ISTANBUL TİCARET UNIVERSITY

GRADUATE SCHOOL OF FINANCE

INTERNATIONAL FINANCE MASTER PROGRAM

THE IMPACT OF FINANCIAL INCLUSION ON FINANCIAL STABILITY: EVIDENCE FROM TEN AFRICAN COUNTRIES

Master Thesis

SHUAB ALI AWIL

Istanbul, 2023

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Dedication

I dedicate all the required information in this title ‘The Impact of financial inclusion on financial stability’ has been written in accordance with academic manners and ethical commitment. I would clarify that all the materials, sources, data, and all extra inputs have benefited well throughout the writing procedure of this thesis. All matters contained in this thesis are my personal opinion and do not reflect the official view of Istanbul Ticaret University

SHUAB ALI AWIL

Istanbul 2023

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May Allah reward you all abundantly.

ABSTRACT

This study investigates the impact of financial inclusion on financial stability in ten African countries, Rwanda, Uganda, and Kenya, South Africa, Ghana, Egypt; Senegal, Angola, the Gambia, and Nigeria, between 2005 and 2020. To analyze our data, we used the Stata software in a regression model that includes feasible generalized least squares (FGLS) regression OLS, fixed effect, and random effect estimations. This has a lot of benefits, such as working with dynamic panel models, controlling heteroscedasticity and potential indigeneity (independent variables that are not completely endogenous), and controlling autocorrelation within a panel or group. Our research shows that some predictor variables, such as bank credit to bank deposits (BCRE), and the number of commercial bank branches per 100,000 adults (BRAN) have a statistically significant effect on financial stability in some countries in Africa. In general, the main objectives of research have been achieved. The empirical findings show that there is a statistically positive relationship between financial inclusion and financial stability. The research findings also give and recommend that financial inclusion in those countries be placed as a top priority on the government's agenda in the next few years as an integral part of Africa's 2030 Vision, with governments and financial institutions receiving empowering information that helps in developing appropriate financial development strategies, enhancing the regulatory structure, and boosting financial stability for the entire system.

Keywords: Financial Inclusion, Financial Stability, Panel Regression, African Countries

ÖZET

Bu çalışma, finansal içermenin finansal istikrar üzerindeki etkisini on Afrika ülkesinde, Ruanda, Uganda ve Kenya, Güney Afrika, Gana, Mısır'da araştırmaktadır; Senegal, Angola, Gambiya ve Nijerya, 2005 ve 2020 yılları arasında. Verilerimizi analiz etmek için, uygulanabilir genelleştirilmiş en küçük kareler (FGLS) regresyon OLS, sabit etki ve rastgele etki tahminlerini içeren bir regresyon modelinde Stata yazılımını kullandık. Bunun, dinamik panel modelleriyle çalışmak, heteroskedastisiteyi ve potansiyel yerelliği (tamamen içsel olmayan bağımsız değişkenler) kontrol etmek ve bir panel veya grup içindeki otokorelasyonları kontrol etmek gibi birçok faydası vardır. Araştırmamız, banka kredisinden banka mevduatına (BCRE) ve 100.000 yetişkin başına ticari banka şubesi sayısı (BRAN) gibi bazı belirleyici değişkenlerin, Afrika'daki bazı ülkelerde finansal istikrar üzerinde istatistiksel olarak anlamlı bir etkiye sahip olduğunu göstermektedir. Genel olarak araştırmanın temel amaçlarına ulaşılmıştır. Ampirik bulgular, finansal kapsayıcılık ile finansal istikrar arasında istatistiksel olarak pozitif bir ilişki olduğunu göstermektedir. Araştırma bulguları ayrıca, bu ülkelerdeki finansal katılımın, Afrika'nın 2030 Vizyonu'nun ayrılmaz bir parçası olarak, hükümetlerin ve finans kurumlarının uygun kalkınmaya yardımcı olacak güçlendirici bilgiler almasıyla birlikte, önümüzdeki birkaç yıl içinde hükümetin gündeminde birinci öncelik olarak yer almasını sağlamakta ve tavsiye etmektedir. finansal gelişme stratejileri, düzenleyici yapının güçlendirilmesi ve tüm sistem için finansal istikrarın artırılması.

Anahtar Kelimeler: Finansal Kapsayıcılık, Finansal Istikrar, Panel Regresyon, Afrika Ülkeleri

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LIST OF ABBREVIATIONS

FI: Financial Inclusion

FS: Financial Stability

OLS: Ordinary Least Square

FGLS: Feasible Generalized Square

REM: Random Effect Model

FEM: Fixed Effect Model

BZS: Bank Z-sore

BRAN: The number of commercial bank branches per 100,000 adults

ATM: The number of ATMS per 100,000 adults

BCRE: Bank credit to bank deposit (%)

ROA: Return on Asset

1. INTRODUCTION

The goal of financial inclusion is to remove barriers to market participation that prevent the poor and disadvantaged from benefiting from the full potential of market exchange. In order to alleviate poverty, advance inclusive development, and fulfill the Sustainable Development Goals (SDGs), most people now think that giving people access to financial services is a key way to fight poverty and achieve long-term growth. In the last few years, reforms in African economies have become more focused on bringing more people into the financial system. Policymakers made these changes to improve people's lives, reduce poverty and inequality, encourage new ideas, and speed up economic growth. In many developed countries, economic growth is mostly going to a small number of rich people and regions, while the majority of the population and those regions remain poor. Due to the countries large, financially deprived rural population, financial inclusion is crucial to African countries' long-term production. The enormous numbers of rural residents and other poor places are the key economic market of the future, so it's crucial that they have access to financial services (Agarwal, 2010). Even though financial institutions have made significant progress, the majority of the world's impoverished still lack access. to official banking institutions that can securely control money and connect net savings and net debtors (Hannig and Jansen, 2011). In the context of ten African countries where research has never been conducted before, which countries have a large population in rural areas that faces economic difficulties, financial inclusion is essential to Kenya, Uganda, and Rwanda, South Africa, Ghana, Egypt, Senegal, Angola, the Gambia, and Nigeria’s long-term development. Rural and poor populations, who will be the future drivers of economic growth, require financial inclusion. Regarding those countries mentioned above, they have the same problem. Ahmad (2018) states that a stable financial system may effectively allocate resources and manage financial systemic hazards. and keep prices from going up or down in ways that aren't good for monetary resistance. A stable financial system also gets rid of any financial imbalances that come up on their own or because of something unexpected. The information and transaction costs that affect savings, investment plans, technology advancement, and economic performance are decreased by a robust financial system that is open to all (Beck et al. 2009). Such a system also influences the long-run levels of growth. This could be challenged on the grounds that the strategy for financial inclusion aims to achieve a large number of consumers with features such as transparent information and changeable rules. The goal of this research is to empirically determine the connection between financial inclusion and financial stability as a factor in economic stability. Potential investors in Africa will also help this study because it will help them learn more about financial inclusion and how it affects the growth of the economy, especially in those countries mentioned above. It is also important to use this research for their governments, which want to set up an integrated financial system that will help their economy grow.

1.2 Social Exclusion and Financial Exclusion

The United Nations (UN, 2007, Ehrbeck, Pickens, And Tarazi, 2012) reported that 2.7 billion people worldwide lack availability of traditional financial services like payment services, credit, insurance, or accounts for savings. This is a worldwide problem, with more than 80% of households across the majority of Africa being economically marginalized. For institutions to reach the goal of financial inclusion, they must first come up with processes and strategies to train their employees to think about, plan for, and provide individualized financial services and products. Social exclusion, according to the Department of International Development (DFID), occurs when some people are systematically penalized because of their race, color, religion, sexual preference, caste, ancestry, gender, age, disability, HIV status, migration status, or place of residence. It is complex, dynamic, and relational, and its effects on people change throughout time. Social exclusion is a concept created by society and varies depending on what is considered "normal". Kempson and Whyley (1999) classify six types of financial exclusion, including physical access exclusion, access exclusion, condition exclusion, pricing exclusion, marketing exclusion, and self-exclusion. Access exclusion refers to the limitation of access via risk evaluation methods; condition exclusion is when the terms of financial products make them unacceptable for some people's needs; price exclusion is when some people can only obtain financial products at costs they cannot afford; marketing exclusion is the practice of successfully excluding some people through targeted marketing and sales; and self-exclusion occurs when people decide it is pointless to apply for a financial product because they feel they will be rejected. The six main causes of exclusion from standard banking include a lack of knowledge about the purpose and role of banks, financial services and products, and interest rates (Dupas and Jonathan, 2012; Kempson et al., 1999). Other causes include a lack of data, a lack of understanding of financial terms and conditions, excessive transaction fees, an absence of access, and illiteracy. Sinclair, McHard, Dobbie, Lindsay, and Gillespie (2009) suggest that financial exclusion can occur due to access exclusion, condition exclusion, price exclusion, marketing exclusion, and self-exclusion, which is consistent with Kempson and Whyley's (1999) forms of financial exclusion.

Figure1: Relationship between financial inclusion and social exclusion

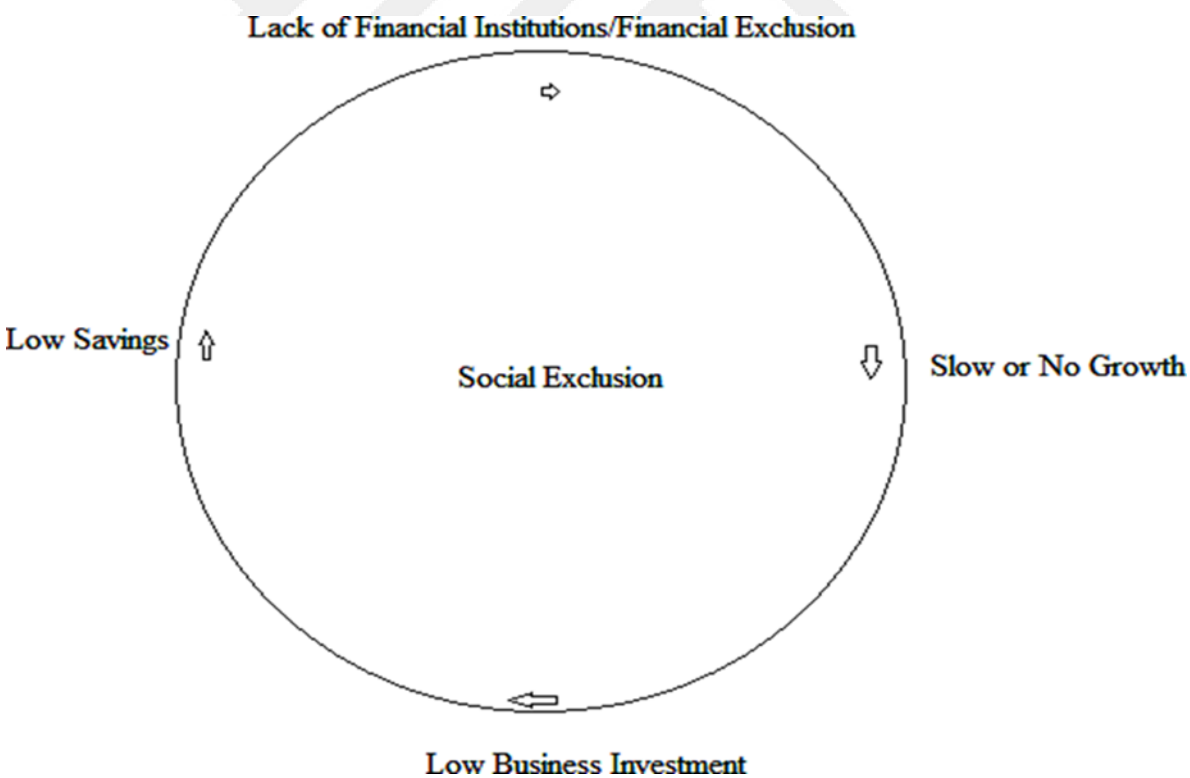


Figure 1 Relationship between Financial Inclusion and Social Exclusion

Source: (Sahrawat 2012).

