Countries' Income Classifications	-0.208	0.218	-0.244	-0.081	-0.493	-0.505	-0.341	-0.810	-0.928
Log of Depositors at ODCs per 1,000 Adults	-2.900 ***								
Log of Borrowers at ODCs per 1,000 Adults		0.153							
D1. Banks' Deposits as a Percentage of GDP			-0.066 **						
Banks' Loans as a Percentage of GDP				-0.067 ***					
Log of Number of Branches of ODCs per 1,000 km2					-1.931 **				
Log of Number of Branches of ODCs per 100,000 Adults						-1.826 *			
Account							-0.072 ***		
Saved								-0.037	
Borrowed									-0.084 **
Constant	47.417 ***	14.760 **	23.549 ***	22.049 ***	25.346 ***	26.662 ***	28.522 ***	27.102 ***	27.473 ***
Observations	238	238	791	789	668	668	328	328	328
Number of Countries	51	51	133	133	125	125	130	130	130
Average Period (years)	4.7	4.7	5.9	5.9	5.3	5.3	2.5	2.5	2.5
F test	3.91 ***	2.93 **	7.79 ***	7.46 ***	9.26 ***	9.16 ***	8.47 ***	5.22 ***	3.25 ***
R-Squared within	0.207	0.151	0.155	0.151	0.124	0.114	0.205	0.142	0.150
R-Squared between	0.502	0.105	0.159	0.202	0.247	0.257	0.498	0.339	0.393
R-Squared Overall	0.514	0.160	0.137	0.170	0.211	0.219	0.490	0.330	0.379
Correlation ( $u_i, Xb$ )	0.449	-0.616	-0.118	0.179	0.085	0.207	0.447	0.326	0.402
Rho	0.959	0.978	0.972	0.971	0.970	0.971	0.940	0.945	0.945

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

### Appendix 2.17: Pairwise Correlation for Variables Included in HDI Regressions

	HDI	Technological Progress	Government Expenditure (%GDP)	Trade (%GDP)	World-Bank Countries' Income Classifications	Percentage of Urban Population
HDI	1.000					
Technological Progress	-0.104 ***	1.000				
Government Expenditure (%GDP)	0.309 ***	-0.168 ***	1.000			
Trade (%GDP)	0.265 ***	0.003	0.164 ***	1.000		
World-Bank Countries' Income Classifications	0.853 ***	-0.123 ***	0.354 ***	0.325 ***	1.000	
Percentage of Urban Population	0.681 ***	-0.106 ***	0.261 ***	0.173 ***	0.650 ***	1.000
Sarma (2008)	0.759 ***	-0.086 **	0.286 ***	0.274 ***	0.667 ***	0.584 ***
SA	0.571 ***	-0.112 ***	0.312 ***	0.335 ***	0.514 ***	0.464 ***
SP	0.783 ***	-0.049	0.020	0.282 ***	0.725 ***	0.594 ***
Sarma (2012)	0.799 ***	-0.106 ***	0.315 ***	0.284 ***	0.735 ***	0.598 ***
CP	0.832 ***	-0.140 ***	0.436 ***	0.259 ***	0.751 ***	0.631 ***
AMM	0.376 ***	0.186 ***	0.088	0.089	0.319 ***	0.345 ***
DEA Sinha (2013)	0.648 ***	-0.075 *	0.206 ***	0.341 ***	0.601 ***	0.427 ***
FDH Sinha (2013)	0.626 ***	-0.077 *	0.232 ***	0.416 ***	0.608 ***	0.356 ***
CT	0.493 ***	-0.377 ***	0.222 ***	0.165 ***	0.433 ***	0.331 ***
NI	0.871 ***	-0.084 **	0.307 ***	0.203 ***	0.752 ***	0.630 ***
Log Depositors at ODCs per 1,000 Adults	0.791 ***	-0.112 **	0.339 ***	0.337 ***	0.660 ***	0.583 ***
Log of Borrowers at ODCs per 1,000 Adults	0.816 ***	-0.114 **	0.138 ***	0.188 ***	0.679 ***	0.635 ***
Banks' Outstanding Deposits (%GDP)	0.481 ***	-0.075 **	0.049	0.318 ***	0.478 ***	0.403 ***
Banks' Outstanding Loans (%GDP)	0.632 ***	-0.117 ***	0.143 ***	0.292 ***	0.588 ***	0.496 ***
Log of Branches of ODCs per 100,000 Adults	0.595 ***	-0.062 *	0.220 ***	0.122 ***	0.530 ***	0.379 ***
Log of Branches of ODCs per 1,000 km2	0.439 ***	-0.035	0.005	0.223 ***	0.381 ***	0.202 ***
Account at FFI	0.805 ***	-0.104 **	0.419 ***	0.307 ***	0.791 ***	0.577 ***
Saved at FFI	0.655 ***	-0.115 **	0.345 ***	0.269 ***	0.662 ***	0.496 ***
Borrowed from FFI	0.551 ***	-0.075	0.105 **	0.132 ***	0.435 ***	0.362 ***

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% level, respectively.

## **Chapter 3:**

# **What are the Determinants of Financial Inclusion at the Country Level?**

## **Abstract**

This chapter studies the determinants of financial inclusion (FI) using a wide selection of possible variables from the existing literature. FI is measured using the index of Sarma (2012) and the new index NI suggested in the second chapter of this thesis. In addition, six selected indicators from the IMF's Financial Access Survey (FAS) database and three selected indicators from the World-Bank's global financial inclusion (FINDEX) are also included. The study covers 80 countries (where data permit) from 2011 and 2017. The analysis includes fixed effects panel regressions, and two stage least squares (2SLS). The findings show that income (measured by the natural logarithm of GDP per capita), human development (HDI), rule of law (rule of law index), and banks' liquidity (banks' credit to banks' deposit ratio) are the main determinants of the level of FI at macro-economic level.



### **3.1. Introduction**

Financial Inclusion (FI) defined as a procedure for providing all the income segments of society (especially the low-income segment) and all entities (mainly micro and small enterprises MSEs) with access to an affordable and quality range of financial products and services. Formal accounts facilitate wage transfers, government payments and remittances as well as inspiring savings and facilitating credit. Access to a full range of financial products and services helps to generate income, building assets, smoothing consumption, and managing risks, which consequently promotes economic growth and reduces poverty (Mirakhor and Iqbal, 2012).

Empirical evidence has shown that FI boosts saving, leading to an improved allocation of funds and more productive investment (Bruhn and Love, 2014). It supports the expansion of MSEs, which has positive effects on employment status and income (Karlan and Zinman, 2010; and Cull and Xu, 2013). The increase in FI enhances economic activities and improves economic growth (Burgess and Pande, 2005; Beck et al, 2007; Beck et al, 2009; Swamy 2010; Kpodar and Andrianaivo, 2011; Mirakhor and Iqbal, 2012; Hariharan and Marktanner, 2012; Oruo, 2013; Sahay et al., 2015; Onaolapo, 2015; Kim et al, 2018; and Molyneux et al. 2018). Greater FI helps to transform societies by giving the most economically disenfranchised segments of the population access to capital, which helps them to improve their education, health and other human development features as well as reducing income inequality (Clarke et al., 2006; Beck et al., 2007; García-Herrero and Turégano, 2015; and the second chapter of this thesis).

The importance associated with enhancing FI is reflected in the position taken by number of international institutions, such as the Consultative Group to Assist the Poor (CGAP), the Group of Twenty (G20), the World Bank and the International Monetary Fund IMF, which have developed initiatives aimed at boosting global FI. The concept of FI, with its economic and social dimensions, has therefore begun to be of widespread concern for governments, politicians and economists.

It is worth mentioning that previous studies have used several measures to capture FI. Note that choosing a particular measure of FI can influence the interpretations of FI in a certain country or region, which raises the question of the reliability of studies that

examine FI both within and across countries. Building on the second chapter of this thesis, the index of Sarma (2012) and the new index (NI) suggested in the second chapter are used to examine the key determinants of FI. Using a single index that summarizes the complex nature of FI – by combining several indicators into one – allows researchers to measure FI by including a variety of micro and macro-economic factors of interest (Cáamara and Tuesta; 2014).

Note that including simpler FI indicators provides a broader understanding of the ways in which FI interact with the selected determining factors including various macroeconomic variables. These indicators are: outstanding deposits and loans as a percentage of GDP; number of deposit and loan accounts at other depositary corporation ODCs<sup>10</sup> per 1,000 adults; number of branches of ODCs per 100,000 adults and per 1,000 kilometer squares; percentage of population with an account at formal financial institutions (FFIs); and percentage of population saved at (and borrowed from) FFI. This chapter aims to analyze the main determinants of FI at macro-economic level, using an extensive array of potential determinants from the existing literature. The study covers 80 countries (where data permit) over the period between 2011 and 2017 (seven years).

The estimations are undertaken using fixed effects, and two stage least squares (2SLS) with instrumental variables (IV). Overall, the results show that: income (the natural logarithm of GDP per capita); human development (human development); rule of law (index); banks' liquidity (banks' credits to deposits ratio) are the main determinants of the level of FI at macro-economic level. The findings of this chapter contribute to our understanding of the key determinants of FI which provide policymakers important areas for reform if they are to implement strategies that raise the level of FI within a country.

The paper is structured as follow. The first section reviews the literature about the main determinants of FI, and highlight the possible determinant from related topics. The second section describes the data collected for this chapter. Then, the third section highlight the methodology used in this study. The fourth section covers the analysis of results. The final section summarizes the main findings and concludes the study.

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<sup>10</sup> Other depositary corporations are defined by the FAS as all resident financial corporations and quasi-corporations (except the central bank) that are mainly engaged in financial intermediation and that issue liabilities are included in the national definition of broad money.

## **3.2. Literature Review**

Factors determining FI and possible determinants from related topics can be split into four main types: macro-economic; political economic; social; and financial factors.

### **3.2.1. Macro-Economic Factors**

Greenwood and Jovanovic (1990) argue that economic growth reduces the fixed cost of joining financial intermediaries, which increases the percentage of banked population, while the formation of financial intermediaries boosts growth by enhancing capital allocation. In this way, financial development and economy have bidirectional relationship. Sharma (2016) reveals the positive impact of FI on growth, using various banking penetration, availability, and the use of banking services using vector autoregressive model (VAR) and Granger causality tests. She finds directional causality between geographic banking penetration and economic development and a unidirectional causality between the number of deposits account and GDP.

Gourène and Mendy (2017) apply the Dumitrescu and Hurlin (2012) procedure for testing Granger causality in a panel to investigate the bidirectional relationship between FI (measured by the rate of demographic penetration and use of financial services) and economic growth (GDP per capita growth). The authors use data from eight member countries of the West African Economic and Monetary Union between 2006 and 2015. They find a bidirectional relationship between FI and growth over a 4 to 8-year period.

Kim et al (2018) study the relationship between FI and economic growth using dynamic panel GMM estimation and panel VAR analysis for 55 member countries of the Organization of Islamic Cooperation (OIC) between 1990 and 2013. They use simple indicators from FAS to represent FI (ATM per 100,000 adults; branches of banks per 100,000 adults; deposit accounts with commercial banks per 1,000 adults; borrowers from commercial banks per 1,000 adults; and life insurance premium volume to GDP). Kim et al (2018) show that FI positively effects economic growth in OIC countries. They also use the panel Granger causality test suggested by Dumitrescu and Hurlin (2012) to show that FI and economic growth have mutual causalities with each other.

However, Evans and Alenoghena (2017) use a Bayesian VAR model to study the relationship between GDP per capita and FI in 15 African countries between 2005 and

2014. They find that GDP per capita has a significantly positive impact on FI, but FI has insignificant impact on GDP per capita. They also find evidence that credit supply, broad money, literacy, servers and internet users have significantly positive impacts on FI.

Ghosh (2008) claims that economic structure appears to influence banks' strategy toward FI. He finds that a larger percentage of agriculture in GDP tends to reduce geographic inclusion. In addition, Toxopeus and Lensink (2007) study the relationship between remittance inflows and FI in developing countries. They find that remittances have a development effect through FI. Fiscal policy also plays a role in determining FI since increasing government expenditure is expected to boost investment and job creation leading to enhanced FI. García-Herrero and Turégano (2015) use government expenditure to capture government size and find that unequal income distribution is connected to lower fiscal redistribution, as captured by government expenditure.

Andrianaivo and Kpodar (2011) study the impact of information and communication technologies – measured by mobile and fixed telephone penetration rates and the cost of local calls – on economic growth for African countries between 1988 and 2007, again using system GMM estimators. The results confirm that information and communication technologies significantly enhances economic growth. Moreover, the same authors find that the positive effect of mobile phone penetration on growth is partially derived from higher FI. Bansal (2014) discuss the view that modern information and communication technologies can play a key role in developing a platform to extend financial services in remote areas. It can boost the level of FI by increasing bank efficiency levels and this in-turn reduces the cost of access to financial service.

### **3.2.2. Political Economic Factors**

Institutional quality is considered one of the factors that determine the level of FI, since empirical evidence suggests that institutions affect economic performance, which can be considered a source of comparative advantage (Levchenko, 2007). Furthermore, Ali et al. (2016) examine the impact of institutional quality on FI using a dynamic GMM panel estimator for 52 developing countries between 2004 and 2010. The results confirm that in developing countries institutional quality enhances both access to and use of financial services. Moreover, Ali et al. (2016) find that because economic growth and financial openness positively affect FI, policymakers should strengthen institutional quality since it has an impact on improving FI.

Gopalan and Rajan (2015) argue that stronger legal rights are associated with a higher level of FI since a lack of adequate legal infrastructure to enforce contracts may lead to financially excluding some households and businesses. Gopalan and Rajan (2015) use legal rights as a control variable when they examine the relationship between foreign bank entry and FI for 57 developing economies over the period 2004-2009. The authors find that legal rights become slightly significant when controlled for foreign bank entry. In addition, Naceur et al (2015) use legal rights as a control variable in their analysis of the relationship between the development of Islamic banking and FI in the member countries of the Organization of Islamic Cooperation over a 10-year period (2004–13). Naceur et al (2015) discover that stronger legal rights are associated with a greater share of adults borrowing from or holding accounts in FFIs.

Knack and Keefer (1995) argue that the protection of property rights is crucial to investment and economic growth. Even after controlling for investment and institutional effects on growth. Property rights extend to impacting not only the magnitude of investments, but also the allocative efficiency of all inputs. Protection of private property rights encourages investors and lenders. Park and Mercado (2015) use the relationship between the rule of law and FI. They argue that the rule of law indicates the degree to which agents believe in the rules of society, mainly in property rights, the quality of contract enforcement and that of the courts. Park and Mercado (2015) find that a high regard for the rule of law positively affects FI.

### **3.2.3. Social Factors**

Allen et al. (2012) collect data from the FINDEX database to study the factors underpinning FI across 123 countries in 2011, using binary regression analysis. They find that gender, income, age, urbanization, education, household size, marital status (being married), and employment are the individual characteristics that determine FI. Similarly, Zins and Weill (2016) examine the determinants of FI using a probit model for 37 African countries in 2014, with data taken from the FINDEX database. They conclude that gender, income, education and age are the main determinants of FI. Several studies, such as Greene and Rhine (2013) in the USA, Akudugu (2013) in Ghana, Pena et al. (2014) in Mexico, and Tuesta et al. (2015) in Argentina, have also found similar results.

Cole et al. (2013) collect data from the U.S. Census, the Survey of Income and Program Participation, and the Federal Reserve Bank of New York Consumer Credit Panel/Equifax dataset to study the relationship between education and financial market participation using various forms of regression analysis including OLS estimation and two stage least squares. They find that education (years of schooling) increases financial market participation (measured by investment income and equity ownership) and reduces the probability that an individual will declare bankruptcy, experience foreclosure, or is delinquent on a loan. Similarly, Goodstein & Rhine (2013) use binary regression to analyze the US Current Population Survey administered by Census in 2011. They find that socio-economic characteristics such as income and education are determinants of having a bank account.

Sarma and Pais (2011), using their index, study the relationship between FI and the Human Development Index (HDI) compiled by the United Nations Development Program (UNDP). Based on data for 49 countries in 2004, Sarma and Pais (2011) find that their index and HDI move closely in step with each other. They also find that income (measured by GDP per capita), inequality (Gini Coefficient), adult literacy and urbanization (percentage of rural population) are important factors in explaining the level of FI in a country. Raichoudhury (2016) examine the relationship between FI and the Human Development Index (HDI) across 107 countries in 2013. He uses Sarma's index (2012) as well as selected simple indicators from FAS to capture the level of FI. He finds that human development and FI move closely in step with one another.

Moreover, Naceur et al (2015) argue that the size of population and its density positively affect banks' cost-effectiveness in lending, therefore aiding FI. Hence, Naceur et al (2015) use the log of population to proxy for market size and the log of population density to proxy for the ease of service provision. In addition, they find a positive relationship between densely populated areas and banks' branches and ATM penetration. Allen et al. (2013) argue that the relationship between population density and FI appears to be stronger in the countries of Africa than in other developing nations. They also find that countries with the highest levels of financial depth and FI in Africa tend to be those with small geographical areas and dense populations, such as Cape Verde, Comoros and Mauritius.

### **3.2.4. Characteristics of the Financial System**

Carbó et al (2005) explain that price can lead to the exclusion of some individuals from the financial system, if they cannot re-pay loans or fees. Similarly, Cáamara and Tuesta (2014) claim that the level of interest rate has a negative relationship with FI, since an increase in interest rates leads to financial exclusion due to the higher costs associated with financial intermediation. Love and Martínez Pería (2014) examine bank competition using the Lerner index and find that competition is related to higher FI (all else being equal) since it leads to increased access for firms to overdrafts, loans, or bank credit lines. However, Naceur et al (2015) find that the effect of banking competition is not clear despite using the same proxy (Lerner index). They explain that banking competition is related to the perception that obstacles to financing are lower.

Gopalan and Rajan (2015) find that foreign banks have a positive relationship with FI using fixed effect panel of 57 emerging and developing economies over the period 2004-2009. However, this relationship may turn out to be negative if foreign bank entry is followed by greater bank concentration. Owen and Pereira (2018) study the role of banking system structure as a determinant of cross-country variability in financial outreach for households using a fixed effects panel for 83 countries over a decade. They find that greater banking concentration is related to more FI, if the banks' market power is limited. Owen and Pereira (2018) also find evidence that in countries where banks are permitted to engage in a wider scope of activities there is higher FI. Additionally, their result suggests that competition (lower market power) is an important aspect for FI. However, Rojas-Suarez and Amado (2014) found using cross-sectional regression of FINDEX 2011 data that bank concentration is negatively related to FI.

Rojas-Suarez and Amado (2014) and Gopalan and Rajan (2015) use the ratio of overhead costs to total assets to denote banks' operational inefficiency. They argue that high ratios restrict FI because it raises the fixed costs of maintaining accounts and extending loans, together with reducing savings and deposits payments (Rojas-Suarez and Amado, 2014; Gopalan & Rajan, 2015). Ghosh (2008) capture efficiency through the ratio of bank costs to income and use this as a control variable when studying the relationship between FI and financial fragility. They find the cost to income ratio to be negative, suggesting that inefficient banks are more prone to risk-taking and this can impact FI (see below).

Another factor linked to FI is the depth of credit information. This is expected to have a positive relationship with FI through reducing information asymmetries in the process of lending, leading to greater bank outreach due to lower bank costs (Gopalan and Rajan, 2015). Naceur et al (2015) also use the depth of credit information a control variable in their analysis of FI in OIC countries. They find that greater quality credit information is related to a higher percentage of adults and firms borrowing from and holding accounts in mainstream financial institutions.

Ghosh (2008) compare non-performing loans to gross loans to indicate financial fragility and find that FI and financial fragility are intertwined, each tending to reinforce the other. However, Han and Melecky (2013) studied the connection between a broader access to bank deposits prior to the 2008 financial crisis and the dynamics of bank deposit growth during the crisis. They found that an increase of 10% in the share of individuals with access to bank deposits can alleviate the rate of deposit withdrawal by approximately 3-8% points, which can enhance the resilience of bank funding and boost the overall stability of the financial system (namely a higher Z-score). This effect appears to be stronger in countries with middle incomes that have greater depositor confidence.

Morgan and Pontines (2014) also use non-performing loans and bank Z-scores to measure financial stability. They find evidence that increased lending to MSEs – as a percentage of total bank lending – enhances financial stability, largely by reducing non-performing loans. Besides, it reduces the probability of default by financial institutions. The authors explain that this result is consistent with the literature: that lending to MSEs leads to the diversification of banks' assets. Thus, risk will be reduced; deposit stability will be increased, and the transmission of monetary policy will be enhanced. Therefore, Morgan and Pontines (2014) propose that policy methods aimed at increasing FI, at least to MSEs, are likely to contribute to financial stability.

Chauvet and Jacolin (2017) study the impact of FI and bank concentration on the performance of firms in developing and emerging countries using a sample of 55,596 firms in 79 countries. They find that FI (the distribution of financial services across firms) has a positive impact on firm growth if the banking system is less concentrated, which suggests more competition. In addition, they find that firm growth benefits more from competition only at high levels of FI, while foreign and state-owned firms benefit more



from bank concentration. Chauvet and Jacolin (2017) stress that the quality of the banking system is key in promoting firm performance in countries with limited financial deepening.

Shihadehet and Liu (2019) studied the relationship between FI and banks' performance at bank level. They included bank level information for 189 countries and 701 commercial banks in two single years 2011 and 2014. They used return on equity (ROE) and return on assets (ROA) as proxies for banks' performance. they also used the log of branches as a financial inclusion indicator. Their finding show that there is positive and significant relationship between FI and banks' performance using OLS regression.

### **3.3. Data Description**

The dependent variable is FI, which is captured by the index of Sarma (2012) and the new index (NI) proposed in the second chapter. Note that these indexes are suggested in the second chapter of this thesis as the most consistent measure of FI. The indexes use information from the financial access survey FAS database that covers supply-side information and is available on a yearly basis from 2004. In addition, nine simple indicators of FI are also included in the analysis. Six of the FI indicators are collected from the same database (FAS), namely: banks' outstanding deposits and loans as a percentage of GDP; the number of deposit and loan accounts at ODCs per 1,000 adults; and the number of branches of ODCs per 100,000 adults and per 1,000 kilometers squared. In addition, the natural logarithm of these indicators is also included to check whether the determinant effect these indicators proportionally.

The other three are collected from the global financial inclusion database (FINDEX) provided by the world-bank. These indicators are the percentage of population that have account at formal financial institutions (FFIs), the percentage of population saved at FFIs, and the percentage of population borrowed from FFIs. Using these nine indicators will act as a cross check on the findings of FI indexes and will also provide us with a deeper understanding of simple measures of FI. The study covers 80 countries (where data permit) over the period between 2011 and 2017 (7 years).

**Table 3.1: Summary of Previous Studies about Financial Inclusion**

Factor	Literature	Findings
Economy and Economic Growth	Sharma (2016), Gourene & Mendy (2017), Kim et al (2018), & Ali et al. (2016), Evans and Osi (2017)	GDP per capita and GDP growth is positively related to financial inclusion
Unemployment Rate	Goodwin et al. (2000), & Samara & Pais (2011)	Unemployed people have less opportunity to participate in the banking system
Interest rates	Demirguc-Kunt, Laeven & Levine (2003), Carbó et al (2005), & Cáamara & Tuesta (2014)	Interest rates have a negative relationship with financial inclusion
Remittance Inflows	Toxopeus & Lensink (2007)	Remittance inflows have a development effect through financial inclusion
Information & Communication Technologies	Andrianaivo & Kpodar (2011), Bansal (2014), & Ouma et al. (2017)	Modern ICT can play a key role in developing a platform to extend financial services in remote areas.
Rule of Law	Park and Mercado (2015)	Rule of law positively affects financial inclusion
Institutional Quality	Ali et al. (2016)	In developing countries, institutional quality enhances both access and use of financial services.
Legal Rights (Property Rights)	Gopalan & Rajan (2015), Knack and Keefer (1995), & Naceur et al (2015)	Stronger legal rights are associated with a higher level of financial inclusion because a lack of inadequate legal contracts enforcement may lower the level of inclusion.
Human Development	Sarma & Pais (2011), Raichoudhury (2016), & Molyneux et al. (2018)	Human Development is positively correlated with financial inclusion.
Illiteracy	Cáamara & Tuesta (2014)	Illiteracy rates have a negative relationship with financial inclusion.
Age Dependency Ratio	Naceur et al (2015)	Control for demographic trends and corresponding savings behaviour.
Population Size & Population Density	Allen et al. (2013) Naceur et al (2015)	Population density has a positive relationship with banks' branch and ATM penetration.
Social Factors (Gender, Income, Education and Age)	Zins & Weill (2016), Greene & Rhine (2013), Cano et al. (2013), Akudugu (2013), Cámara et al. (2013), Hoyo et al. (2013), Peña et al. (2014), & Tuesta et al. (2015)	These studies found that gender, income, education and age are the determinants of FI.
Banking Efficiency	Demirguc-Kunt, Laeven & Levine (2003), Ghosh (2008), Rojas-Suarez & Amado (2014), & Gopalan & Rajan (2015)	Inefficiency limits access and prevents financial inclusion.
Financial Instability (Financial Fragility)	Ghosh (2008), Han & Melecky (2013), & Morgan & Pontines (2014)	Financial instability has a negative relationship with financial inclusion. However, Ghosh (2008) argues that financial fragility is intertwined with financial inclusion, each tending to reinforce the other
Financial openness	Ali et al. (2016)	Financial openness has a significantly positive effect on financial inclusion.
Depth of credit information	Gopalan & Rajan (2015) & Naceur et al (2015)	The depth of credit information has a positive relation with financial inclusion as it reduces information asymmetries in the process of lending.
Foreign Banks	Gopalan & Rajan (2015)	Foreign banks have a positive relationship with FI. But this relationship may turn out to be negative if foreign bank entry is followed by high banking concentration.
Banking Concentration	Owen & Pereira (2018) Chauvet and Jacolin (2017)	Greater banking concentration is related to more FI, on condition that the market power of banks is limited.
Bank Competition	Love & Martínez Pería (2014), Owen & Pereira (2018) & Chauvet and Jacolin (2017)	Banking competition is linked to greater financial inclusion.

The potential determinants of FI (independent variables) used in this paper are collected from various databases including the World Development Indicator (WDI), Global Financial Development (GFDD), UNDP, and Worldwide Governance Indicators (WGI). The potential determinants of FI that are included in the study are the following:

- Income: it is captured by GDP per capita. This variable is available from WDI and expected to be positively related to FI. Note that the natural logarithm of GDP per Capita is used to smooth the data. This variable is also suggested by Evans and Osi (2017). FI and income are expected to have bidirectional relationship, although Evans and Osi (2017) do not find such a link. This is because income has been found to determine the level of FI and FI also lead to boosts income – several researchers also suggested that GDP growth and FI have a bidirectional relationship such as Sharma (2016) Kim et al (2018).
- Government size: it is measured by government expenditures as a percentage of GDP. Information about government expenditures is available from WDI. Note that the relationship between Government size and FI has not been previously studied in the literature.
- Rule of Law: the proxy used is rule of law index (percentage), which is available from the WGI database. The index captures the level of agents' confidence in the rules of society, mainly property rights, contract enforcement quality, the courts, and the police, together with the likelihood of crime and violence (the World Bank definition). Note that the stricter the enforcement of law, the greater the expectation that it will raise the level of FI (Park and Mercado, 2015). The rule of law index was selected over legal rights because of data availability, since the later has been modified in 2014, and includes more aspects in its measure.
- Human Development: it is presented by the Human Development Index HDI, which is provided by the UNDP and has a value between 0 (lowest level) and 1 (highest level). Human Development is found to be positively correlated with financial inclusion (Sarma and Pais, 2011; and Raichoudhury, 2016). The relationship between FI and human development might potential be bidirectional. This is because the levels of health, income and education are the main components of HDI and these variables are also important for FI.
- Banks' concentration: It represents market structure and measured by the percentage of the assets of the largest three commercial banks over the total assets

of banks. The variable is available from GFDD. Owen and Pereira (2018) find that greater banking concentration is related to more FI, when the banks' market power is limited. however, Gopalan and Rajan (2015) and Rojas-Suarez and Amado (2014) found negative relationship.

