MOBILE MONEY IN DEVELOPING ECONOMIES: A SUBSTITUTE OR COMPLEMENT TO TRADITIONAL FINANCIAL INSTRUMENTS

A Thesis
submitted to the Faculty of the
Graduate School of Arts and Sciences
of Georgetown University
in partial fulfillment of the requirements for the
degree of
Master of Public Policy

By

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Washington, D.C.
April 12, 2018
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ABSTRACT

Recent years have witnessed a growing interest in mobile money as part of financial inclusion programs aimed at providing access for more people to the formal financial system. However, instead of determining how mobile money can expand financial inclusion which is thoroughly studied in the literature, this thesis analyzes whether the implementation of a viable mobile payment system hinges on an existing traditional bank based monetary payment system. In conclusion, the mobile money is a modern complement, rather than an effective substitute, to traditional modes of finance. Therefore, before applying the mobile money in the financial inclusion project, the policy makers should consider the development level of traditional financial system.
ACKNOWLEDGEMENTS

I sincerely appreciate my friends, administrative staff and my professors at the McCourt School of Public Policy for their support in the last two years. Special thanks to my thesis advisor Professor Andreas Kern, who has always provided professional advices to my thesis as well as my career development. Finally, I would like to thank my family for their endless love and support.

Many thanks,
Jiaqi Li
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1. Introduction

According to the World Bank, financial inclusion refers “individuals and business having access to affordable financial products and services that meet their needs – i.e. transactions, payments, savings, credit and insurance – delivered in a responsible and sustainable way”. Financial inclusion in developing countries has been targeted by the World Bank and other international financial institutions as an important goal of international development. Financial inclusion helps people to manage risk and improve their overall welfare. It also helps a country’s economy and social development (Cull, Ehrbeck and Holle, 2014). However, many economies exhibit a substantial degree of financial repression, which is reflected in limited development opportunities for SMEs and weak purchasing power for poor households. Constrained accessibility to credit can hurt SMEs by limiting their profitability and sustainability and hurt individuals because these SMEs could have generated job opportunities and reshaped the economic development model for the country. Financial exclusion can also impede the formal financial system from empowering poor households’ consumption, and encourage people to turn to the informal system, which may lead to financial instability (Cull, Ehrbeck and Holle, 2014).

Safaricom’s M-PESA program, which was launched in March 2007 in Kenya, is often cited when scholars emphasize how successful mobile money can be in promoting financial inclusion (Allen et al., 2012). However, the former literature about the success of Kenya have failed forming a comprehensive model of whole developing world (Jack and Suri, 2016). The question is whether Kenya’s success can be copied in all the other developing countries. Will mobile money be generalized as substitute for the traditional banking system in all financial inclusion projects? In

what circumstance will people decide to have mobile money accounts? To answer these questions, we should enlarge sample to include all the developing countries and determine the factors of mobile money account ownership.

My thesis analyzes the role of mobile money in relations with the traditional financial system. It aims at deriving viable policy options to foster financial inclusion in developing countries through reconsidering the position of mobile money in the portfolio of financial inclusion strategies. Mobile money service providers, international development organizations, traditional banks and governments are the main stakeholders, but they may not operate in the same way from country to country.

For example, in the successful case of Kenya, mobile money service is provided by Safaricom, which is supported by the United Kingdom’s Department of International Development, Vodafone (a British multinational telecommunications company), and the Kenyan government (Hughes and Lonie, 2007). Moreover, due to the low-level of access to financial services in Kenya as reported by IMF, the country’s Central Bank announced its commitment to exploring “all reasonable options for correcting the financial access imbalance” and began to work closely with Vodafone and Safaricom to ensure the success of M-PESA (Buku and Meredith, 2012: 386). Although different players in Kenya cooperated well with each other, we are not able to generalize this relationship to other developing countries because governments and national banks may not expect to be replaced by mobile money service providers. Therefore, the ideal institutional context for mobile money cannot be ascertained on the basis of the Kenya case alone and should be further analyzed through a thorough assessment of critical influence factors of mobile money account ownership.
The hypothesis to be tested is that ownership and usage of accounts at traditional banks, and the financial infrastructure influence individuals’ decisions to use mobile money accounts for financial transactions. Before mobile money, traditional banks played a key role in providing financial services and including more people in the financial system. Despite the fact that the mobile money is gradually prevailing, some mobile money platforms still require people to have an account with a traditional financial service provider (e.g., a bank) and people tend to use traditional bank accounts to support their mobile money transactions. This model has been quite successful in high income economies, where at an increasing pace, traditional banks are rolling out mobile solutions for their customers.

If we can confirm through testing the hypothesis that people are more likely to have mobile money accounts when they have already been enrolled in the traditional financial service sectors and the financial infrastructure is well-functioned, we can conclude that mobile money is a complement to traditional banking systems. Thus, decision makers should reconsider the importance of mobile money in the portfolio of financial inclusion projects and put more emphasis on inclusion with traditional banks in developing areas. Alternatively, if the penetration of traditional banks and the construction level of financial infrastructure are not correlated or have a negative impact on the mobile money account ownership, mobile money can be the substitute for the traditional banks and can be developed independently to enable more people to have the access to financial services, regardless of the development of traditional financial system.