1.3 Problem Statement

The development of the banking industry is acknowledged as a requirement for growth and the alleviation of poverty (Chibba, 2009). However, the method for this growth is not clearly identified since the wide-ranging strategy in general economic progress while disregarding the special characteristics of financial inclusion challenges has not delivered expected results. This requires studying financial inclusion on a smaller scale rather than a larger scale. This study aims to gather information from a wide range of sources and look for specific areas that have never been looked at before but could be used as the basis for strong financial inclusion, which is a sign of progress in the banking industry. Hannig and Jansen (2010) shows that one of the most important criteria for scientific proof policy is data that is accurate and complete and covers all aspects of financial inclusion. Financial inclusion presents multiple challenges due to its definition; it changes based on the amount of GDP of a country and geographic location. It is important for policy decisions and the measurement of progress In the context of ten African countries where research has never been conducted before, which have a huge rural population and face economic difficulties, financial inclusion is essential to Kenya, Uganda, and Rwanda, South Africa, Ghana, Egypt, Senegal, Angola, the Gambia, and Nigeria’s long-term development. Rural and poor populations, who will be the future drivers of economic growth, require financial inclusion. Regarding those countries mentioned above, they have the same problem. The millions of individuals living in rural regions and other poor places are the economic key market of the future, so it's crucial that they have access to financial services (Agarwal, 2010). Even though financial institutions have made significant progress, the majority of the world's impoverished still lack access to formal banking institutions that can securely control money and connect net savings and net debtors (Hannig and Jansen, 2011).

1.4 Purpose of the Study

Investigating the impact of financial inclusion on financial stability in ten African countries namely, Kenya, Uganda, Rwanda, South Africa, Ghana, Egypt, Senegal, Angola, the Gambia, and Nigeria's, the purpose of the study is

- To investigate the relationship between Financial Inclusion and Financial Stability.
- Find out the degree of financial inclusion in Uganda, Rwanda,
  Kenya South Africa, Ghana, Egypt; Senegal, Angola, the Gambia, and Nigeria.
- Find out the important components of financial inclusion.

1.5 Significance of the Research

This study emphasizes the significance of financial inclusion in the development of the economies in Kenya, Uganda, Rwanda, South Africa, Ghana, Egypt, Senegal, Angola, the Gambia, and Nigeria. It also identifies key elements influencing the financial stability and inclusion of the African population. The study also provides macroeconomic information for the financial system by looking at how well local banks are doing and how potential investors in ten African countries are taking advantage of the opportunities. Finally, it is important for local governments to build an integrated financial framework for economic development.

1.6 Research Questions:

- Is there a link between financial inclusion and financial stability?
- Does Financial Inclusion Affect Financial Stability in Kenya, Uganda, Rwanda, Nigeria, Ghana, Senegal, Angola, Egypt, South Africa, and Senegal?

2. LITERATURE REVIEW

Financial inclusion (FI) and financial stability (FS) are important concepts in the field of financial development and growth. A literature review was conducted to introduce these concepts, beginning with definitions of financial inclusion and its origin. It also outlines the basis for the study's conceptual model, which is not thorough the article also covers the various perspectives on how financial inclusion and financial stability are related.

2.1. Financial Inclusion

Financial inclusion is defined differently depending on the purpose and metrics used. Hannig and Jansen (2010) and Garca (2016) state that the aim of finance is to encourage the "underbanked" community into the capital market, where they can send and receive money for such things as borrowing, income, compensation, and pensions. Access to formal financial services, such as official bank accounts, for instance, leads to the alleviation of poverty, economic success, and increased financial inclusion. Shettar (2016) defines financial inclusion as the low-cost financing of large segments of a tiny population that seeks to integrate those who are economically alienated from the traditional banking system. Increasing the proportion of poor individuals who have access to banking services is what financial inclusion involves.

The diagram below summarizes everything related to financial inclusion.

Source: Shettar 2016

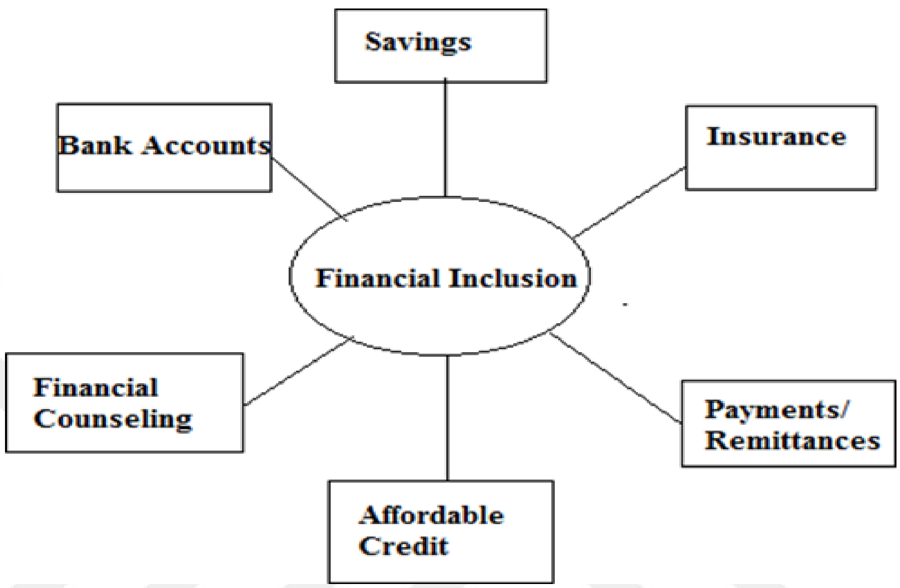
Global institutions such as the World Bank, the IMF, and the Partnership for Financial Inclusion, as well as the OECD and the G-20, have been supporting and pushing countries to undertake organized public policies that promote financial inclusion (CMIF, 2015). Financial inclusion can have an impact on financial stability in both positive and negative ways. Both internally and externally, financial inclusion can make a country more stable (Hawkins, 2006; Han and Melecky, 2013). This shows that getting more money is good for the economy in both the short and long term. A structured financial sector with limited services could improve both full rights and stability (Beck & Kunt, 2005). Tran and Nguyen (2020) showed that the Z-score is significantly improved by financial inclusion, which has a positive effect on the Z-score, and my findings also show the same result.

Khan (2011) shows that there are a few fundamental techniques that show the positive effects of financial inclusion on stability. First, financial inclusion promotes comprehensive discount transactions and enables banking industry modifications by giving chance for financial firms to operate in freshly formed enterprises or increasingly broad markets.

Morgan and Pontines (2014) studied the relationship between financial stability and financial inclusion to see if people have been showing stability or if there is massive trade. According to Dema (2015), there is a common understanding and agreement that financial stability and inclusion are expanding and, if sought in a clear manner, can help legislators create a flexible and inclusive financial system while also promoting social fairness. The problem, regrettably, is to ensure that nationally and internationally, policy positions are matched but instead streamlined with both the active engagement of authorities, the finance industry, and multilateral agencies.

Mehrotra and Yetman (2015) show that the massive development of uncontrolled financial systems may have a detrimental impact on brokers of finance, potentially leading to financial risks. Regarding Demographic penetration in the banking sector is measured by the number of commercial bank branches per 100,000 adults, ATMs per 100,000 adults, and the average number of people having access to each bank's physical outlets (Beck & Kunt, 2005). According to this study, having a high level of demographic penetration makes it easier for clients to reach the ATMs or commercial bank branches that are available per 100,000 adults. Ghosh (2008) investigates how the population's access of financial services is related to a rise in financial stability. This can lead to banks losing their credibility in credit evaluation processes, creating a higher risk of loan default. The most important findings of the study are that, although formal and informal institutions are present in rural areas, many rural residents lack access to financial services (Mutua and Oyugi, 2007). Because of this, it is challenging for providers of financial inclusion to keep up with the expanding rates of private credit. In comparison to other emerging nations, Sub-Saharan Africa has a low private credit percentage of 17%, whereas other developing countries range from 34% to 43%. Financial inclusion is the provision of accessible financial services through the current financial system to people who are frequently excluded, such as access to deposits, loans, insurance, and payment and remittance facilities (Thorat, 2006).

Figure 2: Scope of Financial Inclusion



Source: (Sahrawat, 2010.)

Sharma & Kukreja (2013) shows that financial inclusion is required to reach a variety of goals, including:

1: Economic Objectives: Financial inclusion can function as a boon for emerging economies by promoting inclusive expansion in all sectors of society and reducing differences in wealth and investments.

2: Mobilization of Savings: If the poorer portions are given access to finance, the funds that are usually accumulated in one 's families can be vital for macroeconomic variable.

3: Larger Market for the financial system: There will be a pressing need for these bigger economy for the economic markets to satisfy the necessities of a sizable segment of people, one that frees up the option for innovative banks in the retail industry and therefore can contribute to the emergence of the commercial banks as well.

World Bank (2014) defined by the Consensual omission is as a situation where a class of people or a strong prefers not to include banking institutions, perhaps because they get nothing out of people or for cultural or religious purposes.

Financial stability could be influenced by financial inclusion, either positively or negatively. Both internally and externally, financial inclusion can make a country more stable (Hawkins, 2006; Han and Melecky, 2013). This shows that getting more money is good for the economy in both the short and long term. A structured financial sector with limited services could improve both full rights and stability (Beck & Kunt, 2005).

Digital banking and online banking are online alternatives to physical establishments. Digital banking allows for virtually all types of daily banking operations, while online banking uses digital tools such as computers, smartphones, and tablets. In Africa, there are a small number of branches and mobile telecoms, making it increasingly popular, with 70% of adults not having a bank account. Huet and Chakroun (2018) noted that this highlights the importance of digital banking in the modern world. Han and Melecky (2013), financial inclusion is evaluated by accessibility to and use of deposits prior to the 2008 crisis, as well as the proportion of individuals using bank deposits in 2011. The result was that increasing access to and utilization of savings accounts can minimize withdrawals during crisis moments, increase banks' proportion of steady financing, and reduce total bank deposit volatility during economic downturns. Furthermore, a 10% increase in the number of people who have access to deposits would reduce the deposit drop to 8%, increasing the stability of the economic system and the financial services system. Luo (2014) investigated the relationship between financial liberalization and bank development, discovering that it improves profit efficiency while having a mixed impact on cost efficiency. He also discovered that increased competition in banking results in higher costs but poorer profit efficiency for banks as a result of financial liberalization.