- Banks' liquidity: this is presented by the ratio of banks' credit to banks' deposit that is available from the GFDD. The relationship between FI and banks' liquidity needs to be investigated since it has not been studied in the literature. It is important to know if high liquidity in the banking system will enhance or reduce the levels of FI. Such a finding may help policymakers to set bank liquidity regulation approaches to help aid the level of FI.
- Financial Stability: measured by banks' Z-score which is provided by the GFDD. The relationship between FI and financial stability is expected to be positive (Morgan and Pontines, 2014; and Han and Melecky, 2013). This is because lending to MSEs leads to the diversification of banks' assets. Thus, risk will be reduced; deposit stability will be increased, and the transmission of monetary policy will be enhanced. The reason behind choosing banks' Z-score to capture financial instability over nonperforming loans to gross loans is data availability since the nonperforming loans to gross loans is not available for some of the countries included in the analysis.
- Banks' Performance: which is captured by banks' Net Interest Margin that is available from the GFDD. The relationship between FI and banks' performance is expected to be positive (Shihadeh et. al., 2018). Banks are motivated to raise access to financial services as they are seeking higher returns.
- Banks' operational efficiency: this is captured by banks' cost to income ratio. The variable is available from GFDD. The increase in the ratio of overhead cost to total assets indicates a decrease in the efficiency level of banks, which is expected to negatively affect the level of FI (Ghosh, 2008; Rojas-Suarez and Amado, 2014; and Gopalan and Rajan, 2015). The reason behind choosing banks' cost to income ratio over overhead cost to total assets is the high pairwise correlation between overhead cost and net interest margin.
- Population Demography: captured by the percentage of urban population that is collected from WDI. It is expected that people who live in rural areas are less likely to be financially included as discussed in the literature (Leyshon and Thrift, 1993; World Bank Global Financial Inclusion report 2011).

- **Countries' Income Classifications:** it is a dummy variable used to control for countries' different stage of economic development. Countries are categorized into four groups based on the World Bank's classifications. Low income group represents countries with GNI per capita less than \$1025, whereas lower middle signifies countries with GNI per capita between \$1025 and \$4035. Upper middle presents countries with GNI per capita between \$4035 and \$12475, and high income covers countries with GNI per capita more than \$12475. The GNI Income Group gives Low income group the value 1, lower middle income group the value 2, upper middle income group the value 3, and high income group the value 4.

Note that 80 countries are covered in the study. The list of countries covered in the analysis are reported in Appendix 3.1. Note that the dataset is unbalanced because the analysis only covers countries that have data for all the selected FI indicators and indexes. This caused the number of countries to vary. The descriptive summary statistics is reported in Appendix 3.2 and pairwise correlation is summarized in Appendix 3.3 and 3.4. the stationarity tests are reported in Appendix 3.5.

### 3.4. Methodology

First, fixed effects panel regression estimates are used to study the possible determinants of FI. Robust standard errors (heteroskedasticity-robust) are applied for all regressions. Note that all the mentioned determinants will be included in the fixed effect regression except for income and human development (see model 1). This is because they have a bidirectional relationship with FI. Note that all countries are included but Liberia because bank concentration data is not available (79 countries).

$$FI_{it} = BC_{it} + CTI_{it} + BCBD_{it} + NIM_{it} + Z_{it} + law_{it} + GOV_{it} + PUP_{it} + IG_{i,t} \quad (1)$$

where

$FI_{it}$ : the value of the index of FI (and the selected FI indicators) for the  $i^{th}$  country at the  $t^{th}$  period

$BC_{it}$ : banks' concentration in country  $i$  at time  $t$ ,

$CTI_{it}$ : banks' costs to income ratio (banking operational inefficiency) in country  $i$  at time  $t$ ,

$BCBD_{it}$ : the ratio of banks' credits to deposits ratio in country  $i$  at time  $t$ ,

$NIM_{it}$ : banks' net interest margin in country  $i$  at time  $t$ ,

$Z_{it}$ : banks' Z-score in country  $i$  at time  $t$ ,

$law_{it}$ : the index of the rule of law in country  $i$  at time  $t$ ,

$GOV_{it}$ : government expenditure as a percentage of GDP for the  $i^{th}$  country at the  $t^{th}$  period,

$PUP_{it}$ : percentage of urban population in country  $i$  at time  $t$ ,

$IG_{i,t}$ : income classification of a country  $i$  at time  $t$  based on GNI per Capita (World-Bank's income Classification).

Furthermore, fixed effect two stage least squares (2SLS) with an instrumental variable (IV) is used to study FI relationship with income and human development (in a separate regressions). It is worth mentioning that banking characteristics was dropped from the 2SLS regressions because they are linked to both the dependent (FI) and the main independent variables (income and human development). For instance, increasing the banks' credit to banks' deposit leads to increase the number of loans and outstanding loans, which leads to higher level of FI as well as higher income. Additionally, the dummy variable that control for countries' income classifications has also been removed from the 2SLS because of its high collinearity with income and human development.

Note that only 76 countries are included in the 2SLS regressions (excluding Belize, Bhutan, Eswatini, and Trinidad and Tobago). This is because the first three countries have only one observation in FINDEX database. Trinidad and Tobago has two observation on FINDEX (2011 and 2017) and it has no data about government expenditure as a percentage of GDP after 2015.

Trade as a percentage of GDP is selected as an IV to study the effect of income on FI (see Model 2). Note that trade is expected to be correlated with income and uncorrelated with the unobserved error term. Trade as a percentage of GDP data is provided by the WDI. Trade was chosen because it facilitates more efficient production through shifting economic resources to countries that have comparative advantage (Makki and Somwaru, 2004). Trade captures the impact of external developments in income distribution (García-Herrero and Turégano, 2015).

$$FI_{it} = GOV_{it} + law_{it} + PUP_{it} + [\ln(GDPC_{it}) = Trade_{it}] \quad (2)$$

where

$GDPC_{it}$  represents GDP per capita for country  $i$  at time  $t$ ,

$Trade_{it}$  is trade as a percentage of GDP for country  $i$  at time  $t$ .

The education index is also used as an IV to study the effect of human development on FI. The reason behind choosing the education index as an IV is that a society with high HDI, particularly skilled labor with higher financial literacy, would be able to make much better use of financial services than society with lower level of human development and high financial illiteracy. Note that the education index is provided by the UNDP. The value of the index ranges between 0 (the lowest) and 1 (the highest). The index of

education is correlated with human development and uncorrelated with the unobserved error term. The model used to estimate the relationship between FI and human development is the following:

$$FI_{it} = GOV_{it} + law_{it} + PUP_{it} + [HDI_{it} = EDU_{it}] \quad (3)$$

Where:

$HDI_{it}$  is the human development index in country  $i$  at time  $t$ ,

$EDU_{it}$  stands for education index – that is made by UNDP – in country  $i$  at time  $t$ .

### 3.5. Analysis of Results

Table 3.2 report the result of the possible determinants of FI using fixed effect panel regressions for the FI indicators and indexes. The result in tables 3.2 and 3.3 show that banks' concentration has no relationship with FI. The only indicator that has negative relationship banks' concentration is the number of branches per 100,000 adults at 10% level. The result in the literature is unclear as some paper such as Rojas-Suarez and Amado (2014) and, Gopalan and Rajan (2015) found negative relationship with FI, whereas found the opposite (Owen and Pereira, 2018).

The common between the three papers is that they used simple measures of FI. Another common is that bank concentration was not their main variable of interest. Some of these papers have also suggested an interaction variable. It seems that bank concentration does not have a relation with FI, but it can accelerate the effect on FI. For instance, Rojas-Suarez and Amado (2014) explains that when bank concentrating is coupled with low enforcement of legal system then it has a negative effect on FI. Whereas, Owen and Pereira (2018) demonstrate that when bank concentration is coupled with high competition then concentration will have very strong positive effect.

Banks' credit to banks' deposit ratio show a positive relationship with FI measured by the index of Sarma (2012) and NI, as an increase in the ratio by 1% increase the indexes by 0.001 (note that the maximum value of the index is 1) at 1% and 10% level, respectively. The increase in ratio means that banks are providing more loans. An increase in banks' credit to banks' deposit ratio by 1% leads to an increase in number of loan accounts at ODCs per 1,000 adults and outstanding loans (percentage of GDP) by 0.4% and 0.8% (0.353%) at the 5% level, respectively.

The increase in loans and outstanding loans suggests also that there will be more deposit accounts. A 1% increase in banks' credit to banks' deposit ratio leads to an increase in number of deposit accounts at ODCs per 1,000 adults by 5.346 (0.4%) at the 1% significance level. It seems that the increase in economic activities as a result of the increase in loans and outstanding loans motivates banks to expand their coverage. The increase in banks' credit to banks' deposit ratio by 1% is positively related to the increase in the number of branches of ODCs per 1,000 kilometer squares and per 100,000 adults by 0.119 units (approximately 0.5%) and 0.118 units (roughly 0.4%) at the 1% level, respectively. However, banks' credit to banks' deposit show a weak negative relationship with the percentage of population saved at FFIs.

Net interest margin cost to total assets – which capture banks' performance – has not shown any relationship with FI. The only FI indicator that shows a significant relationship with net interest margin is outstanding loans as a percentage of GDP, where an increase in net interest margin by one unit leads to a decrease in outstanding loan as a percentage of GDP by 0.621%. This result is unlike Shihadeh and Liu (2019). However, the difference between the result could be because they used OLS estimate, which do not control for banks and countries specific characteristics. In addition, Shihadeh and Liu (2019) did not control for macro-economic factors such as rule of law, and government expenditures. Since most of the FI indicators and indexes in this analysis show no relationship between FI and banks' performance, regulator do not need to worry a lot about banks' performance when they set strategies to enhance the level of FI.

Financial stability has shown a weak positive relationship with FI as an increase in banks' Z-score by one unit is associated with an increase in percentage of population with an account at FFIs by 1.04% at 5% level, which is similar to Han and Melecky's (2013) findings. Furthermore, a one unit increase in banks' Z-score is related to an increase in the natural logarithm of loan accounts at ODCs per 1,000 adults by 1.5% at the 10% level. This result is consistent with the findings revealed by Morgan and Pontines (2014). However, an increase in banks' Z-score by 1 unit is associated with a decrease in the number of branches of ODCs per 1,000 kilometer squares by 0.565 units at the 5% level.

It seems that banks' Z-score has a different relationship with various aspects of FI, which leads banks' Z-score to have weak positive relationship with the overall level of FI based on the NI where an increase in banks' Z-score by one unit is linked to an increase in NI



by 0.4% at the 10% level of significance. However, the index of Sarma (2012) shows no significant relationship with banks' Z-score. The reason behind the difference in results is that Han and Melecky (2013) and Morgan and Pontines (2014) use simple measures as a proxy for FI. These proxies only capture one aspect of FI, whereas FI indexes capture a broader picture. Ghosh (2008) focuses only on one country (India) and this also may explain the different results.

The rule of law shows a positive relationship with FI indexes as adequate legal contract enforcement encourages financial institutions to lend more as they have trust in the legal system to enforce borrowers to pay back loans and interest. Therefore, financial institutions view the rule of law improvement as a positive sign. A 1% increase in the rule of law index is related to the percentage of population borrowed from FFIs and the number of loan accounts at ODCs per 1,000 adults by 0.17% (at 5% level), and 2.665 units (at 1% level), respectively. This finding consist with the literature as suggested by Gopalan and Rajan (2015), Naceur et al (2015) and Knack and Keefer (1995)

The increase in lending likely boosts economic activities and create new jobs that leads to an increase in the number of deposit accounts. The increase in the rule of law index by 1% is related to an increase in number of deposit accounts at ODCs per 1,000 adults by 7.435 units (at 10% level). An improvement in the rule of law index by 1% raises the level of FI measured by the index of Sarma (2012) and NI by 0.003 and 0.002 at the 5% level, respectively. These findings are consistent with the literature (Knack and Keefer, 1995; Park and Mercado, 2015; Naceur et al, 2015; and Gopalan and Rajan, 2015).

Government spending is found to promote all the aspects of FI. An increase in government spending as a percentage of GDP by 1% leads to an increase in the index of Sarma (2012) and NI by approximately 0.006 and 0.007, respectively. Government spending effects FI in two ways. One way is through the redistribution of wealth among individuals in society. Another way is through improving economic activities which increases income and job creation.

A 1% increase in government spending as a percentage of GDP relates to an increase in the number of deposit and loan accounts per 1,000 adults by 20.01 (at 10% level) and 7.19 (at 1% level), respectively. This increase as a proportion in the number of deposit

and loan accounts per 1,000 adults equal to 3.2% (at the 5% level) and 3.8% (at the 1% level). Furthermore, the increase in government spending as a percentage of GDP increase by 1% is associated with an increase in banks' outstanding deposits and loans as a percentage of GDP by 1.48% and 1.46% at 5% level, respectively. It appears that expansionary fiscal policy leads banks to increase their coverage. Thus, the increase in government spending as a percentage of GDP by 1% is related to improvements in the number of branches of ODCs per 1,000 kilometer squares and per 100,000 adults by 0.498 unit (about 3.1%) and 0.517 unit (around 2.5%) at 5% level, respectively.

The percentage of urban population – that capture the population demography – has an insignificant relationship with the level of FI unlike what has been discussed in the literature (World Bank Global Financial Inclusion report 2011 mentioned that distance was one of the reason for being financially excluded). This is might because this paper includes financial characteristics (liquidity, performance, efficiency and stability) as well as other macro-economic factors (government expenditure and rule of law) which has not been included in the previous papers. The dummy variable that control for countries' different stage of economic development show a significantly positive relationship with FI indexes, number of deposits and percentage of population with an account at FFIs.

Banks' cost to income ratio has also show no relationship with FI. This is not unclear as most of the previous studies tend to show a positive relationship between bank efficiency and FI. It is worth mentioning that the result remains the same even when cost to income ratio is replaced with overhead cost to income ratio.

The overall R-squared for the fixed effect panel regression of the Sarma index (2012) and NI show that the model explains 60% and 64.9% of the variation, respectively. However, the overall R-squared for the fixed effect panel regression of the natural logarithm of banks' outstanding deposits (and as a percentage of GDP), and the number branches of ODCs per 1,000 kilometer squares are considerably lower. The F-test that jointly examines whether all individual effects  $u_i$  are zero is significant in all regressions in Table 3.2 and 3.3, apart from the fixed effect panel regression of the natural logarithm of banks' outstanding deposits.

**Table 3.2: Determinants of Financial Inclusion Using Fixed Effect Estimations**

Independent Variable	Dependent Variables							
	New Index	Sarma's (2012) Index	Deposit Accounts at ODCs per 1,000 Adults	Loan Accounts at ODCs per 1,000 Adults	Banks' Deposits (%GDP)	Banks' Loans (%GDP)	Number of Branches of ODCs per 1,000 km2	Number of Branches of ODCs per 100,000 Adults
Bank Concentration	-1E-4	-2E-4	-0.097	-0.019	-0.184	-0.065	-0.029	-0.043 *
Banks' Credits to Deposits Ratio	0.001 *	0.001 ***	5.346 ***	0.698	-0.080	0.353 ***	0.119 ***	0.118 ***
Net Interest Margin	-0.002	0.000	3.284	-1.000	0.183	-0.621 **	-0.162	-0.095
Z-Score	0.004 *	0.003	9.487	2.969	0.216	0.157	-0.565 **	-0.242
Rule of Law	0.002 **	0.003 **	7.435 *	2.665 ***	-0.223	-0.046	0.054	0.016
Banks' Costs to Income Ratio	3E-4	3E-4	0.556	0.926	0.009	0.037	-0.003	0.062
Government Expenditure (%GDP)	0.006 **	0.007 **	20.005 *	7.191 **	1.484 **	1.461 ***	0.498 **	0.517 ***
Percentage of Urban Population	0.002	0.001	6.958	1.651	-0.040	-0.216	-0.012	-0.039
World-Bank Countries' Income Classifications	0.038 ***	0.022 **	92.113 **	15.393	2.858	1.800	-0.067	0.490
Constant	-0.038	-0.111	-634.355	-89.401	47.816 **	3.674	15.461 **	7.048
Observations	483	483	483	483	483	483	483	483
Number of Countries	79	79	79	79	79	79	79	79
Average Period (years)	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
F test	6.41 ***	4.93 ***	3.97 ***	2.57 **	2.56 ***	10.45 ***	2.06 **	5.63 ***
R-Squared within	0.160	0.173	0.160	0.073	0.018	0.380	0.216	0.316
R-Squared between	0.651	0.608	0.447	0.523	0.001	0.119	0.001	0.085
R-Squared Overall	0.649	0.600	0.443	0.503	1E-4	0.137	0.001	0.097
Correlation ( $u_i, Xb$ )	0.317	0.365	0.208	0.448	-0.217	-0.081	-0.184	-0.004
rho	0.935	0.943	0.956	0.957	0.791	0.969	0.992	0.977

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

**Table 3.3: Determinants of Financial Inclusion Using Fixed Effect Estimations**

Independent Variable	Dependent Variables								
	Having an Account at FFIs	Saved at FFIs	Borrowed from FFIs	Log Deposit Accounts at ODCs per 1,000 Adults	Log Loan Accounts at ODCs per 1,000 Adults	Log Banks' Deposits	Log Banks' Loans	Log Number of Branches of ODCs per 1,000 km2	Log Number of Branches of ODCs per 100,000 Adults
Bank Concentration	0.043	0.027	0.033	-0.002	-0.003	-0.014	-0.004	-0.002	-0.001
Z-Score	1.043 **	0.190	0.155	0.015	0.015 *	0.015	0.003	-0.003	-0.005
Rule of Law	0.257	0.101	0.169 **	0.007	0.010 *	-0.004	0.005	-0.001	-0.001
Banks' Costs to Income Ratio	-0.049	-0.007	0.003	0.000	0.002	0.023	0.005	0.001	0.001
Government Expenditure (%GDP)	0.624	-0.170	0.121	0.032 **	0.038 ***	0.002	0.033 **	0.031 ***	0.025 ***
Percentage of Urban Population	0.696	0.030	-0.007	0.000	0.006	0.009	0.002	0.004	0.001
World-Bank Countries' Income Classifications	9.373 **	1.566	0.108	0.114 ***	0.083	-0.187	0.128	0.036	0.005
Constant	-58.847 *	12.696	-4.241	5.274 ***	3.426 ***	23.994 ***	21.835 ***	1.075 ***	2.142 ***
Observations	204	204	204	483	483	483	483	483	483
Number of Countries	79	79	79	79	79	79	79	79	79
Average Period (years)	2.6	2.6	2.6	6.1	6.1	6.1	6.1	6.1	6.1
F test	2.49 **	1.13	1.43	3.08 ***	3.03 ***	1.34	5.11 ***	6.81 ***	4.15 ***
R-Squared within	0.164	0.088	0.067	0.151	0.112	0.040	0.122	0.240	0.197
R-Squared between	0.447	0.272	0.004	0.509	0.589	0.019	0.293	0.036	0.147
R-Squared Overall	0.424	0.233	0.005	0.490	0.555	2E-4	0.282	0.029	0.139
Correlation ( $u_i, Xb$ )	-0.530	0.225	-0.589	0.345	0.439	0.000	0.344	0.004	0.169
rho	0.855	0.851	0.790	0.957	0.952	0.808	0.982	0.996	0.986

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

Note that it is a challenge to compare our results precisely with most of the previous literature. For instance, Akudugu (2013), Goodstein and Rhine (2013), Pena et al. (2014), Tuesta et al. (2015), and Zins and Weill (2016) use different statistical methods, such as logit and probit which provide different explanatory power statistics (pseudo r-squared log likelihood). Besides, they use survey samples and cover a small number of countries. In addition, they include simple indicators such as the number of population with an account at FFIs rather than including an index that measures FI. Other researchers have tried to study FI at the micro level.

Ghosh (2008) studies the relationship between FI and fragility at the state-owned banks (banks level) in India using three stage least squares for the period between 1997 and 2007. He runs 3SLS regression separately on four simple FI indicators, namely geographic inclusion, demographic inclusion, loan accounts per capita and loan to income ratio. The r-squares in his study are higher than those reported here. However, his study are only applied to one country, which is India, and studied inclusion at the microeconomic level.

For further investigation, time effects have been added to the previous fixed effect regressions and the results are reported in Appendix 3.6 and 3.7. Note that the results have slightly changed. The FI relationship with Z-score turns insignificant with all aspects of FI. It seems that the relationship is driven by the time dimension. Regulators can still can set strategies to enhance FI without worrying about the stability of the banking system.

The relationship between government expenditures as a percentage of GDP and the FI indexes become insignificant. It remains positive and significant with banks' outstanding deposits and loans as a percentage of GDP and the number of branches of ODC per 100,000 adults and per 1,000 kilometer squares. This finding mean that government expenditures have a limited effect on some aspects of FI. Nevertheless, government pay unemployment benefits, which most probably is paid through bank transactions (at least in high and upper middle-income countries). This means that all individuals in need of unemployment benefits must have an account at FFIs, which enhances the level of FI.

However, this segment of society is unlikely to be able to receive loans because they do not have sustainable income.

Surprisingly, the percentage of the urban population shows a significantly negative relationship with some aspects of FI. The negative relationship is not clear and needs to be further investigated. It is worth mentioning that the regressions in Appendix 3.6 and 3.7 have been re-estimated without including the percentage of urban population and the coefficients have remained the same. This relationship between demography and FI is covered more in following 2SLS regressions.

The relationship between rule of law and FI remains the same, except that the rule of law index reveals a positive and significant relationship with the percentage of population with an account at FFIs. A 1% increase in the rule of law index is linked to a 0.37% increase in the percentage of population with an account at FFIs. Banks' concentration also remains mostly the same except that it shows a positive and significant relationship with the percentage of population with an account at FFIs. An increase in the percentage of the assets of the largest three banks to banks' total asset by 1% leads to an increase in the percentage of population with an account at FFIs by 0.13%.

The result of banks' credit to banks' deposits has remain unchanged. The banks' costs to income ratio also remain insignificant with all aspects of FI. Note that replacing banks' cost to income ratio with banks' overhead cost to total assets has also led to the same findings. However, the results are not reported in this chapter because of the shortage of time.

Table 3.4 and 3.5 report the relationship between income – measured by the natural log of GDP per capita – and FI using fixed effects 2SLS with trade (as a percentage of GDP) as an IV. Table 3.4 and 3.5 show that income has a positive and significant relationship with FI. An increase in income by 1% leads to both the Sarma' 2012 index and NI to increase by approximately 0.005 at the 1% level, respectively. The increase in income enables more individuals to open deposit accounts. The increase in income by 1% is associated with an increase in deposit accounts at ODCs per 1,000 adults and percentage of population with an account at FFIs by 16.44 units (approximately 1.57%) and 0.78% at 1% level, respectively.

Moreover, a higher level of income increases the chances of receiving loans, which boosts the number of loan accounts and outstanding loans. A 1% increase in income is related to an increase in outstanding loans (percentage of GDP) and number of loan accounts at ODCs per 1,000 adults by 1.55% (0.47%) and 4.51 units (approximately 0.88%) at 5% level, respectively. Furthermore, an increase in income encourages financial institutions to cover more geographical areas through opening new branches. A 1% increase in income is linked to an increase in the number of branches of ODCs per 1,000 kilometer squares by 0.19 units (roughly 0.69%). The results consist with the literature such as Greenwood and Jovanovic (1990) and Evans and Alenoghena (2017)

The relationship between rule of law and FI disappears in Table 3.4 and 3.5. The result of government expenditure as a percentage of GDP remain similar to Table 3.4 and 3.5 in terms of sign and significance. The result of percentage of urban population show a positive relationship with FI indexes and the number of deposit and loan accounts per 1,000 adults. The negative relationship between the percentage of urban population and some aspects of FI has completely disappeared. Although a dummy that controls for countries' income classifications was use in the fixed effect regressions, it seems that it is important to control for income when we study the relationship between FI and demography.

The F-test jointly tests whether all individual effects  $u_i$  are zero is significant in all regressions in both the first and second stages in Table 3.4 and 3.5. (apart from the regressions where the dependent variable is the natural logarithm of banks' outstanding deposit and banks' outstanding deposit as a percentage of GDP). The result of weak instrument robust inference (the Anderson-Rubin Wald test), in Tables 3.4 and 3.5, reject the null hypothesis of the joint significance tests of endogenous regressors in the main equations in most of the regressions. The only exceptions are the regressions where the dependent variable is the number of branches of ODCs per 100,000 adults, and the natural logarithm of banks' outstanding deposits (and as a percentage of GDP).