To test my hypothesis, I rely on data that captures household financial behavior and countries’ construction level of financial infrastructure. Also, the development level of the internet and relevant demographic variables need to be controlled to yield an unbiased result. According to
these requirements, data from the Global Financial Inclusion (Global Findex), Database 2014, the IMF’s Financial Access Survey 2014 (FAS) and a dataset from the United Nations specialized agency for ICTs (ITU) are merged to generate the data to test the hypothesis. Global Findex can provide information about the account ownership of mobile money and other financial behaviors of representatives who participated in the survey. IMF FAS, which is a country-level dataset, can supply facts about the financial infrastructures in all different countries. And ITU’s datasets are important to support my control variables on the development of the internet and mobile cellular.

2. Literature Review and Theoretical Considerations

2.1 Financial Inclusion

2.1.1 Definition and measurement

The goal of financial inclusion is helping the unbanked people enter the financial system and so they can access the financial services including savings, payments and transfers. The individual or group can be excluded from the financial system voluntarily or passively (Demirgüç-Kunt and Klapper, 2012: 285).

To measure financial inclusion, previous research constructed analysis with three dimensions—the supply side, the demand side and the monitoring framework (Shailesh and Chakrabarty, 2012). On the supply side, the level of financial inclusion is measured by the services and products that were offered by the formal banks and other financial institutions. The demand side issues in financial inclusion include knowledge of financial products and services, and credit absorption capacity.
In regard to monitoring, the World Bank has four indicators to measure financial inclusion using the Global Findex database (Asli Demirguc-Kunt and Leora Klapper, 2012). The first set of indicators are related to the formal bank accounts including the using frequency, the reason for using, the obstacles of access the account, and the alternative to formal accounts. The characteristics of saving and borrowing behaviors are composed the second and the third set of indicators respectively. The fourth set of indicators is mainly about the insurance products.

### 2.1.2 Benefits

A growing body of research shows that financial inclusion can benefit individuals significantly. (Allen, Demirguc-Kunt, Klapper and Peria, 2012: 2). For example, several studies have illustrated the poverty and inequality can result from the absence of financial services (e.g., Banerjee and Newman, 1993; Beck Demirguc-Kunt, and Levine, 2007). At the same time, many studies have indicate the specific benefits of access to the financial market. For example, personal saving (Aportela, 1999), investment (Dupas and Robinson, 2009), and consumption (Dupas and Robinson, 2009) can be increased when household or enterprises are included in the financial system. Some scholars have stated that the access to financial tools can enhance the women empowerment (Ashraf et al., 2010). Also, some studies have also found that credit and insurance products can benefit underserved communities, although the result is not significant (Karlan and Morduch, 2010; Banerjee et al., 2010).

Countries can be benefit from the expansion of financial inclusion on the microeconomic, local economic, and macroeconomic level. First, once people are included in the formal financial system, they are more likely to access the credit, savings, insurance and mobile money. The expansion of
microcredit can help the small and medium business owners to invest for the future development while savings can help poor households to manage their cashflows and then they can be able to cope with the potential financial shocks. Additionally, insurance acts as an instrument to protect the farmers from natural disasters and save poor households from huge medical spending. For individuals, being included in an innovative financial platform such as mobile money can also reduce the transaction fees. Such platform may also complement and promote the growing of the formal system. More commercial bank branches offer different regions an opportunity to improve the local economic performance. On the country level, broader access to banks can minimize the inequality with a better distribution of capital and risk in the country. Also, well-regulated financial inclusion can have positive effects on national financial stability due to that individuals transfer from the informal banking system to the formal one (Cull, Ehrbeck, and Holle, 2014.).

2.1.3 Financial inclusion initiatives

Financial inclusion has become a subject of growing interest for researchers, policy makers, and other financial sector stakeholders (Allen, Demirgüç-Kunt, Klapper and Peria, 2012: 2). Governments or large enterprises have operated some financial inclusion projects. For example, Grupo Elektra, one of Mexico’s largest retailers for electronics and household goods, received a banking license to offer the financial services. Then, Grupo Elektra launched Banco Azteca, which was a project that opened 815 financial institution branches in all its stores. In this project, the low and middle-income customers, who were previously underserved by traditional banking industry, were the targeted group. Even if people only save $5, they were be able to open the accounts with
Banco Azteca. And, within the first month, 157,000 accounts were opened, increasing to 250,000 accounts by the end of December 2002 (Bruhn and Love, 2014: 7 - 9).

Sometimes, governments have taken the lead in opening the branches of banks in the populous unbanked rural locations. India is a good example. The Central Bank of India initiated a program that aimed at expanding the branches of financial institutions in all the Indian states in order to enable people from different income groups can access the financial services. From 1969 to 1990, the program have opened the new branches in approximately 30,000 rural areas that were lack of the formal branches before the program.

Some inclusion initiatives are designed to focus on specific groups. A famous example is the Islamic finance program which aims at expanding financial inclusion among Muslim adults (Demirguc-Kunt et al, 2014.). Despite the fact that the financial assets of Muslim adults only share less than 1 percent of the total assets, the growth rate of Islamic financial assets have been rapid as the total funds were increased 150 percent from 2007 to 2011 (Davies, 2011).

Since financial inclusion can benefit the economic growth and individual welfare, government and international organizations have devoted increasing efforts on implementing financial inclusion initiatives, while academics have generated a rigorous discussion about the merit of financial inclusion.