Prasad (2010) states that greater economic inclusion in earnings improves the funds of household savings by reducing dependence on external financing, resulting in better stability.

Dittus and Klein (2011) stress the importance of developing innovative banking legislation that is based on the characteristics and risks of each commercial bank.

Awad and Eid (2018) shows that there is "growing recognition that bank credit plays an important part in minimizing undernourishment, increasing economic stability, and assisting equality." To obtain economic stability, advances must be made in buyer rights protection, asset accumulation, and wealth creation (Atkinson and Messy, 2013).

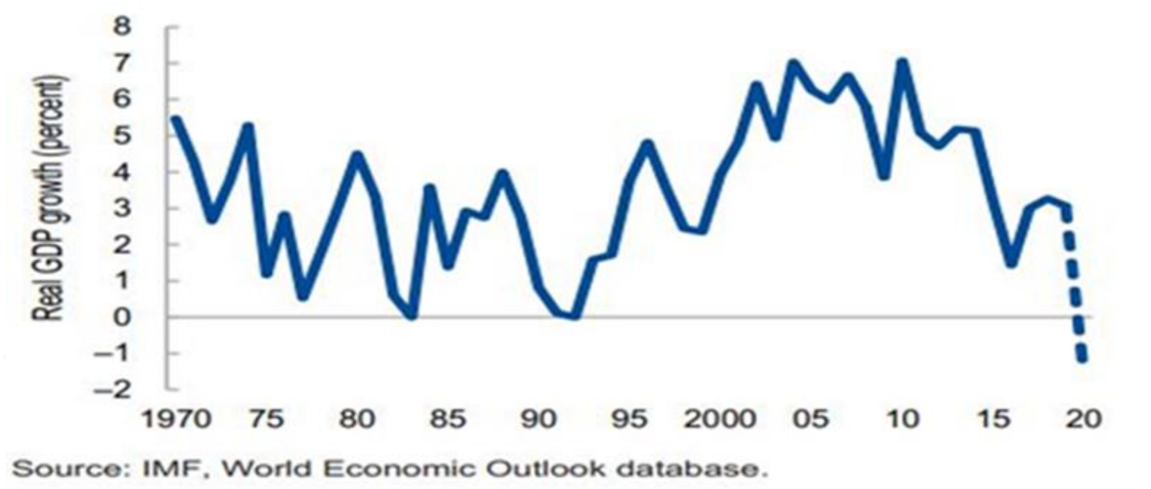
Financial inclusion seems to have become the subject of current debate, an important policy proposal, and a source of extreme importance among various nations, capacity-building associations, budgetary government agencies, and legislators, whereas financial inclusion is becoming linked to the Sustainable Development Goals (SDGs) (World Bank, 2014). A growing market formation can stimulate financial institutions to provide financing for a variety of businesses, resulting in survival and improvement (Greenwood and Smith, 1997). According to Demirgüç-Kunt and Beck (2008), "theory shows that financial expulsion performs as a damper on industrial prosperity." Christine Lagarde, IMF Managing Director, emphasized that financial inclusion has a larger effect on a country's increase as well as the expansion of businesses (Lagarde, 2016).

2.2 Financial Inclusion in Africa

In recent decades, African countries have seen improvements in access to financial services. More financial services, especially loans, are now available to consumers and enterprises in many African countries as the financial sector develops. Similarly, emerging technologies like mobile money enable expanding the availability of financial products, including savings and payment solutions. As a way to help the poorest people get more banking services, it has been suggested and done to let them use their cell phones to do so. in addition to the conventional method of microfinance. Nonetheless, some African countries' financial systems remain underdeveloped when compared to other emerging regions, despite the fact that most of those countries have undertaken major financial sector reforms in the past two decades. Inadequate adult and enterprise usage of financial goods and services hinders the development of a more advanced finance system in Africa. For example, according to the

Global Findex database, less than a quarter of people in Africa have an account with a formal financial organization. Instead, many adults in Africa save and borrow money without using a formal banking institution. In the same way, Access to financing is a serious issue for many African small and medium-sized enterprises (SMEs). Compared to other countries, many African businesses do not have enough credit access from a financial institution. This is a big reason why businesses cannot grow as fast as they could. Furthermore, other sources of finance, such as financial markets, remain underdeveloped. Fin Access (2006) found that the percentage of the population excluded from banking services has decreased from 38.4% to 32.7%, and there has been a significant rise in the use of banking services from 18.9% to 22.6%. From 2004 to 2006, the maximum percentage of people who were able to access services from formal sources increased from 26.4% to 45.5%. significantly improved. Ndii (2009) states that the number of people who can use M-PESA has grown and that a quarter of the adults in the country have M-PESA cards. user shows that this is true. While commercial banks saw a 92 percent increase in customers, microfinance institutions (MFIs) saw a 117% increase. Customers departed from SACCOs and the Postbank. Foreign direct investment (FDI) in sub-Saharan Africa fell by 28% to $28.5 billion, according to the 2018 World Investment Report. West Africa saw an 11% fall in FDI to $11.3 billion, and Central Africa saw a 22% decline to $5.7 billion., and Southern Africa fell 66% to $3.8 billion. East Africa was Africa's fastest-growing area, with FDI totaling $7.6 billion in 2017, down 3% from 2016. However, FDI inflows to the SSA declined by 12 percent between 2020 and 2019, while inflows to Central Africa increased steadily. In 2020, The real GDP growth rate for sub-Saharan Africa is predicted to fall by 1.6 percent, the smallest increase ever. According to estimates, Southern and East Africa, which were most severely affected by the coronavirus, will recover from a 3.0 percent GDP reduction in 2020. While GDP growth in Angola is predicted to rebound from a two-year recession and reach -5.4 percent in 2020, GDP growth in South Africa is predicted to fall to -6.4 percent. In 2020, it is predicted that Central and West Africa's growth will decline by -0.8 percent. According to estimates, Nigeria's GDP will grow by 1.8 percent in 2020, primarily as a result of improved performance in the oil and non-oil sectors.

Figure 3: GDP of Sub-Saharan African.



2.3 Financial Innovation in Africa
2.3.1 Digital Banking

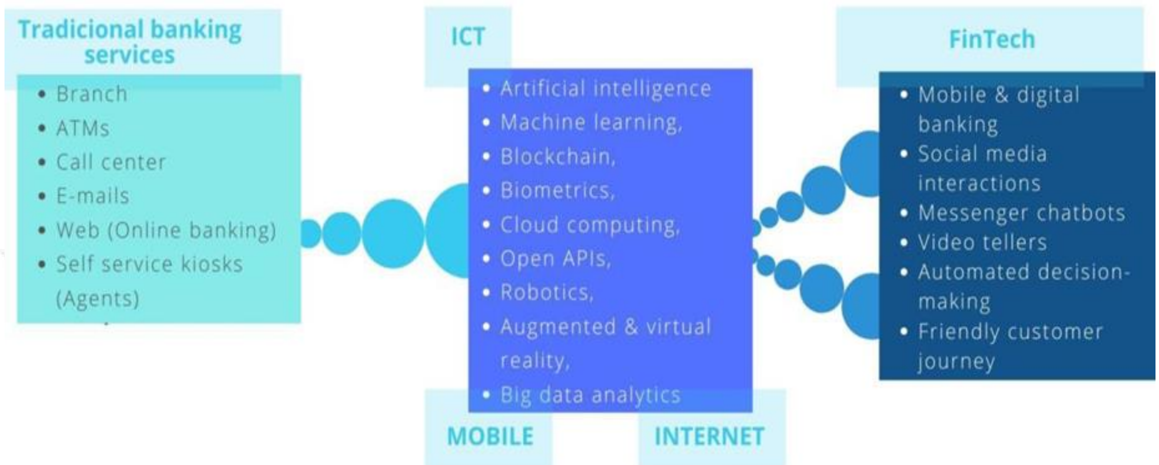
The terms electronic banking and internet banking are used interchangeably to refer to electronic versions of brick-and-mortar financial institutions. Digital banking allows customers to conduct transactions whenever and wherever they choose, while online banking has become increasingly popular in sub-Saharan Africa. Huet and Chakroun (2018) state that 346 million mobile money accounts have already been set up in Africa, compared to 120 million bank accounts. Orange, a telecommunications company in Mali, has introduced its Orange-Money mobile banking system, which has quickly put standard banks at a disadvantage. As a result, banks in Africa should expand their online banking services, including money transfers, e-payments, cashing out, etc. Financial institutions in sub-Saharan Africa lack bank accounts and are struggling to expand their services to a traditionally untapped customer base. The region has 5 branches for every 100,000 people, compared to a global average of 13 branches. Digitalization has enabled African banks to attract a large customer base and compete favorably with telecommunications companies that have made significant progress with their mobile money applications. World Bank data (2020) highlights the importance of digital banking services for businesses.

2.4 Digital Transformation in the Financial Sector

According to Maldonado (2015), the appearance of new and formidable competitors (technology behemoths, internet suppliers, mobile phone manufacturers, FinTech, and start-ups) has led to an increase in competition.) presents a threat to the established order, in which banks still have a dominating and respected position. There is no denying that, during the past ten years, traditional financial technology has endured a significant transition. Many people are paying attention to the new varieties of FinTech businesses, which represent innovation and a developing industry at the moment (Zavolokina et al., 2016). Lee & Jae (2018) argue that creative FinTech solutions are posing a threat to a broad range of standard banking services, from payments to investment advice. Cryptocurrency is a prime example, as it is revolutionizing many standard banking services with improved transaction security and more rapid currency exchange at lower costs. In addition, FinTech innovation, according to Ozili (2018), is already fundamentally changing the current financial environment by offering quicker financial services. Also, Haddad and Hornuf (2019) state that new FinTech firms that offer financial services alongside established technology firms could quickly become competitors to long-standing financial firms. There may be a decrease in the size and quantity of physical branches as a result of new FinTech services. Therefore, according to the OECD (2017), ICT can carry out the majority of bank workers' duties. However, we must take into account the fact that many people still want to contract a loan with a person instead of a program, even though this perception is shifting, especially among younger generations.

Celaschi (2017) indicates that this term indicates the fourth industrial revolution's most complicated and contemporary condition, in which real-time user behavior influences manufacturing and it is both quantitative and qualitative responses. Banking transactions have grown more efficient and secure with the use of ITCs as a result of all of these advances. As mobile and Internet technologies keep getting better (Mushtaq & Bruneau, 2019), digital banking is growing quickly.

Figure 4: Transition from traditional banking to FinTech



Source: Mushtaq & Bruneau, 2019

2.5. Fintech

The present research in the fintech business is expanding rapidly due to the emergence of new fintech companies (KPMG, 2017). The goal of fintech is to provide the quickest, cheapest, and most efficient solutions in the financial industry using technology and innovation.