**Table 3.4: The Effect of Income (GDP per Capita) on Financial Inclusion Using Two Stage Least Squares Fixed Effects Estimation**

		New Index		Sarima's Index (2012)		Deposit Accounts at ODCs per 1,000 Adults		Loan Accounts at ODCs per 1,000 Adults		Banks' Deposits (%GDP)		Banks' Loans (%GDP)		Branches of ODCs per 1,000 km2		Branches of ODCs per 100,000 Adults	
Stage		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Main Variable	Log GDP per Capita		0.455 ***		0.477 ***		1652.59 ***		453.021 ***		53.04		47.155 **		19.245 ***		7.662
Instrumental Variable	Trade (%GDP)	-0.003 ***		-0.003 ***		-0.003 ***		-0.003 ***		-0.003 ***		-0.003 ***		-0.003 ***		-0.003 ***	
Control Variables	Rule of Law	0.006 ***	-0.001	0.006 ***	-0.001	0.006 ***	-4.605	0.006 ***	-0.111	0.006 ***	-0.532	0.006 ***	-0.318 *	0.006 ***	-0.072	0.006 ***	-0.037
	Government Expenditure (%GDP)	-0.001 **	0.012 ***	-0.001 **	0.014 ***	-0.001 **	47.931 ***	-0.001 **	10.466 ***	-0.001 **	1.745	-0.001 **	2.272 ***	-0.001 **	0.877 ***	-0.001 **	0.784 ***
	Percentage of Urban Population	-0.006 ***	0.003 ***	-0.006 ***	0.003 ***	-0.006 ***	11.864 ***	-0.006 ***	3.597 ***	-0.006 ***	0.173	-0.006 ***	-0.085	-0.006 ***	0.017	-0.006 ***	-0.048
Observations		469		469		469		469		469		469		469		469	
Number of Countries		76		76		76		76		76		76		76		76	
Average Period (years)		6.2		6.2		6.2		6.2		6.2		6.2		6.2		6.2	
F test		11.48 ***	9.15 ***	11.48 ***	9.21 ***	11.48 ***	8.6 ***	11.48 ***	5.66 ***	11.48 ***	0.92	11.48 ***	8.11 ***	11.48 ***	6.59 ***	11.48 ***	6.87 ***
Centered R2		0.126	-0.712	0.126	-0.638	0.126	-0.493	0.126	-0.179	0.126	-0.078	0.126	-0.307	0.126	0.036	0.126	0.068
Weak-instrument-robust inference Anderson-Rubin Wald test (chi-sq)		31.43 **		36.43 ***		29.92 ***		17.55 ***		1.76		10.31 ***		10.71 ***		2.01	
Under-identification test (Kleibergen-Paap rk LM statistic)		11.82 ***		11.82 ***		11.82 ***		11.82 ***		11.82 ***		11.82 ***		11.82 ***		11.82 ***	
Weak identification test (Cragg-Donald Wald F statistic)		27.997		27.997		27.997		27.997		27.997		27.997		27.997		27.997	
Kleibergen-Paap rk Wald F statistic		21.883		21.883		21.883		21.883		21.883		21.883		21.883		21.883	
Stock-Yogo weak ID test critical values:																	
10% maximal IV size		16.38		16.38		16.38		16.38		16.38		16.38		16.38		16.38	
15% maximal IV size		8.96		8.96		8.96		8.96		8.96		8.96		8.96		8.96	
Endogeneity Test		20.775 ***		25.478 ***		21.831 ***		9.002 ***		1.823		11.622 ***		3.442 *		0.438	

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

The results remain the same even when World-Bank Countries' Income Classifications is included



**Table 3.5: The Effect of Income (GDP per Capita) on Financial Inclusion Using Two Stage Least Squares Fixed Effects Estimation**

		Having an Account at FFIs		Saved at FFIs		Borrowed from FFIs		Log Deposit Accounts at ODCs per 1,000 Adults		Log Loan Accounts at ODCs per 1,000 Adults		Log Banks' Deposits		Log Banks' Loans		Log Branches of ODCs per 1,000 km2		Log Branches of ODCs per 100,000 Adults	
Stage		(1)	(2)			(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Main Variable	Log GDP per Capita	78.49 ***		1.446		3.707		1.566 ***		0.881 **		-1.502		1.543 ***		0.701 **		-0.098	
Instrumental Variable	Trade (%GDP)	-0.005 ***		-0.005 ***		-0.005 ***		-0.003 ***		-0.003 ***		-0.003 ***		-0.003 ***		-0.003 ***		-0.003 ***	
Control Variables	Rule of Law	0.007 ***	-0.298	0.007 ***	0.091	0.007 ***	0.130 ***	0.006 ***	-0.004	0.006 ***	0.005	0.006 ***	0.005	0.006 ***	-0.005	0.006 ***	-0.006 **	0.006 ***	-0.001
	Government Expenditure (%GDP)	0.002	0.250	0.002	-0.420	0.002	0.116	-0.001 **	0.059 ***	-0.001 **	0.046 ***	-0.001 **	-0.024	-0.001 **	0.053 ***	-0.001 **	0.046 ***	-0.001 **	0.032 ***
	Percentage of Urban Population	-0.005	0.893 ***	-0.005	0.055	-0.005	0.027	-0.006 ***	0.005	-0.006 ***	0.009 *	-0.006 ***	0.008	-0.006 ***	0.006	-0.006 ***	0.006	-0.006 ***	0.001
Observations		206		206		206		469		469		469		469		469		469	
Number of Countries		76		76		76		76		76		76		76		76		76	
Average Period (years)		2.7		2.7		2.7		6.2		6.2		6.2		6.2		6.2		6.2	
F test		10.23 ***	6.1 ***	10.23 ***	0.95	10.23 ***	1.57	11.48 ***	8.28 ***	11.48 ***	12.26 ***	11.48 ***	0.09	11.48 ***	2.69 **	11.48 ***	11.26 ***	11.48 ***	7.61 ***
Centered R2		0.224	-0.082	0.224	0.022	0.224	0.031	0.126	-0.381	0.126	0.092	0.126	-0.028	0.126	0.118	0.126	-0.033	0.126	0.066
Weak-instrument-robust inference Anderson-Rubin Wald test		20.47 ***		0.4		0.39		18.79 ***		3.78 *		0.17		3.23 *		6.2 ***		0.16	
Under-identification test (Kleibergen-Paap rk LM)		7.314 ***		7.314 ***		7.314 ***		11.82 ***		11.82 ***		11.82 ***		11.82 ***		11.82 ***		11.82 ***	
Weak identification test (Cragg-Donald Wald F)		24.837		24.837		24.837		27.997		27.997		27.997		27.997		27.997		27.997	
Kleibergen-Paap rk Wald F statistic		23.838		23.838		23.838		21.883		21.883		21.883		21.883		21.883		21.883	
Stock-Yogo weak ID test critical values:																			
10% maximal IV size		16.38		16.38		16.38		16.38		16.38		16.38		16.38		16.38		16.38	
15% maximal IV size		8.96		8.96		8.96		8.96		8.96		8.96		8.96		8.96		8.96	
Endogeneity Test		9.614 ***		0.022		0.436		12.573 ***		0.893		0.418		0.376		4.352 **		0.692	

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

The results remain the same even when World-Bank Countries' Income Classifications is included

The result of under-identification test (the Kleibergen-Paap rk LM statistic) rejects the null hypothesis of under-identification in all regressions in Table 3.4 and 3.5. Also, the weak identification tests (Cragg-Donald Wald F statistic and Kleibergen-Paap rk wald F statistic) are above the critical values of the Stock-Yogo weak identification test in all regressions. The endogeneity test is checking whether the IV method is required to estimate the equation or not. The null hypothesis assume that income is an exogenous variable. In Table 3.4 and 3.5, the endogeneity test shows that the IV method is needed for half of the regressions (FI indexes, and loans as a percentage of GDP, number of deposit and loan accounts per 1,000 adults, number of branches of ODCs per 1,000 kilometer squares and percentage of population with an account at FFIs). Note that the result of the test consists with the findings in the literature (Greenwood and Jovanovic, 1990; Sharma, 2016; Gourène and Mendy, 2017; Kim et al, 2018).

For further investigation, time effects are added to the 2SLS regressions and the results are reported in Appendix 3.8 and 3.9. Please note that half of the results in Appendix 3.8 and 3.9 fail to reject the null hypothesis of the joint significance tests of endogenous regressors in the main equations for the weak instrument robust inference (the Anderson-Rubin Wald test). These regressions relate to: banks' outstanding deposits as a percentage of GDP; percentage of population saved at (and borrowed from) FFIs; the natural logarithm of number of deposit (and loan) accounts at ODCs per 1,000 adults; the natural logarithm of banks' outstanding deposits (and loans); as well as the natural logarithm of branches of ODCs per 100,000 adults and per 1,000 kilometer squares. Therefore, the result of these regressions will not be discussed.

The natural logarithm of GDP per capita in the rest of the regressions has shown the same sign and significance to the results in Tables 3.4 and 3.5. However, the value of the coefficients is different. On one hand, the coefficient of natural logarithm of GDP per capita in Appendix 3.8 and 3.9 is much smaller in regressions where the dependent variable is FI indexes and banks' outstanding loans as a percentage of GDP than in Tables 3.4 and 3.5.

On the other hand, the coefficient of natural logarithm in Appendix 3.8 and 3.9 is larger in regressions where the dependent variable is the number of deposit and loan accounts at ODCs per 1,000 adults and branches of ODCs per 1,000 adults compared to Tables

3.4 and 3.5. The natural logarithm of GDP per capita shows a significantly positive relationship with branches of ODCs per 100,000 adults as a 10% increase in GDP per capita relates to a 1.77 unit in branches of ODCs per 100,000 adults. The endogeneity tests in Appendix 3.8 and 3.9 still show that there is a bidirectional relationship between income and FI as in Tables 3.4 and 3.5.

It is worth mentioning that government expenditure as a percentage of GDP, in Appendix 3.8 and 3.9 remains positive and significant for most of the FI indicators and indexes. Unlike the results of government expenditure as a percentage of GDP in Appendix 3.6 and 3.7. The percentage of urban population shows an insignificant relationship with FI in Appendix 3.8 and 3.9.

Table 3.6 and 3.7 reports the relationship between human development – measured by the HDI – and FI using fixed effects 2SLS. The index of education is used as an IV in the 2SLS to overcome the potential issue of bidirectional relationship between human development and FI. Table 3.6 and 3.7 shows that human development has a significantly positive relationship with FI. The increase in human development level indicates that individuals have higher levels of education and skills, which means that they can make better financial decisions. Therefore, an improvement in the level of human development can lead the number of deposit and loan accounts as well as bank's outstanding deposits and loans to increase. This result consists with the literature (Raichoudhury, 2016)

An increase in the value of HDI by 0.01 (note that the maximum value of the index is 1) is associated with an improvement in number of deposits at ODCs per 1,000 adults, the percentage of population with an account at FFIs, and percentage of population who saved at FFIs by 78.14 (8.6%), 4.99% and 1.23% at the 1% level, respectively. In addition, the same amount of increase in the value of HDI is related to an increase in the number of loans at ODCs per 1,000 adults and percentage of population borrowed from FFIs by 17.88 (6.63%) and 0.63% at 5% level, respectively. A 0.01 increase in the value of HDI is connected to an increase in banks' outstanding deposits and loans as a percentage of GDP by 4.487% and 1.348% (equal to 6.5% increase in outstanding loans) at the 5% level, respectively. Thus, HDI shows a significant positive relationship with FI indexes, since an increase in the value of HDI by 0.01 is related to 0.019 increase in the value of Sarma's 2012 index and 0.022 increase in the value of NI.

**Table 3.6: The Effect of Human Development on Financial Inclusion Using Two Stage Least Squares Fixed Effects Estimation**

		New Index		Sarima's Index (2012)		Deposit Accounts at ODCs per 1,000 Adult		Loan Accounts at ODCs per 1,000 Adult		Banks' Deposits (%GDP)		Banks' Loans (%GDP)		Branches of ODCs per 1,000 km2		Branches of ODCs per 100,000 Adults	
Stage		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Main Variable	HDI	2.193 ***		1.924 ***		7814.06 ***		1788.03 ***		448.738 **		134.811 ***		-6.816		-37.543 *	
Instrumental variable	Education Index	0.625 ***		0.625 ***		0.625 ***		0.625 ***		0.625 ***		0.625 ***		0.625 ***		0.625 ***	
Control Variables	Rule of Law	2E-4 ***	0.001 **	2E-4 ***	0.002 **	2E-4 ***	5.629 **	2E-4 ***	2.201 ***	2E-4 ***	-0.317 ***	2E-4 ***	-0.066 ***	2E-4 ***	0.045 ***	2E-4 ***	0.018 ***
	Government Expenditure (%GDP)	2E-4	0.006 ***	2E-4	0.008 ***	2E-4	10.512	2E-4	5.084 *	2E-4	0.864	2E-4	1.766 ***	2E-4	0.736 ***	2E-4	0.764 ***
	Percentage of Urban Population	1E-4	1E-4	1E-4	-5E-4 *	1E-4	0.691	1E-4	0.502	1E-4	-0.335 ***	1E-4	-0.376 ***	1E-4	-0.064	1E-4	-0.059
Observations		469		469		469		469		469		469		469		469	
Number of Countries		76		76		76		76		76		76		76		76	
Average Period (years)		6.2		6.2		6.2		6.2		6.2		6.2		6.2		6.2	
F test		285.3 ***	43.84 ***	285.3 ***	33.77 ***	285.3 ***	26.82 ***	285.3 ***	12.54 ***	285.3 ***	7.65 ***	285.3 ***	12.49 ***	285.3 ***	5.57 ***	285.3 ***	6.82 ***
Centered R2		0.734	0.418	0.734	0.293	0.734	0.258	0.734	0.122	0.734	0.079	0.734	0.139	0.734	0.044	0.734	0.072
Weak-instrument-robust inference Anderson-Rubin Wald test (chi-sq)		111.71 ***		65.2 ***		76.19 ***		25.65 ***		5.17 **		8.1 ***		0.09		2.85 *	
Under-identification test (Kleibergen-Paap rk LM statistic)		87.871 ***		87.871 ***		87.871 ***		87.871 ***		87.871 ***		87.871 ***		87.871 ***		87.871 ***	
Weak identification test (Cragg-Donald Wald F statistic)		1010.849		1010.849		1010.849		1010.849		1010.849		1010.849		1010.849		1010.849	
Kleibergen-Paap rk Wald F statistic		908.872		908.872		908.872		908.872		908.872		908.872		908.872		908.872	
Stock-Yogo weak ID test critical values: 10% maximal IV size 15% maximal IV size		16.38 8.96				16.38 8.96		16.38 8.96		16.38 8.96		16.38 8.96		16.38 8.96		16.38 8.96	
Endogeneity Test		0.001		0.001		0.418		0.572		0.107		0.353		0.123		0.606	

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

The results remain the same even when World-Bank Countries' Income Classifications is included

**Table 3.7: The Effect of Human Development on Financial Inclusion Using Two Stage Least Squares Fixed Effects Estimation**

		Having an Account at FFIs		Saved at FFIs		Borrowed from FFIs		Log Deposit Accounts at ODCs per 1,000 Adults		Log Loan Accounts at ODCs per 1,000 Adults		Log Banks' Deposits		Log Banks' Loans		Log Branches of ODCs per 1,000 km2		Log Branches of ODCs per 100,000 Adults	
Stage		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Main Variable	HDI	499.38 ***		123.49 ***		63.45 **		8.250 ***		6.418 ***		5.275		6.306 ***		1.964 **		-0.433	
Instrumental variable	Education Index	0.648 ***		0.648 ***		0.648 ***		0.625 ***		0.625 ***		0.625 ***		0.625 ***		0.625 ***		0.625 ***	
Control Variables	Rule of Law	1E-4	0.154	1E-4	0.080	1E-4	0.145 **	2E-4	0.003	2E-4	0.009 **	2E-4	-0.005	2E-4	0.003	2E-4	-0.002	2E-4	0.001
	Government Expenditure (%GDP)	-1E-4	0.197	-1E-4	-0.516 *	-1E-4	0.080	2E-4	0.037 ***	2E-4	0.032 **	2E-4	-0.018	2E-4	0.034 **	2E-4	0.039 ***	2E-4	0.033 ***
	Percentage of Urban Population	1E-4	0.261 **	1E-4	-0.052	1E-4	-0.036	1E-4	-0.007 **	1E-4	0.002	1E-4	0.011	1E-4	-0.004	1E-4	0.001	1E-4	1E-4
Observations		206		206		206		469		469		469		469		469		469	
Number of Countries		76		76		76		76		76		76		76		76		76	
Average Period (years)		2.7		2.7		2.7		6.2		6.2		6.2		6.2		6.2		6.2	
F test		113.8 ***	30.7 ***	113.8 ***	5.37 ***	113.8 ***	2.98 ***	285.3 ***	38.34 ***	285.3 ***	19.06 ***	285.3 ***	3.38 ***	285.3 ***	8.61 ***	285.3 ***	14.34 ***	285.3 ***	7.73 ***
Centered R2		0.737	0.576	0.737	0.140	0.737	0.091	0.734	0.379	0.734	0.147	0.734	0.008	0.734	0.083	0.734	0.131	0.734	0.085
Weak-instrument-robust inference Anderson-Rubin Wald test		57.48 ***		14.82 ***		4.78 **		88.53 ***		36.34 ***		2.19		20.65 ***		6.47 **		0.37	
Under-identification test (Kleibergen-Paap rk LM statistic)		87.871 ***		87.871 ***		87.871 ***		87.871 ***		87.871 ***		87.871 ***		87.871 ***		87.871 ***		87.871 ***	
Weak identification test (Cragg-Donald Wald F statistic)		1010.849		1010.849		1010.849		1010.849		1010.849		1010.849		1010.849		1010.849		1010.849	
Kleibergen-Paap rk Wald F statistic		908.872		908.872		908.872		908.872		908.872		908.872		908.872		908.872		908.872	
Stock-Yogo weak ID test critical values: 10% maximal IV size 15% maximal IV size		16.38 8.96		16.38 8.96		16.38 8.96		16.38 8.96		16.38 8.96		16.38 8.96		16.38 8.96		16.38 8.96		16.38 8.96	
Endogeneity Test		0.014		0.15		1.465		0.732		0.106		1.081		0.745		0.067		0.004	

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

The results remain the same even when World-Bank Countries' Income Classifications is included

HDI seems to have positive relationship with geographical coverage but negative relation with the demographical coverage. If the value of HDI increased by 0.01 then branches of ODCs per 1,000 kilometer squares potentially will increase as a proportion by 1.98% at 5% level, however branches of ODCs per 100,000 adults is expected to decline by 0.375 unit at 10% level of significance. The relationship between human development and demographical coverage indicates that societies with higher levels of human development (particularly educational level) tend to use ways other than visiting banks' branches for undertaking financial transactions such as via the use of ATMs, internet banking, bank-landlines and bank mobile apps.

Note that the weak instrument robust inference rejects the null hypothesis of the joint significance tests of endogenous regressors in the main equations in most of the 2SLS regressions. (Although this is not the case for the regressions where the dependent variable is branches of ODCs per 1,000 kilometers squares, the natural logarithm of branches of ODCs per 100,000 adults and the natural log of banks' outstanding deposit have fail to reject the null hypothesis). The under-identification test reveals that there is no under-identification in all regressions. Likewise, the weak identification tests (the Cragg-Donald Wald F statistic and Kleibergen-Paap rk wald F statistic) are above the critical values of the Stock-Yogo weak identification test in all regressions.

Comparing these results with those of the effects of FI on human development in the second chapter of this thesis shows that human development affects FI greater than the effect of FI on human development. However, the endogeneity test reveals that the IV method is not needed for the 2SLS regressions. Therefore, we run the 2SLS regressions for FAS's FI indicators for the same countries but a longer number of years (2006 to 2017) to further check whether the bidirectional relationship exists over a longer period<sup>11</sup>. The result shows that most of the FI indicators and Sarma's 2012 index require the IV method. (These results are not reported).

Furthermore, time effects have been added to the 2SLS to further check the relationship between human development and FI. The results are reported in Appendix 3.10 and 3.11. As in Appendix 3.8 and 3.9, most of the results in Appendix 3.10 and 3.11 fail to reject

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<sup>11</sup> Please note that indicators from FINDEX are only available for 3 single years (2011, 2014 and 2017).

the null hypothesis of the joint significance tests of endogenous regressors in the main equations for the weak instrument robust inference (the Anderson-Rubin Wald test). The regressions that rejected the null hypothesis of weak instrument robust inference are the FI indexes and number of deposit accounts at ODCs per 1,000 adults (and natural logarithm). The result of regressions that fail to reject the null hypothesis of weak instrument robust inference will not be discussed.

HDI in Appendix 3.8 and 3.9 has shown a positive and significant relationship with the indexes for FI. An increase in HDI by 0.01 is related to an increase in the index of Sarma (2012) and NI by 0.014 and 0.011 at the 5% level of significance, respectively. Also, a 0.01 increase in the value of HDI is associated with 7.514 unit (2.7%) increase in the number of deposit account at ODCs per 1,000 adults.

### **3.6. Conclusion**

FI is said to be important for promoting saving, improving allocation of funds and more productive investments. It supports the expansion of MSEs, which has positive effects on employment, income and economic growth. Providing low-income segments of society with access to financial services help in reducing income inequality. This paper analyzes the main determinants of FI at the macro-economic level using a wide array of possible indexes and indicators of FI. The study covers 80 countries from 2011 to 2017.

The index of Sarma (2012) and NI are used as proxies for FI. Simpler indicators of FI from the FAS and FINDEX database are also included to offer a deeper understanding of the way in which FI interacts with selected macroeconomic and other factors. These FI indicators are: banks' outstanding deposits and loans as a percentage of GDP; the number of deposit and loan accounts at ODCs per 1,000 adults; the number of branches of ODCs per 100,000 adults and per 1,000 kilometer squares; percentage of population with an account at FFIs; percentage of population saved at FFIs; and percentage of population borrowed from FFIs.

The empirical analysis is carried out using a series of regression estimates. First, fixed effects panel regression is used to estimate the link between FI variables and a range of explanatory variables obtained from the literature of FI and related topics. These

explanatory variables are: the percentage of total assets of the biggest three banks; banks' credit to banks' deposits ratio; banks' cost to income ratio; banks' Z-score; banks' net interest margin; government expenditure as a percentage of GDP; and rule of law index; and the percentage of urban population.

Second, fixed effects 2SLS with IV are carried out to study the relationship between income (measured by the natural logarithm of GDP per capita) and FI. Trade as a percentage of GDP is chosen to be the IV. Third, fixed effect 2SLS with IV are applied to study the relationship between human development (using HDI) and FI. The education index is chosen as an IV. Additional analysis that includes time effects is also carried and reported in the appendix.

The findings of this paper show that FI has no relationship with banks' stability unlike previous studies. The reason behind the difference in results between this paper and previous papers, namely Han and Melecky (2013), and Morgan and Pontines (2014), is that they use simple measures as a proxy for FI. These proxies only capture one aspect of FI, whereas FI indexes capture the overall picture. The difference in results between this paper and Ghosh (2008) about financial stability is that he only focused on one India whereas this paper derives results from 79 countries.

Banks' performance that is captured by net interest margin has no relationship with FI unlike what has been suggested by Shihadeh and Liu (2019). However, please note that the difference might have been a result of the methodology they used, which OLS estimate that do not control for banks and countries specific characteristics. In addition, Shihadeh and Liu (2019) did not control for macro-economic factors such as rule of law, and government expenditures.

Banks' cost to income ratio has also show no relationship with FI. This is not unclear as most of the previous studies tend to show a positive relationship between bank efficiency and FI. It is worth mentioning that the result remains the same even when cost to income ratio is replaced with overhead cost to income ratio. Finding that financial stability, banks' performance and banks' efficiency have no relationship with FI means that regulators can set strategies to enhance FI without worrying about the stability or the performance of the banking system.



The relationship between banks' concentration and FI is ambiguous as some of the previous paper suggested positive relationship (Owen and Pereira, 2018; and Chauvet and Jacolin, 2017) whereas others show the opposites (Rojas-Suarez and Amado, 2014; and Gopalan and Rajan, 2015). Note that these papers do not include data about financial demography, financial geography, or outstanding deposits and loans. The common between these papers is that they used simple measures of FI and included bank concentration but not as their main variable of interest. Some of these papers have also used an interaction variable. It seems that bank concentration does not have a direct relationship with FI, but it accelerates the effect on FI. this chapter banks' concentration showed no relationship with FI.

The main determinants of FI are: rule of law; banks' liquidity (banks' credit to banks' deposit); income; and human development. The increase in banks' credit to banks' deposit ratio means that banks are providing more loans and outstanding loans, which indicates that there will be greater jobs creation and consequently, more deposit accounts. The increase in economic activities because of the increase in loans and outstanding loans motivates banks to expand their coverage. Central banks, based on this finding, can help in enhancing the level of FI through changing bank liquidity policies. Note that this is the first paper to discuss the effect of banks' credits to deposits – as far as I am aware.

Adequate legal contract enforcement also encourages financial institutions to lend more as they have trust in the legal system to enforce borrowers to pay back loans and interest. Politicians and regulators can enhance FI by improving the rule of law, which is considered by financial institutions as a positive sign. The increase in lending boosts economic activities and creates new jobs that leads to increases in the number of deposit accounts. This finding consist with the literature as suggested by Gopalan and Rajan (2015), Naceur et al (2015) and Knack and Keefer (1995)

An increase in income enables more individuals to open deposit accounts and increases the chances of receiving financial services, which boosts the number of loan accounts and outstanding loans. Furthermore, an increase in income encourages financial institutions to cover more geographical areas through opening new branches. Governments and central banks can play a key role in raising income.

The increase in the level of human development indicates that individuals have higher levels of education and skills, which means that they can make better financial decisions. An improvement in the level of human development lead to increased FI. Therefore, it is important for government policy on focusing on broad human development goals (such as improving education) which will also provide household awareness of the importance of being financially included.

The relationship between government expenditures as a percentage of GDP and FI indexes has a positive and significant relationship with FI. However, government expenditures have a limited effect on some aspects of FI, so it may not be the most effective strategy to enhance the level of FI. The main role that government expenditure can play is to continue to offer household social benefits via banks / financial institutions to enhance the level of FI.

The findings of this paper contribute to our understanding of the key determinants of FI at the macro-economic level. In addition, understanding the key determinants of FI will enable politicians, policymakers, regulators to set strategies that raise the level of FI within a country. Also, it provides a guide for future work in the area of FI.

### Appendix 3.1: Countries Covered in the Analysis

Number	Countries Name	Number	Countries Name
1	Afghanistan	41	Kenya
2	Albania	42	Latvia
3	Algeria	43	Lebanon
4	Argentina	44	Lesotho
5	Armenia	45	Liberia
6	Azerbaijan	46	Madagascar
7	Bangladesh	47	Malawi
8	Belgium	48	Malaysia
9	Belize	49	Malta
10	Bhutan	50	Mauritania
11	Bolivia	51	Mauritius
12	Bosnia & Herzegovina	52	Mongolia
13	Brazil	53	Montenegro
14	Bulgaria	54	Morocco
15	Burundi	55	Mozambique
16	Cambodia	56	Myanmar
17	Chad	57	Namibia
18	Chile	58	Nepal
19	Colombia	59	Netherlands
20	Congo, Democratic Republic	60	Nicaragua
21	Costa Rica	61	North Macedonia
22	Dominican Republic	62	Pakistan
23	Ecuador	63	Palestine
24	Egypt	64	Panama
25	El Salvador	65	Paraguay
26	Estonia	66	Peru
27	Eswatini	67	Poland
28	Gabon	68	Portugal
29	Greece	69	Rwanda
30	Guatemala	70	Saudi Arabia
31	Guinea	71	South Africa
32	Haiti	72	Spain
33	Honduras	73	Tanzania
34	Hungary	74	Thailand
35	India	75	Trinidad & Tobago
36	Indonesia	76	Turkey
37	Italy	77	Uganda
38	Jamaica	78	United Arab Emirates
39	Japan	79	Zambia
40	Jordan	80	Zimbabwe

### Appendix 3.2: Summary Statistics

Variable Name	Obs.	Mean	Median	Standard Deviation	Minimum	Maximum	Skewness	Kurtosis
Sarma (2012) Index	497	0.392	0.371	0.244	0.044	0.839	0.277	1.916
New Index	497	0.478	0.523	0.223	0.109	0.801	-0.300	1.766
Having an Account at FFIs	211	50.159	45.863	27.395	9.005	98.992	0.273	1.848
Saved at FFIs	211	17.746	14.263	13.641	1.982	60.422	1.274	4.181
Borrowed from FFIs	211	10.714	10.013	5.632	2.065	23.653	0.413	2.530
Deposit Accounts at ODCs per 1,000 Adults	497	1326.58	1141.39	985.599	154.678	3784.600	0.923	3.205
Loan Accounts at ODCs per 1,000 Adults	497	430.446	356.148	355.329	19.095	1276.980	0.796	2.743
Outstanding Deposits (%GDP)	497	51.403	42.429	34.139	12.185	350.195	2.239	14.501
Outstanding Loans (%GDP)	497	46.687	42.134	30.272	6.837	120.000	0.814	2.885
Branches of ODCs per 1,000 km2	497	24.949	9.640	34.313	0.539	122.000	1.797	5.098
Branches of ODCs per 100,000 Adults	497	22.631	17.300	18.385	2.660	77.100	1.556	5.111
Log Deposit Accounts at ODCs per 1,000 Adults	497	6.829	7.040	1.004	3.310	8.891	-0.768	3.491
Log Loan Accounts at ODCs per 1,000 Adults	497	5.525	5.875	1.314	0.651	8.035	-1.058	4.024
Log Outstanding Deposits	497	23.914	23.431	2.485	13.115	45.524	1.225	14.335
Log Outstanding Loans	497	23.709	23.362	2.423	12.319	29.354	-0.153	3.730
Log Branches of ODCs per 1,000 km2	497	2.202	2.266	1.789	-2.620	7.467	0.075	3.132
Log Branches of ODCs per 100,000 Adults	497	2.799	2.851	0.914	0.293	5.257	-0.282	3.385
Bank Concentration	499	64.562	62.300	19.110	36.700	99.700	0.284	1.883
Banks' Costs to Income Ratio	509	56.436	56.396	10.339	36.411	75.497	-0.028	2.285
Banks' credit to banks' deposit Ratio	505	92.501	89.315	33.734	40.417	166.891	0.523	2.700
Net Interest Margin	509	5.021	4.733	2.434	1.324	9.886	0.400	2.220
Z-Score	509	14.354	12.293	7.939	4.723	33.407	0.888	2.971
Rule of Law	509	45.022	44.700	23.189	8.170	87.300	0.185	2.096
Government Expenditure (%GDP)	507	15.975	15.502	4.723	8.322	25.787	0.351	2.335
Percentage of Urban Population	509	56.831	60.531	22.635	8.27	97.934	-0.231	2.103
World-Bank Countries' Income Classifications	509	2.589	3.000	1.024	1.000	4.000	-0.115	1.887
HDI	508	0.687	0.720	0.135	0.447	0.881	-0.294	1.852
Education Index	508	0.628	0.656	0.145	0.385	0.863	-0.100	1.847
Log Real GDP per Capita	509	8.376	8.480	1.272	5.520	10.900	-0.105	2.182
Trade (%GDP)	507	82.757	76.424	35.775	32.542	159.195	0.580	2.412