### 2.2 Mobile Money and Financial Inclusion

#### 2.2.1 Definition of mobile money

Generally, mobile money refers to the financial services that delivered through a mobile device. Their services range from payments (such as peer-to-peer transfers) to banking (such as account
balance inquiries). People can text message to send or receive the payments and deposit money into the mobile money platform (Klein and Mayer, 2011). Over the past decade, mobile money operators have evolved from platforms connecting individuals to sophisticated networks catering to various transaction needs. Institutional investors and borrowers also find that the mobile money platform is better than the traditional banks in terms of efficiency and price. Meanwhile, although some people do not believe in the security and reliability of formal financial systems, they may turn to the mobile service to manage their assets. For all of these reasons, a growing number of people are utilizing the mobile money platforms instead of the traditional banks.

2.2.2 Factors driving mobile money development

Mallat (2007) analyzed the factors that affect individual consumers’ adoption of mobile payments. He found that the availability of mobile technology and the ability to complement traditional services like cash payments can determine the adoption level of mobile money. His interviewees treated mobile payment as alternative for traditional payment methods.

On a macro level, utility, capacity and an enabling environment should be foundations of mobile money ecosystems (Jenkins, 2008). Utility refers to the ability of mobile money agencies to satisfy people with easy, cheap, and safe financial services. Capacity means that the players in the mobile money platforms, including agents, retail outlets, mobile service operators and banks, have sufficient knowledge to provide financial services. Lastly, government should act as the regulator in the mobile money ecosystem to ensure financial system stability and the financial inclusion in the traditional banking system.
2.2.3 Mobile money in financial inclusion initiatives

Mobile service has developed rapidly around the world and mobile money is increasingly popular as a tool to reduce poverty and to include more people into the financial market. (Lauren, 2015). The first mobile banking program, SMART Money launched in the Philippines in 2003. People can complete transactions through cell phones by linking the personal accounts and mobile service (Lallana, 2004). The mobile money initiatives started booming in 2003 and there are more than 72 mobile money projects were initiated in 42 developing countries from 2003 to 2012 (Tobbin, 2012). Among these initiatives, M-PESA, which was launched in Kenya, achieved a great success. About one year after March 2007, more than 2 million people registered the accounts with M-PESA. The number of registration reached 10 million within three years after the launch of M-PESA. The increasing demand for mobile money also resulted in the growth of M-PESA retail agents; at the end of 2011, there were over 35,000 M-PESA agents serving the large customer base. Over two million transactions were conducted over M-PESA (Buku and Meredith, 2012).

M-PESA owes its success to a range of factors. One of them is the large demand in Kenya to transfer funds between urban and rural areas. Moreover, almost all financial service options were either unavailable to the majority of Kenya’s consumers or were extremely unreliable and insecure. Therefore, in Kenya, mobile money successes as the substitute for traditional financial system.

EKO India Financial Service did not achieved the same success as M-PESA. Although the international development organizations spoke highly of the program, the EKO only have 180,000 users registered and 700 branches opened in three states (Delhi, Bihar, and Jharkhand). While EKO was supported by World Bank’s Consultative Group to Assist the Poor (CGAO) and the Bill &
Melinda Gates Foundation, EKO did not experience a fast growth upon launching (Burgess, Pande and Wong, 2005).

Through comparing M-PESA and EKO, scholars have identified key differences that explain their different outcomes (Lauren, 2015). First, while Kenyan banks have only recently begun expanding to serve low-income communities, EKO, was designed specifically to help the underserved communities in India. Also, M-PESA is sponsored by the mobile network operators (MNOs), but EKO was run by formal banks. Also, the M-PESA platform is more user-friendly because it only providing sending and receiving services (Lauren, 2015).

Nonetheless, all mobile money inclusion efforts face challenges. In general, such efforts require the proper ecosystem, which takes time to grow. Indeed, it can take years for a large number of adults begin to use basic services (CGAP, 2014). Based on the past literature, the hypothesis of this paper is to test whether enhancing the mobile money require a certain level of traditional financial account ownership.
3. Empirical Assessment

3.1 Overview of the Datasets

The 2014 Global Financial Inclusion (Global Findex) database was developed by Finance and
Private Sector Development Team of the Development Research Group of the World Bank. The
Global Findex provides the information about people’s use of financial services over time. This
dataset has over 100 indicators, including gender, age, group and household income. 150,000
representatives from 143 countries participate in the survey in 2014.

The International Monetary Fund (IMF) Financial Access Survey (FAS) is a source of global
supply-side data on access to, and use of, basic consumer financial services. The FAS indicators
of FAS include the geographic outreach of financial services, and the use of financial services. In
2014, 174 countries responded to the survey and 42 countries reported data on mobile money.

The International Telecommunication Union (ITU) is the United Nations specialized agency for
information and communication technologies (ICTs). ITU collects communication and technology
statistics for 200 countries for over 100 indicators, including the usage of internet and subscription
for mobile-cellular.

Merging these three datasets together create a single dataset that contains 305 indicators and
146,688 observations from 142 countries. All the models are conducted with information in the
merged dataset.

3.1.1 Dependent variable

When evaluating the adoption level of mobile money, the adoption outcome is measured by
whether targeted individuals accepted the invitation to have and use a mobile money account
(Batista and Vicente, 2013). Thus, to determine the role of mobile money in my model, the ownership of a mobile money account is the dependent variable, which is measured by a question about whether survey respondents have a mobile money account or not. I use this variable as the dependent variable in all my models.