Figure5: The graphic concept of Fintech

Source: KPMG 2017

Lee and Jae (2018) show the significance of fintech by highlighting how it may lower costs, boost the use of financial services, and enhance the stability of numerous stock market industries. In the same way, Zavolokina et al. (2016) state that Fintech gives people significant ways to grow, such as through transparency, limited access, and making financial services easier to use. Traditional banking services are becoming less and less used because they are expensive, challenging, and even take time. Traditional banks, for example, need a significant amount of time to determine whether a client applies for credit (Ozili, 2018). Fintech is recognized as an important financial industry innovation and is rapidly increasing. The sharing economy, favorable laws, and advancements in Internet technology all contribute to it (Wiradinata, 2018). According to Lee and Jae (2018), fintech developed globally following the financial crisis by merging, among other things, e-finance and internet technology. (Chetty et al., 2019) Because of this, even traditional financial institutions have started taking Fintech seriously and are making plans to compete with them, cooperating with them. Fintech today proposes to reshape the finance sector by, among other things, enhancing (1) the quality of banking industries, (2) lowering costs, (3) the development of new innovations, and (4) the development of a diverse, democratic, and secure economic system (Wiradinata, 2018). Drasch et al. (2018), Due to its quick cycle times and minimal internal administrative processes, finance technology is able to develop new ideas faster than large traditional businesses. According to KPMG (2017), four factors have mostly driven the growth of the fintech industry.

Figure 6: The drivers of Fintech

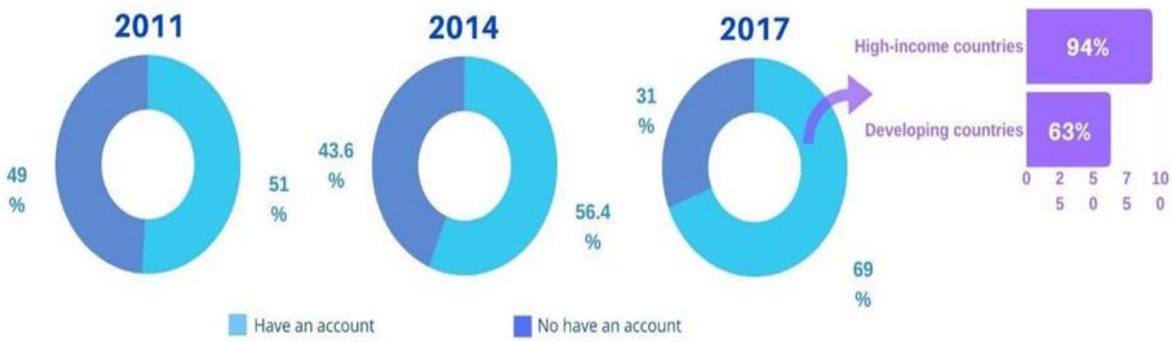
Source: KPMG, 2017

According to Haddad & Hornuf (2019), countries experience an increase in Fintech startups when the sector is well-developed, venture capital is widely available, and market regulations are liberal.

2.6 World Current Situation

The percentage of individuals with accounts is rising; the Global Findex database reports that 69% of adults now have accounts, compared to 62% in 2014. Adults hold accounts in 94% of high-income economies but only 63% of undeveloped ones (WBG, 2017).

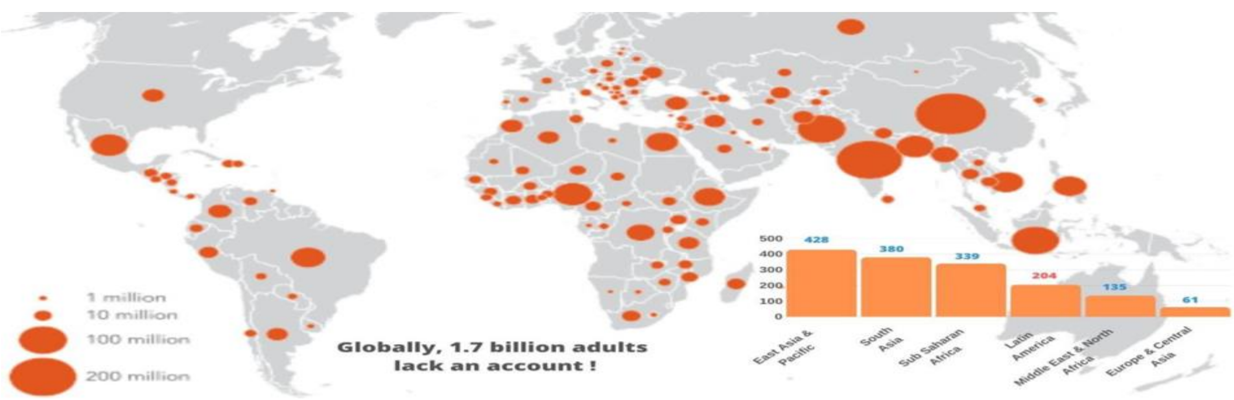
Figure7: Accounts evolution (WBG, 2017).



Source: WBG 2017

This can be observed; there are still large levels of financial exclusion throughout the globe. There are approximately 1.7 billion adults globally who are unbanked. However, 31 developing countries have experienced an unusual growth in FI rates as a result of high levels of active mobile money usage, especially through mobile wallets (WBG, 2017).

Figure8: Unbanked Adults (OECD, 2017) & (WBG, 2017)



Source: WBG 2017

People who are poor and have no utilization of financial institutions often use cash, which can be dangerous, insecure, and hard to handle. The literature also shows that some of the unbanked may choose not to use the banking system on purpose because (1) they are opposed to interacting with financial institutions, (2) they are unfamiliar with the benefits, and (3) they don't know how to use digital services (Ozili, 2018). Bayero's (2015) study shows that for FI to work well, governments and other institutions need to put in a lot of money, time, and trust in the idea of FI. If any of these are missing, it will take longer for everyone to have access to formal banking services.

2.7 Poverty and financial inclusion

Financial inclusion is crucial to income growth and resolving the fundamental problem of poverty. Adams Smith (1776) expressed the idea of providing equal opportunities for all. Prof. Yunus, a Nobel Prize winner in 2006, proposed banking the unbanked to alleviate poverty. He thought that society is in trouble because most people are poor and miserable, rather than because of problems in the market.

2.8 Theoretical Foundation

Finance-Growth Theories

A competitive growth environment with a "supply-leading" or "demand-following" effect characterizes financial development. It is thought that in order to accelerate growth and close income gaps and poverty, access to a secure, straightforward, and affordable source of money is necessary. There are theoretical disagreements regarding the significance of financial systems to economic growth; some economists believe it to be minor or unimportant, whereas others believe it to be significant. According to the supply-driven theory, financial markets adapt to the growing demand for financial services from an economy that is already growing, resulting in growth. The majority of hypotheses have demonstrated a beneficial relationship between financial progress and economic expansion. This argument has been backed by Serro et al. (2012), Ndebbio, Goldsmith, McKinnon, Levine, and Zervos (1996), who have all supported this theory.

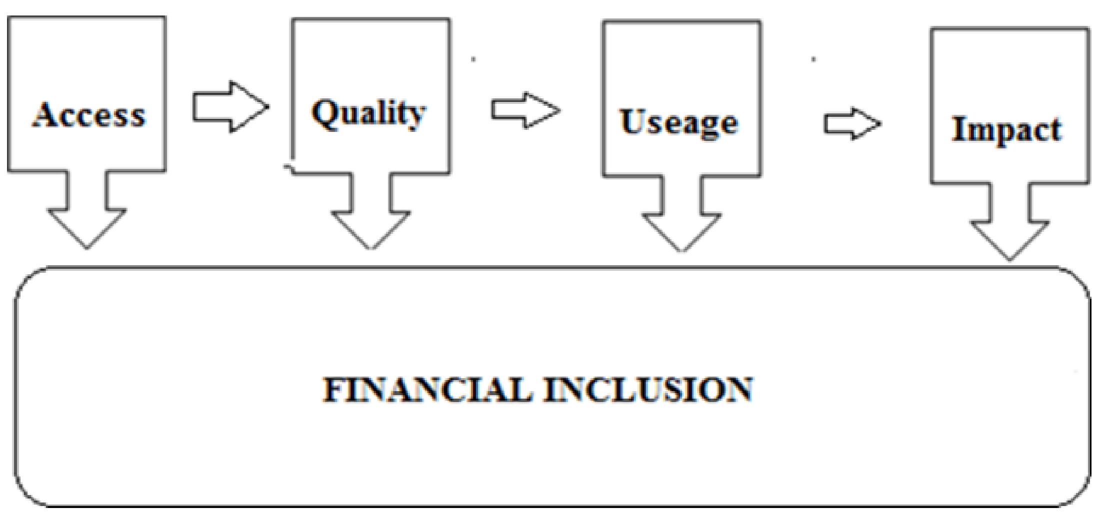
2.9 Financial Intermediation Theory

Ndebbio (2004), financial intermediation is the degree to which institutions of banking connect their credit, savings, and deficiency departments. The question of why shareholders choose to finance loans to banks first before lending to consumers is an important one that theories try to address. According to certain justifications, banks can successfully manage their debtors and carry out the stipulated monitoring duties (Diamond, 1984). Lower monitoring costs, are one reason for this competitive edge. Diamond argues that in order to acquire primary financial securities, intermediaries provide services by creating secondary financial assets. If an intermediary doesn't do anything, investors who bought its secondary stocks may as well save money by purchasing the primary securities directly they would have spent on the intermediary. Stock market tensions can be a major mechanism for maintaining the distribution of income or creating rural poverty. Market difficulties, such as information factors that play a role in the price of transactions and information inequality a pivotal role in shaping fundamental choices like the building up of human and physical resources as well as choosing a career path. The Entrepreneurship theories are built on the idea that smart but poor people can get help from outside sources to start new businesses. Growth, progress, and the transmission of wealth across generations are all connected with one another in the financial sector. Not only does finance affect the distribution of resources throughout the economies, but it also affects the differential economy prospects of individuals born into wealthy and impoverished households. The role of financial inclusion is to lessen the impact of these barriers to trade. When one side of a negotiation has access to more or more accurate information than the other, this is called information asymmetry. Considering that not all financial institutions have accessing to the information they require for their making decision processes, information asymmetry makes markets unsustainable. Asymmetric information, systemic risk, and information monopolies are a few examples of this issue. In adverse selection models, the uninformed party lacks knowledge while establishing an accepted concept of or agreement to the transaction, although in systemic risk, the uninformed party is in the know about how the transaction will be The existence of financial exclusion can be related, in part, to the fact that transaction costs, if too high, cause product prices to rise. Reducing these fees is a primary goal of financial inclusion programs. So, these theoretical models suggest that making people's chances better by fixing flaws in financial markets has positive rather than negative incentive effects carried out or is powerless to take legal action if the agreement is broken. In their article "Reducing Financial Market Inadequacies to Increase Individual Opportunities," Demirguc Kunt and Levine (2007) state that this practice results in positive, rather than negative, incentive effects. Based on all these items, Lack of availability of credit could be a way to keep your income steady. Lack of availability of credit could be a way to keep your income mechanism for maintaining income disparity or poverty traps as well as for retarding economic progress. In total, the above models point to five main functions of financial institutions: gathering information about borrowers, reducing risk through contracts, building up capital, improving corporate governance, and making transactions easier.