### Appendix 3.3: Pairwise Correlation with Dependent Variables

	Sarma (2012) Index	NI	Having an Account at FFIs	Saved at FFIs	Borrowed from FFIs	Deposit Accounts at ODCs per 1,000 Adult	Loan Accounts at ODCs per 1,000 Adult	Deposits (%GDP)	Loans (%GDP)	ODCs' Branches per 1,000 km2	ODCs' Branches per 100,000 Adults	Log Deposit Accounts at ODCs per 1,000 Adult	Log Loan Accounts at ODCs per 1,000 Adult	Log Deposits	Log Loans	Log ODCs' Branches per 1,000 km2	Log ODCs' Branches per 100,000 Adults
Bank Concentration	-0.144 ***	-0.182 ***	-0.042	0.052	-0.231 ***	-0.122 ***	-0.109 **	-0.109 **	-0.117 ***	-0.128 ***	-0.178 ***	-0.213 ***	-0.169 ***	-0.353 ***	-0.409 ***	-0.197 ***	-0.243 ***
Banks' Costs to Income Ratio	-0.152 ***	-0.093 **	-0.085	-0.059	-0.112	-0.109 **	-0.022	-0.242 ***	-0.213 ***	0.037	0.052	-0.177 ***	-0.133 ***	-0.189 ***	-0.220 ***	0.005	-0.042
Banks' Credits to Deposits Ratio	0.388 ***	0.468 ***	0.329 ***	0.095	0.373 ***	0.289 ***	0.505 ***	-0.027	0.374 ***	-0.039	0.328 ***	0.332 ***	0.541 ***	0.175 ***	0.304 ***	0.104 **	0.388 ***
Net Interest Margin	-0.634 ***	-0.576 ***	-0.503 ***	-0.399 ***	-0.085	-0.527 ***	-0.464 ***	-0.504 ***	-0.651 ***	-0.451 ***	-0.465 ***	-0.514 ***	-0.437 ***	-0.562 ***	-0.603 ***	-0.400 ***	-0.474 ***
Z-Score	0.042	-0.001	-0.060	0.079	0.044	-0.063	-0.068	0.387 ***	0.264	0.105 **	-0.030	0.084 *	0.082 *	0.055	0.033	0.137 ***	0.051
Rule of Law	0.763 ***	0.706 ***	0.782 ***	0.667 ***	0.186 ***	0.680 ***	0.652 ***	0.468 ***	0.673 ***	0.384 ***	0.360 ***	0.681 ***	0.616 ***	0.425 ***	0.515 ***	0.369 ***	0.417 ***
Government Expenditure (%GDP)	0.247 ***	0.265 ***	0.393 ***	0.308 ***	-0.171 **	0.227 ***	0.270 ***	0.109 **	0.205 ***	0.086 *	0.049	0.246 ***	0.242 ***	0.024	0.053	0.020 ***	0.110 **
Percentage of Urban Population	0.591 ***	0.598 ***	0.448 ***	0.352 ***	0.203 ***	0.540 ***	0.520 ***	0.385 ***	0.535 ***	0.228 ***	0.296 ***	0.545 ***	0.548 ***	0.469 ***	0.522 ***	0.222 ***	0.401 ***
World-Bank Countries' Income Classifications	0.784 ***	0.847 ***	0.759 ***	0.569 ***	0.261 ***	0.715 ***	0.719 ***	0.399 ***	0.627 ***	0.305 ***	0.399	0.753 ***	0.758 ***	0.511 ***	0.615 ***	0.331 ***	0.517 ***
HDI	0.764 ***	0.803 ***	0.634 ***	0.398 ***	0.343 ***	0.699 ***	0.645 ***	0.415 ***	0.572 ***	0.289 ***	0.468 ***	0.757 ***	0.743 ***	0.499 ***	0.580 ***	0.373 ***	0.585 ***
Education Index	0.796 ***	0.845 ***	0.756 ***	0.539 ***	0.351 ***	0.718 ***	0.665 ***	0.393 ***	0.608 ***	0.295 ***	0.442 ***	0.779 ***	0.724 ***	0.500 ***	0.583 ***	0.368 ***	0.546 ***
Log Real GDP per Capita	0.812 ***	0.858 ***	0.760 ***	0.617 ***	0.282 ***	0.723 ***	0.730 ***	0.480 ***	0.694 ***	0.357 ***	0.416 ***	0.768 ***	0.778 ***	0.578 ***	0.673 ***	0.370 ***	0.529 ***
Trade (%GDP)	0.272 ***	0.243 ***	0.346 ***	0.342 ***	0.188 ***	0.189 ***	0.269 ***	0.306 ***	0.360 ***	0.010	0.023	0.154 ***	0.264 ***	-0.134 ***	-0.132 ***	0.026	0.088 *

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

### Appendix 3.4: Pairwise Correlation for Independent Variables

	Bank Concentration	Banks' Costs to Income Ratio	Banks' credit to banks' deposit Ratio	Net Interest Margin	Z-Score	Rule of Law	Government Expenditure (%GDP)	Percentage of Urban Population	World-Bank Countries' Income Classifications	HDI	Education Index	Log Real GDP per Capita	Trade (%GDP)
Bank Concentration	1.000												
Banks' Costs to Income Ratio	0.129 ***	1.000											
Banks' Credits to Deposits Ratio	-0.181 ***	0.041	1.000										
Net Interest Margin	0.052	0.179 ***	-0.148 ***	1.000									
Z-Score	0.053	-0.249 ***	-0.140 ***	-0.056	1.000								
Rule of Law	0.006	-0.169 ***	0.370 ***	-0.543 ***	0.027	1.000							
Government Expenditure (%GDP)	0.391 ***	0.119 ***	0.025	-0.297 ***	-0.107 **	0.389 ***	1.000						
Percentage of Urban Population	-0.080 *	-0.074 *	0.261 ***	-0.456 ***	0.139 ***	0.458 ***	0.204 ***	1.000					
World-Bank Countries' Income Classifications	-0.057	-0.063	0.409 ***	-0.589 ***	0.003	0.715 ***	0.358 ***	0.647 ***	1.000				
HDI	-0.175 ***	-0.158 ***	0.370 ***	-0.537 ***	0.119 ***	0.620 ***	0.164 ***	0.676 ***	0.832 ***	1.000			
Education Index	-0.126 ***	-0.066	0.394 ***	-0.563 ***	-0.043	0.725 ***	0.329 ***	0.713 ***	0.874 ***	0.851 ***	1.000		
Log Real GDP per Capita	-0.062	-0.077 *	0.393 ***	-0.620 ***	0.094 **	0.740 ***	0.319 ***	0.735 ***	0.950 ***	0.844 ***	0.889 ***	1.000	
Trade (%GDP)	0.215 ***	-0.090 **	0.006	-0.217 ***	0.073 *	0.346 ***	0.289 ***	0.217 ***	0.295 ***	0.197 ***	0.297 ***	0.291	1.000

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

### Appendix 3.5: Fisher Unit-root Test for Panel Data Using Dickey-Fuller

Variable	Inverse chi-squared	Inverse Normal	Inverse Logit	Modified Inverse chi-squared	Number of Panels	Average Periods
Sarma (2012)	394.043 ***	-0.794	-5.352 ***	14.734 ***	80	6.21
NI	539.606 ***	-4.583 ***	-12.675 ***	23.311 ***	80	6.21
Deposit Accounts at ODCs per 1,000 Adults	297.588 ***	0.459	-3.189 ***	9.050 ***	80	6.21
Loan Accounts at ODCs per 1,000 Adults	344.7294 ***	-1.1603	-5.9302 ***	11.8281 ***	80	6.21
Banks' Outstanding Deposits (%GDP)	265.082 ***	0.971	-2.073 **	7.135 ***	80	6.21
Banks' Outstanding Loans (%GDP)	328.679 ***	-1.811 **	-5.945 ***	10.882 ***	80	6.21
Branches of ODCs per 100,000 Adults	273.666 ***	0.577	-2.123 **	7.641 ***	80	6.21
Branches of ODCs per 1,000 km2	191.945 ***	3.838	1.714	2.825 ***	80	6.21
Log Depositors at ODCs per 1,000 Adults	432.605 ***	-1.970 **	-8.453 ***	17.006 ***	80	6.21
Log of Borrowers at ODCs per 1,000 Adults	408.255 ***	-2.286 **	-7.681 ***	15.571 ***	80	6.21
Log Banks' Outstanding Deposits	186.487 ***	3.317	1.688	2.504 ***	80	6.21
Log Banks' Outstanding Loans	332.481 ***	-1.3881 *	-5.040 ***	11.106 ***	80	6.21
Log of Branches of ODCs per 100,000 Adults	188.956 ***	3.770	1.680	2.649 ***	80	6.21
Log of Branches of ODCs per 1,000 km2	283.082 ***	1.722	-1.227	8.196 ***	80	6.21
Bank Concentration	298.802 ***	-2.054 **	-5.172 ***	8.591 ***	80	6.32
Banks' Costs to Income Ratio	393.488 ***	-3.616 ***	-8.691 ***	13.850 ***	80	6.36
Banks' credit to banks' deposit Ratio	640.268 ***	-6.918 ***	-17.583 ***	28.004 ***	80	6.31
Net Interest Margin	325.762 ***	-1.108	-5.792 ***	9.966 ***	80	6.36
Z-Score	314.289 ***	-2.497 ***	-5.769 ***	9.308 ***	80	6.36
Rule of Law	421.662 ***	-5.695 ***	-11.726 ***	15.466 ***	80	6.36
Government Expenditure (%GDP)	272.356 ***	-0.558	-3.619 ***	6.903 ***	80	6.34
Percentage of Urban Population	224.005 ***	4.3514	2.8053	4.1298 ***	80	6.36
HDI	322.539 ***	0.279	-3.579 ***	9.781 ***	80	6.36
Education Index	348.302 ***	-1.948 **	-5.950 ***	11.2587 ***	80	6.36
Log Real GDP per Capita	410.163 ***	-2.824 ***	-7.840 ***	14.807 ***	80	6.36
Trade (%GDP)	212.877 ***	0.999	-1.482 *	3.492 ***	80	6.34

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

FI indicators from FINDEX database are not included because they are not available in a yearly basis.

### Appendix 3.6: Determinants of Financial Inclusion Using Fixed Effects and Time Effects

Independent Variable	Dependent Variables							
	New Index	Sarma's (2012) Index	Deposit Accounts at ODCs per 1,000 Adults	Loan Accounts at ODCs per 1,000 Adults	Banks' Deposits (%GDP)	Banks' Loans (%GDP)	Number of Branches of ODCs per 1,000 km <sup>2</sup>	Number of Branches of ODCs per 100,000 Adults
Bank Concentration	-3E-4	-2E-4	0.409	0.127	-0.147	-0.050	-0.027	-0.047 *
Banks' Costs to Income Ratio	1E-4	3E-4	-0.243	0.796	-0.050	0.012	-0.005	0.067
Banks' Credits to Deposits Ratio	0.001 ***	0.002 ***	6.598 ***	1.001	-0.005	0.382 ***	0.121 ***	0.112 ***
Net Interest Margin	-0.002	-0.001	-2.289	-1.869	-0.327	-0.800 **	-0.171	-0.060
Z-Score	0.001	0.000	-0.100	0.428	-0.269	-0.041	-0.575 **	-0.202
Rule of Law	0.002 ***	0.002 **	7.715 **	2.692 ***	-0.177	-0.025	0.058	0.011
Government Expenditure (%GDP)	0.003	0.003	10.498	4.434	1.135 *	1.311 ***	0.500 ***	0.549 ***
Percentage of Urban Population	-1E-4	0.000	1.056	0.052	-0.319 **	-0.327 ***	-0.013	-0.016
World-Bank Countries' Income Classifications	0.017	0.007	30.038	-1.942	0.200	0.788	-0.007	0.717
Constant	0.167 ***	0.062	-37.286	68.573	13.778	13.828	15.233 **	4.97
Observations	483	483	483	483	483	483	483	483
Number of Countries	79	79	79	79	79	79	79	79
Average Period (years)	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
F test	18.05 ***	7.4 ***	6.08 ***	4.09 **	28.75 ***	48.59 ***	3.02 ***	4.11 ***
R-Squared within	0.493	0.374	0.376	0.073	0.084	0.453	0.198	0.256
R-Squared between	0.619	0.533	0.387	0.523	0.170	0.046	0.002	0.111
R-Squared Overall	0.615	0.514	0.374	0.503	0.103	0.063	0.001	0.111
Correlation ( $u_i, X_b$ )	0.536	0.402	0.263	0.513	-0.595	-0.221	-0.223	0.020
rho	0.971	0.964	0.971	0.967	0.836	0.976	0.992	0.977

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.



### Appendix 3.7: Determinants of Financial Inclusion Using Fixed Effects and Time Effects

Independent Variable	Dependent Variables								
	Having an Account at FFIs	Saved at FFIs	Borrowed from FFIs	Log Deposit Accounts at ODCs per 1,000 Adults	Log Loan Accounts at ODCs per 1,000 Adults	Log Banks' Deposits	Log Banks' Loans	Log Number of Branches of ODCs per 1,000 km2	Log Number of Branches of ODCs per 100,000 Adults
Bank Concentration	0.122 **	0.022	0.027	-0.001	-0.002	-0.013	-0.004	-0.002	-0.002
Banks' Costs to Income Ratio	-0.087	-0.011	0.011	-0.001	0.001	0.020	0.004	4E-4	0.001
Banks' Credits to Deposits Ratio	0.134 ***	-0.073 *	0.002	0.006 ***	0.005 ***	-0.002	0.010 ***	0.005 ***	0.004 ***
Net Interest Margin	-0.432	0.277	0.310	-0.006	-0.001	-0.024	-0.012	2E-4	0.002
Z-Score	-0.135	-0.071	0.058	0.003	0.004	-0.006	-0.009	-0.007	-0.005
Rule of Law	0.356 **	0.071	0.139 **	0.006 *	0.010 *	-0.003	0.004	-0.001	-0.001
Government Expenditure (%GDP)	0.151	-0.375	-0.039	0.018	0.024	-0.014	0.021	0.026 ***	0.025 ***
Percentage of Urban Population	0.136	-0.121	-0.093	-0.008 ***	-0.001	-0.004	-0.006 ***	0.002	0.001
World-Bank Countries' Income Classifications	0.399	-0.734	-1.248	0.024	-0.008	-0.349	0.033	0.008	0.005
Constant	17.940	32.374 ***	7.263	6.163 ***	4.226 ***	25.414 ***	22.695 ***	1.362 ***	2.143 ***
Observations	204	204	204	483	483	483	483	483	483
Number of Countries	79	79	79	79	79	79	79	79	79
Average Period (years)	2.6	2.6	2.6	6.1	6.1	6.1	6.1	6.1	6.1
F test	15.59 ***	3.19 ***	4.29 ***	28.46 ***	6.36 ***	3.75 ***	5.11 ***	6.81 ***	4.15 ***
R-Squared within	0.618	0.226	0.210	0.464	0.274	0.056	0.256	0.302	0.199
R-Squared between	0.561	0.070	0.057	0.174	0.474	0.123	0.104	0.012	0.144
R-Squared Overall	0.592	0.050	0.045	0.174	0.451	0.072	0.102	0.010	0.136
Correlation ( $u_i, Xb$ )	0.299	-0.554	-0.639	0.120	0.467	-0.520	0.135	-0.042	0.170
rho	0.885	0.924	0.819	0.981	0.969	0.838	0.987	0.996	0.986

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

### Appendix 3.8: The Effect of Income (GDP per Capita) on Financial Inclusion Using Two Stage Least Squares (Fixed Effects and Time Effects)

		New Index		Sarima's Index (2012)		Deposit Accounts at ODCs per 1,000 Adults		Loan Accounts at ODCs per 1,000 Adults		Banks' Deposits (%GDP)		Banks' Loans (%GDP)		Branches of ODCs per 1,000 km2		Branches of ODCs per 100,000 Adults	
Stage		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Main Variable	Log GDP per Capita		0.143 **		0.233 ***		755.179 ***		175.343 **		3.592		28.887 *		20.392 ***		13.155 **
Instrumental Variable	Trade (%GDP)	-0.004 ***		-0.004 ***		-0.004 ***		-0.004 ***		-0.004 ***		-0.004 ***		-0.004 ***		-0.004 ***	
Control Variables	Rule of Law	0.005 ***	0.001 *	0.005 ***	0.001	0.005 ***	1.594	0.005 ***	1.737 **	0.005 ***	-0.163	0.005 ***	-0.177	0.005 ***	-0.069	0.005 ***	-0.069
	Government Expenditure (%GDP)	-0.009 ***	0.007 ***	-0.009 ***	0.011 ***	-0.009 ***	38.623 ***	-0.009 ***	7.275 **	-0.009 ***	1.430	-0.009 ***	2.114 ***	-0.009 ***	0.904 ***	-0.009 ***	0.837 ***
	Percentage of Urban Population	-0.006 ***	2E-4	-0.006 ***	5E-4	-0.006 ***	3.435	-0.006 ***	1.003	-0.006 ***	-0.342	-0.006 ***	-0.240 *	-0.006 ***	0.055	-0.006 ***	0.023
Observations		469		469		469		469		469		469		469		469	
Number of Countries		76		76		76		76		76		76		76		76	
Average Period (years)		6.2		6.2		6.2		6.2		6.2		6.2		6.2		6.2	
F test		11.8 ***	24.9 ***	11.8 ***	13.99 ***	11.8 ***	9.62 ***	11.8 ***	7.7 ***	11.8 ***	12.09 ***	11.8 ***	6.17 ***	11.8 ***	2.88 ***	11.8 ***	2.98 ***
Centered R2		0.238	0.413	0.238	0.157	0.238	0.187	0.238	0.186	0.238	0.079	0.238	0.007	0.238	0.060	0.238	0.056
Weak-instrument-robust inference Anderson-Rubin Wald test (chi-sq)		5.86 **		11.87 ***		10.22 ***		4.06 **		0.01		4.73 **		8.94 ***		5.61 **	
Under-identification test (Kleibergen-Paap rk LM statistic)		16.543 ***		16.543 ***		16.543 ***		16.543 ***		16.543 ***		16.543 ***		16.543 ***		16.543 ***	
Weak identification test (Cragg-Donald Wald F statistic)		38.175		38.175		38.175		38.175		38.175		38.175		38.175		38.175	
Kleibergen-Paap rk Wald F statistic		29.693		29.693		29.693		29.693		29.693		29.693		29.693		29.693	
Stock-Yogo weak ID test critical values:																	
10% maximal IV size		16.38		16.38		16.38		16.38		16.38		16.38		16.38		16.38	
15% maximal IV size		8.96		8.96		8.96		8.96		8.96		8.96		8.96		8.96	
Endogeneity Test		2.722 *		8.6 ***		6.115 **		0.609		0.099		5.287 **		2.797 *		2.331	

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

The results remain the same even when World-Bank Countries' Income Classifications is included

### Appendix 3.9: The Effect of Income (GDP per Capita) on Financial Inclusion Using Two Stage Least Squares (Fixed Effects and Time Effects)

		Having an Account at FFIs		Saved at FFIs		Borrowed from FFIs		Log Deposit Accounts at ODCs per 1,000 Adults		Log Loan Accounts at ODCs per 1,000 Adults		Log Banks' Deposits		Log Banks' Loans		Log Branches of ODCs per 1,000 km2		Log Branches of ODCs per 100,000 Adults	
Stage		(1)	(2)			(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Main Variable	Log GDP per Capita		46.04 ***		-8.631		-1.240		0.332		-0.269		-3.152		0.476		0.309		-0.021
Instrumental Variable	Trade (%GDP)	-0.005 ***		-0.005 ***		-0.005 ***		-0.004 ***		-0.004 ***		-0.004 ***		-0.004 ***		-0.004 ***		-0.004 ***	
Control Variables	Rule of Law	0.007 ***	-0.010	0.007 ***	0.140	0.007 ***	0.131 *	0.005 ***	0.003	0.005 ***	0.012 ***	0.005 ***	0.016	0.005 ***	0.002	0.005 ***	-0.003	0.005 ***	-0.001
	Government Expenditure (%GDP)	-3E-4	0.235	-3E-4	-0.528 *	-3E-4	-0.004	-0.009 ***	0.043 ***	-0.009 ***	0.030 **	-0.009 ***	-0.034	-0.009 ***	0.041 **	-0.009 ***	0.041 ***	-0.009 ***	0.032 ***
	Percentage of Urban Population	-0.007 **	0.386 ***	-0.007 **	-0.148	-0.007 **	-0.060	-0.006 ***	-0.008 ***	-0.006 ***	-0.003	-0.006 ***	-0.016	-0.006 ***	-0.006	-0.006 ***	0.002	-0.006 ***	0.000
Observations		206		206		206		469		469		469		469		469		469	
Number of Countries		76		76		76		76		76		76		76		76		76	
Average Period (years)		2.7		2.7		2.7		6.2		6.2		6.2		6.2		6.2		6.2	
F test		9.65 ***	23.17 ***	9.65 ***	4.46 ***	9.65 ***	5.58 ***	11.8 ***	22.02 ***	11.8 ***	10.39 ***	11.8 ***	0.031 **	11.8 ***	10.6 **	11.8 ***	7.71 ***	11.8 ***	3.25 ***
Centered R2		0.282	0.503	0.282	0.153	0.282	0.223	0.238	0.415	0.238	0.184	0.238	-0.032	0.238	0.211	0.238	0.152	0.238	0.086
Weak-instrument-robust inference Anderson-Rubin Wald test		10.52 ***		0.91		0.04		1.65		0.57		0.7		0.32		1.45		0.01	
Under-identification test (Kleibergen-Paap rk LM statistic)		6.768 ***		6.768 ***		6.768 ***		16.543 ***		16.543 ***		16.543 ***		16.543 ***		16.543 ***		16.543 ***	
Weak identification test (Cragg-Donald Wald F statistic)		18.201		18.201		18.201		38.175		38.175		38.175		38.175		38.175		38.175	
Kleibergen-Paap rk Wald F statistic		16.883		16.883		16.883		29.693		29.693		29.693		29.693		29.693		29.693	
Stock-Yogo weak ID test critical values: 10% maximal IV size 15% maximal IV size		16.38		16.38		16.38		16.38		16.38		16.38		16.38		16.38		16.38	
		8.96		8.96		8.96		8.96		8.96		8.96		8.96		8.96		8.96	
Endogeneity Test		9.996 ***		0.649		0.176		0.434		3.762 *		1.115		0.434		0.545		0.235	

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

The results remain the same even when World-Bank Countries' Income Classifications is included

**Appendix 3.10: The Effect of Human Development on Financial Inclusion Using Two Stage Least Squares (Fixed Effects and Time Effects)**

		New Index		Sarima's Index (2012)		Deposit Accounts at ODCs per 1,000 Adult		Loan Accounts at ODCs per 1,000 Adult		Banks' Deposits (%GDP)		Banks' Loans (%GDP)		Branches of ODCs per 1,000 km2		Branches of ODCs per 100,000 Adults	
Stage		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Main Variable	HDI	1.071 ***		1.401 ***		7349.77 ***		508.838		378.944		80.383		14.813		-9.567	
Instrumental variable	Education Index	0.401 ***		0.401 ***		0.401 ***		0.401 ***		0.401 ***		0.401 ***		0.401 ***		0.401 ***	
Control Variables	Rule of Law	2E-4 ***	0.001 ***	2E-4 ***	0.002 ***	2E-4 ***	3.901	2E-4 ***	2.568 ***	2E-4 ***	-0.236	2E-4 ***	-0.039	2E-4 ***	0.039	2E-4 ***	0.005
	Government Expenditure (%GDP)	2E-4	0.006 ***	2E-4	0.009 ***	2E-4	28.646 ***	2E-4	5.540 *	2E-4	1.216	2E-4	1.830 ***	2E-4	0.724 ***	2E-4	0.730 ***
	Percentage of Urban Population	1E-4	-0.001	1E-4	-0.001 ***	1E-4	-0.387	1E-4	0.065	1E-4	-0.346 ***	1E-4	-0.394 ***	1E-4	-0.056	1E-4	-0.050
Observations		469		469		469		469		469		469		469		469	
Number of Countries		76		76		76		76		76		76		76		76	
Average Period (years)		6.2		6.2		6.2		6.2		6.2		6.2		6.2		6.2	
F test		175.3 ***	27.17 ***	175.3 ***	16.63 ***	175.3 ***	13.88 ***	175.3 ***	6.95 ***	175.3 ***	12.62 ***	175.3 ***	6.3 ***	175.3 ***	2.58 ***	175.3 ***	3.07 ***
Centered R2		0.835	0.466	0.835	0.306	0.835	0.303	0.835	0.163	0.835	0.093	0.835	0.148	0.835	0.043	0.835	0.086
Weak-instrument-robust inference Anderson-Rubin Wald test (chi-sq)		7.72 ***		11.09 ***		18.35 ***		0.514		1.07		0.8		0.09		0.11	
Under-identification test (Kleibergen-Paap rk LM statistic)		48.151 ***		48.151 ***		48.151 ***		48.151 ***		48.151 ***		48.151 ***		48.151 ***		48.151 ***	
Weak identification test (Cragg-Donald Wald F statistic)		344.501		344.501		344.501		344.501		344.501		344.501		344.501		344.501	
Kleibergen-Paap rk Wald F statistic		228.447		228.447		228.447		228.447		228.447		228.447		228.447		228.447	
Stock-Yogo weak ID test critical values: 10% maximal IV size 15% maximal IV size		16.38 8.96		16.38 8.96		16.38 8.96		16.38 8.96		16.38 8.96		16.38 8.96		16.38 8.96		16.38 8.96	
Endogeneity Test		0.005		0.013		0.538		0.808		0.207		0.535		0.221		0.721	

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

The results remain the same even when World-Bank Countries' Income Classifications is included

**Appendix 3.11: The Effect of Human Development on Financial Inclusion Using Two Stage Least Squares (Fixed Effects and Time Effects)**

		Having an Account at FFIs		Saved at FFIs		Borrowed from FFIs		Log Deposit Accounts at ODCs per 1,000 Adults		Log Loan Accounts at ODCs per 1,000 Adults		Log Banks' Deposits		Log Banks' Loans		Log Branches of ODCs per 1,000 km2		Log Branches of ODCs per 100,000 Adults	
Stage		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Main Variable	HDI	195.82		13.256		-18.39		2.649 *		-2.344		-25.15		-4.487		-0.755		-0.125	
Instrumental variable	Education Index	0.406 ***		0.406 ***		0.406 ***		0.401 ***		0.401 ***		0.401 ***		0.401 ***		0.401 ***		0.401 ***	
Control Variables	Rule of Law	2E-4 *	0.257	2E-4 *	0.078	2E-4 *	0.128 **	2E-4 ***	0.005 **	2E-4 ***	0.011 ***	2E-4 ***	-0.005	2E-4 ***	0.006 *	2E-4 ***	-0.001	2E-4 ***	-0.001
	Government Expenditure (%GDP)	6E-5	0.226	6E-5	-0.547 *	6E-5	0.002	2E-4	0.039 ***	2E-4	0.033 ***	2E-4	0.005	2E-4	0.039 ***	2E-4	0.039 ***	2E-4	0.032 ***
	Percentage of Urban Population	-1E-4	0.116 *	-1E-4	-0.097	-1E-4	-0.054	1E-4	-0.097 ***	1E-4	-0.002	1E-4	1E-5	1E-4	-0.009 *	1E-4	3E-4	1E-4	4E-4
Observations		206		206		206		469		469		469		469		469		469	
Number of Countries		76		76		76		76		76		76		76		76		76	
Average Period (years)		2.7		2.7		2.7		6.2		6.2		6.2		6.2		6.2		6.2	
F test		106.9 ***	27.77 ***	106.9 ***	4.69 ***	106.9 ***	5.59 ***	175.3 ***	23.96 ***	175.3 ***	12.12 ***	175.3 ***	4.17 ***	175.3 ***	8.46 ***	175.3 ***	6.95 ***	175.3 ***	3.25 ***
Centered R2		0.842	0.619	0.842	0.213	0.842	0.212	0.835	0.429	0.835	0.228	0.835	0.040	0.835	0.151	0.835	0.155	0.835	0.089
Weak-instrument-robust inference Anderson-Rubin Wald test		1.27		0.16		0.10		2.96 *		0.91		1.03		0.73		0.37		0.01	
Under-identification test (Kleibergen-Paap rk LM statistic)		19.226 ***		19.226 ***		19.226 ***		48.151 ***		48.151 ***		48.151 ***		48.151 ***		48.151 ***		48.151 ***	
Weak identification test (Cragg-Donald Wald F statistic)		108.816		108.816		108.816		344.501		344.501		344.501		344.501		344.501		344.501	
Kleibergen-Paap rk Wald F statistic		87.924		87.924		87.924		228.447		228.447		228.447		228.447		228.447		228.447	
Stock-Yogo weak ID test critical values: 10% maximal IV size 15% maximal IV size		16.38		16.38		16.38		16.38		16.38		16.38		16.38		16.38		16.38	
Endogeneity Test		0.229		0.188		0.982		0.686		0.047		1.081		0.768		0.044		0.002	

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

The results remain the same even when World-Bank Countries' Income Classifications is included

## **Chapter 4:**

### **Can Islamic Banks Raise the Level of Financial Inclusion in the Muslim World?**

## **ABSTRACT**

This chapter examines the difference in the level of financial inclusion (FI) between countries with a considerable Muslim population (CCMPs) and the rest of the world (RW) for 80 countries (where data permit) between 2011 and 2017 using random effects estimates. FI is measured by the index of Sarma (2012) and the new index (NI) suggested in the second chapter of this thesis; simple indicators from the IMF's Financial Access Survey (FAS) database and the World Banks's global financial inclusion (FINDEX) database are also included. The results indicate that CCMPs generally do not have a lower level of FI than the RW, namely no significant difference in geographical and demographical coverage. There is also no significant difference in entities' level of inclusion. The difference between the two groups only appears to be significant in the percentage of population participating in the financial system.