3.3.2 Independent variable

My independent variables measure the ownership and usage of traditional financial accounts, and the level of physical financial infrastructure. To calculate account ownership (Allen et al., 2012), past researchers have used the question following questions from the of Global Findex survey—

“Do you, either by yourself or together with someone else, currently have an account at a bank, credit union, cooperative, post office, or microfinance institution? An account can be used to save money, to make or receive payments, or to receive wages and remittances.”

To test the significance of the independent variable, the baseline models add control variables step by step. Model I is the original model without any control variables. Model II controls household-level variables including gender, age, weight, education level, and income level. On the basis of model II, model III takes the country fixed effect into consideration. Model IV controls the economic development and country-level technology penetration, which includes the country’s income level, and number of Internet and mobile cellular users. In addition to the household-level and country-level control variables, model V includes the construction level of financial infrastructure.
3.2 Data Description

3.2.1 Mobile money account ownership

In my dataset, mobile money service only refers to the services that can be provided without accounts with formal banks. The questionnaire inquires the representative about their use of financial service. 58 percent of the people were reported having a financial account. 2 percent of respondents have a mobile money account only. Among the survey population who have mobile money accounts only, 84% are from Sub-Saharan African, 5.5% from Latin America and Caribbean, and 5.4% from East Asia and the Pacific. Sub-Saharan Africa has the best performance in mobile money account penetration, reflecting the importance of mobile money in those developing countries.

3.2.2 Traditional financial account and card ownership

Overall, 56 percent of adults in the survey had a traditional financial account. In OECD countries financial account ownership is almost universal: 94 percent of adults reported having an account with a financial institution in 2014. In developing countries, only 54 percent did. 41.39 percent of all representatives had a debit card, and 19.3 percent has credit card. In developing economies 27 percent of all adults reported owning a debit card, while 10 percent reported having credit card.

Globally, 15 percent of adults with an account at a financial institution reported making no deposit or withdrawal in the past 12 months. For those having a the record of deposit or withdrawal, in high-income OECD countries in 2014, 84 percent of adults with an account at a financial institution reported making at least one deposit, and 87 percent reported at least one withdrawal. In
developing countries, by contrast, only about half those with such accounts reported making a deposit or withdrawal in a month. Thus, there is still a huge gap between developing countries and developed countries in term of the ownership of traditional financial accounts and card services.

3.2.3 Usage of traditional financial account

3.2.3.1 How do people receive the payment from business or government?

My data indicate that people around the world receive wages, payments from governments and income from agriculture products through cash, financial accounts or mobile money accounts. 33 percent of all adults received wages in the past 12 months, and 57 percent of this group receive the wage through an account with a financial institution. Among those in high-income OECD economies who reported received wages, 86 percent said they received the payment into an account. In developing economies, only 41 percent of wage recipients reported receiving their wage payments into an account.

People also received the government transfers, which included any kind of social benefit payment. 13 percent of adult respondents reported having received government transfers in the past 12 months. In high-income OECD economies that 83 percent reported receiving government payments into an account, and nearly 50 percent of respondents in developing economies received government payments through an account. About 25 percent of adults from developing countries also reported receiving payments for the sale of their family’s agriculture products in the past 12 months and 13 percent of them are through an account. One of the reasons why government plays such an important role in financial inclusion is that government can bank the unbanked people by transferring payments through financial instruments.
3.2.3.2 How do people send payments to businesses or governments?

The payments that people sent to businesses or governments include utility bills and school fees. Globally, 33 percent of adults in the sample of this dataset pay utility bill completely through an account, but almost 90 percent of adults from developing countries reported making the payments exclusively in cash. 13 percent of the adults pay school fees are through an account, and in developing economies 90 percent pay the school fees in cash.

3.2.3.3 How do people complete payments between one another?

The dataset reports that 15 percent of adults in the developing countries sent money to people living in other places. Meanwhile, 19 percent of representatives receive this kind of payment in 2014. People living in the developing areas always use cash to send the domestic remittance (70 percent) and 74 percent of them received in cash.

3.2.3.4 How do people save or borrow?

Globally, in 2014, a quarter of the adults in my sample reported having saved money at a traditional bank in the past 12 months. The high-income OECD countries had more than 70 percent of savers reported saving money through banks but this number are 40 percent in the developing economies. In addition, 42 percent of the adults reported having borrowed money in the past 12 months. In high-income OECD countries the most frequently source of new loans was a formal financial institution, and 18 percent of adults reported that they had borrowed from banks. In developing countries, people often borrow the money from the family and friends (29 percent).
3.2.4 Financial infrastructure construction level

Commercial banks include the banks that are mainly engaged in financial intermediation and that issue liabilities included in the broad national definition of money. On average, around the world there are 19 branches of commercial banks per 100,000 people. In high-income OECD countries, 29 branches of commercial banks serve 100,000 people, while in developing countries 16 branches serve same amount of people. Overall, there are nearly 1.4 million branches of commercial banks. On average, there are 105 commercial banks in each country and total around 15,000 globally. Averagely, each OECD high-income country has 289 commercial banks while developing countries have 54 such banks in 2014. Bhutan and Namibia had 5 institutions, while the United States had 5586 institutions. The availability of ATMs is also an important indicator in measuring the construction level of financial infrastructure. Globally in 2014, 51 ATMs were available for 100,000 people. In OECD high income countries, 101 ATMs were available for every 100,000 people while developing countries had only 37 ATMs per 100,000 people.