2.10 Measuring Financial inclusion

According to Hannig and Jansen (2010) and Serrao, Sequeira, and Hans (2012), there are four criteria that can be used to gauge the degree of complexity of financial inclusion.

Figure 9: Measures of Financial Inclusion

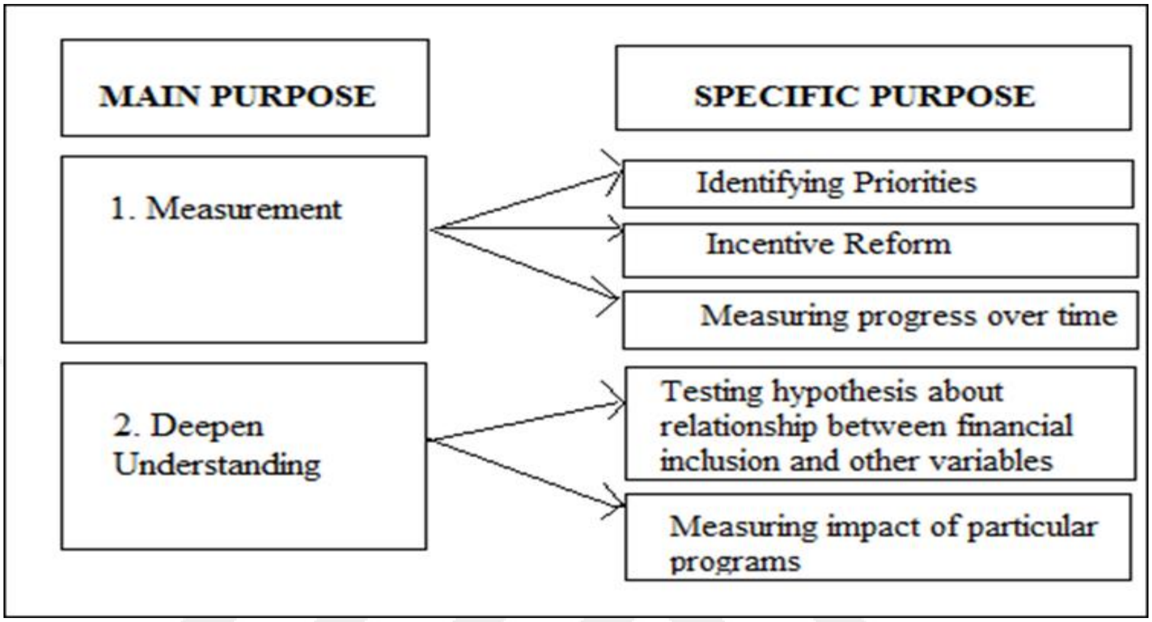


Source: Hannig and Jansen, (2010).

- ✓ **Access**: using formal banking services and products. Evaluating levels of access may entail consideration of possible barriers to obtaining and utilizing a credit card. Access to credit cards can be evaluated by monitoring open accounts and determining the percentage of people with them. Factors such as the cost and accessibility of bank service locations should be considered. The percentage of people with accounts is a simple indicator of access.
- ✓ **Quality**: The financial service's or product's connection to the consumer's attitude toward excellence comprises the user's expertise, as expressed in attitudes and beliefs towards the connection between financial services and consumers, which is essential to understand as it involves the user's expertise and beliefs. It also looks at the options available and their awareness.
- ✓ **Usage**: emphasizes stability and intensity of financial services and goods used, in addition to the basic adoption of banking services.
- ✓ **Impact:** Measuring improvements in customers' activities that may be connected to the use of a financial instrument or service presents significant methodological difficulties to survey design.

The index of financial inclusion uses various metrics to measure Financial inclusion (IFI) involves measuring the penetration of different financial institutions into an economy. These are all statistics from 2008. Some indicators always provide limited information about an economy's financial system when evaluated separately (Chattopadhyay, 2011). Hannig and Jansen (2010) proposed two primary objectives for evaluating financial inclusion: estimating and tracking those who are unable to access financial accounts. Data collected It is possible to determine how many people have access to financial products or services, track improvement over time, and understand the challenge of financial inclusion. This kind of information is better for helping come up with solutions and figuring out how effective policies are.

Figure 10: Measurement Objectives



Source: Porteous (2009) as cited by Hannig and Jansen (2010)

2.11 Benefits of Financial Inclusion

Financial inclusion has various advantages for low-income households. It boosts the use of deposit accounts, which helps banks keep far more safe deposit accounts during challenging times, and it enables individuals with low incomes to save for the future, promoting personal financial stability (Han & Melecky, 2013). Financial inclusion can give impoverished households options to save, trade, and borrow, as well as help deal with financial instability caused by unplanned events. It also improves financial stability and prevents systemic risk by increasing the size and security of banks' deposit bases and limiting banks' reliance on "non-core" financing. Engaging lower-income populations in the financial sector can strengthen the stability of the banking system's deposit and loan bases, helping to maintain local economies during macro-crises.

2.12 Financial Stability

According to the European Central Bank (ECB 2012), financial stability refers to the ability of the financial system, which includes financial proxies, the capital industry, and industry systems, to endure shocks. As a result, this could decrease the potential for interruption in bank lending methods that are strong. According to Ahmad (2018), a secure banking system is effective utilize assets, manage banking system uncertainty, and minimize undesired price movements of tangible or financial assets that may impair financial resistance. A stable financial system also eliminates monetary inequalities that arise either directly or through unexpected events. When there are shocks, the system will be able to handle them through self-correcting mechanisms that keep bad things from causing problems in the real economy and other financial systems. Financial stability is the most important policy component for long-term economic growth since most economic transactions happen through the financial system. Financial stability is referred to as the capacity of the banking system to survive shocks without starting compounding processes that affect the distribution of savings to capital markets and the processing of transactions in business (Tommaso Padoa-Schiopp, 2003). Concerns about financial instability have grown progressively since the global financial crisis began in 2007. However, whether financial institutions should be accountable for financial stability in addition to their traditional tasks is uncertain. Dyk (2010) suggests that financial stability is a need for efficient use of resources, essential institutions, and asset prices. Lenders and deposits are the main entities in the banking system, and their financial stability indicators are based on them. Financial stability is a concept that has been discussed for many years, but no definitive conclusion has been reached. Some scholars suggest that monetary authorities effectively employ interest rates to counter the trend of financial inequality (Woodford 2012). However, the legal foundation for ensuring financial stability should be as transparent as feasible in order to define financial institutions' responsibilities and assess their performance (Allen and Wood 2006). Financial stability is often considered a stated policy goal in their statutes (Oosterloo and De Haan 2004). Financial stability is defined by financial sector disruptions affecting data flows, variation from optimal saving, market bubbles, and market volatility (Gerl and Hemánek, 2006; Dyk, 2010). Profitability measures bank stability, and institutions should consider financial inclusion as a business opportunity and employ creative delivery mechanisms to reach the poor. The concept suggests that the ability to deal with financial shocks is determined by the specific qualities of monetary institutions, particularly their financial structure. Allen and Gale's (2000 and 2004) theory suggests that financial competition makes it harder to manage risks over time, leading to a higher risk of crises. According the South African Reserve Bank's 2004 Financial Stability Assessment emphasizes the importance of financial stability, which requires an efficient regulatory framework, functioning financial markets, and strong institutions.

2.13 Sources of Instability

During a long time, the two most commonly accepted theories for financial crises were periodic and market-based. Minsky and Kindleberger (1978) focused on the numerous forces that lead to periodic excess. When a beneficial occurrence causes asset prices to rise, the process that leads to a crisis is frequently launched. A bid-up like this is more likely if a large amount of time has passed since the previous crisis, and the motivations of fear and greed have become more incompatible. Pricing increases attract additional purchases in the expectation that the current trend will continue (bandwagon effects). Furthermore, financial profits make future margin acquisitions easier to finance. When markets are clearly overvalued or when anything outside of the market disturbs people's trust, they fall. This can have disastrous impacts on people, particularly financial service providers whose portfolios are secured by loans. Monetarists (e.g., Friedman and Schwartz, 1963) argue that financial instability is rare or exceptional in the absence of a disruption in the monetary base. The financial system, according to this theory, is the primary source of financial instability. Failures in monetary and fiscal policy either generate financial instability or little disturbances can have a big impact. According to Schwartz (1986), semi-crises are situations that do not result in a significant decrease in the amount of money. The Minsky-Kindle Berger account of cyclical excess puts an unpleasant responsibility on atypical or unstable behavior that is not supported by any coherent Theories of microeconomics explaining why economic players might behave in such a destabilizing manner. The monetarist perspective is more intellectually solid, but it is severely constrained in that it excludes the possibility of crises caused by nonmonetary reasons. This is a significant omission because Gertler (1988) claims that one of the most important factors determining economic activity is the role of financial institutions in making intertemporal transactions easier.

2.14 Fragility in Financial Institutions

Role of financial intermediation

Understanding the importance of information asymmetry in assessing the fragility of the banking system and the nature of monetary intermediaries in the face of a rapid fall in confidence has been a significant achievement in recent years. Asymmetric knowledge produces negative concerns about choice and ethical risk, both of which the insurance industry has long been aware of. Two types of challenges will arise for insurance businesses if the cost of insurance versus a specific event is set irrespective of the traits or actions of the insured. To begin, people who are most at risk will want to insure (information asymmetry) because insurance is relatively inexpensive, but those who are less at risk may "self-insure," i.e., avoid sharing reducing risk with a policy plan. Second, once an agreement is in place, individuals who have insurance have a reason to change their behavior in ways that harm the company's interests (this is known as "moral hazard"). When a homeowner with complete insurance undertakes less safety, this is an example of a moral hazard. Akerlof (1970) explained how this strategy can be employed in any market when the worth of the items offered is unclear. Buyers in the used automobile market, for example, often know if the vehicle they wish to sell is of good or low quality (an "iemon"). Buyers will not be prepared to pay more than their estimate of the average worth of vehicles on the market since they do not have access to the information. The issue is that this mean is lower than for nice cars but greater than for 'lemons.' Owners of nice cars want to keep them for personal use, while owners of lemons want to sell them. Gresham's Law is in effect, as Jensen points out. Bad cars perform admirably when sold at the same price. A similar tendency can be found in the credit market (Stieglitz and Weiss, 1981). Borrowers are more aware of this than most savers. Big initiatives with substantial risks would have too low interest rates as opposed to real-time. the risk-return characteristics of the projects in which they wish to invest than most savers. Interest rates would be too low for large-scale projects with high risks compared to real-time if loan market prices were equal, representing an average risk-return ratio. Because of information asymmetry, a disproportionate amount of "bad" ideas would be offered for finance, whereas successful enterprises would be conceivable.