Then, the paper study whether the introduction of IBF could help raise the level of FI in countries where IBs operate. The analysis covers the period between 2011 and 2017 using fixed effects panel regressions for 80 countries. IBs have no significant relationship with the overall level of FI as the negative relationship with some aspects of FI cancel off the positive relationship with other aspects. The paper highlight five reasons behind the negative relationship that IBs have with some of the aspects of FI. First, the limited number of Islamic financial products and services. Second, the low ratio of credits to deposits in IBs, which considered one of the main determinant of FI. Third, the risk and cost of financial services in IBs. Fourth, previous studies that suggested introducing IBs to enhance the level of FI in CCMPs have not directly measured the relationship between IBs and FI. Fifth, financial awareness and financial literacy.

#### **4.1. Introduction**

Financial Inclusion (FI) can be defined as a procedure for providing all the income segments of society (especially the low-income segment) and other entities (mainly micro- and small enterprises (MSEs)) with access to an affordable and quality range of financial products and services. From a macro-economic perspective, an increase in FI boosts savings, leading to an improvement in the allocation of funds and more productive investment (Bruhn and Love, 2014). Hariharan and Marktanner (2012) and Babajide et al (2015) have shown that FI can boost economic growth because FI can generate capital due to its strong positive correlation with total factor productivity. They demonstrate that FI can increase savings and the efficiency of financial intermediation, foster entrepreneurship and thus improve economic growth.

FI helps poor households and MSEs to enhance their ability to overcome the issue of financial market imperfections such as transaction costs and information asymmetries. Without increasing FI, these parties are limited to their own savings and earnings by their lack of collateral, credit history, and connections. Therefore, economists, politicians and policymakers around the globe have recently become more interested in promoting FI. This acknowledgement is reflected in the position taken by the Consultative Group to Assist the Poor (CGAP) and the Group of Twenty (G20). This movement in FI is related to the role of financial development in promoting economic growth, which has been extensively studied in the literature (McKinnon-Shaw, 1973; Merton and Bodie, 1995; Levine, 1997).

This chapter focuses on countries with considerable Muslim populations (CCMPs) defined as countries where the population contains 30% of Muslims or above. It is worth mentioning that the Organization of Islamic Cooperation (OIC) includes a number of countries where the Muslim population is below 30% of the total population. For instance, according to Pew Research some members of OIC such as Gabon, Guyana, Mozambique, Suriname, Togo and Uganda have a Muslims percentage of population equal to 10%, 7.3% 17.9%, 13.9%, 20%, and 14%, respectively. Yet countries such as Bosnia and Herzegovina, Ethiopia, Kosovo, North Macedonia, and Tanzania are not members of the OIC but have relatively high Muslim populations (50.7%, 33.9%, 95.6%, 33.3%, and 35.2%, respectively of their country's total).



Based on the literature, Muslims countries tend to have lower levels of FI due to religious reasons (the Global Financial Development Report, 2011 and 2014; The OIC Outlook Report, 2014; El-Zoghbi and Tarazi, 2013; Mohieldin et al, 2011). This chapter studies the gap in the level of FI between CCMPs and the rest of the world (RW) using the index of Sarma (2012) and the new index (NI) suggested in the second chapter of this thesis. In addition, selected indicators of FI from the IMF's financial access survey (FAS) and the World Bank's global financial inclusion database (FINDEX) are also included.

The difference is measured by dummy that distinguish between CCMPs and the RW using random effects estimates. The result shows that there is insignificant difference in the overall level of FI between CCMPs and the RW. Both groups of countries have insignificant difference in financial coverage and in firms' level of FI. Note that the difference between the two groups only appears to be significant in the percentage of population participating in the financial system.

Then, the paper focuses on whether the introduction of Islamic Banks (IBs) has enhanced the level of FI across the world. Fixed effects panel data regressions are used to investigate the effect of IBs on the level of FI. The indicators about Islamic banks have been used, which are the percentage of IBs to total number of banks and the percentage of IBs' assets to total banks' assets. The findings show that there is no significant relationship between IBs and the level of FI. This is because IBs have negative relationship with some aspects of FI and positive relationship with other aspects, which lead them to cancel off.

The paper highlight five reasons behind the negative relationship that IBs have with some of the aspects of FI. First, the limited number of Islamic financial products and services. Second, the low ratio of credits to deposits in IBs, which considered one of the main determinant of FI. Third, the risk and cost of financial services in IBs. Fourth, previous studies that suggested introducing IBs to enhance the level of FI in CCMPs have not directly measured the relationship between IBs and FI. Fifth, financial awareness and financial literacy. The research sub-questions are addressed as follow:

1. Is the level of FI in CCMPs lower than the level of FI in the RW?
2. Can IBs increase the level of FI in CCMPs?

The paper is structured as follows. The first section is a review of the literature. The second section contains a description of the data and methodology. The third section includes a descriptive analysis and panel regressions. The fourth section summarizes the main findings and concludes the study.

## **4.2. Literature Review**

### **4.2.1. Background**

Borrowing constraints and financial market imperfections are the main causes of inequality as they prevent the talented poor from making profitable investments in physical and human capital; subsequently, this prevents the economy from growing to its full potential (Galor and Zeira, 1993; Banerjee and Newman, 1993). Therefore, reducing financial exclusion is desirable to reduce inequality as well as enhancing economic growth (Swamy 2010; Mirakhor and Iqbal, 2012; Hassan et al, 2018; Burgess and Pande, 2005; Beck et al, 2007; Beck et al, 2009; Bruhn and Love, 2014). FI is inextricably linked to the theory of financial development. FI supports the expansion of MSEs, which has a positive effect on income and employment rate (Karlan and Zinman, 2009; and Cull and Xu, 2013).

Researchers and policymakers have highlighted a number of solutions to the issue of financial exclusion. One solution is the expansion of non-bank financial institutions that provide micro-credit, such as credit unions, community banks, institutions of Rotating Savings and Credit Associations in poor and rural areas, since these institutions provide funds at lower interest rates than commercial banks do (McKillop et al., 2007; Fuller and Mellor, 2008; Yusuf et al., 2009). In addition, government institutions and other non-profit organizations, and certain voluntary institutions also provide subsidized credit to poorer households. Another possible solution is the introduction of IBF, mainly to overcome the issue of self-exclusion for religious reasons (the Global Financial Development Report, 2014).

## **4.2.2. Islamic Banking and Finance**

### **4.2.2.1. Introduction to the Principles of Islamic Finance (IBF)**

IBF is a key example that shows how finance can meet the cultural and ethical requirements of individuals, entities and governments (The City UK report, 2017). IBF follows Sharia (Islamic law) in prohibiting Riba (usury, narrowly interpreted as interest), Gharar (referring to a high level of uncertainty, deception and ambiguity), and investments involving sinful activities such as gambling and producing alcoholic drinks. The main principles underlying IBF date back to the foundations of Islam in the 7<sup>th</sup> century, though Islamic financial services have been offered by banks only since the 1960s (Abedifar et al, 2014).

The prohibition of Riba is derived from two basic Sharia principles (ElZoghbi and Tarazi, 2013). First, money cannot be treated as a commodity and money can increase in value only when it undertakes genuine economic activity by being linked to other resources and backed by assets. Second, the providers of funds should share the risk of the project undertaken. The reason behind the prohibition of Riba is that Islam (like some other religions) is against all forms of economic and social exploitation, and aims to develop a system that secures socio-economic justice (Ul-Hassan, 2005). Ul-Hassan (2005) and Salleh et al (2011) highlight the fact that the banning of Riba targets the protection of property rights and instils moral behavior in society.

From a socio-economic point of view, Riba has four disadvantages. One, it deflects money from its main function, which is store of value, medium of exchange and unit of measure (Baumol and Blinder, 1991). Riba leads money to being treated as a commodity in itself. Riba also increases the inflation rate, which can adversely affect the real economy (Ul-Hassan, 2005). Riba may lead to the expropriation of wealth from either a borrower or a lender because of the conflict of interests (Daryanani, 2008; Salleh et al, 2011). In addition, Riba financing makes the financial system fragile because repayments are affected adversely by the economic cycle (Salleh et al, 2011). Finally, Riba financing leads to the financial exclusion of the underprivileged, who do not have the collateral or income required to justify interest-based credit. Consequently, financial exclusion can widen the gap between the rich and the poor. The latter do not have so much access to financial services, and this limits their ability to build their wealth.

Though Islamic finance prohibits interest on loans, Sharia recognizes the time value of money since various Islamic financial instruments, such as “Murabaha” allows the price of a good to exceed its current value for a deferred payment (Abedifar et al, 2014). However, Abedifar et al, (2014) mentioned that the rationale behind the permissibility of Murabaha is explained by Sen (1998) as follows: “if financial markets are imperfect a seller may find it optimal to provide a menu of deferred payment strategies” (page 435). Besides, Murabaha represents an economic transaction in practice, which not only benefits buyers and sellers but also enhances the overall economic environment.

Gharar refers to a high level of uncertainty, deception and ambiguity in a contract. Gharar can occur in the terms of a contract if the consequences of a transaction are not clear or there is uncertainty about whether the transaction will take place (Ahmed et al, 2015). In addition, Gharar can affect the object of a contract if the subject matter of the sale and its delivery are uncertain (Ahmed et al, 2015). Gharar is present when either the object of sale does not exist or one of the counterparties (or both) has no knowledge of the object being exchanged. Thus, Islamic financial institutions (ISFIs) place restrictions on taking part in some financial derivatives contracts and several forms of insurance policy because they carry a high level of uncertainty (Abedifar et al, 2014). The goal of the prohibition of Gharar is to promote fairness and justice in financial transactions (Daryanani, 2008).

The principles of IBF significantly emphasize social justice through the sharing of both profit and loss (PLS) and equality through Zakat (alms) – which are mandatory – and Qarad Al-Hassan (interest-free lending, benevolent lending). Mohieldin et al (2011) state that in a Muslim society all members should have the same opportunities to develop themselves, including access to the natural resources given by God.

The Islamic concept of development has three dimensions (Mirakhor and Askari, 2010). The first dimension states the dynamic process of the growth of the individual toward perfection. The second dimension refers to the development of the earth through the use of natural resources to afford the material requirements of all humankind. The third dimension specifies the development of human collectivity toward unity and full integration. Therefore, happiness and fulfilment in a human life can be achieved only through the full development of an individual along all three dimensions.

#### 4.2.2.2. Brief History of Islamic Banking and Finance (IBF)

Muslims began to develop a system for mobilizing resources to finance economic activities and consumer needs without Riba with the foundation of Islam (Abedifar et al, 2014). From the twelfth to thirteenth centuries, PLS and non-interest-based borrowing and lending formed the basis of commerce and industry in the Mediterranean region (Goitein, 1971). However, Islamic financial innovation was halted until the middle of the twentieth century, after many Muslim countries had gained their independence, when the idea of developing IBF appeared. The introduction of IBF aimed to enable Muslims to practice financial transactions that were consistent with Sharia principles.

The Nasser Social Bank was the first interest-free bank. It was established in Egypt in 1971 for social purposes. The first private initiative Islamic bank was the Dubai Islamic Bank founded in 1975. According to Abedifar et al (2014), the establishment of the Islamic Development Bank is considered the most important step in the history of Islamic banking, because the bank has been a key financier and promoter of several IBF initiatives. Furthermore, Pakistan, Iran and Sudan expressed the desire to gradually eliminate interest based systems altogether from their economies and replace them with banking systems based entirely on Islamic principles. As noted in the Islamic Financial Services Industry Stability Report (2017), IBs hold 100% of the market shares in both Iran and Sudan. From the 1980s onwards, the number of IBs has increased sharply and several conventional banks based in CCMPS have set up Islamic windows from which to offer Islamic financial services.

The global market for IBF has grown rapidly over the last three decades, reaching over \$2 trillion in assets size by 2017 (the Islamic Financial Services Industry Stability Report, 2018). The Islamic Finance industry contains three key sectors: banking, capital markets and Takaful (Islamic Insurance). IBs (and the Islamic windows of conventional banks) are the dominant components of the Islamic finance industry, accounting for 76% of Islamic finance's total asset value. The fast growth of IBF has attracted policymakers' attention as a potential channel for increasing the level of FI among Muslim adults (Demirguc-Kunt et al, 2013). Some 6% of unbanked adults globally mention religious concerns as a reason for being financially excluded (based on the 2017 Global Financial Inclusion Report).

According to the Islamic Financial Services Industry Stability Report (2018), Islamic banking is considered systemically important in 12 countries where the assets of Islamic banking comprise 15% or more of their overall banking assets. These countries account for 92% of all global Islamic banking assets. The largest are Iran, accounting for 34.4% of global Islamic banking assets, followed by Saudi Arabia with 20.4%, then the United Arab Emirates (UAE) and Malaysia with 9.3% and 9.1%, respectively. Kuwait and Qatar come next with 6.0% of global Islamic banking assets each.

#### 4.2.2.3. Islamic Banks During the Global Financial Crisis (GFC)

Beck et al (2013) compare conventional banks with IBs and find few substantial differences in business orientation. IBs rely more on non-deposit funding, and have a higher proportion of fee income and loan-deposit ratios after controlling for time-variant country-fixed effects. Yet these authors discover evidence that IBs are less cost-effective, but have a higher intermediation ratio, better asset quality and higher capital.

The principles of risk-sharing and linking finance to the real economy would limit the amount of debt that can be created. Furthermore, the prohibition against using derivative instruments for speculation should produce a more resilient and stable financial system. This is confirmed by studies which compare the performance of Islamic banking with its conventional counterpart (Ahmed et al, 2015). In the period before the 2008 GFC (1995-2007), IBs had higher capitalization and liquidity reserves than conventional banks had, indicating more stability (Beck et al, 2013).

During the 2008-09 GFC IBs suffered more than conventional banks in terms of reduced capital ratios, greater leverage and weaker returns on average equity, but over 2006 and 2009 IBs, on average, performed better than conventional banks, especially as regards higher returns on average assets and liquidity (Parashar and Venkatesh, 2010). After the 2008-09 financial crisis IBs were more resilient and achieved higher credit and asset growth than conventional banks (Hasan and Dridi, 2010). Islamic finance has gained momentum since the GFC because IBs were less affected by the crisis as they did not hold interest bearing securitized assets. Thus, IBs were assessed more favorably by rating agencies in the post-crisis years (Beck et al., 2013).

IBs appear to use predominantly debt-based contracts while their use of equity based modes is minimal (Khan 2010) and while some Islamic finance institutions use products resembling derivatives these were not significant enough to have a major impact on IBs during the crisis (Ahmed 2009). Generally, the downturn in Islamic performance during 2008 was mainly due to a deterioration in broad economic conditions over the year to 18 months. But the aforementioned studies generally find that over a longer time period IBs were more stable than their conventional counterparts. This is conformed also by Abedifar et al (2013) who show that small Islamic banks are generally lower risk than their conventional counterparts.

More recently, however, things have changed and Islamic banking can no longer claim to be superior to conventional banking in all the dimensions of stability (Islamic Financial Services Industry Stability Report, 2018). According to the aforementioned report, the capitalization of EU banks is now stronger than that of many IBs, and the non-performing loans ratio of European Union (EU) banks is also lower than that of IBs – although IBs outperform EU banks in terms of return on assets (ROA), return on equity (ROE) and the cost-to-income (efficiency) ratio.

#### 4.2.2.4. Financial Inclusion in Countries with a Considerable Muslim Population (CCMPs)

Several CCMPs have some of the highest poverty rates in the world (Obaidullah and Khan 2008). Therefore, having access to a full range of financial services is important for poverty reduction (Asian Development Bank, 2000; and United Nations Capital Development Fund, 2006). CCMPs have faced challenges compared to the RW in increasing the level of FI because of the low base they start from and the limited availability of financial products and services overall.

The OIC Outlook Report (2014) show that only 28%<sup>12</sup> of adults in the member countries of OIC have an account at a formal financial institution compared to 51% worldwide (these figures are based on 2012 data released from the FINDEX database). Furthermore, only 11% and 8% of adults in OIC countries have saved and borrowed from formal

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<sup>12</sup> The average percentage of people with a bank account at a formal financial institution.

financial institutions (FFIs), respectively. Based on the Global Financial Development Report (2014), adults that have an account at FFIs in OIC countries are around 25% compared to 57% (of total population) in the RW.

The number of poor and underprivileged people with an income of less than \$2 per day who live in the OIC countries is around 700 million. Moreover, only 9% of Muslim adults globally have a formal saving account compared to 18% of non-Muslim adults (Demirgüç-Kunt, et al 2014). The data provided by FINDEX shows that 7% of respondents in the OIC countries refer to religious reasons for not having a formal account, and this increases to 12% in the Middle East and North Africa.

Kammer et al. (2015) shows that the lack of Sharia-compliant products is a major reason for the financial exclusion of around 32% of SMEs. The report covers nine countries in the MENA region (Iraq, Pakistan, Yemen, Saudi Arabia, Egypt, Lebanon, Morocco, Tunisia, and Jordan) and highlights the fact that the market gap for IBF credits to the SMEs value may be between \$8.63 billion and \$13.20 billion. In addition, the potential total of deposits that could reach un-served and underserved SMEs is estimated to range between \$9.71 billion and \$15.05 billion.

Demirguc-Kunt et al (2013) use a sample of 65,000 Muslim adults from 64 economies – ignoring countries where less than 1% or more than 99% were Muslim – to investigate the demand for formal financial services among Muslim adults. They find that Muslims are considerably less likely to have an account or savings at a FFIs compared to non-Muslims. However, this can be traced to the extent to which Islamic Financial Institutions (ISFIs) are present in each country. This result is consistent with the findings of the Global Financial Development Report (2014), which highlights that the size of Islamic assets per adult member of the population is negatively related to the proportion of adults referring to religious reasons for not having a formal account.

Demirguc-Kunt et al (2013) survey Muslim adults (5,000 interviews) in five Arab countries (Algeria, Egypt, Morocco, Tunisia, and Yemen) that have emerging Islamic finance industries. They discover a modest demand for Sharia-compliant banking services with only 8% of those surveyed saying that they used Islamic banking services among those who had an account at or had borrowed from FFIs in the past year. However,



the authors find evidence of a hypothetical preference in 45% of respondents for Sharia-compliant products despite their higher cost.

Mohieldin et al (2011) show that although OIC countries have more microfinance deposits and loan accounts (an average of 68 and 35 accounts per 1,000 adults) compared to other developing countries (an average of 48 and 30 accounts per 1,000 adults) and other low income countries (an average of 62 and 44 accounts per 1,000 adults), the value of micro-financial deposits and loans as a percentage of GDP is still much lower in OIC countries (0.61% and 0.79%) than in developing countries (0.78% and 0.97%) and low income countries (0.92% and 1.19%).

The 2014 Global Financial Development Report points out that the number of IBs per 100,000 adults is negatively related to the percentage of firms mentioning that their main operational constraint is access to finance. This relationship is exceptionally strong in OIC countries. The report also states that increasing the number of ISFIs can also lead to an increase in enterprises that operate in OICs.

Naceur et al (2015) examine the relationship between Islamic banking developments and FI in OIC countries. They find that the use of financial services in the OIC countries has not increased as fast as expected although physical access to financial services in these countries has grown rapidly. In addition, Naceur et al (2015) find a weak positive empirical link to lending to households and to firms. They explain that although OIC countries have improved financial access, they did not tend to modify Islamic banking with the objective of increasing the level of FI.

A 2007 CGAP survey identifies that Islamic microfinance products are limited. Over 70% of all Islamic financing is Murabaha (cost plus mark-up), which is very close to conventional financing and out of reach for many poor people. The other available product is Qarad Al-Hassan, which is often considered a form of charity instead of being a self-sustaining business arrangement (El-Zoghbi and Tarazi, 2013). The narrow range of products available generally excludes low-income individuals and SMEs from all Sharia-compliant products.

The implementation of risk-sharing products is still low. The CGAP survey (2013) shows the number of active clients who have been provided with risk-sharing financial products in five countries (Indonesia, Sudan, Pakistan, Ivory Coast and Sri Lanka). The survey indicates that out of roughly a million clients, only 6,854 were offered Musharakah micro-finance products and 2,426 were offered Mudarabah micro-finance products (almost 1% of all clients). However, the value of these loans weighs more in terms of value (about 6.36% of the total value).

The need for a high level of transparency and vigilant reporting on profit and loss contracts (because asymmetric information issues are involved) is the reason behind the low implementation of risk-sharing financial products. Therefore, risk-sharing financial products affect operating costs, mainly for MSEs, which are not familiar with the formal accounting requirements that govern these products. Another reason is that micro-enterprises are relatively volatile, which raises their risk compared to larger businesses. The microcredit crisis in Morocco is considered an example of MSEs' volatility (Chehade and Nègre, 2013).

Mohieldin et al. (2011) argue that, since the Islamic finance industry is still at an early stage, most members of staff have little familiarity with Islamic finance. The knowledge gap regarding Sharia law among employees affects the development of many institutions. Together with the innovation of financial products and services geared to Islamic microfinance, the connection with Sharia law increases the complexity of these provisions.

Naceur et al (2015) highlight three policy dimensions that could assist Islamic finance in enhancing financial access. First policy could improve the current operating model of IBs. These authors suggest that IBs need to establish SME units that should focus more on the market dynamics and tailor Islamic financial products to suit the specific needs of SMEs. IBs also need to introduce credit evaluation techniques to improve pricing and reduce risk's exposure. This would result in the improved development of equity-related instruments such as Musharakah and Mudarabah. Naceur et al (2015) also highlight the potential of the private equity and venture capital that IBs can benefit from<sup>13</sup>.

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<sup>13</sup> Their suggestion is based on Kammer et al. (2015).

Second, IBs can mobilize additional resources such as Zakat and Waqf. Naceur et al (2015) also mention the important role of Qard-al-Hassan in reducing the burden of high interest charges and Zakat funds in covering the risk of default and building capacity and skills – similar arguments are made by Iqbal and Mirakhor (2013). The authors suggest that lending should be based on risk-sharing in financial products, because they avoid inflicting high interest rates on poor people and MSEs. The final policy action related to a range of factors include improvements to financial infrastructure (covering credit reporting and rights); financial education; banking competition; consumer protection; and an enhanced regulatory and supervisory framework for Islamic finance.

Mohieldin et al (2011) argue that policymakers need to develop a more supportive regulatory and supervisory framework to improve access to finance in the OIC countries. They need to strengthen the financial infrastructure for FI, especially credit information systems. Additionally, policymakers should build countrywide institutions with the relevant legal infrastructure to use Zakah, Waqf, and Qard-al-Hassan effectively. Mohieldin et al (2011) stress that the lack of Islamic microfinance products and financial innovation is also limiting the effort to expand FI. Thus, applying Islamic financial engineering will enable financial institutions to pool their assets and introduce marketable securities that would enable MSEs to be better financed.

### **4.3. Data and Methodology**

In this analysis FI is mainly measured by the index of FI constructed by Sarma (2012) and the NI. These indexes are analyzed in significant detail in the second chapter of this thesis. The indicators used to construct these indexes are collected from the FAS database. FAS data are considered supply side data as the information is gathered from central banks and other banking / financial sources. Note that the index gives values between 0 and 1, where 1 represents full inclusion and 0 complete exclusion.

In addition, nine simple other indicators are selected from the FAS and FINDEX database. Six of these indicators are collected from FAS database: deposits and loans as a percentage of GDP; the number of deposit and loan at Other Depository Corporations (ODCs) per 1,000 adults; and the number of branches of ODCs per 100,000 adults and per 1,000 kilometer squares. Additionally, three indicators are collected from FINDEX,

which is primarily from household survey data. These indicators are: the percentage of the population with an account at FFIs; the percentage of the population who have saved at FFIs; and the percentage of the population who borrowed from FFIs.

There are 55 countries with a percentage of Muslims in the population above or equal to 30% of the total. However, three CCMPs (namely Bahrain, Somalia and Turkmenistan) have no data in the FAS and so are excluded from the analysis. The data about Islamic banks in CCMPs are collected from three sources: the Islamic Financial Services Board (IFSB) database, the Bank-Focus database, and the 2014 Islamic Banking Database (IBD) from the World Bank. The IFSB database gives macro-level information about IBs for 22 countries. Of these, information on 20 out of the 22 countries are collected from the IFSB database. The only countries excluded are the United Kingdom (as it is not part of the CCMPs since the percentage of Muslim population is only around 5%) and Bahrain (because it has no data in the FAS database).

The Bank-Focus database gives micro-level information (bank level data) about ISFIs for 36 countries (27 of them CCMPs). This database offers information on an additional five countries (Guinea, the Maldives, Nigeria, Senegal and Tanzania) and partial data for two more (Algeria and Iraq<sup>14</sup>). Although Bank-Focus provides micro-level information, these five countries have only one IB. Thus, information was useful to gain macro level information for these five countries.

For the remaining countries information was collected manually using the listed names given by the 2014 IBD and Bank-Focus database. The data collected manually gives information on six CCMPs (Afghanistan, Albania, Bosnia and Herzegovina, Gambia, Kazakhstan, Kyrgyzstan and Niger)<sup>15</sup>. The total number of CCMPs with data about IBF is 33 (after excluding Bahrain, Somalia, Turkmenistan and Iraq). Additionally, Five CCMPs had IBs from which data is not available. These countries are Azerbaijan, Mauritania, Morocco<sup>16</sup>, Niger, and Yemen. It is worth mentioning that although the data about Islamic banks were collected only for CCMPs, the number of IBs is collected

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<sup>14</sup> Iraq was excluded because of limited data for the rest of the Islamic financial institutions.

<sup>15</sup> Algeria has 2 Islamic banks, one was collected from Bank-Focus and one collected manually.

<sup>16</sup> Six IBs were established in 2017 in Morocco after the government released especial regulation for IBs.

across the world using the three databases mentioned earlier. Note that the number of IBs in CCMPs and the RW are reported in Appendix 4.1 and 4.2, respectively.

The collected data about IBs include the following indicators: number of IBs, number of IBs' branches, the IBs' outstanding deposits and loans, and IBs' net income. The collected data are used to measure the percentage of IBs' deposits to total deposits; the percentage of IBs' loans to total loans, the number of IBs' branches per 1,000 square kilometers, the number of IBs' branches per 100,000 adults, and IBs' Return on Assets (ROA). The country's average value of these measured indicators is reported in the Appendix 4.3. Although the number of CCMPs with data about IBF is 33, the number of CCMPs included in the analysis is only 22 countries. This is because the CCMPs included in the analysis must have data about the nine FI indicators as well as the two indexes of FI. The total number of countries covered in the study is 80 countries, 22 CCMPs and 58 countries from the RW (see Appendix 4.4).