3.3 Results

To estimate the probability of having a mobile money account need to specify a regression in which the dependent variable can take two values. Also, the time span of my dataset is one year (2014). For a binary response model, a probit model is an appropriate specification (Butler and Moffitt, 1982). I will utilize several baseline models to determine whether having a mobile money account or not will be influenced by having a formal financial account or not.
Appendix Table 1 reflects the probit regression result for the effect of traditional account ownership on mobile money account ownership. Model I (Column (1)) only has the traditional financial account ownership as the independent variable. The model II (Column (2)) controls gender, weight, age, education level and income level of households joining in the survey. Model III adds the country fixed effect. Model IV (Column (4)) controls not only the household level variables, but also country level variables including the country’s income group, the percentage of individuals using the internet, and mobile-cellular telephone subscriptions. In model V, we control the construction level of financial infrastructure including the number of ATMs, number of branches of commercial banks, and number of commercial banks institutions.

Table 2 to 4 estimates the effect of traditional financial account ownership on the mobile money account ownership in Sub-Saharan Africa, Latin America & Caribbean and South Asia. To evaluate the role of mobile money in the financial inclusion projects in developing areas, we applied the baseline model in the areas that have most developing countries. The results of table 5 to 8 assess how the traditional account ownership influences mobile money in countries from different income groups.

### 3.3.1 Baseline models

Results with the binary outcome of whether having a mobile money account or not are presented in my baseline models (Table I). All the results are based on probit regressions using different control variables. Model I indicates a positive relationship between having mobile money account and having traditional bank account, statistically significant at the 1% level of significance. This coefficient indicates that people having a traditional bank account are 44% more likely to use the
mobile money service. However, the specification of Model I did not control other variables which may be the important determinants of the mobile money account ownership. In the model II, with the household level variables controlled, the positive relationship is still statistically significant at the 1% level of statistical significance. In terms of magnitude, having a traditional bank account increases the probability of mobile money account ownership by 42%. Model III adds country fixed effect which increase the magnitude of coefficient to 0.7, and it remains statistically significant. Model V adds country-level variables; the statistical significance of the coefficient of traditional bank account ownership is maintained at 1% level of significance. The magnitude of coefficient increases to 0.66, which means people owning financial bank accounts are 67% more likely to register a mobile money account. Model V include the construction level of financial infrastructure as the control variables, improving the explanatory power of the model that predicts 12.1% of variance of dependent variable. In addition, the coefficient of traditional bank account ownership is significant at 1% level and the magnitude of effect is 0.72, which means people with traditional bank accounts are 72% more likely to own mobile money accounts. In summary, the baseline models that include different levels of control variables confirm the relationship between traditional bank account ownership and mobile money account ownership.

3.3.2 Developing regions

When the baseline models are applied in specific areas, the coefficients of traditional bank account ownership are statistically significant at 1% level of significance in all the models but the magnitudes of coefficients differ depending on the regions.
Compared with the models specified for Latin America & Caribbean and South Asia, the models in Sub-Saharan Africa generally have the highest magnitude of coefficients. Without the control variables, having traditional bank account in Sub-Saharan Africa can increase 72% possibility of having mobile money account, compared to 50% in Latin America & Caribbean, and 42% in South Asia. For Sub-Saharan Africa, if we control household level variables in model II and both household level and country level variables in model IV, having a traditional bank account will respectively lead to a 62% increase and a 79% increase in the possibility of having a mobile money account. Based on the same specifications, the coefficients of traditional bank account ownership in Latin America & Caribbean are 0.51 and 0.59. In South Asia, the magnitudes of coefficients of traditional bank account ownership on mobile money account are 0.15 and 0.40, which are lower than other areas. In Sub-Saharan Africa, when we include the country fixed effect in the model, the traditional bank account ownership will increase 76% of the possibility of having a mobile money account. In the same model, in Latin America & Caribbean and South Asia, people who have traditional bank accounts are 60% and 43% more likely to have mobile money accounts. If we include all the control variables, having traditional bank account can increase 81%, 60% and 43% possibility of having mobile money account in Sub-Saharan Africa, Latin American & Caribbean, and South Asia respectively.

To summarize, the use of mobile money service for people living in Sub-Saharan Africa, where mobile money is strongly promoted, is most likely to be influenced by the traditional bank account ownership.
3.3.3 Countries’ income groups

The coefficients in all of my models specified for countries’ income groups are positive and significant at 1% level of significance. As for magnitudes, the impacts of traditional bank account ownership decrease from low income countries to lower middle income countries but rise again in lower middle income countries and high income countries (See Appendix: table 5 - 8).

In the absence of control variables, having a traditional financial account can respectively increase 80%, 49%, 73% and 96% possibilities of having a mobile money account in low income, lower middle income, upper middle income and high income countries. When we include all the control variables, impacts of formal bank account ownership go up to 59% and 84% in lower and upper middle income countries, but decline to 77% and 84% in low and high income countries respectively. The change of coefficients’ magnitudes from Model I to V in middle income countries follows the same trend as the baseline models but the low and high income countries do not. The impact of traditional bank account ownership in lower middle income countries is smaller than in other groups. Therefore, promoting the mobile money service in lower middle income countries will face the comparatively slightest restrictions from traditional bank service. However, people living in those low-income countries still desire formal bank service.