Contagion

Looked at the market dynamics that might turn initial trouble into a run as well as some of the reasons why banks can engage in risky lending practices. However, there is another reason the financial sector is viewed as especially vulnerable to systematic instability. The reason is that it is thought to spread failure like a virus from one failing organization to another. Two primary factors make the financial sector more susceptible to contagion than others. To begin, the interbank market, OTC derivatives transactions, and the accounts and settlements system all contribute to a web of claims and obligations (Schoenmaker, 1996). Due to the increased interconnectedness of domestic and global capital markets, they have grown in significance and complexity in recent years. Second, information asymmetry makes it harder for creditors to judge a company's financial health, which adds to their uncertainty. Institutions based on publicly available information, as opposed to other sectors. So, investors might think that problems at one institution could be signs of trouble at other institutions with a similar economic structure.

Payment and settlement systems

The settlement payment system presents a unique source of contagion risk. In the time between making a payment and receiving the counter value, banks with payment system participation face credit exposures, either on their own or on behalf of their customers. A common example of a transaction involving a bank's clients would be the sale of a portion of a client's security portfolio, such as a pension fund. On the payment date, the purchaser advises the pension fund's bank to make a payment. The retirement fund would likely request that its bank release the funds throughout the day so that it can put them to use (by, for example, withdrawing cash to invest in the fund market or purchase additional financial securities). Similarly, the pension fund's bank will anticipate receiving an in-payment from the purchaser's bank equal to the out-payment made to the pension fund's customer. When settlement between banks occurs daily on a net basis at the conclusion of business, if the seller's bank does not provide money to fulfill its net obligation or if there is another interruption in the procedure for settlement, the retirement fund's bank is exposed to its clearing counterparty. Furthermore, the bank may not have enough money to cover its own settlement commitments. Because money flows are connected, problems at one institution can quickly spread to other parts of the system. As use of the payment system has increased, so has the associated risk. Debt risks in payment systems have grown at a rate far above that of either real growth or the expansion of activities in the stock and currency markets, which may have an impact on the economy or the fiscal health of financial institutions (BIS, 1994, Chapter VIII). Several authors (Corrigan, 1996) say that these exposures, which can be several times larger than a bank's capital, are the biggest threat to the stability of the financial system as a whole.

2.15 Runs' on Financial Intermediaries

Diamond and Dybvig (1983) have explained the behavioral processes behind the "run" phenomenon in commercial banks. The portfolio of an industrial bank is safe when customer repayments occur at random over time and assets are kept to maturity. When depositors believe in the bank's stability and other deposits' ability to limit transactions, the situation will stay stable. However, if anything occurs to increase the rate of withdrawals from deposits, it becomes rational for all customers to make withdrawals as they will be forced to sell illiquid assets, suffering losses and lowering their equity. Diamond and Dybvig (1983) suggest that depositors may withdraw their funds if they are interested in a potential banking operation, and they would benefit collectively if they were able to participate in legal cooperation and agree not to make precipitous withdrawals. This is due to the fact that the banking institution's appraisal is dependent on numerous equilibriums, and it is more valuable in a good equilibrium than in a bad equilibrium. To increase the bank's value, depositors should participate in legal cooperation and agree not to make precipitous withdrawals. However, they cannot conspire and must withdraw their funds first while the institution is still able to pay.

2.16 Monetary policy, financial stability, and the Taylor rule

Financial stability is a complex concept that is not always accepted. This work provides a framework for describing financial insecurity as a situation in which several firms are affected by a financial crisis that occurs outside of their control. The measures covered in this study have been established and require a reasonable definition of financial stability. The function of financial instability considerations in financial regulation can be divided into two distinct perspectives: Bernanke et al. (2002) Borio and White (2004), Roubini (2006)), and Woodford (2008). The strongest thing a banking system can do is focus on both price and output balances. The task of disaster reduction falls to regulating devices rather than interest rates. If financial instabilities persist, the banking system is tasked with repairing the situation.

2.17 Taylor Rule Extensions

As it was the focus of one of the first conversations about Taylor rule extensions. Taylor rules are directly related to asset values and are probably the most widely studied of all the measures. The focus is on credit and leverage, whose statements tend to be closely related to asset prices. Both of these portions have received increasing attention in the wake of the mortgage crisis in the United States. The final section discusses the rule's use of credit quality. This is important because of the current European sovereign debt crisis, and rising spreads may be one reason why the ECB recently lowered interest rates.

2.18 Financial Stability Measures

The Z-score is a financial analysis measurement used to distinguish good banks from failing companies, as proposed by Goyeau and Tarazi (1992). It calculates the probability of losses exceeding a bank's equity, with a high score indicating a low failure probability. The equation below can be used to represent the indication.

$$Z = (ROA + E/A)/\sigma\ ROA$$

Where:

ROA: is the return on asset

ROA: is the standard deviation of return on asset

The Bank-Z score is a quantitative measure of the default probability of a country's banking sector and is commonly used as a financial stability indicator at the level of individual institutions. It is composed of three dimensions: financial resilience, volatility, and the cost of a crisis. Financial resilience is assessed using factors such as banking firms' economic stability, liquidity positions, and borrowing systemic risk. Total assets is a well-known metric that, according to the Basel Committee on Banking Supervision (2010), is negatively related to the potential level of risk. Nonperforming loans (NPLs) are responsible for two varied contexts, and the provision-to-nonperforming-loan ratio (Abedifar et al., 2013) shows that there was enough planning for capacity. Volatility is calculated by computing the year-on-year GDP growth at the global level of debt prices, bankers' exceptional borrowings, payment interest rates, and capital adequacy with excellent cash allocation. The decline, the expenses of government oversight to alleviate and fix the crisis, and the maximal tier of noticed default risk (the peak ratio of NPLs to total loans) are all indicators of bank failures.

3. DATA AND METHODOLOGY

3.1 Introduction

This section outlines the preliminary testing, data, and analysis used to study the impact of financial inclusion on financial stability in ten African countries. it discusses the sample, data, and sources. The regression model describes the dependent and independent variables, assumptions, regression equations, and model assumptions.

3.2 Data and Sample Collection

This study examines the impact of financial inclusion on financial stability in ten countries in Africa, namely Kenya, Uganda, South Africa, Ghana, Egypt, Senegal, Angola, Gambia, Rwanda, and Nigeria. Depending on data availability, data from the World Bank's global financial development indicators and the IMF Financial Access Survey cover sixteen years (2005–2020). Panel data from 160 observations is collected.

3.2 Research Design

This research examines the impact of financial inclusion on financial stability in ten African countries. it covers ten countries, which are Rwanda, Uganda, Kenya, South Africa, Ghana, Egypt, Senegal, Angola, the Gambia, and Nigeria, from 2005 to 2020, collecting 160 observations and used the Stata software in OLS, Fixed effect, and Random effect estimations to perform our data, has several advantages, including compatibility dynamic with panel models, control heteroscedasticity and potential indigeneity (independent variables that are not completely endogenous), and autocorrelation within a panel or group. Our model is based on dynamic panel data from the World Bank's financial development indicators (2020) and Global financial indicators.

3.3 Descriptive Statistics

This research uses descriptive panel data from ten African countries and covers sixteen years from 2005 to 2020.

3.4 Testing Correlation

The correlation matrix is a multi-linearity analysis of variables, where both variables have a positive correlation coefficient and Zero correlation coefficients show no linear link between them.

3.5 Panel Regression Test

Panel data analysis is a thesis estimation approach that uses pooled OLS, fixed effects, and random effects to study return of capital. According to Baltagi (2005), panel data analysis enhances statistical validity and reduces omitted variable bias. It also considers individual heterogeneity and provides insight into correlation and complex behavioral models (Gujarati, 2003).

$yit = \beta 0 + \beta 1x1it + \beta 2x2it + ... + \beta kxkit + uit$ 1

"t" represents the time period, "k" the kth explanatory variable, "0" the intercept, "k" the coefficient of each variable, and "uit" the integrated error term. Errors have inconsistent results.

This is written as $uit = \alpha i + uit$ 2

The most important idea is that the pooled OLS, fixed effect, and random effect panel data can be classified using error estimates (Baltagi, 2005).

3.6 Pooled Regression

The method under investigation is called cluster regression. It has ordinate and slope Coefficients that are always the same. Ordinary least squares can combine and regress this model's data. There are 160 observations included in the regression model, however there are no cross-sectional or temporal data. When expanding a cross-sectional analysis to panel data, it is common sense to apply a similar estimator as part of the process. Pols is equivalent to OLS when applied to data that has been pooled over time (t) and cross section in the same way that OLS does (Wooldridge, 2010).

$$Y_{it} = x_{it} + u_{it} = POLS$$

Based on the following:

1. E $[X^{0i} \ (Y_i - X_{i\beta})] = 0$, Therefore, the error term contains a mean with no condition connected to it.

2. $A \equiv E\ (X_{0i}\, X_i)$, the matrix A has a rank of K and is non-singular.

3.7 Fixed Effect Model

The most important idea is that Wooldridge (2008) and LSDV (2010) provide reliable intercept models for non-observed fixed-effects estimators, allowing for the calculation of an accurate estimate of variables.

the model will be written:

$Y_{it} = X_{it} + U_{it} = X_{it\beta} + \alpha_i + V_{it}$

With i=1, 2...........N, t=1, 2...........T.

3.8 Random Effect Model

One of the models that account for unobserved effects is named the random effects estimator, and its general form is as follows:

$Yit = x_i t_\beta + ci + u_{it} = 1, 2 \ldots\ldots T.$

This estimate requires ci-xit orthogonality and stronger stick exogeneity assumptions

(Wooldridge, 2010). The unobserved effect is random since it is unrelated to the variables that explain the phenomena.

In this case, the model could be stated as follows:

$yt = \beta0 + X_{it}1\beta1 + {}_{xit}2\beta2 + \ldots. + {}_{xit}\, k\beta k + u_{it}$

$= \beta0 + {}_{xit}1\ \beta1 + {}_{xit}2\ \beta2 + \ldots\ldots + {}_{xit}k\ \beta k + ai + v_{it}$

With i=1, 2….N, t=1, 2……T. and k=1, 2…..K.

The random effects regression approach investigates intangible characteristics such as bravery and comprehension in participants. Panel data shows individual effects. The random-effects model examines how attributes affect the response variable in panel data sets. Another strategy that is frequently used is known as the "fixed-effects regression model."

3.9 Housman Test

Housman tests tell the difference between fixed and random effects. The Housman null hypothesis suggests that the chosen model has a random effect and the alternative hypothesis has a fixed effect. Data that violates the covariance assumption is only fit the fixed effects model (Wooldridge 2009).

3.10 Heteroscedasticity

Homoscedasticity is also examined, and heteroscedasticity complicates regression. Positive standard deviations fluctuate with heteroscedasticity. Suppose they reject the null hypothesis.