The analysis is carried out as follows. First, a descriptive analysis of the Islamic financial market is carried, mainly for the 33 CCMPs (especially the 22 CCMPs included in the analysis). Second, several univariate random effect estimations are undertaken to determine the gap in the level of FI between the two groups of countries (using dummy variable to distinguish between CCMPs with the RW) – see model 1.

#### Random Effects Model

$$FI_{it} = IS_i + e_{it} \quad (1)$$

Where:

$IS_i$  is a dummy variable given the value 1 if country  $i$  has a considerable Muslim population and 0 otherwise.

Then, several multivariate random effects estimates are applied to further investigate whether the difference in the level of FI does hold even when the determinants of FI and financial system characteristics (discussed in chapter three) are included in the analysis (see model 2). The included variables are: banks' concentration; banks' cost to income ratio; banks' net interest margin; banks' credits to banks deposits ratio; banks' Z-score; rule of law; government expenditure as a percentage of GDP; and a dummy variable to control for the stage of economic development.

These variables are collected from various databases, including the World Development Indicator, Global Financial Development, and Worldwide Governance Indicators. Note that the dummy variable that control for countries stage of economic development categorizes countries into four groups based on the World Bank's classifications. Low income group represents countries with GNI per capita less than \$1025, whereas lower middle class signifies countries with GNI per capita between \$1025 and \$4035. Upper middle class presents countries with GNI per capita is between \$4035 and \$12475, and high income group is more than \$12475. The GNI Income Group gives Low income group the value 1, lower middle income group the value 2, upper middle income group the value 3, and high income group the value 4. The variables' descriptive summary is reported in appendix 4.5 and pairwise correlation are reported in Appendix 4.6 and Appendix 4.7.

$$FI_{it} = BC_{it} + CTI_{it} + BCBD_{it} + NIM_{it} + Z_{it} + law_{it} + GOV_{it} + IG_{i,t} + IS_i \quad (2)$$

where

$FI_{it}$ : the value of the index of FI (and the selected FI indicators) for the  $i^{th}$  country at the  $t^{th}$  period

$BC_{it}$ : banks' concentration in country  $i$  at time  $t$ ,

$CTI_{it}$ : banks' costs to income ratio (banking operational inefficiency) in country  $i$  at time  $t$ ,

$BCBD_{it}$ : the ratio of banks' credits to deposits ratio in country  $i$  at time  $t$ ,

$NIM_{it}$ : banks' net interest margin in country  $i$  at time  $t$ ,

$Z_{it}$ : banks' Z-score in country  $i$  at time  $t$ ,

$law_{it}$ : the index of the rule of law in country  $i$  at time  $t$ ,

$GOV_{it}$ : government expenditure as a percentage of GDP for the  $i^{th}$  country at the  $t^{th}$  period,

$IG_{i,t}$ : income classification of a country  $i$  at time  $t$  based on GNI per Capita (World-Bank's income Classification).

Finally, a number of panel fixed effects models are applied to investigate whether the introduction of IBs have enhanced the level of FI. The main independent variable is the percentage of IBs to total number of banks. Note that the analysis covers all IBs that exists in the selected sample (80 countries: 22 CCMPs and 58 non-CCMPs). The fixed effects models that have been used is the following:

#### Fixed Effects Models

$$FI_{it} = BC_{it} + CTI_{it} + BCBD_{it} + NIM_{it} + Z_{it} + law_{it} + GOV_{it} + IG_{i,t} + PIB_{it} \quad (3)$$

Where:

$PIB_{it}$  the percentage of Islamic banks to total number of banks in country  $i$  at time  $t$ .

For farther investigation, the number of IBs is replaced with the percentage of Islamic banks' assets to total banks assets in order to furtherly examines the effect of IBs on the level of FI. The model applied is the following:

$$FI_{it} = BC_{it} + CTI_{it} + BCBD_{it} + NIM_{it} + Z_{it} + law_{it} + GOV_{it} + IG_{i,t} + PIBA_{it} \quad (4)$$

Where:

$PIBA_{it}$  the percentage of Islamic banks' assets to total banks' assets.

## 4.4. Discussion

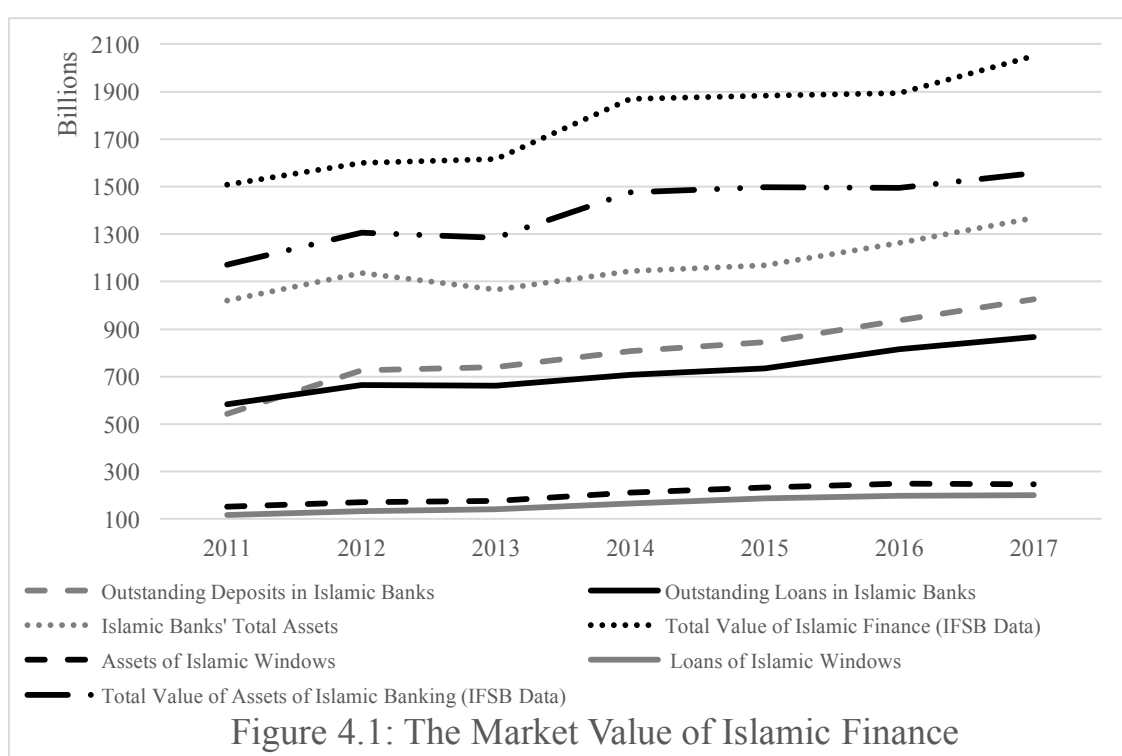
### 4.4.1. Islamic Banking and Finance in Countries with Considerable Muslim Population (CCMPs)

The number of IBs world-wide reached 249, based on the collected data, which was derived from the three databases mentioned above in the data description. Note that Islamic investment banks are excluded from the analysis because they do not lend to individuals or entities directly. As noted earlier, the global market for Islamic finance has increased from \$1.6 trillion in 2012 to over \$2 trillion by 2017 (see Islamic Financial Services Industry Stability Reports from 2012 to 2018).

The average annual growth rate in the global market for Islamic finance over the period was 5.45%. The total value of the assets of IBs, which account for a large proportion of the Islamic finance market, increased from around \$1.3 trillion to nearly \$1.6 trillion, an average growth rate of 4.25% – lower than that of the broader Islamic finance market (which includes mutual funds, Sukuk and Islamic insurance). This difference in growth is a result of the rapid increase in the Sukuk financial market (Islamic bonds).

Figure 4.1 gives detail information about the Islamic Finance between 2011 and 2017. The information about Islamic Windows (in conventional banks) and the total value of Islamic Finance and the total value of Islamic Banking (IBs plus Islamic Windows) are estimated for 2011 and 2012. The number of IBs in the select sample of sample is 95. The total assets of the IBs in the selected sample reached over \$592 billion in 2017, which about 50% of the total value of IBs' assets. The total outstanding deposits of IBs in the selected sample reached over 450 billion in 2017. The total outstanding loans by IBs in the selected sample is approximately \$404.5 billion in 2017.

The IBs' average ROA in the selected sample in 2017 is around 1.14% whereas the average ROA for the selected sample is 1.96%. The average credits to deposits ratio of IBs in the sample in 2017 is around 72.8% compared to 85.5% for the average banking system in the sample (and 85.7% for the RW). Note that the ratio is normally used to assess banks' liquidity and indicates the ability of a bank to cover non-performing loans and customers' withdrawals. This result is consistent with the literature that generally finds that Islamic bank tend to have more liquidity (Parashar and Venkatesh, 2010; and Beck et al, 2013). Note that credits to deposits ratio is suggested in the second paper as one of the main determinants of FI.



#### 4.4.2. Financial Inclusion in Countries with Considerable Muslims Population

Univariate random effect models are applied to check the difference in the level of FI between CCMP and the RW. A dummy variable that distinguishes between the two groups are used, where the CCMPs are given the value 1 and the RW is given the value 0. Table 4.1 report the results of the three simple measures collected from FINDEX database. The results reported in Table 4.1 show that the CCMPs in the sample have a lower level of FI than the RW (RW refers to the 58 countries included in the sample). The percentage of population with an account at FFIs in CCMPs is lower than the RW



by 14.5% at 5% level of significance. The percentage of the population who saved at (borrowed from) FFIs in the CCMPs is lower than in the RW by 8.6% (2.1%) at 1% (10%) level. It is worth mentioning that all the data are provided by FINDEX cover individuals only and do not represent firms and institutions.

In addition, multivariate random effects models with time effects are used to further investigate the difference in the level of FI between the CCMP and the RW. The aim of using the multivariate models is to see if the difference in the level of FI between the CCMP and the RW still exist when the determinants of FI and financial system characteristics are taken into consideration. The result of using the multivariate random effects models are reported in Table 4.2.

**Table 4.1: The Difference in the Level of Financial Inclusion (FINDEX) between Countries with A Considerable Muslim Population and the Rest of the World Using Univariate Random Effects**

Independent Variable	The Dependent Variable		
	Having an Account at FFIs	Saved at FFIs	Borrowed from FFIs
Dummy for Islamic Countries	-14.526 **	-8.636 ***	-2.144 *
Constant	52.841 ***	19.790 ***	11.222 ***
Observations	211	211	211
Number of Countries	80	80	80
Average Period (years)	2.6	2.6	2.6
Wald Test	6.15 **	11.46 ***	2.74 *
R-Squared between	0.061	0.091	0.031
R-Squared Overall	0.063	0.084	0.032
rho	0.857	0.862	0.663

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

The dummy variable that distinguishes between the CCMPs and the RW shows that the CCMPs have a lower at some aspects FI than the RW has. Nonetheless, the difference is much lower. The percentage of population with an account at (and saved at) FFIs in the CCMPs is lower than in the RW by 7.95% (7.2%) at 5% level. However, the difference in the percentage of population who borrowed form FFIs turns out to be insignificant.

**Table 4.2: The Difference in Level of Financial Inclusion (FINDEX) between Countries with Considerable Muslim Population and The Rest of the World Using Random Effects and Control Variables**

Independent Variables		The Dependent Variable		
		Having an Account at FFIs	Saved at FFIs	Borrowed from FFIs
<b>Variable under Study</b>	Dummy for Islamic Countries	-7.951 **	-7.232 ***	-1.457
<b>Control Variables</b>	Banks' Concentration	0.041	0.036	-0.021
	Banks' Cost to Income Ratio	-0.050	-0.013	-0.003
	Banks' Net Interest Margin	-0.822	-0.190	0.028
	Banks' Z-Score	-0.137	0.091	0.017
	Banks' credit to banks' deposit	0.060	-0.075 ***	0.033 ***
	Government Expenditure (%GDP)	0.174	-0.195	-0.289 ***
	Rule of Law	0.510 ***	0.246 ***	0.027
	World-Bank Countries' Income Classifications	6.367 ***	2.805 **	0.748
Constant		3.199	7.371	8.845 **
Observations		203	203	203
Number of Countries		79	79	79
Average Period (years)		2.6	2.6	2.6
Wald Test		789.34 ***	141.53 ***	69.62 ***
R-Squared within		0.596	0.161	0.161
R-Squared between		0.735	0.598	0.318
R-Squared Overall		0.735	0.558	0.274
Rho		0.802	0.758	0.628

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

Looking at the supply side information provided by the FAS, the index of Sarma (2012) and all the simple indicators have shown insignificant difference in level of FI between CCMPs and the rest of the world. However, the NI has shown that there is a difference in level by 0.09 (the index gives values between 0 and 1) but only at 10% level. There are three reasons behind the difference in the result reported by the index of Sarma (2012) and NI. First, NI uses data for all ODCs whereas Sarma (2012) uses data for banks only. Second, NI uses the number of depositors, which is closer to the percentage of population with an account at FFIs, whereas Sarma (2012) uses number of deposit accounts. Third, NI includes data about number of borrowers, which is close to the percentage of population borrowed from FFIs.

Table 4.4 reports the result of the multivariate random effects models with time effects to check if the difference in the level of FI between the CCMP and the RW exist when the determinants of FI and financial system characteristics are included in the regression. The results indicate that there is no significant difference in the level of FI. Though the FINDEX findings show that the CCMPs have lower levels of FI than the RW, the FAS findings show that the difference between the CCMPs and the RW is insignificant. This because the FAS includes data not only about individuals but also about entities (firms and institutions), which may not have lower access to financial services.

To sum up, there is difference in percentage of population that are financially included but not in the overall level of FI. In other world, entities (firms and institutions) in both groups have similar level of FI. Additionally, the geographical and demographical coverage in both group is close. Based on the results, the answer for the first sub-question is that the overall level of FI, that is captured by the indexes of FI, in CCMPs is not significantly lower than the rest of the world.

#### **4.1.1. Islamic Banking and Financial Inclusion in Countries with a Considerable Muslim Population (CCMPs)**

The aim of this sub-section is to check whether the introduction of IBF has raised the level of FI in countries where IBs operate. Fixed effect panel regressions were carried out to study the effect of IBF on FI. The main independent variable is the percentage of IBs to total number of banks and the percentage of IBs' assets to total banks' assets (run in separate regressions).

**Table 4.3: The Difference in Level of Financial Inclusion (FAS) between Countries with Considerable Muslim Population and The Rest of the World Using Random Effects**

Independent Variable	The Dependent Variable							
	Sarma's (2012) Index	NI	Deposit Accounts at ODCs per 1,000 Adults	Loan Accounts at ODCs per 1,000 Adults	Banks' Deposits (%GDP)	Banks' Loans (%GDP)	Branches of ODCs per 1,000 km2	Branches of ODCs per 100,000 Adults
Dummy for Islamic Countries	-0.061	-0.091 *	-325.177	-105.663	5.033	-1.574	-4.714	-5.236
Constant	0.397 ***	0.489 ***	1364.741 ***	440.846 ***	49.605 ***	45.750 ***	25.477 ***	23.101 ***
Observations	497	497	497	497	497	497	497	497
Number of Countries	80	80	80	80	80	80	80	80
Average Period (years)	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
Wald Test	1.4 **	2.9 *	2.23	1.65	0.34	0.04	0.33	1.61
R-Squared between	0.012	0.031	0.023	0.018	0.005	0.001	0.004	0.018
R-Squared Overall	0.020	0.044	0.027	0.021	0.002	0.004	0.003	0.021
rho	0.969	0.970	0.970	0.972	0.782	0.958	0.990	0.973

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

**Table 4.4: The Difference in Level of Financial Inclusion (FAS) between Countries with Considerable Muslim Population and The Rest of the World Using Random Effect Model and Control Variables**

Independent Variables		The Dependent Variable							
		Sarma's (2012) Index	NI	Deposit Accounts at ODCs per 1,000 Adults	Loan Accounts at ODCs per 1,000 Adults	Banks' Deposits (%GDP)	Banks' Loans (%GDP)	Branches of ODCs per 1,000 km2	Branches of ODCs per 100,000 Adults
<b>Variable Under Study</b>	Dummy for Islamic Countries	0.001	-0.047	-111.964	-37.463	0.681	5.460	-0.301	-1.737
<b>Control Variables</b>	Banks' Concentration	0.000	-1E-4	0.352	0.122	-0.211 **	-0.053	-0.029	-0.051 **
	Banks' Cost to Income Ratio	0.000	1E-4	-0.425	0.810	-0.100	-0.006	-0.001	0.069
	Banks' Net Interest Margin	-0.004	-0.004 *	-6.642	-3.309	-2.453 ***	-1.275 ***	-0.268 *	-0.163
	Banks' Z-Score	0.001	0.001	-0.207	0.311	1.227 ***	0.374 *	-0.492 **	-0.152
	Banks' credit to banks' deposit	0.002 ***	0.001 ***	6.193 ***	1.277 **	-0.121 *	0.358 ***	0.114 ***	0.113 ***
	Government Expenditure (%GDP)	0.004 **	0.003 **	12.952	5.780 **	0.351	1.278 ***	0.528 **	0.518 ***
	Rule of Law	0.004 ***	0.003 ***	11.418 ***	4.246 ***	0.374 ***	0.154 *	0.099 **	0.035
	World-Bank Countries' Income Classifications	0.033 ***	0.044 ***	94.943 ***	28.579	3.948	3.680 **	0.442	1.143
Constant		-0.099 *	0.061	-263.357	-115.003	40.721 ***	-21.312 **	10.727	2.191
Observations		483	483	483	483	483	483	483	483
Number of Countries		79	79	79	79	79	79	79	79
Average Period (years)		6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Wald Test		227.71 ***	348.96 ***	121.75 ***	89.86 ***	153.93 ***	172.87 ***	35.99 ***	50.75 ***
R-Squared within		0.355	0.474	0.365	0.184	0.194	0.276	0.118	0.170
R-Squared between		0.653	0.688	0.458	0.542	0.244	0.497	0.027	0.119
R-Squared Overall		0.634	0.683	0.441	0.524	0.214	0.442	0.042	0.104
rho		0.925	0.935	0.957	0.950	0.536	0.920	0.981	0.957

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

The reason behind the selection of the main dependent variable is the availability of data, which covers not only CCMPs but also non-Muslim countries where IBs operate (see Appendix 4.1 and 4.2). The dependent variable is FI captured by the two indexes mentioned earlier (Sarma (2012) and NI) as well as nine simple indicators (six from the FAS and three from the FINDEX). The control variables used in the fixed effect models were the same as the one used earlier in Table 4.2 and 4.4. Note that robust standard errors are applied for heteroscedasticity. The analysis covers the period between 2011 and 2017.

Tables 4.5 and 4.6 report the result where the main independent variable is the percentage of IBs to total number of banks. From Table 4.5, a 1% increase in the percentage of IBs to total number of banks is positively related to 2.24% increase in percentage of population with an account at FFIs. This is because IBs removes the religious reasons for being financially excluded. However, this relationship is weak since it is only significant at 10% level. The increase in the percentage of IBs by 1% is associated with an increase in the percentage of population saved at FFIs by 2.27% at 1%. This is because IBs give individuals the chance to save and invest in financial products and services that compliant with the Islamic rules.

The percentage of IBs is also related to the percentage of borrowed from FFIs as it gives individuals the opportunity to receive financial services that compliant with the Islamic rules. An increase in the percentage of IBs by 1% is linked to 0.73% increase in the percentage of borrowed from FFIs at 10%. Table 4.6 reveals that the percentage of IBs to total number of banks is only related to NI. An increase in the percentage of IBs by 1% is related to 0.003 increase in the level of FI measured by NI. Since the percentage of IBs has weak positive relationship with the percentage of population with an account at (and borrowed from) FFIs and insignificant relationship with most of FAS indicators, time effects was added to further investigate the relationship between the introduction of IBs and FI.

**Table 4.5: The Effect of Islamic Banks on the level of Financial Inclusion (FINDEX)**

Independent Variables		The Dependent Variable		
		Having an Account at FFIs	Saved at FFIs	Borrowed from FFIs
Variable Under Study	Percentage of Islamic Banks to Total Number of Banks	224.909 *	227.245 ***	72.962 *
Control Variables	Banks' Concentration	0.049	0.034	0.037
	Banks' Cost to Income Ratio	-0.008	-0.026	0.001
	Banks' Net Interest Margin	0.659	0.262	0.285
	Banks' Z-Score	1.149 **	0.043	0.146
	Banks' credit to banks' deposit	0.027	-0.099 **	-0.007
	Government Expenditure (%GDP)	0.813	-0.114	0.144
	Rule of Law	0.309	0.112	0.169 ***
	World-Bank Countries' Income Classifications	7.928 **	2.279	0.562
Constant		-29.333	7.319	-8.303
Observations		202	202	202
Number of Countries		79	79	79
Average Period (years)		2.6	2.6	2.6
F Test		2.4 **	2.89 ***	3.74 ***
R-Squared within		0.125	0.177	0.0902
R-Squared between		0.169	0.004	4E-4
R-Squared Overall		0.186	0.008	1E-4
Corr(u <sub>i</sub> ,X <sub>b</sub> )		-0.780	-0.710	-0.075
Rho		0.892	0.955	0.881

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

**Table 4.6: The Effect of Islamic Banks on the level of Financial Inclusion (FAS)**

Independent Variable		The Dependent Variable							
		Sarma's (2012) Index	NI	Deposit Accounts at ODCs per 1,000 Adults	Loan Accounts at ODCs per 1,000 Adults	Banks' Deposits (% GDP)	Banks' Loans (% GDP)	Branches of ODCs per 1,000 km2	Branches of ODCs per 100,000 Adults
Variable Under Study	Percentage of Islamic Banks to Total Number of Banks	0.289	0.327 **	1463.577	449.061 ***	33.786	17.533	11.616	-2.685
Control Variables	Banks' Concentration	-2E-4	-1E-4	-0.107	-0.024	-0.184	-0.066	-0.029	-0.043 *
	Banks' Cost to Income Ratio	2E-4	3E-4	0.484	0.889	0.002	0.028	-0.005	0.061
	Banks' Net Interest Margin	-3E-4	-0.002	2.782	-1.179	0.162	-0.642 **	-0.169	-0.096
	Banks' Z-Score	0.003	0.004 **	10.894	3.227	0.205	0.116	-0.568 **	-0.248
	Banks' credit to banks' deposit	0.001 ***	0.001 *	5.251	0.660	-0.081	0.353 ***	0.118 ***	0.118 ***
	Government Expenditure (%GDP)	0.007 **	0.006 **	21.211	7.497 **	1.496 **	1.454 ***	0.502 ***	0.514 ***
	Rule of Law	0.003 **	0.002 **	8.413	2.896 ***	-0.220	-0.060	0.055	0.013
	World-Bank Countries' Income Classifications	0.020 **	0.035 ***	79.832	12.981	3.119	2.460	0.016	0.583
Constant		-0.065	0.046	-316.587	-14.315	44.320 ***	-9.018	14.412 **	4.966
Observations		482	482	482	482	482	482	482	482
Number of Countries		79	79	79	79	79	79	79	79
Average Period (years)		6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
F test		4.5 ***	4.22 ***	3.5 ***	4.25 ***	2.42 **	9.57 ***	1.16	2.25 **
R-Squared within		0.175	0.154	0.158	0.065	0.018	0.129	0.217	0.242
R-Squared between		0.558	0.551	0.362	0.414	0.012	0.306	0.001	0.119
R-Squared Overall		0.550	0.553	0.357	0.411	0.015	0.294	0.002	0.119
Correlation ( $u_i, X_b$ )		0.362	0.336	0.219	0.309	-0.115	0.032	0.062	0.012
rho		0.949	0.949	0.962	0.942	0.783	0.963	0.992	0.976

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.



The result of the fixed effect – time effect regressions is reported in appendix 4.8 and 4.9, respectively. Note that all coefficients of the percentage of IBs have turned to be insignificant but, the relationship with percentage of population who save at FFIs that remain positive and significant. A 1% increase in percentage of IBs is related to a positive increase in percentage of population who save at FFIs by 2% at 1% level. It is worth mentioning that the log of FAS indicators have been used in the analysis but have not shown any significant relationship with the percentage of IBs. Although, IBs have a relationship with one of the FI aspects, the result of the percentage of IBs do not have a strong positive effect on the overall level of FI that is captured by the index of Sarma (2012) and NI.

The second variable used to study the relationship between FI and IBs is the percentage of IBs' assets to total bank assets. Table 4.7 and 4.8 summarize the result of the fixed effect regressions. There are only three simple measures of FI that show positive relationship with the percentage of IBs' assets to total bank assets. The first one is the log of branches of ODCs per 1,00 kilometer squares. This is because one Islamic bank open and grow, they keep covering more area to attract more customer. An increase in percentage of IBs' assets to total bank assets by 1% is linked to an increase in branches of ODCs per 1,00 kilometer squares by 0.8% increase in branches of ODCs per 1,00 kilometer squares. The second simple measure is the percentage of population with an account at FFIs. As previously mentioned, this is might be because IBs encourage the population with no account at FFIs because of religious reasons to open a bank account the fit the Islamic rules.

An increase in the percentage of IBs' assets to total bank assets by one is associated with an increase in is the percentage of population with an account at FFIs by 0.39 at 10% level. The third simple measure is the log of deposit accounts per 1,000 adults, which show positive relationship at 1% level of significance. The increase in is the percentage of IBs' assets to total bank assets is related to an increase in deposit accounts per 1,000 adults by 1.7%. As a result of the positive relationship between percentage of IBs' assets to total bank assets and the three aspects of FI, FI inclusion seems to have positive relationship with the overall level of FI at 5% level. An increase in the percentage of IBs' assets by 1% relates to an increase in level of FI by 0.02.