3.3.4 Robustness checks

To minimize the effects of misspecification errors, I include several variables related to the behaviors of traditional banks as a robustness check. In table 9, the variation of mobile money account ownership is determined by other financial behaviors related to formal financial institutions.
While people having debit cards are 71% more likely to have the mobile money account, credit card ownership will decrease 53% possibility of using mobile money service. The coefficients on debit and credit cards are statistically significant at the 1% level of significance. People who have saved in financial institutions are 60% more likely to have a mobile money account. The borrowing behavior at the traditional financial institutions also positively affects mobile money account ownership. In terms of magnitude, borrowing from financial institutions can increase 51% possibility of having a mobile money account. Both sending and receiving domestic remittance through formal banks have a positive relationship with mobile money account ownership and the coefficient of these behaviors are statistically significant at 1% level of significance. If people send or receive domestic remittance through traditional financial institutions, they are 39% or 49% more likely, respectively, to have mobile money accounts. In addition, paying utility bill and school fee via traditional banks can increase 86% and 99% respectively the possibility of using mobile money service, and people who receive wages, government transfers, and agriculture payments by banks are 69%, 58%, and 110% respectively more likely to have mobile money accounts. The coefficients of all paying and receiving variables are statistically significant at the 1% level of significance.

Overall, most of financial behaviors at traditional banks influence the possibility of having a mobile money account. This result supports some credibility of the conclusion that mobile money account ownership is strongly influenced by the financial inclusion conducted by the traditional banks.
4. Policy Implication and Concluding Results

Since Safaricom’s M-PESA program launched, mobile money has become increasingly prevalent in international development due to the fact that mobile money platforms can include more unbanked people into the financial system. Even though the international organizations keep emphasizing the benefits of mobile money alone, my analysis shows that the extent of mobile money account ownership strongly depends on the development of traditional financial system. People who have traditional bank accounts are more likely to have the mobile money accounts, especially for people living in low-income countries and Sub-Saharan Africa. Also, mobile money is more popular among those people, who tend to conduct the financial activities through traditional banking system.

The mobile money platforms can be constrained by individual’s income level. Mobile money development requires people to own mobile devices and purchase other mobile services. In areas of extreme poverty, mobile money does not have a material foundation at the individual level, since people cannot afford cell phones or the internet service. Also, people with limited assets do not have the demand of transaction or other financial services (Laura, 2016). Thus, mobile money project face severe challenges in promoting at the bottom of the pyramid. For example, although international organizations promote mobile money service in Africa, a certain number of people are still less likely to use mobile money accounts, especially those without access to the mobile service or electricity.

Another important condition of mobile money development is the individual’s financial literacy. While education on using the traditional financial tools encounters many difficulties, teaching unbanked people about how to complete their financial activities in a telecommunication system
can be more challenging. From the robustness check result, I can see that people who can finish transaction through traditional banks are more likely to own a mobile money bank account. The awareness of traditional financial tools can fundamentally limit the introduction of mobile money to a new country.

On the country level, the traditional financial infrastructure can influence the development of mobile money. Low-income countries may face severe problems in promoting financial inclusion in the traditional system as the financial institutions and ATMs are less available. Indeed, my empirical result shows that the low-level inclusion in the traditional banking registration can restrict the process of popularizing mobile money.

Moreover, the obstacles to mobile money development can also come from the government and major banks. While mobile money projects are often initiated by international organizations, other stakeholders like governments and major banks may also participate as operators. But governments may worry that mobile money platforms can affect the domestic financial regulation and incent some financial crimes. At the same time, the mobile money platform can occupy shares of the financial service market and cause major banks to lose their clients. For example, instead of having their agents, the mobile money networks in Nigeria are operated by banks that are licensed by the Nigerian Central Bank for protectionist reasons (Laura, 2016). Since the Nigerian government and central banks are concerned about losing control over the financial market, mobile money in Nigeria is not as successful as in Kenya (Laura, 2016).

With the above-mentioned limitations, mobile money for boosting financial inclusion should act as complement rather than the substitute to traditional financial services. When deciding on
whether we should introduce mobile money to a new country or how much we should invest in mobile money, two factors should be taken into consideration.

Firstly, the targeted country’s income level and financial infrastructure status. Specifically, for a lower-middle-income country where the financial institutions are well-developed and people can afford mobile devices and the Internet, mobile money will be a worthwhile investment. However, if policy makers decide to introduce mobile money in extremely poor countries or areas, traditional financial account ownership and mobile service’s penetration should be evaluated as preconditions.

Second, the attitude of government in the targeted country should be evaluated before any efforts to introduce mobile money. If the government is conservative about financial innovations and concerned about the risk from the new technology, the mobile money is less likely to satisfy the market demand. In the countries where governments are not positive about the cooperating with foreign players, the financial inclusion projects that led by international organizations or multinational corporates tend to be not that successful.

Prospect of financial inclusion projects should also consider the portfolio of investment. Since mobile money development is strongly affected by the traditional financial system, the projects should be devoted to the improvement of traditional financial tools. Nevertheless, the construction of traditional financial infrastructure and the education on financial literacy should be paid with more attentions to include more people into the financial system.