3.1.1 Variables selection

Financial Inclusion

Financial inclusion is regarded as an independent variable. The study adopts the variable selection strategy Cihak et al. (2016) and Ghosh (2008) to represent financial inclusion as a proxy. Therefore, utilization of the banking system and use of financial services should be divided into two groups when defining an inclusive financial system. Wherein financial services are used for accounts, credit, savings, and payments. How easy it is for people to get financial services is a measure of how accessible the financial system is. Where to account for bank credit to bank deposit, Number of commercial bank branches and ATMs per 100,000 adults ten African countries financial inclusion used as an independent variable. three financial indicators are used to represent financial inclusion and accessibility in these indicators enables us to assess the effect of financial inclusion on financial stability from different perspectives.

Financial stability

Financial stability is used as the dependent variable. This study used data to calculate resilience, which was measured by the Bank Z-score. The Bank-Z score measures the default probability of a country's banking sector and is widely used as a financial stability indicator.

Table 1: Identification of Variables

Variables		**Descriptions**
Dependent Variable	BZS	It captures the probability of default of a country's commercial banking system. Bank Z-Score is the Financial stability indicator.
Independent Variables	BRAN	The Number of commercial bank branches per 100,000 adults.
	ATM	

		The Number of ATMs per 100,000 adults.
	BCRE	Bank credit to bank deposits (%) is the financial resources provided to the private sector by domestic money banks as a share of total deposits.

Source: Global financial development.

3.12 Model Specification

Morgan and Pontines (2014) state that the Z score is a quantative technique used to measure a banking firm's credit risk, which is used to predict financial stability. I used regression model includes feasible generalized least squares (FGLS) regression, POLS, FEM, and REM to identify the most important details.

$BZS_{it} = \alpha + \beta 1 * BCRE_{it} + \beta 2 * BRAN_{it} + \beta 3 * ATM_{it} + \varepsilon_{it}$ (i=1,…., N, and t=,….,T)

The ROA, equity/assets, and standard deviation are used to calculate a bank's score based on bank scope.

4. EMPIRICAL FINDINGS

Table 2: Descriptive Statistics of Variables

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Z-Score	**160**	**16.009**	**3.53**	**9.606**	**25.377**
BCRE	**160**	**72.017**	**27.139**	**17.998**	**126.176**
BRAN	**160**	**13.861**	**18.21**	**0.745**	**59.108**
ATMs per	**160**	**41.006**	**89.684**	**0.229**	**369.614**

In Table 2, a summary of descriptive data for variables is shown. The average Z-score for the bank is 16, and its highest possible score is 25.377. This shows that 16 percent is the average rate of growth in the African region. Also, the ratio of bank loans to savings (BCRE), the number of commercial bank branches per 100,000 adults (BRAN), and the number of ATMs per 100,000 adults (ATM) are 72%, 14%, and 41%, respectively. Kenya has both the best BCRE value (72%) and the highest Z-score rate.

Table 3: Correlation Matrix

Variables	(1)	(2)	(3)	(4)
(1) Z-Score	1.000			
(2) BCRE	0.208	1.000		
(3) BRAN	-0.181	0.099	1.000	
(4) ATMs	-0.123	0.420	0.800	1.000

Table 4: Summary of the POLS, FEM, and REM Regression

	(1)	**(2)**	**(3)**
VARIABLES	**OLS**	**Fixed Effect**	**Random Effect**
BCRE	0.0401***	0.0457***	0.0396***
	(0.0121)	(0.0121)	(0.0122)
BRAN	-0.0052	0.0005	-0.0063
	(0.0273)	(0.0271)	(0.0274)
ATMs per	-0.0091	-0.0123**	-0.0089
	(0.0061)	(0.0061)	(0.0061)
Constant	13.5679***	13.2283***	13.6230***
	(0.9579)	(0.9575)	(0.9648)
Observations	160	159	159
R-squared	0.0975	0.1366	
Number of years		16	16

Standard errors in parentheses

***** p<0.01, ** p<0.05, * p<0.1**

The regression analysis through R square shows a result of 0.097, which is quite a normal effect size, so it means that 97% of changes in the dependent variable are all caused by changes in the independent variables.

Table 5 Hausman Test Endogeneity

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	9.096181	3	0.0280

Null: Random Effect is appropriate

Alt: Fixed Effect is appropriate

We reject the null hypothesis because the p-value is less than 0.05. which means, our study the fixed effect model is preferred over the random effect model.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
ATMSPER	-0.001324	0.002987	0.000039	0.4902
BANK_BRAN	0.209066	0.056612	0.004472	0.0226
BANK_CREDIT_TO_BNK	0.042649	0.040169	0.000097	0.8016

The p-value shows that the coefficients are statistically insignificant as the p-value of ATM and BCRE is more than 0.05 while the p-value of BRAN is statistically significant at less than 0.05.

I used the pooled OLS (POLS), fixed effects modeling (FEM), and random effects modeling (REM) regression measures based on panel data. Table 4 displays a summary of the POLS, FEM, and REM regression methods that were used to find out how financial inclusion indicators affected the financial stability of 10 African countries. The number of ATMs for every 100,000 adults has a negative effect on the Z-score of the bank. Starting with the OLS result, a 1% increase in the ATM reduces the Z-score by about 0.9 percent, and the random effect model yields a similar conclusion. Furthermore, according to the fixed effect model, a 1% rise in ATM results is negatively significant at a level of 5%, while the number of commercial bank branches per 100,000 adults (BRAN) has a negative impact. According to the OLS and the random results, a 1% increase in the BRAN reduces the Z-score by about 0.52%. Regarding the bank credit to bank deposits (%), it has a positive and significant effect on the bank Z-score at the 10% level for OLS, and the random effect model and similar fixed effect model have positive and significant effects at 10%. On the other hand, the fixed effect model shows that a 1% increase in the number of commercial bank branches per 100,000 adults (BRE) results in a 0.05% fall in the z-score. A greater level of demographic penetration and geographic availability means that customers have greater access to banking institutions (Beck & Kunt, 2005). Consistent with the findings of Ghosh (2008), Accessibility to the banking system can be said to generally beneficial to financial stability. Furthermore, the bank credit to bank deposits (BCRE) affects the bank Z-score positively and significantly at the 10% level for OLS and the random effect model, while the fixed effect model affects the bank Z-score positively and significantly at 10%, it means week statically, Furthermore, the positive influence of the bank credit to bank deposit variable (BCRE) on increasing institutions' account penetration correlates with a more stable financial system, according to research on financial security in African countries, and the BCRE promotes the impact of financial institutions and facilitates other financial services. Hawkins (2006), Cull et al. (2012).

CONCLUSION

Financial inclusion seeks to remove barriers to market participation and ensure the poor and disadvantaged benefit from the full potential of market exchange, helping to alleviate poverty, advance inclusive development, and fulfill the Sustainable Development Goals. This research has examined the effect of financial inclusion on financial stability in some African countries. It covers 10 countries, which are Rwanda, Uganda, and Kenya, South Africa, Ghana, Egypt, Senegal, Angola, Gambia and Nigeria, from 2005 to 2020. According to the literature, Financial stability may be impacted either positively or negatively by improved financial inclusion. The primary objective was to determine if financial inclusion, development, and stability in ten countries in a specific African region had any effect on the level of financial institutions. Positive benefits included more stable and different financial institution financing sources, more efficient and broader financial intermediation, and an improved ability to deal with risks and shocks. Negative impacts included rising shocks from excessive credit growth for creditworthy individuals, worsening credit ratings, loss of institution reputations, and an increase in uncontrolled financial entities. The results of our research indicate that some predictor variables have a statistically significant impact on the bank Z-score (BZS), showing that the financial stability in some African countries is positively significant at a level of 10% impacted by financial inclusion as measured by bank credit to bank deposits (BCRE) and negatively affected by BRAN but is not significant in Financial inclusion and stability in 10 African countries are positively correlated with the number of BRANs and ATMs per 100,000 adults. Hence financial inclusion in those countries Africa's 2030 Vision should be a top priority, with governments and financial institutions providing empowering information to develop financial development strategies, increase regulatory structure, and boost financial stability.

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APPENDIX:

Table 1: Identification of Variables

Variables		**Descriptions**
Dependent Variable	BZS	It captures the probability of default of a country's commercial banking system. Bank Z-Score is the Financial stability indicator.
Independent Variables	BRAN	Number of commercial bank branches per 100,000 adults.
	ATM	Number of ATMs per 100,000 adults.
	BCRE	Bank credit to bank deposits (%) is the financial resources provided to the private sector by domestic money banks as a share of total deposits.

Source: Global financial development.

Table2: Descriptive Statistics of Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Z-Score	160	16.009	3.53	9.606	25.377
BCRE	160	72.017	27.139	17.998	126.176
BRAN	160	13.861	18.21	0.745	59.108
ATMs per	160	41.006	89.684	0.229	369.614

Table 3: Correlations of the variables

Variables	(1)	(2)	(3)	(4)
(1) Z-Score	1.000			
(2) BCRE	0.208	1.000		
(3) BRAN	-0.181	0.099	1.000	
(4) ATMs	-0.123	0.420	0.800	1.000

Table4: Summary of the POLS, FEM, and REM Regression

	(1)	**(2)**	**(3)**
VARIABLES	**OLS**	**Fixed Effect**	**Random Effect**
BCRE	0.0401***	0.0457***	0.0396***
	(0.0121)	(0.0121)	(0.0122)
BRAN	-0.0052	0.0005	-0.0063
	(0.0273)	(0.0271)	(0.0274)
ATMs per	-0.0091	-0.0123**	-0.0089
	(0.0061)	(0.0061)	(0.0061)
Constant	13.5679***	13.2283***	13.6230***
	(0.9579)	(0.9575)	(0.9648)
Observations	160	159	159
R-squared	0.0975	0.1366	
Number of years		16	16

Standard errors in parentheses

***** p<0.01, ** p<0.05, * p<0.1**

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	9.096181	3	0.0280

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
ATMSPER	-0.001324	0.002987	0.000039	0.4902
BANK_BRAN	0.209066	0.056612	0.004472	0.0226
BANK_CREDIT_TO_BNK	0.042649	0.040169	0.000097	0.8016

Data

years	Id	ATMsper	Bank bran	Bank credit to bnk	Z-Score
2005	Uganda	1.578829	1.2056512	56.86569	9.959654
2006	Uganda	1.8546527	1.2155964	66.2514	10.55228
2007	Uganda	2.1565692	1.4108397	62.91766	11.02806
2008	Uganda	2.629941	2.0844718	74.53191	12.84626
2009	Uganda	3.3625275	2.4152483	72.74811	14.14878
2010	Uganda	3.6284681	2.5199378	71.50514	12.08893
2011	Uganda	3.8780648	2.4508433	86.11301	14.04612
2012	Uganda	4.2220293	2.7657679	82.7077	15.23922
2013	Uganda	4.8586037	2.9652173	79.97277	14.00582
2014	Uganda	4.4556826	3.0524829	80.16142	14.16196
2015	Uganda	4.63736	3.0328938	83.23788	13.19216
2016	Uganda	4.540493	2.8823936	80.0009	15.14695
2017	Uganda	4.1961426	2.6652423	75.05976	16.19445
2018	Uganda	4.1453386	2.5842217	77.89778	15.02385