**Table 4.7: The Effect of Islamic Banks on the level of Financial Inclusion (FINDEX and FAS)**

Independent Variables		The Dependent Variable								
		Having an Account at FFIs	Saved at FFIs	Borrowed from FFIs	Log Deposit Accounts at ODCs per 1,000 Adults	Log Loan Accounts at ODCs per 1,000 Adults	Log Banks' Deposits	Log Banks' Loans	Log Number of Branches of ODCs per 1,000 km2	Log Number of Branches of ODCs per 100,000 Adults
Variable Under Study	Percentage of Islamic Banks Assets to Total Banks' Assets	0.394 *	-0.037	-0.217	0.017 ***	-0.007	0.003	-0.007	0.008 ***	-1E-4
Control Variables	Banks' Concentration	0.018	0.019	0.019	-0.001	-0.003	-0.015	-0.005 *	-0.002 *	-0.002 *
	Banks' Cost to Income Ratio	0.017	-0.026	-0.007	0.000	0.003	0.025	0.006	0.001	0.001
	Banks' Net Interest Margin	0.902	0.402	0.291	-0.002	-0.006	-0.004	-0.013	0.003	0.004
	Banks' Z-Score	1.240 ***	0.041	0.133	0.016	0.016 *	0.018	0.004	-0.002	-0.005
	Banks' credit to banks' deposit	0.041	-0.110 **	-0.022	0.004 **	0.003 *	-0.006	0.008 ***	0.005 ***	0.004 ***
	Government Expenditure (%GDP)	0.663	-0.203	0.123	0.031 **	0.034 *	-0.005	0.023	0.034 ***	0.028 ***
	Rule of Law	0.310	0.125	0.199 ***	0.005	0.009	-0.004	0.004	0.000	-0.001
	World-Bank Countries' Income Classifications	6.768 *	0.717	-0.301	0.116 *	0.072	-0.223	0.120	0.026	0.007
Constant		-20.729	21.416 *	-1.116	5.273 ***	3.950 ***	24.795 ***	22.264 ***	1.197 ***	2.113 ***
Observations		196	196	196	468	468	468	468	468	468
Number of Countries		77	77	77	78	78	78	78	78	78
Average Period (years)		2.5	2.5	2.5	6	6	6	6	6	6
F Test		2.17 **	1.44	1.95 *	3.26 ***	2.57 ***	0.74	7.33 ***	6.1 ***	6.01 ***
R-Squared within		0.125	0.177	0.0902	0.147	0.090	0.021	0.110	0.263	0.230
R-Squared between		0.169	0.004	4E-4	0.431	0.548	0.055	0.291	0.021	0.123
R-Squared Overall		0.186	0.008	1E-4	0.402	0.513	0.034	0.270	0.014	0.118
Corr(u <sub>i</sub> ,X <sub>b</sub> )		-0.030	0.082	-0.075	0.265	0.494	-0.425	0.983	-0.028	0.127
Rho		0.809	0.854	0.881	0.963	0.959	0.821	0.983	0.996	0.987

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

**Table 4.8: The Effect of Islamic Banks on the level of Financial Inclusion (FAS Database)**

Independent Variable		The Dependent Variable							
		Sarma's (2012) Index	NI	Deposit Accounts at ODCs per 1,000 Adults	Loan Accounts at ODCs per 1,000 Adults	Banks' Deposits (% GDP)	Banks' Loans (% GDP)	Branches of ODCs per 1,000 km <sup>2</sup>	Branches of ODCs per 100,000 Adults
Variable Under Study	Percentage of Islamic Banks Assets to Total Banks' Assets	0.001	0.002**	2.825	1.094	0.042	0.001	0.042	-0.005
Control Variables	Banks' Concentration	-2E-4	-1E-4	-0.125	0.023	-0.198	-0.101**	-0.048*	-0.045*
	Banks' Cost to Income Ratio	0.001	0.001	1.475	1.260	0.019	0.045	0.004	0.065
	Banks' Net Interest Margin	-0.001	-0.002	2.690	-1.721	0.213	-0.585*	-0.142	-0.060
	Banks' Z-Score	0.003	0.004**	11.448	3.418	0.211	0.119	-0.569**	-0.253
	Banks' credit to banks' deposit	0.001***	0.001*	4.575***	0.591	-0.087	0.356***	0.124***	0.127***
	Government Expenditure (%GDP)	0.007**	0.006**	20.890*	6.976**	1.512**	1.522***	0.530***	0.557***
	Rule of Law	0.002*	0.002**	6.909	2.257**	-0.230	-0.054	0.062	0.005
	World-Bank Countries' Income Classifications	0.021**	0.034***	68.741	12.678	2.866	2.323	-0.038	0.761
Constant		-0.049	0.059	-182.003	14.804	46.551***	-8.441	14.158**	3.212
Observations		468	468	468	468	468	468	468	468
Number of Countries		78	78	78	78	78	78	78	78
Average Period (years)		6	6	6	6	6	6	6	6
F test		4.36***	3.98***	2.58**	2.02**	2.38**	9.72***	2.14**	2.25**
R-Squared within		0.157	0.139	0.128	0.065	0.018	0.376	0.231	0.261
R-Squared between		0.557	0.563	0.371	0.414	0.000	0.255	0.002	0.124
R-Squared Overall		0.542	0.553	0.356	0.411	0.001	0.272	0.006	0.122
Correlation ( $u_i, X_b$ )		0.410	0.381	0.287	0.469	-0.205	0.015	-0.151	0.002
rho		0.954	0.950	0.966	0.965	0.784	0.963	0.992	0.976

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

For more information, time effect has been added to the result and reported in Appendix 4.10 and 4.11. Surprisingly, the result show negative relationship between the percentage of IBs' assets and the number of deposit account per 1,000 adults at 1% level, where an increase in the percentage of IBs' assets is related to a decline in number of deposit account per 1,000 adults by 5.66 units. This is like Naceur et. al (2015) descriptive analysis where they find that member countries of OIC that do not have IBs experienced significantly faster growth in commercial bank deposit accounts (12%) than OIC countries with IBs (8%).

Furthermore, percentage of IBs' assets is also weakly linked to a decrease in the percentage of population with an account at FFIs at 10%. The percentage of IBs' assets have also shown negative and significant relationship with percentage of population borrowed from FFIs, loan account at ODCs per 1,000 adults and outstanding loans at 5% level. A 1% increase in the percentage of IBs' assets is related to a decrease by 0.366% in percentage of population borrowed from FFIs, 1.49% in loan account at ODCs per 1,000 adults, and 1.83% in outstanding loans.

However, the percentage of IBs' assets have positive relationship with branches of ODCs per 1,000 adults. This is because the higher the percentage of IBs' total asset the more the IB expand their geographical coverage. An increase in the percentage of IBs' assets by 1% is linked to an increase in branches of ODC per 1,000 adults by 0.4%. Note that the results of the relationship of percentage of IBs' assets are similar to Naceur et al (2015) who found that the use of financial services in the OIC countries has not increased as fast as expected although physical access to financial services in these countries has grown rapidly. It seems that the positive effect has canceled off the negative effects and the overall effect on FI is insignificant since both indexes of FI do not show significant results. This result consists with the view of Naceur et al (2015) that although OIC countries have improved financial access, they did not tend to modify Islamic banking with the objective of increasing the level of FI.

There are five main reasons behind the negative relationship found in the analysis. The first reason is the limited number of Islamic financial products and services. Kammer et al. (2015) shows that the lack of Sharia-compliant products is a major reason for the financial exclusion of around 32% of SMEs. Note that two third the countries included

in the data are also included in this chapter. A 2007 CGAP survey highlighted that over 70% of all Islamic financing is Murabaha, which is very close to conventional financing and out of reach for many poor people. The other available product is Qarad Al-Hassan, which is often considered a form of charity instead of being a self-sustaining business arrangement (El-Zoghbi and Tarazi, 2013).

Furthermore, risk-sharing products, which best suits MSEs, is limited due to moral hazard and adverse selection. The CGAP survey (2013) shows, in 5 countries, that only 9,300 were offered Musharakah and Mudarabah micro-finance products out of about a million clients (almost 1% of all clients). The narrow range of products available generally excludes low-income individuals and SMEs from all Sharia-compliant products and led to the negative relationship between IBs and number of loan accounts per 1,000 kilometers. Therefore, IBs can have a stronger effect on FI level if they improve financial innovation.

The second reason is the low ratio of credits to deposits in IBs (Parashar and Venkatesh, 2010; and Beck et al, 2013), which considered one of the main determinant of FI. The average credits to deposits ratio of IBs in the sample in 2017 is approximately 72.8% whereas the average banking system in the sample is to 85.5% (and 85.7% for the RW). Note that this is probably the main reason behind the negative relationship between percentage of IBs' assets and outstanding loans. Although banks' liquidity indicates the ability of a bank to cover non-performing loans and customers' withdrawals, it is important for regulators to make balance strategy between risk and FI. Especially that IBs has the potential to get to the same level of liquidity applied by conventional banks.

The third reason is the risk and cost of the financial services in IBs. It is worth mentioning that IB provides alternative way to finance. The risk of these contracts is different as well as time needed and their cost too. For instance, if a customer seeks a loan then IB may apply Murabaha where the bank will buy a product then sell it to the customer and then the bank act as an agent to sell the product to a third party. This long process cost time and money.

To overcome the second and third issue this paper suggest that central banks in CCMPs need to set a regulations and goals that aim set IBs in the right direction towards higher

level of FI. Similarly, Naceur et al (2015) and Kammer et al. (2015) also pointed that IBs need to improve the current operating model and to benefit from private equity and venture capital. IBs also need to the development of IBF products and services to increase satisfy the different needs of customers.

IFC (2014) notes that IBs need to change their operating models to serve SMEs. The IFC report number of solutions. One is to set separate SME business units within IBs, to recognize the market dynamics of SME, and to tailor Islamic financial products to their specific needs. Moreover, IBs need to train their staff in Shari'ah-compliant products mainly those related to loan applications for SMEs. IBs need to develop credit evaluation techniques to better price and reduce risk exposure to SMEs. The report also emphasized that IBs can explore the opportunities of private equity and venture capital that suite to Islamic modes of finance.

The four reason is that several papers that suggested using IBF have not directly measured the relationship between IBs and FI. For instance, Demirgüç-Kunt, et al (2014) shows that 7% of respondents in the OIC countries refer to religious reasons for not having a formal account. Please note that the percentage of people refer to religious reasons for not having a formal account does not proxy for the level of FI. The global financial development report (2014) also pointed that the size of Islamic assets per adult member of the population is negatively related to the proportion of adults referring to religious reasons for not having a formal account as well as the percentage of firms mentioning that their main operational constraint is access to finance. Again, these two variables do not measure the level of FI.

The fifth reason is financial awareness. Demirguc-Kunt et al (2013) survey 5,000 Muslim adults in five Arab countries and realized a modest demand for Sharia-compliant banking services. They also find that only 8% of those surveyed saying that they used Islamic banking services among those who had an account at or had borrowed from FFIs in the past year. This finding is very important as it shows that though people prefer Sharia-compliant banking services they did not use them. These finding can be linked to the negative relationship between the percentage of IB's assets and number of deposit account at ODCs per 1000 adults and percentage of population with an account at FFIs. It seems that people do not have enough information about IBs and their products and

services. It also seems that IBs have not marketed themselves enough. Besides, central banks especially in CCMPs need to work along with Islamic and conventional banks to improve financial literacy.

Based on the findings, the answer for the second sub-question is that IBs currently do not enhance the level of FI in countries where they operate. However, central banks where IBs operate have to take into consideration the five points mentioned earlier and evaluate the business model used by IBs in order to use IBs to enhance the level of FI. Central banks need to encourage Islamic financial innovations to develop new Islamic financial products and services that suits MSEs and low income segments. Central banks also need to monetary the ratio of credit to deposit in IBs since the ratio tend to be lower in IBs compared to conventional banks.

## **4.2. Conclusion**

This paper studies the difference in the level of FI between the CCMPs and the RW. The index of Sarma (2012) and the NI suggested in the second chapter of this thesis are used as then main proxies for FI. Nine indicators are also selected from the FAS and the FINDEX databases. The analysis covers 80 countries (where data permit) between 2011 and 2017 using random effect estimates. The results confirm that CCMPs have similar overall level of FI in terms of geographical and demographical coverage and firms and institutions access to finance. However, CCMPs have a lower percentage of population participating in the financial system than the RW has (see Table 4.1 and 4.2).

The potential for IBF is analyzed as a way to improve FI in the CCMPs. The number of IBs world-wide had reached 249, of which 218 were operating in CCMPs (95 included in the sample). The total assets of the IBs in the selected sample reached over \$592 billion in 2017, which about 50% of the total value of IBs' assets. The total outstanding deposits of IBs in the selected sample reached over 450 billion in 2017. The total outstanding loans by IBs in the selected sample is approximately \$404.5 billion in 2017. The ratio of credits to deposits for IBs in the selected sample is approximately in 2017 is around 72.8% compared to 85.5% for the average banking system in the sample, which consists with the literature that Islamic bank tend to have a more liquidity (Parashar and Venkatesh, 2010; and Beck et al, 2013).

Next, the focus shifts to study whether the introduction of IBF could help raise the level of FI in countries where IBs operate between 2011 and 2017 using fixed effects panel regressions and 80 countries. The Findings show that the percentage of IBs total banks has a positive relationship with IBs. The percentage of IBs' assets to total banks' asset is has a positive relationship with number of branches of ODCs per 1,000 kilometer squares. However, the increase in the percentage of IBs' assets to total banks' asset by 1% is related to a decline by 5.66 units in the number of deposit account per 1,000 adults at 1% level, 0.39 in the percentage of population with an account at FFIs, 0.366% in percentage of population borrowed from FFIs, 1.49% in loan account at ODCs per 1,000 adults, and 1.83% in outstanding loans. However, IBs have no significant relationship with the overall level of FI that is captured by the index of Sarma (2012) and NI as the positive and negative effect of IB on the different aspects of FI cancel of each other.

There are five reasons behind the negative relationship found in the analysis. First, the limited number of Islamic financial products and services. Therefore, IBs must invest in developing Islamic financial products and services. Second, the low ratio of credits to deposits in IBs, which considered one of the main determinant of FI. Although banks' liquidity indicates the ability of a bank to cover non-performing loans and customers' withdrawals, it is important for regulators to make balance strategy between risk and FI. Especially that IBs has the potential to get to the same level of liquidity applied by conventional banks. The third reason is the risk and cost of the financial services in IBs. To overcome the second and third issue this paper suggest that central banks in CCMPs need to set a regulations and goals that aim set IBs in the right direction towards higher level of FI.

The four reason is that several papers that suggested using IBF have not directly measured the relationship between IBs and FI. For instance, Demirgüç-Kunt, et al (2014) shows that 7% of respondents in the OIC countries refer to religious reasons for not having a formal account. Please note that the percentage of people refer to religious reasons for not having a formal account does not proxy for the level of FI.

The fifth reason is financial awareness. People prefer Sharia-compliant banking services but they do not use them. These finding can be linked to the negative relationship between the percentage of IB's assets and number of deposit account at ODCs per 1000 adults



and percentage of population with an account at FFIs. It seems that people do not have enough information about IBs and their products and services. It also seems that IBs have not marketed themselves enough. Besides, central banks especially in CCMPs need to work along with Islamic and conventional banks to improve financial literacy.

Central banks where IBs operate should take into consideration these five points and evaluate IBs' business to use them to improve the level of FI. Central banks need to encourage Islamic financial innovations to develop new Islamic financial products and services that suits MSEs and low income segments. Central banks also need to monetary the ratio of credit to deposit in IBs since the ratio tend to be lower in IBs compared to conventional banks.

**Appendix 4.1: The Number of Islamic Banks in Countries with  
a Considerable Muslim Population (CCMPs) in 2017**

Countries with Muslims Population	Number of Islamic Banks	Countries with Muslims Population	Number of Islamic Banks
Afghanistan	1	Lebanon	5
Albania	1	Libya	1
Algeria	2	Malaysia	16
Azerbaijan	1	Maldives	1
Bangladesh	8	Mali	0
Bosnia and Herzegovina	1	Mauritania	5
Brunei Darussalam	2	Morocco	6
Burkina Faso	0	Niger	1
Cameroon	0	Nigeria	1
Chad	0	North Macedonia	0
Comoros	0	Oman	2
Cote d'Ivoire	0	Pakistan	5
Djibouti	1	Qatar	5
Egypt	3	Saudi Arabia	4
Ethiopia	1	Senegal	1
Gambia	1	Sierra Leone	0
Guinea	1	Sudan	37
Guinea-Bissau	0	Syria	4
Indonesia	13	Tajikistan	0
Iran	34	Tanzania	1
Iraq	30	Tunisia	2
Jordan	4	Turkey	5
Kazakhstan	1	United Arab Emirates	7
Kosovo	0	Uzbekistan	0
Kuwait	6	Palestine	3
Kyrgyz	1	Yemen	4

#### Appendix 4.2: The Number of Islamic Banks in the Rest of the World in 2017

Country	Number of Islamic Banks	Country	Number of Islamic Banks	Country	Number of Islamic Banks	Country	Number of Islamic Banks	Country	Number of Islamic Banks
Angola	0	China, Macao	0	Guyana	0	Moldova	0	St. Kitts & Nevis	0
Anguilla	0	China	1	Haiti	0	Mongolia	0	St. Lucia	0
Antigua & Barbuda	0	Colombia	0	Honduras	0	Montenegro	0	St. Vincent & the Grenadines	0
Argentina	0	Congo, Democratic Rep.	0	Hungary	0	Montserrat	0	Suriname	1
Armenia	0	Congo, Rep.	0	Iceland	0	Mozambique	0	Swaziland	0
Aruba	0	Costa Rica	0	India	0	Myanmar	0	Sweden	0
Australia	1	Croatia	0	Ireland	0	Namibia	0	Switzerland	1
Austria	0	Cyprus	2	Italy	0	Nepal	0	Thailand	1
Bahamas	0	Czech	0	Jamaica	0	Netherlands	0	Timor-Leste	0
Barbados	0	Denmark	0	Japan	0	New Zealand	0	Togo	0
Belarus	0	Dominica	0	Kenya	3	Nicaragua	0	Tonga	0
Belgium	0	Dominican	0	Kiribati	0	Norway	0	Trinidad & Tobago	0
Belize	0	Ecuador	0	South Korea	0	Palau	0	Uganda	0
Benin	0	El Salvador	0	Lao	0	Panama	0	Ukraine	0
Bhutan	0	Equatorial Guinea	0	Latvia	0	San Marino	0	United Kingdom	5
Bolivia	0	Estonia	0	Lesotho	0	Sao Tome and Principe	0	United States	2
Botswana	0	Fiji	0	Liberia	0	Serbia	0	Uruguay	0
Brazil	0	Finland	0	Lithuania	0	Seychelles	0	Vanuatu	0
Bulgaria	0	France	0	Luxembourg	0	Singapore	1	Venezuela	0
Burundi	0	Gabon	0	Madagascar	0	Slovak	0	Vietnam	0
Cambodia	0	Georgia	0	Malawi	0	Slovenia	0	Zambia	0
Canada	0	Germany	1	Malta	0	Solomon Islands	0	Zimbabwe	0
Cabo Verde	0	Ghana	0	Marshall Islands	0	South Africa	1		
Central African Rep.	0	Greece	0	Mauritius	0	South Sudan	0		
Chile	0	Grenada	0	Mexico	0	Spain	0		
China, Hong Kong	1	Guatemala	0	Micronesia	0	Sri Lanka	2		

### Appendix 4.3: The Average Value of Constructed Islamic Banking Measures

Country	Islamic Banks' Branches per 1,000 km2	Islamic Banks' Branches per 100,000 adults	Islamic Employees per 100,000 adults	Percentage of Islamic Deposits to Total Deposits	Percentage of Islamic Loans to Total Loans	Islamic Banks' Loans to Assets	Islamic Banks' Loans to Deposits	Islamic ROA	Percentage Islamic Banks to Total Number of Banks	Percentage Islamic Banks' Assets to Banks' Total Assets
Afghanistan	0.074	0.266	3.076	0.021	0.029	0.173	0.315	0.001	0.064	0.212
Albania	0.151	0.177	3.309	0.005	0.005	0.346	0.474	-0.008	0.063	0.852
Algeria	0.014	0.117	4.035	0.021	0.018	0.497	0.667	0.032	0.100	0.02969
Azerbaijan	-----	-----	-----	-----	-----	-----	-----	-----	0.013 <sup>17</sup>	-----
Bangladesh	6.972	0.809	23.025	0.187	0.214	0.746	0.903	0.010	0.150	0.215
Bosnia and Herzegovina	0.539	0.909	10.538	0.030	0.025	0.618	0.965	0.009	0.037	0.03684
Brunei	4.896	8.254	365.986	0.468	0.537	0.434	0.537	0.025	0.230	-----
Egypt	0.128	0.207	8.043	0.056	0.043	0.279	0.324	0.052	0.078	0.05902
Gambia	0.684	0.624	10.704	0.044	0.067	0.294	0.461	0.033	0.082	-----
Guinea	0.040	0.134	4.023	0.030	0.029	0.404	0.535	0.009	0.072	0.045
Indonesia	1.589	1.570	20.337	0.037	0.037	0.647	0.865	0.009	0.100	0.055
Iran	11.007	30.087	371.521	1.000	1.000	0.584	0.914	0.014	1.000	1.000
Jordan	1.543	2.471	64.293	0.174	0.213	0.979	0.832	0.018	0.157	0.15635
Kazakhstan	0.001	0.023	0.942	0.000	0.000	0.348	1.023	0.049	0.028	0.001
Kenya	-----	-----	-----	-----	-----	-----	-----	-----	0.060	0.014
Kuwait	9.549	5.820	230.241	0.639	0.500	0.574	0.914	0.011	0.223	0.782
Kyrgyzstan	-----	-----	-----	0.024	0.011	0.335	0.420	-0.011	0.042	0.018
Lebanon	1.543	0.382	7.947	0.003	0.005	0.278	0.597	-0.002	0.095	0.008
Malaysia	6.798	9.718	41.681	0.354	0.259	0.645	0.827	0.010	0.375	0.345
Maldives	12.396	1.204	43.352	0.052	0.023	0.226	0.262	0.008	0.138	0.059
Mauritania	-----	-----	-----	-----	-----	-----	-----	-----	0.349	0.1764
Morocco <sup>18</sup>	-----	-----	-----	-----	-----	-----	-----	-----	0.250	0.033
Niger	0.010	0.121	2.722	-----	-----	-----	-----	-----	0.089	-----
Nigeria	0.017	0.015	0.281	0.002	0.002	0.448	0.636	0.001	0.049	0.003
Oman	0.053	0.498	15.595	0.026	0.025	0.638	1.721	-0.025	0.113	0.033
Pakistan	1.356	0.860	11.768	0.081	0.084	0.459	0.554	0.010	0.139	0.7473
Qatar	6.069	3.512	91.947	0.371	0.289	0.635	0.980	0.020	0.294	0.379
Saudi	0.368	3.515	80.829	0.258	0.268	0.677	0.847	0.022	0.171	0.33238
Senegal	0.154	0.327	9.810	0.047	0.047	0.681	0.867	0.017	0.046	0.063
South Africa	-----	-----	-----	-----	-----	-----	-----	-----	0.031	0.002
Sudan	0.380	3.191	-----	1.000	1.000	0.556	0.703	0.056	1.000	1.000
Syria	0.247	0.383	7.720	0.061	0.005	0.253	0.433	0.035	0.200	-----
Tanzania	-----	-----	-----	-----	-----	-----	-----	-----	0.021	0.006
Thailand	-----	-----	-----	-----	-----	-----	-----	-----	0.033	0.005
Tunisia	0.531	0.962	12.420	0.040	0.026	0.575	0.784	0.005	0.023	0.007
Turkey	1.305	1.725	27.289	0.056	0.064	0.761	1.356	0.010	0.117	0.062
UAE	3.879	3.576	131.326	0.211	0.199	0.654	0.945	0.013	11.98	0.375
Palestine	4.886	1.152	32.685	0.408	0.593	0.530	0.678	0.013	0.160	0.231
Yemen	0.097	0.302	9.582	-----	-----	-----	-----	-----	0.250	-----
Average	2.493	2.674	54.901	0.190	0.187	0.509	0.745	0.015		

<sup>17</sup> Used to have one Islamic bank up until 2014 the shutdown after words which lead the average to be low.

<sup>18</sup> Six Islamic Bank just have been established in 2017.

#### Appendix 4.4: Countries Covered in the Analysis

Number	Countries Name	Number	Countries Name
1	Afghanistan *	41	Kenya
2	Albania *	42	Latvia
3	Algeria *	43	Lebanon *
4	Argentina	44	Lesotho
5	Armenia	45	Liberia
6	Azerbaijan *	46	Madagascar
7	Bangladesh *	47	Malawi
8	Belgium	48	Malaysia *
9	Belize	49	Malta
10	Bhutan	50	Mauritania *
11	Bolivia	51	Mauritius
12	Bosnia & Herzegovina *	52	Mongolia
13	Brazil	53	Montenegro
14	Bulgaria	54	Morocco *
15	Burundi	55	Mozambique
16	Cambodia	56	Myanmar
17	Chad *	57	Namibia
18	Chile	58	Nepal
19	Colombia	59	Netherlands
20	Congo, Democratic Republic	60	Nicaragua
21	Costa Rica	61	North Macedonia *
22	Dominican Republic	62	Pakistan *
23	Ecuador	63	Palestine *
24	Egypt *	64	Panama
25	El Salvador	65	Paraguay
26	Estonia	66	Peru
27	Eswatini	67	Poland
28	Gabon	68	Portugal
29	Greece	69	Rwanda
30	Guatemala	70	Saudi Arabia *
31	Guinea *	71	South Africa
32	Haiti	72	Spain
33	Honduras	73	Tanzania *
34	Hungary	74	Thailand
35	India	75	Trinidad & Tobago
36	Indonesia *	76	Turkey *
37	Italy	77	Uganda
38	Jamaica	78	United Arab Emirates *
39	Japan	79	Zambia
40	Jordan *	80	Zimbabwe

Note: The asterisks \* refers to Countries with Considerable Muslim Population CCMPs

#### Appendix 4.5: Summary Statistics

Variable Name	Obs.	Mean	Median	Standard Deviation	Minimum	Maximum	Skewness	Kurtosis
Sarma (2012) Index	497	0.392	0.371	0.244	0.044	0.839	0.277	1.916
New Index	497	0.478	0.523	0.223	0.109	0.801	-0.300	1.766
Having an Account at FFIs	211	50.159	45.863	27.395	9.005	98.992	0.273	1.848
Saved at FFIs	211	17.746	14.263	13.641	1.982	60.422	1.274	4.181
Borrowed from FFIs	211	10.714	10.013	5.632	2.065	23.653	0.413	2.530
Deposit Accounts at ODCs per 1,000 Adults	497	1326.58	1141.39	985.599	154.678	3784.600	0.923	3.205
Loan Accounts at ODCs per 1,000 Adults	497	430.446	356.148	355.329	19.095	1276.980	0.796	2.743
Outstanding Deposits (%GDP)	497	51.403	42.429	34.139	12.185	350.195	2.239	14.501
Outstanding Loans (%GDP)	497	46.687	42.134	30.272	6.837	120.000	0.814	2.885
Branches of ODCs per 1,000 km2	497	24.949	9.640	34.313	0.539	122.000	1.797	5.098
Branches of ODCs per 100,000 Adults	497	22.631	17.300	18.385	2.660	77.100	1.556	5.111
Log Deposit Accounts at ODCs per 1,000 Adults	497	6.829	7.040	1.004	3.310	8.891	-0.768	3.491
Log Loan Accounts at ODCs per 1,000 Adults	497	5.525	5.875	1.314	0.651	8.035	-1.058	4.024
Log Outstanding Deposits	497	23.914	23.431	2.485	13.115	45.524	1.225	14.335
Log Outstanding Loans	497	23.709	23.362	2.423	12.319	29.354	-0.153	3.730
Log Branches of ODCs per 1,000 km2	497	2.202	2.266	1.789	-2.620	7.467	0.075	3.132
Log Branches of ODCs per 100,000 Adults	497	2.799	2.851	0.914	0.293	5.257	-0.282	3.385
Bank Concentration	499	64.562	62.300	19.110	36.700	99.700	0.284	1.883
Banks' Costs to Income Ratio	509	56.436	56.396	10.339	36.411	75.497	-0.028	2.285
Banks' credit to banks' deposit Ratio	505	92.501	89.315	33.734	40.417	166.891	0.523	2.700
Net Interest Margin	509	5.021	4.733	2.434	1.324	9.886	0.400	2.220
Z-Score	509	14.354	12.293	7.939	4.723	33.407	0.888	2.971
Rule of Law	509	45.022	44.700	23.189	8.170	87.300	0.185	2.096
Government Expenditure (%GDP)	507	15.975	15.502	4.723	8.322	25.787	0.351	2.335
World-Bank Countries' Income Classifications	509	2.589	3.000	1.024	1.000	4.000	-0.115	1.887
Percentage of Islamic Banks to Total Number of Banks	508	0.031	0.000	0.067	0.000	0.390	3.025	13.618
Percentage of Islamic Banks' Assets to Banks' Total Assets	494	2.893	0.000	7.876	0.000	38.959	3.060	11.425
Dummy for CCMPs	509	0.263	0.000	0.441	0.000	1.000	1.075	2.156