Future research may develop a more comprehensive model to generate a detailed investment proposal for the financial inclusion projects, especially indicating how effective can mobile money be. Based on my current analysis, policy makers in the national institutions and international organizations should be more cautious about the trendy technology in the financial market.
Without the evaluating of specific country factors, the financial inclusion projects may not achieve the expected results with only the financial innovations.
Appendix: Data Tables

Table 1 Baseline Model

<table>
<thead>
<tr>
<th>Model</th>
<th>Model I</th>
<th>Model II</th>
<th>Model III</th>
<th>Model IV</th>
<th>Model V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent Variable</td>
<td>Having a traditional financial account</td>
<td>0.44**</td>
<td>0.40**</td>
<td>0.70**</td>
<td>0.66**</td>
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<td>YES</td>
<td>YES</td>
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<tr>
<td></td>
<td>Controls II</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Controls III</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Fixed Effect</td>
<td>Country</td>
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<td>-</td>
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<tr>
<td></td>
<td>Fixed</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

| N             | 74,298 | 74,256 | 74,256 | 72,259 | 67,240 |
| Pseudo R²     | 0.026** | 0.047** | 0.298** | 0.093** | 0.121** |

Controls I: Household level control variables (HH)
Controls II: Country level control variables
Controls III: Construction level of financial infrastructure

**: P < 0.01
*: P<0.05
Table 2: Models in Sub-Saharan Africa

<table>
<thead>
<tr>
<th>Model</th>
<th>Model I</th>
<th>Model II</th>
<th>Model III</th>
<th>Model IV</th>
<th>Model V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent Variable</td>
<td>Having a traditional financial account</td>
<td>0.72**</td>
<td>0.62**</td>
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<td>YES</td>
<td>YES</td>
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<tr>
<td></td>
<td>Controls II</td>
<td>Controls III</td>
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<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Fixed Effect</td>
<td>Country</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Fixed Effect</td>
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<td>N</td>
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<td>32,019</td>
<td>30,019</td>
<td>30,022</td>
<td>26,003</td>
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<td>Pseudo R²</td>
<td>0.061**</td>
<td>0.083**</td>
<td>0.283**</td>
<td>0.112**</td>
<td>0.200**</td>
</tr>
</tbody>
</table>

Controls I: Household level control variables (HH)
Controls II: Country level control variables
Controls III: Construction level of financial infrastructure

**: P < 0.01
*: P < 0.05
Table 3: Models in Latin America and Caribbean

<table>
<thead>
<tr>
<th>Model</th>
<th>Model I</th>
<th>Model II</th>
<th>Model III</th>
<th>Model IV</th>
<th>Model V</th>
</tr>
</thead>
<tbody>
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<td>Having a traditional financial account</td>
<td>0.50**</td>
<td>0.51**</td>
<td>0.60**</td>
<td>0.59**</td>
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<td>YES</td>
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<tr>
<td></td>
<td>Controls II</td>
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<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Controls III</td>
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<tr>
<td>N</td>
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<td>13,027</td>
<td>14,027</td>
<td>14,027</td>
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<tr>
<td>Pseudo R²</td>
<td>0.036**</td>
<td>0.062**</td>
<td>0.102**</td>
<td>0.079**</td>
<td>0.082**</td>
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</table>

Controls I: Household level control variables (HH)
Controls II: Country level control variables
Controls III: Construction level of financial infrastructure

**: P < 0.01
*: P<0.05
<table>
<thead>
<tr>
<th>Model</th>
<th>Model I</th>
<th>Model II</th>
<th>Model III</th>
<th>Model IV</th>
<th>Model V</th>
</tr>
</thead>
<tbody>
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<td>0.42**</td>
<td>0.15**</td>
<td>0.43**</td>
<td>0.40**</td>
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<td>YES</td>
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<td>Controls III</td>
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<td>YES</td>
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<td>Fixed Effect</td>
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<tr>
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<td>8,112</td>
<td>8,112</td>
<td>8,112</td>
<td>8,112</td>
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<td>Pseudo R²</td>
<td>0.026</td>
<td>0.052</td>
<td>0.146</td>
<td>0.135</td>
<td>0.146</td>
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</table>

Controls I: Household level control variables (HH)
Controls II: Country level control variables
Controls III: Construction level of financial infrastructure

**: P < 0.01
*: P<0.05
Table 5: Models in Low Income Countries

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Model I</th>
<th>Model II</th>
<th>Model III</th>
<th>Model IV</th>
<th>Model V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having a traditional financial account</td>
<td>0.80**</td>
<td>0.70**</td>
<td>0.86**</td>
<td>0.72**</td>
<td>0.77**</td>
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</table>

<table>
<thead>
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<th>Control Variables</th>
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<th>YES</th>
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<th>YES</th>
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</thead>
<tbody>
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<td>YES</td>
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<tr>
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<td>Controls III</td>
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<table>
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<th>-</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fixed</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Effect</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>N</th>
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<th>21,583</th>
<th>21,583</th>
<th>20,585</th>
<th>17,574</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudo R²</td>
<td>0.065</td>
<td>0.087</td>
<td>0.304</td>
<td>0.147</td>
<td>0.159</td>
</tr>
</tbody>
</table>

Controls I: Household level control variables (HH)
Controls II: Country level control variables
Controls III: Construction level of financial infrastructure
**: P < 0.01
*: P < 0.05
Table 6: Models in Lower Middle Income Countries