2019	Uganda	4.0448869	2.5755543	74.85426	16.70738
2020	Uganda	3.9120597	2.4460497	69.14388	15.13282
2005	Angola	33.777263	40.211027	30.80552	14.34321
2006	Angola	36.140224	40.854166	29.9579	15.012347
2007	Angola	37.341299	40.453074	41.49903	13.49255
2008	Angola	42.317807	46.851857	49.85957	16.3261
2009	Angola	44.827638	46.321892	39.23682	14.49209
2010	Angola	44.738209	46.181377	42.73899	15.39346
2011	Angola	45.934773	47.416539	42.10329	15.82073
2012	Angola	51.359561	48.424729	45.86314	16.37605
2013	Angola	64.885441	49.024556	39.75175	13.62648
2014	Angola	66.842068	54.042523	39.32658	14.78095
2015	Angola	66.907347	54.36222	41.31228	16.14088
2016	Angola	73.004766	53.720488	40.58073	15.66881
2017	Angola	80.447232	53.176984	40.83375	15.03939
2018	Angola	83.906242	51.426406	42.31364	14.33822

2019	Angola	89.993284	55.070517	45.13959	13.49258
2020	Angola	89.260735	46.628742	41.73017	10.41336
2005	Senegal	4.23567	2.5485609	91.27079	14.75033
2006	Senegal	3.99124	2.9629468	86.55933	14.96881
2007	Senegal	5.87342	3.1408155	83.71924	14.2821
2008	Senegal	3.54879	3.8086296	94.57041	15.3983
2009	Senegal	4.98358	3.9917294	86.33007	18.36465
2010	Senegal	3.9931497	4.2444668	83.12641	17.7976
2011	Senegal	4.6749363	4.5526269	92.25888	16.5556
2012	Senegal	4.98358	4.7852943	93.05147	15.82616
2013	Senegal	4.9480258	4.7038375	96.60806	16.22482
2014	Senegal	5.1086972	4.7589576	91.89613	11.45501
2015	Senegal	5.5214071	5.0966835	87.65439	12.98558
2016	Senegal	5.7010266	5.1356356	95.34614	13.84004
2017	Senegal	5.7011696	5.7582955	101.1528	14.24647
2018	Senegal	5.5271402	5.6046752	93.24923	14.17325

2019	Senegal	6.0976775	5.7648817	92.21908	15.72905
2020	Senegal	6.418773	5.2224053	85.06997	15.87033
2005	Rwanda	0.23549614	0.78498712	77.38924	10.17659
2006	Rwanda	0.22914726	0.74472861	91.20049	11.99285
2007	Rwanda	0.2970256	1.0952819	83.77258	14.57865
2008	Rwanda	0.39691245	4.6727421	103.5674	16.11111
2009	Rwanda	0.82402059	4.9967206	92.11725	16.80611
2010	Rwanda	1.4312341	4.9922807	87.24824	19.62815
2011	Rwanda	2.7695502	5.5556845	87.65536	21.64436
2012	Rwanda	4.709467	5.7255506	103.5353	22.81995
2013	Rwanda	5.2355003	6.0662833	102.0113	17.65331
2014	Rwanda	5.621055	5.9409524	103.0253	18.74671
2015	Rwanda	5.6261323	6.2183567	112.248	20.39169
2016	Rwanda	5.7442304	6.2755717	111.8415	20.22506
2017	Rwanda	5.6606936	6.1765696	116.0548	18.42664
2018	Rwanda	5.1867599	5.7690854	108.8573	22.24675

2019	Rwanda	5.0356929	5.3249495	107.2499	23.55324
2020	Rwanda	4.2605171	4.5921741	105.3181	21.75867
2005	Egypt	3.3424817	3.8088279	60.70229	14.28642
2006	Egypt	4.4359188	3.9182973	58.74903	14.1489
2007	Egypt	5.4248414	4.2142291	54.71236	14.56352
2008	Egypt	6.4750904	4.4568804	56.58173	15.79272
2009	Egypt	7.6897031	4.5812554	50.85363	17.08611
2010	Egypt	8.6370988	4.6060944	48.05927	17.11292
2011	Egypt	9.2231554	4.6168401	49.53832	17.60347
2012	Egypt	10.315337	4.5704558	47.67227	20.00707
2013	Egypt	10.943776	4.562718	42.91973	20.85235
2014	Egypt	12.061358	4.5614767	41.02925	21.54306
2015	Egypt	13.695781	4.611762	40.18655	21.43956
2016	Egypt	15.688546	4.740711	40.61675	19.92265
2017	Egypt	17.70667	4.8756364	35.40953	21.54849
2018	Egypt	18.723809	4.9878998	35.57459	20.86885

2019	Egypt	20.070175	6.643889	35.48344	23.47762
2020	Egypt	22.061023	6.7582033	36.82066	22.12914
2005	Kenya	1.5756048	2.5951138	76.41012	17.95073
2006	Kenya	2.9194024	2.6875536	74.68518	18.46835
2007	Kenya	4.6514768	3.5069929	72.59649	19.77238
2008	Kenya	5.9193745	4.0698492	78.20712	18.76598
2009	Kenya	7.1800191	4.360072	75.79092	19.69903
2010	Kenya	8.796067	4.6525347	75.26713	23.05273
2011	Kenya	8.9905313	4.9172702	82.62142	20.42355
2012	Kenya	9.3942604	5.1883462	79.5682	22.17769
2013	Kenya	9.4862424	5.2828491	84.59068	22.99755
2014	Kenya	9.6357854	5.4798228	89.42282	25.37654
2015	Kenya	9.6946776	5.5856752	93.44667	21.19606
2016	Kenya	9.1622546	5.3676462	96.28916	23.69231
2017	Kenya	9.4302125	5.2074802	91.30845	24.62016
2018	Kenya	9.1542151	5.0020208	86.12044	23.96219

2019	Kenya	7.6919576	4.789096	86.81724	24.18792
2020	Kenya	7.3044055	4.6667035	84.22851	21.51275
2005	Ghana	3.45623	3.2016447	75.6142	12.40597
2006	Ghana	3.6745	3.5614754	69.55788	12.91767
2007	Ghana	3.66346	4.5086185	72.66906	10.8071
2008	Ghana	3.7926113	4.7036855	55.46231	9.605982
2009	Ghana	3.8292319	5.0211574	70.71938	10.52352
2010	Ghana	3.8685028	5.2776482	61.79861	12.12848
2011	Ghana	3.9960704	5.2892971	61.60706	11.809
2012	Ghana	5.3613493	5.5690072	64.4888	13.40157
2013	Ghana	7.9391581	5.7215846	72.44203	14.68872
2014	Ghana	7.981283	5.935259	72.39731	13.386
2015	Ghana	9.9923814	6.9830479	71.59618	13.37064
2016	Ghana	10.922064	6.9849093	67.48672	12.63036
2017	Ghana	11.288005	8.4163012	62.87732	13.94477
2018	Ghana	11.514952	8.5433516	54.42196	13.92056

2019	Ghana	11.143033	8.3034751	55.16365	14.12575
2020	Ghana	11.451124	6.1427574	44.72012	14.15553
2005	Gambia	0.60337795	4.2236457	35.7598	14.79569
2006	Gambia	0.58354428	4.901772	37.77819	14.37706
2007	Gambia	0.90241407	5.7528897	38.92668	13.08957
2008	Gambia	1.4166482	6.8652953	39.15734	13.7901
2009	Gambia	3.0522974	7.1571112	37.65161	11.96014
2010	Gambia	3.2531764	8.7429116	37.35634	10.35231
2011	Gambia	3.9383103	8.4673672	36.90325	14.87274
2012	Gambia	5.0511404	8.1008856	35.04434	13.60784
2013	Gambia	5.3493938	8.4852454	33.0764	10.98254
2014	Gambia	5.6231524	8.300844	27.53575	12.31637
2015	Gambia	5.7015793	8.3795939	19.34789	13.49336
2016	Gambia	7.6229026	7.5391344	25.856234	13.95776
2017	Gambia	8.8512535	6.9023536	18.02522	13.87274
2018	Gambia	7.5547483	7.7121389	20.59773	14.03069

2019	Gambia	8.1571976	7.0899007	21.40041	13.33075
2020	Gambia	8.6376187	7.2349285	17.99751	10.93436
2005	South Africa	149.59374	42.578376	121.2197	13.23965
2006	South Africa	157.1103	43.547363	124.9412	13.35563
2007	South Africa	178.73453	35.144038	126.1763	13.31298
2008	South Africa	253.02973	45.399056	120.0944	12.21906
2009	South Africa	297.78642	53.01757	123.6086	13.17148
2010	South Africa	319.23473	56.361929	119.064	14.02741
2011	South Africa	326.53291	58.371205	110.0362	14.67227
2012	South Africa	321.18385	55.819956	113.3408	15.86341
2013	South Africa	321.81347	55.860027	113.3442	14.81967
2014	South Africa	357.59471	59.107968	111.9613	14.72688
2015	South Africa	369.61431	56.000505	110.0896	14.85629
2016	South Africa	364.52912	53.571272	111.8398	16.06648
2017	South Africa	352.21366	54.065911	110.4655	17.25503
2018	South Africa	342.15916	51.921287	110.4134	15.94073

2019	South Africa	328.06948	48.185129	111.2078	15.87728
2020	South Africa	289.06891	45.486874	98.08038	13.42673
2005	Nigeria	0.68012645	4.1766412	95.37292	20.31261
2006	Nigeria	1.7800705	3.7810894	86.33191	17.35191
2007	Nigeria	4.4767406	5.2098738	100.5666	22.05418
2008	Nigeria	8.6415064	6.2680011	103.3556	16.63062
2009	Nigeria	11.463693	6.4822459	91.95659	15.98621
2010	Nigeria	11.22585	6.5643828	73.29123	18.11532
2011	Nigeria	11.943614	6.4087687	60.97476	14.99784
2012	Nigeria	11.493028	5.8166914	56.58675	17.77566
2013	Nigeria	13.311899	5.9039915	60.12266	16.28585
2014	Nigeria	16.188267	5.6067177	71.89502	16.4411
2015	Nigeria	16.211369	4.9802085	74.08922	16.78471
2016	Nigeria	16.738416	4.7421344	83.75281	16.43923
201	Nigeria	16.328233	4.4374166	77.39462	18.36757
2018	Nigeria	16.930262	4.3019147	62.03572	14.80313

2019	Nigeria	17.194856	4.7840562	63.35437	15.37705
2020	Nigeria	16.146698	4.4465654	53.88782	13.62957

List of ten African countries in the research

No	Country	Region
1	Uganda	East Africa
2	Kenya	East Africa
3	Senegal	West Africa
4	Rwanda	East Africa
5	Egypt	Northeast Africa
6	Nigeria	West Africa
7	South Africa	Southern Africa
8	Gambia	West Africa
9	Ghana	West Africa
10	Angola	Central Africa