### Appendix 4.6: Pairwise Correlation with Dependent Variables

	Sarma (2012) Index	NI	Having an Account at FFIs	Saved at FFIs	Borrowed from FFIs	Deposit Accounts at ODCs per 1,000 Adult	Loan Accounts at ODCs per 1,000 Adult	Deposits (%GDP)	Loans (%GDP)	ODCs' Branches per 1,000 km2	ODCs' Branches per 100,000 Adults	Log Deposit Accounts at ODCs per 1,000 Adult	Log Loan Accounts at ODCs per 1,000 Adult	Log Deposits	Log Loans	Log ODCs' Branches per 1,000 km2	Log ODCs' Branches per 100,000 Adults
Bank Concentration	-0.144 ***	-0.182 ***	-0.042	0.052	-0.231 ***	-0.122 ***	-0.109 **	-0.109 **	-0.117 ***	-0.128 ***	-0.178 ***	-0.213 ***	-0.169 ***	-0.353 ***	-0.409 ***	-0.197 ***	-0.243 ***
Banks' Costs to Income Ratio	-0.152 ***	-0.093 **	-0.085	-0.059	-0.112	-0.109 **	-0.022	-0.242 ***	-0.213 ***	0.037	0.052	-0.177 ***	-0.133 ***	-0.189 ***	-0.220 ***	0.005	-0.042
Banks' Credits to Deposits Ratio	0.388 ***	0.468 ***	0.329 ***	0.095	0.373 ***	0.289 ***	0.505 ***	-0.027	0.374 ***	-0.039	0.328 ***	0.332 ***	0.541 ***	0.175 ***	0.304 ***	0.104 **	0.388 ***
Net Interest Margin	-0.634 ***	-0.576 ***	-0.503 ***	-0.399 ***	-0.085	-0.527 ***	-0.464 ***	-0.504 ***	-0.651 ***	-0.451 ***	-0.465 ***	-0.514 ***	-0.437 ***	-0.562 ***	-0.603 ***	-0.400 ***	-0.474 ***
Z-Score	0.042	-0.001	-0.060	0.079	0.044	-0.063	-0.068	0.387 ***	0.264	0.105 **	-0.030	0.084 *	0.082 *	0.055	0.033	0.137 ***	0.051
Rule of Law	0.763 ***	0.706 ***	0.782 ***	0.667 ***	0.186 ***	0.680 ***	0.652 ***	0.468 ***	0.673 ***	0.384 ***	0.360 ***	0.681 ***	0.616 ***	0.425 ***	0.515 ***	0.369 ***	0.417 ***
Government Expenditure (%GDP)	0.247 ***	0.265 ***	0.393 ***	0.308 ***	-0.171 **	0.227 ***	0.270 ***	0.109 **	0.205 ***	0.086 *	0.049	0.246 ***	0.242 ***	0.024	0.053	0.020 ***	0.110 **
World-Bank Countries' Income	0.784 ***	0.847 ***	0.759 ***	0.569 ***	0.261 ***	0.715 ***	0.719 ***	0.399 ***	0.627 ***	0.305 ***	0.399	0.753 ***	0.758 ***	0.511 ***	0.615 ***	0.331 ***	0.517 ***
Percentage of Islamic Banks to Total Number of Banks	-0.024	-0.084 *	-0.101	-0.067	-0.075	-0.048	-0.034	0.155 ***	0.111 **	-0.051	-0.115 **	-0.020	-0.016	0.168 ***	0.158 ***	-0.022	-0.065
Percentage of Islamic Banks' Assets to Banks' Total Assets	-0.015	-0.056	-0.022	-0.040	-0.024	-0.061	-0.039	0.150 ***	0.107 **	-0.008	-0.093 **	-0.011	-0.059	0.165 ***	0.140 ***	0.021	-0.098 **
Dummy for CCMPs	-0.143 ***	-0.209 ***	-0.255 ***	-0.292 ***	-0.182 ***	-0.164 ***	-0.146 ***	0.045	-0.064	-0.055	-0.145 ***	-0.184 ***	-0.173 ***	0.073	0.037	-0.050	-0.154 ***

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

#### Appendix 4.7: Pairwise Correlation for Independent Variables

	Bank Concentration	Banks' Costs to Income Ratio	Banks' credit to banks' deposit Ratio	Net Interest Margin	Z-Score	Rule of Law	Government Expenditure (%GDP)	World-Bank Countries' Income Classifications	%Islamic Banks	%Islamic Banks' Assets	Dummy for CCMPs
Bank Concentration	1.000										
Banks' Costs to Income Ratio	0.129 ***	1.000									
Banks' Credits to Deposits Ratio	-0.181 ***	0.041	1.000								
Net Interest Margin	0.052	0.179 ***	-0.148 ***	1.000							
Z-Score	0.053	-0.249 ***	-0.140 ***	-0.056	1.000						
Rule of Law	0.006	-0.169 ***	0.370 ***	-0.543 ***	0.027	1.000					
Government Expenditure (%GDP)	0.391 ***	0.119 ***	0.025	-0.297 ***	-0.107 **	0.389 ***	1.000				
World-Bank Countries' Income Classifications	-0.057	-0.063	0.409 ***	-0.589 ***	0.003	0.715 ***	0.358 ***	1.000			
Percentage of Islamic Banks to Total Number of Banks	-0.127 ***	-0.209 ***	-0.300 ***	-0.131 ***	0.194 ***	-0.040	-0.040	-0.052	1.000		
Percentage of Islamic Banks' Assets to Banks' Total Assets	-0.124 ***	-0.205 ***	-0.298 ***	-0.093 **	0.145 ***	0.027	-0.011	0.002	0.752 ***	1.000	
Dummy for CCMPs	-0.114 **	-0.178 ***	-0.217 ***	-0.243 ***	0.126 ***	-0.118 ***	-0.194 ***	-0.153 ***	0.713 ***	0.637 ***	1.000

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.



**Appendix 4.8: The Effect of Islamic Banks on the level of Financial Inclusion with Time Effects (FINDEX)**

Independent Variables		The Dependent Variable								
		Having an Account at FFIs	Saved at FFIs	Borrowed from FFIs	Log Deposit Accounts at ODCs per 1,000 Adults	Log Loan Accounts at ODCs per 1,000 Adults	Log Banks' Deposits	Log Banks' Loans	Log Number of Branches of ODCs per 1,000 km2	Log Number of Branches of ODCs per 100,000 Adults
Variable Under Study	Percentage of Islamic Banks to Total number of Banks	106.391	203.856 ***	58.838	0.486	0.424	-2.584	-0.706	0.223	0.150
Control Variables	Banks' Concentration	0.154 *	0.041	0.025	-0.001	-0.002	-0.014	-0.004 *	-0.002	-0.001
	Banks' Cost to Income Ratio	-0.106	-0.034	0.001	-0.002	0.001	0.021	0.004	0.001	0.001
	Banks' Net Interest Margin	-0.355	0.164	0.269	-0.006	-0.001	-0.023	-0.013	1E-4	0.003
	Banks' Z-Score	-0.064	-0.167	0.017	0.002	0.003	-0.006	-0.009	-0.006	-0.005
	Banks' credit to banks' deposit	0.124 **	-0.089 ***	-0.003	0.005 ***	0.005 ***	-0.002	0.010 ***	0.005 ***	0.004 ***
	Government Expenditure (%GDP)	0.202	-0.320	-0.041	0.018	0.024	-0.014	0.022	0.026 ***	0.025 ***
	Rule of Law	0.370 ***	0.083	0.140 **	0.005	0.010 *	-0.004	0.004	-0.001	-0.001
	World-Bank Countries' Income Classifications	0.006	0.587	-0.615	0.053	-0.002	-0.348	0.050	0.004	0.002
Constant		6.162	17.372	-0615	5.662 ***	4.119 ***	25.269 ***	22.348 ***	1.432 ***	2.188 ***
Observations		202	202	202	481	481	481	481	481	481
Number of Countries		79	79	79	79	79	79	79	79	79
Average Period (years)		2.6	2.6	2.6	6.1	6.1	6.1	6.1	6.1	6.1
F Test		18.54 ***	4.33 ***	3.16 ***	7.33 ***	4.91 ***	3.58 ***	12.91 ***	7.07 ***	3.85 ***
R-Squared within		0.646	0.177	0.237	0.147	0.090	0.056	0.254	0.301	0.198
R-Squared between		0.298	0.298	0.003	0.431	0.548	0.097	0.217	0.007	0.109
R-Squared Overall		0.386	0.003	0.001	0.402	0.513	0.057	0.211	0.007	0.108
Corr(u <sub>i</sub> ,X <sub>b</sub> )		0.050	0.000	-0.694	0.393	0.494	-0.489	0.266	-0.044	0.139
Rho		0.924	0.960	0.861	0.975	0.968	0.834	0.985	0.996	0.986

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

### Appendix 4.9: The Effect of Islamic Banks on the level of Financial Inclusion with Time Effects (FAS Database)

Independent Variable		The Dependent Variable							
		Sarma's (2012) Index	NI	Deposit Accounts at ODCs per 1,000 Adults	Loan Accounts at ODCs per 1,000 Adults	Banks' Deposits (% GDP)	Banks' Loans (% GDP)	Branches of ODCs per 1,000 km2	Branches of ODCs per 100,000 Adults
Variable Under Study	Percentage of Islamic Banks to Total number of Banks	0.112	0.140	732.604	278.307	-4.517	5.466	12.830	0.361
Control Variables	Banks' Concentration	0.000	0.000	1.141	0.332	-0.146	-0.075 *	-0.045	-0.044
	Banks' Cost to Income Ratio	0.000	0.000	-0.553	0.692	-0.056	0.011	-0.002	0.066
	Banks' Net Interest Margin	-0.001	-0.002	-2.061	-1.841	-0.340	-0.832 ***	-0.187	-0.060
	Banks' Z-Score	0.000	0.001	-0.410	0.313	-0.309	-0.065	-0.564	-0.205
	Banks' credit to banks' deposit	0.002 ***	0.001 ***	6.596 ***	0.994	-0.006	0.379 ***	0.119 **	0.112 ***
	Government Expenditure (%GDP)	0.004 *	0.003	10.009	4.336	1.148 *	1.355 ***	0.524 **	0.550 ***
	Rule of Law	0.002 **	0.002 ***	7.460 **	2.618	-0.203	-0.031	0.072	0.008
	World-Bank Countries' Income Classifications	0.008	0.019 ***	30.550	-0.648 ***	1.206	1.861	0.092	0.772
Constant		0.007 *	0.019 ***	-16.360	57.220	54.524 ***	-5.542	13.707 **	3.895
Observations		481	481	481	481	481	481	481	481
Number of Countries		79	79	79	79	79	79	79	79
Average Period (years)		6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
F test		5.8 ***	15.32 ***	5.25 ***	3.49 ***	4.63 ***	8.09 ***	2.04 **	3.11 ***
R-Squared within		0.384	0.503	0.387	0.207	0.082	0.440	0.228	0.254
R-Squared between		0.543	0.607	0.355	0.462	0.025	0.242	0.004	0.118
R-Squared Overall		0.539	0.610	0.347	0.457	0.003	0.275	0.009	0.120
Correlation ( $u_i, X_b$ )		0.401	0.528	0.256	0.497	-0.294	-0.009	-0.151	0.120
rho		0.963	0.971	0.973	0.968	0.806	0.967	0.992	0.976

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

**Appendix 4.10: The Effect of Islamic Banks on the level of Financial Inclusion with Time Effects (FINDEX Database)**

Independent Variables		The Dependent Variable								
		Having an Account at FFIs	Saved at FFIs	Borrowed from FFIs	Log Deposit Accounts at ODCs per 1,000 Adults	Log Loan Accounts at ODCs per 1,000 Adults	Log Banks' Deposits	Log Banks' Loans	Log Number of Branches of ODCs per 1,000 km2	Log Number of Branches of ODCs per 100,000 Adults
Variable Under Study	Percentage of Islamic Banks Assets to Total Banks' Assets	-0.684 *	-0.265	-0.366 **	0.007	-0.015 ***	-0.019	-0.018 ***	0.004 **	0.000
Control Variables	Banks' Concentration	0.104	0.020	0.016	-0.001	-0.001	-0.015	-0.004 *	-0.002 *	-0.002
	Banks' Cost to Income Ratio	-0.094	-0.040	-0.011	-0.001	0.001	0.022	0.004	0.001	0.001
	Banks' Net Interest Margin	-0.598	0.202	0.219	-0.007	-0.009	-0.041 **	-0.029 ***	0.004	0.007
	Banks' Z-Score	-0.196	-0.225	-0.023	0.003	0.005	-0.008	-0.010 *	-0.006	-0.005
	Banks' credit to banks' deposit	0.143 ***	-0.093 ***	-0.013	0.005 ***	0.005 ***	-0.003	0.010 ***	0.006 ***	0.004 ***
	Government Expenditure (%GDP)	0.260	-0.365	-0.012	0.018	0.020	-0.021	0.012	0.029 ***	0.027 ***
	Rule of Law	0.361 ***	0.106	0.168 ***	0.004	0.007	-0.004	0.003	-0.001	-0.001
	World-Bank Countries' Income Classifications	-0.372	-0.890	-1.406	0.061	0.014	-0.333	0.014	0.008	0.006
Constant		16.073	17.372	6.365	5.684 ***	4.269 ***	25.574 ***	22.706 ***	1.352 ***	2.119 ***
Observations		195	195	195	465	465	465	465	465	465
Number of Countries		77	77	77	78	78	78	78	78	78
Average Period (years)		2.6	2.6	2.6	6	6	6	6	6	6
F Test		19.07 ***	3.25 ***	3.97 ***	7.33 ***	4.91 ***	3.76 ***	15.61 ***	9.55 ***	4.77 ***
R-Squared within		0.662	0.251	0.290	0.147	0.271	0.057	0.244	0.334	0.234
R-Squared between		0.489	0.000	0.000	0.431	0.511	0.058	0.212	0.004	0.104
R-Squared Overall		0.547	0.003	0.010	0.402	0.490	0.025	0.200	0.005	0.102
Corr(u <sub>i</sub> ,X <sub>b</sub> )		0.263	-0.294	-0.597	0.393	0.517	-0.425	0.243	-0.071	0.111
Rho		0.904	0.897	0.841	0.975	0.971	0.826	0.986	0.997	0.987

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

**Appendix 4.11: The Effect of Islamic Banks on the level of Financial Inclusion with Time Effects (FAS Database)**

Independent Variable		The Dependent Variable							
		Sarma's (2012) Index	NI	Deposit Accounts at ODCs per 1,000 Adults	Loan Accounts at ODCs per 1,000 Adults	Banks' Deposits (% GDP)	Banks' Loans (% GDP)	Branches of ODCs per 1,000 km2	Branches of ODCs per 100,000 Adults
Variable Under Study	Percentage of Islamic Banks Assets to Total Banks' Assets	-0.001	-0.001	-5.665 ***	-0.742	-0.415	-0.155	0.036	0.032
Control Variables	Banks' Concentration	0.000	2E-5	0.331	0.340	-0.171	-0.085 *	-0.054 *	-0.050 *
	Banks' Cost to Income Ratio	0.000	2E-4	0.179	0.974	-0.061	0.014	0.001	0.076
	Banks' Net Interest Margin	-0.002	-0.003	-3.985	-2.548	-0.413	-0.795 **	-0.177	-0.004
	Banks' Z-Score	0.000	0.001	-0.209	0.688	-0.366	-0.079	-0.594 **	-0.207
	Banks' credit to banks' deposit	0.002 ***	0.001 ***	6.138 ***	0.996	-0.002	0.388 ***	0.126 ***	0.121 ***
	Government Expenditure (%GDP)	0.004 *	0.003	11.131	4.235	1.149 *	1.398 ***	0.526 **	0.584 ***
	Rule of Law	0.002 **	0.002 **	6.750 *	1.971	-0.205	-0.044	0.075	-0.002
	World-Bank Countries' Income Classifications	0.011	0.020 ***	29.376	2.392 **	1.280	1.920	0.025	0.890
Constant		0.027 ***	0.164 ***	112.990 ***	75.893	58.937 ***	-4.553	14.662 **	2.451
Observations		465	465	465	465	465	465	465	465
Number of Countries		78	78	78	78	78	78	78	78
Average Period (years)		6	6	6	6	6	6	6	6
F test		14.13 ***	14.13 ***	14.13 ***	3.04 ***	4.95 ***	7.88 ***	1.86 **	2.25 **
R-Squared within		0.389	0.497	0.372	0.191	0.082	0.438	0.237	0.275
R-Squared between		0.541	0.644	0.378	0.498	0.047	0.227	0.004	0.119
R-Squared Overall		0.535	0.643	0.361	0.485	0.011	0.253	0.008	0.117
Correlation ( $u_i, X_b$ )		0.408	0.571	0.288	0.548	-0.367	-0.048	-0.150	0.011
rho		0.967	0.971	0.975	0.970	0.807	0.967	0.992	0.976

Note: The asterisks \*, \*\*, and \*\*\* indicate significance at the 10%, 5%, and 1% levels, respectively.

## **Chapter 5: Conclusion**

## **5.1. Introduction**

Financial exclusion positively related to income inequality as it prevents the talented poor from making profitable investments in physical and human capital, which consequently unable economy to grow at full potential (Galor and Zeira, 1993; Banerjee and Newman, 1993). Income inequality harms economic growth as it rises the redistributive pressure from median voters to permit redistributive taxes (Tabellini and Persson, 1993), or generates social conflict, rent seeking behavior and expropriation (Alesina and Rodrik, 1994; Benhabib and Rustichini, 1996; Benabou, 1996; Perotti, 1996; Acemoglu and Robinson, 2000).

On the other hand, individuals participating in the financial system receive substantial benefits such as access to financial services to expand businesses, build on wealth as well as managing risks and financial shocks (Mirakhor and Iqbal, 2012). Thus, having an access to financial products and services can lead to a more equal distribution of income (Beck et al, 2007; Clarke et al, 2006; and García-Herrero and Turégano, 2015), which in turn reduces poverty (Burgess and Pande, 2005; Swamy (2010). In addition, providing poor and MSEs with financial services help to increase the employment rate (Bruhn and Love, 2014; and Cull and Xu, 2013) and boost economic activities which consequently promote economic growth (Hariharan and Marktanner, 2012; Babajide et al, 2015; Sharma, 2016; and Hassan et al, 2018).

During the last two decades, there is a strong movement to develop financial markets to boost the access of poor and MSEs led by Consultative Group to Assist the Poor (CGAP) and the Group of Twenty (G20), the World Bank, and the International Monetary Fund (IMF). Thus, the concept of financial inclusion (FI) has gained the interest of a wide range of governments, politicians regulators economists, and policymakers owing to its important economic and social dimensions. As defined by the CGAP, FI is the procedure of providing all entities (households and businesses) with access to an affordable and high-quality range of financial products and services, which should be provided responsibly and sustainably in a well-regulated environment.

This thesis focus on studying three main subjects related to FI. Each subject is presented in a chapter (chapter 2, 3 and 4). The first subject is the absence of consensus as to the

most appropriate way to measure FI. Several studies – such as Beck et al (2008) and Demirguc-Kunt and Klapper (2013) – rely on several simple indicators from the IMF’s Financial Access Survey (FAS) or the World Bank’s Global Financial Inclusion FINDEX database. These indicators focus only on one dimension of inclusion, such as the number of deposit accounts per 1,000 adults.

However, some researchers have suggested combining several indicators into a single index to summarize the complex and multidimensional nature of FI. A single index allows researchers to study the relationship between FI and other micro and macro-economic factors of interest (Cáamara and Tuesta; 2014). The main question in the second chapter is the following: What is the Most Consistent Measure of the Level of Financial Inclusion?

The second subject is identifying the determinants of FI at a macro level. It is worth mentioning that previous studies have used several measures to capture FI. Note that choosing a particular measure of FI can influence the interpretations of FI in a certain country or region, which raises the question of the reliability of studies that examine FI both within and across countries. Therefore, it is important to check if their result hold using the various measure of FI. The main question addressed in the third chapter is the following: What are the Determinants of Financial Inclusion at the Country Level?

The third subject focuses on Islamic banks IBs and whether the introduction of Islamic banks in countries with considerable Muslim population (CCMPs) can improves the level of FI in these countries. This is because CCMPs have a higher percentage of population referring to religious reasons for being financially excluded. The main question in the second chapter is the following: Can Islamic Banks Raise the Level of Financial Inclusion in the Muslim World?

The present chapter is structured in five sections, including this introduction. The second highlight the theoretical background. The third section summarizes the contribution of the thesis to the field of financial inclusion in Chapter 2, 3, and 4. The fourth section highlights the policy implications. The fifth and sixth sections list the limitations and suggestions for future research, respectively.

## **5.2. Theoretical Background**

Schumpeter (1911) argued that a well-functioning financial sector is important in order to accelerate economic growth. Arrow (1964) and Debreu (1959) state that the motivation behind the emergence of financial markets and institutions is market frictions (information and transactions costs). A financial system – under the theories of financial development – exists to: mobilize savings, allocate capital, monitor investments and corporate governance, facilitate dealing with risk and the trading of goods, services, and financial contracts (Cole and Slade, 1991; Merton and Bodie, 1995; Levine, 2004).

Levine (1997) highlight two channels through which financial functions can affect economic growth. One way through its impact on the rate of capital formation. Another way is through changing the rate of technological innovation. The importance of this relationship is that it provides insight regarding the priority required to be given to the financial sector reforms in developing countries, mainly where financial market and institutions are not sufficiently developed, which partly clarifies why countries grow at different rates.

It is worth mentioning that financial deepening through providing more loans to MSEs will enable them to invest and being involved in more economic activities which leads to growth. In addition, financial development through financial innovation and financial technologies can lead to expand access to main stream finance and consequently enable poor and underprivileged to invest in real and human capital. This also boosts the income for these segments of society and leads to economic growth.

## **5.3. The Contributions of the Thesis to the Field of Financial Inclusion**

The second chapter of the thesis identifies nine indexes of financial inclusion (IFIs) from the literature and add a new index (NI). These indexes were compared using the six consistency conditions suggested by Bauer et al (1998). In addition, IFIs were compared to the simple indicators provided by the FAS and FINDEX databases to see if they outperform simple indicators. The main contribution of the second chapter is that it shows the most consistent measure of FI, which are those of Sarma (2012) and the new



index (NI) developed in Chapter 2. The most consistent measure of FI will enable researchers to study FI and understand relationship with various political, social and economic factors at macro and micro level.

Please note that previous studies have used several measures to capture FI. Based on the findings of the second chapter, choosing a particular measure of FI can influence the interpretations of FI in a certain country or region, which raises the question of the reliability of studies that examine FI both within and across countries. For instance, the findings of chapter 3 show that FI has no relationship with banks' stability unlike previous studies. The reason behind the difference in results between this paper and previous papers, namely Han and Melecky (2013), and Morgan and Pontines (2014), is that they use simple measures as a proxy for FI. These proxies only capture one aspect of FI, whereas FI indexes capture the overall picture.

The third chapter studies the main determinants of FI using a wide array of its possible determinants and using the most consistent measure of FI. Along with the index of Sarma (2012) and NI, nine simple indicators of FI from the FAS and FINDEX database are included to provide a deeper understanding of the way in which FI interacts with selected determinants. The result shows that income (natural log of GDP per capita), human development (HDI), the rule of law (the index of rule of law), banks' liquidity (banks' credit to banks' deposit) are the main determinants of the level of FI at macro-economic level, which are the main contributions of this chapter.

The findings confirm three determinants that have been mentioned in the literature using the most consistent measures of FI, which are income, human development, and the rule of law. In addition, the chapter suggest a new determinant that have not been explored before – as far as I am aware – which is banks' credit to deposits ratio. Note that previous papers have suggested that banks' financial stability, banks' performance and banks' efficiency have significantly positive relationship with FI, which have not been found in the third chapter. This is because of various reasons, including the selection of measures that capture FI, sample size, control variables and methodology implemented.

The fourth chapter studies the difference in the overall level of FI between CCMPs and the rest of the world (RW). The result shows insignificant difference in the overall level of FI between CCMPs and the RW, especially financial demographical and geographical coverage and insignificant difference in firms' level of FI. But the percentage of population participating in the financial system. The potential of IBs is analyzed in Chapter 4. Addition analysis is carried to see if the introduction of IBs could help raising the level of FI in CCMPs. However, the result turned out to be insignificant. This is because the IBs have a negative relationship with some aspects of FI cancel off the positive relationship with other aspects.

The fourth chapter highlights five reasons behind the negative relationship that IBs have with some of the aspects of FI. First, the limited number of Islamic financial products and services. Second, the low ratio of credits to deposits in IBs, which considered one of the main determinant of FI. Third, the risk and cost of financial services in IBs. Fourth, previous studies that suggested introducing IBs to enhance the level of FI in CCMPs have not directly measured the relationship between IBs and FI. Fifth, financial awareness and financial literacy.

#### **5.4. Policy Implications**

There is no consensus as to the most appropriate way of measuring FI in the literature. The simple measures give only proportion of FI and the IFIs suggested in the literature yield different findings. Finding the appropriate measure of FI is therefore important for regulators and policymakers to set plans, strategies and goals to enhance the level of FI. In addition, using an appropriate measure of FI enable regulators and policymakers to evaluate their plans mathematically and regularly monitor financial institutions to achieve higher level of FI. Therefore, finding the most consistent measure of FI is the main contribution of second chapter of this thesis.

The main contribution of the third chapter is identifying the key determinants of FI. The findings show that income, human development, rule of law, bank's credit to banks' deposit are the main determinants of FI at macro-economic level. The results give

politicians, regulators and policymakers some ideas as to the best way to compose strategies for raising the level of FI in an economy.

For instance, central banks may enhance the level of FI by changing its policies regarding the ratio of banks' credit to banks' deposit. In addition, the results of the third chapter encourage politicians and policymakers to improve the rule of law to enhance the level of FI. This is because improvement in the rule of law encourage lenders to expand financial services among micro and small enterprises MSEs and low income segment of society. Financial education through human development can help to reduce financial illiteracy and improve the level of inclusion. Countries with low and lower middle income should focus on improving financial education in order to boost the level of FI.

The contributions of the fourth chapter give ideas to central banks about IBs relationships with all aspects of FI. Central banks should not expect that the introduction of IBs directly leads to higher level of FI as they need to evaluate IBs' business model and change it in a way that enhance the level of FI. For instance, central banks need to encourage Islamic financial innovations to develop new Islamic financial products and services that suits MSEs and low income segments. They also need to improve the ratio of credit to deposit in IBs since the ratio tend to be lower in IBs compared to conventional banks.

## **5.5. Limitations**

This thesis has various limitations. There are substantial missing data in the second chapter that do not allow for the construction of the ten IFIs in all the countries of interest throughout the full sample period of study. A few countries have data available for the construction of only one index, or, in rare cases, data for a single year. Note that the number of countries for which data are available in all the indexes is small. The number of observations in each index varies because of the availability of data required for each indicator of FI. In addition, even some of the variables, such as credit information<sup>19</sup> that

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<sup>19</sup> The index of credit information provided by the World Bank was changed after 2010. Therefore, researchers can use either the old index (before 2010) or the new index (after 2010), but not both. This reduces the number of observations by half.

have been included in the literature were not included in the third and fourth chapter because of data availability.

## **5.6. Suggestions for Further Research**

Future research in the area of FI can be split into three areas. The first considers variables that may affect FI. For instance, future research could explore the effect of female employment on the level of inclusion. This is because some studies, such as Aterido et al. (2013), Fungacova and Weill (2015) and the 2017 report for Innovations for Poverty Action (IPA) highlight that being female reduces the probability of being financially included. It is interesting to know the effect of the development of financial markets, such as bonds and money markets, on the level of FI.

The bond market provides access to cheaper loans for large, mega and multinational enterprises. This may leave banks with greater liquidity and this can be used to raise the level of FI for smaller clients. In addition, the money market also provides banks with access to short-term loans that can be used for improving FI. So, future work perhaps can consider the development of such markets and how they interact with FI. It is also important to check the effect of FI on countries at different economic development levels. This will enable us to understand if the effect of FI is constant at all levels of economic development. If the FI effect is different, then it is important for policymakers to know at which stage of economic development enhancing FI is beneficial.

The second potential area centers on the effect of FI on political, societal and economic factors. Benhabib (2003) notes that researchers have claimed that inequality harms economic growth through generating social conflict, rent seeking behaviour and expropriation (Alesina and Rodrik, 1994; Alesina and Rodrik, 1994; Benhabib and Rustichini, 1996; Benabou, 1996; Perotti, 1996; Acemoglu and Robinson, 2000). Therefore, FI may positively affect political stability through the reduction of income. As far as I am aware, the link between FI and political stability has not been investigated. In addition, the shadow economy and money laundering may negatively affect countries socially, political, and economically. Therefore, it is important to study the role of FI in reducing the size of the informal economy using consistent measures of FI.

The third area relates to ways of how to improve FI. It is important for Islamic finance to innovate new Islamic financial instruments to enhance FI. Researchers in the area of Islamic banking and finance should also study how Zakat can be used to enhance FI. It may also be valuable to study AL-Qarad AL-hassan institutions in Iran and see whether they can be introduced into other Muslims countries. Furthermore, some researchers such as Sinha (2013), have suggested that insurance should be part of FI, along with access to a full range of banking services. Few studies so far have discussed this subject in detail and it is therefore important to investigate these matters further.

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