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Model I</th>
<th>Model II</th>
<th>Model III</th>
<th>Model IV</th>
<th>Model V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having a traditional financial account</td>
<td>0.49**</td>
<td>0.44**</td>
<td>0.49**</td>
<td>0.57**</td>
<td>0.59**</td>
</tr>
</tbody>
</table>

Control Variables
- Controls I: YES
- Controls II: YES
- Controls III: YES

Fixed Effect
- Country Fixed Effect: YES

N | 30,138 | 30,122 | 29,122 | 29,123 | 28,123 |

Pseudo R² | 0.033 | 0.040 | 0.318 | 0.1052 | 0.161 |

Controls I: Household level control variables (HH)
Controls II: Country level control variables
Controls III: Construction level of financial infrastructure

**: P < 0.01
*: P < 0.05
### Table 7: Models in Upper Middle Income Countries

<table>
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<th>Model IV</th>
<th>Model V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>Having a traditional financial account</td>
<td>0.73**</td>
<td>0.68**</td>
<td>0.84**</td>
<td>0.75**</td>
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<td>Control</td>
<td>Controls I</td>
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<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Variables</td>
<td>Controls II</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td>Controls III</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed</td>
<td>Country</td>
<td>YES</td>
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<td>-</td>
<td></td>
</tr>
<tr>
<td>Effect</td>
<td>Fixed Effect</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
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<td>18,517</td>
<td>17,517</td>
<td>18,517</td>
<td>17,509</td>
</tr>
<tr>
<td>Pseudo R²</td>
<td>0.054</td>
<td>0.098</td>
<td>0.261</td>
<td>0.178</td>
<td>0.238</td>
</tr>
</tbody>
</table>

Controls I: Household level control variables (HH)
Controls II: Country level control variables
Controls III: Construction level of financial infrastructure
**: P < 0.01
*: P<0.05
Table 8: Models in High Income Countries

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Model I</th>
<th>Model II</th>
<th>Model III</th>
<th>Model IV</th>
<th>Model V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having a traditional financial account</td>
<td>0.96**</td>
<td>0.94**</td>
<td>0.84**</td>
<td>0.84**</td>
<td>0.84**</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control Variables</th>
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<th>YES</th>
<th>YES</th>
<th>YES</th>
</tr>
</thead>
<tbody>
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<td>Controls I</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls II</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls III</td>
<td>YES</td>
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<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fixed Effect</th>
<th>Country</th>
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<th>-</th>
<th>-</th>
<th>-</th>
</tr>
</thead>
<tbody>
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<td>Fixed Effect</td>
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</tbody>
</table>

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<tbody>
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<td>0.054</td>
<td>0.109</td>
<td>0.126</td>
<td>0.126</td>
<td>0.126</td>
</tr>
</tbody>
</table>

(The construction of financial infrastructure variables were omitted in model V of high income countries.)

Controls I: Household level control variables (HH)
Controls II: Country level control variables
Controls III: Construction level of financial infrastructure

**: P < 0.01
*: P < 0.05
Table 9 Robustness Checks

<table>
<thead>
<tr>
<th>Robustness Check Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Has a debit card</td>
<td>0.71**</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2. Has a credit card</td>
<td>-</td>
<td>0.53**</td>
<td></td>
<td></td>
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<tr>
<td>3. Saved in financial institutions</td>
<td>0.60**</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Borrowed in financial institutions</td>
<td>0.51**</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>5. Send domestic remittance through financial institutions</td>
<td>0.39**</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Receive domestic remittance through financial institutions</td>
<td>0.49**</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Control Variables

<table>
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<tr>
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<th>YES</th>
<th>YES</th>
<th>YES</th>
<th>YES</th>
<th>YES</th>
</tr>
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<tbody>
<tr>
<td>Controls I</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls II</td>
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N

<table>
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<th>66,710</th>
<th>66,842</th>
<th>13,612</th>
<th>17,569</th>
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<tbody>
<tr>
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<td>0.111</td>
<td>0.104</td>
<td>0.104</td>
<td>0.092</td>
<td>0.088</td>
<td>0.095</td>
</tr>
<tr>
<td>Robustness Check Variables</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td></td>
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<td>------------</td>
<td>------------</td>
<td>------------</td>
<td>------------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>7. Paid utility bill through financial institutions</td>
<td>0.86**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Paid school fee through financial institutions</td>
<td></td>
<td>0.99**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Receive wage through financial institutions</td>
<td></td>
<td></td>
<td>0.69**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Receive government transfers through financial institutions</td>
<td></td>
<td></td>
<td></td>
<td>0.58**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Receive agriculture payment through financial institutions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.10**</td>
<td></td>
</tr>
</tbody>
</table>

Control Variables

| Controls I | YES | YES | YES | YES | YES |
| Controls II | YES | YES | YES | YES | YES |
| Controls III | YES | YES | YES | YES | YES |

N  | 30,580  | 16,755  | 16,779  | 6,753  | 15,228  |
Pseudo $R^2$  | 0.173  | 0.140  | 0.125  | 0.174  | 0.140  |

Controls I: Household level control variables (HH)
Controls II: Country level control variables
Controls III: Construction level of financial infrastructure

**: P < 0.01
*: P<0.05
Bibliography


