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Predicting Financial Inclusion in Sub-Saharan Africa

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Abstract

Sub-Saharan Africa is arguably the region with the poorest infrastructure network around the globe as such informal banking system complements largely the formal banking system in reaching the unbanked within the region so as to grant them affordable access to financial services. Controlling for age, income quantile, education level, gender and citizenry, this work finds a statistically significant relationship between these variables and ownership of Mobile Money Accounts. Furthermore it uses transaction made on these accounts in recent time as a proxy for measuring Financial Inclusion and on this basis predicts Financial Inclusion within the region in question using Global Findex 2014 while making policy recommendations.

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Chapter 1

Introduction

Financial inclusion refers to the delivery of financial services of an economy to its populace. An inclusive financial system facilitates efficient allocation of productive resources and thus can potentially reduce the cost of capital. More so, access to appropriate financial services can significantly improve the day-to-day management of individual and household finances. It also serves the purpose of reducing the growth of informal sources of credit (such as money lenders) that are often found to be exploitative. Thus, an all-inclusive financial system enhances efficiency and welfare by providing avenues for secure and safe saving practices by facilitating a whole range of efficient financial service networks [Sarma and Pais, 2011].

The Global Financial Inclusion (GFI) Index database founded by the World bank in 2011 and updated every three years, provides comparable indicators showing how people around the world save money, borrow, make payments and manage risk. it further provides a handful indicators that enhances comparative studies by different interest groups; among these indicators are representative gender distribution of countries across the globe, age groups and nationwide household income distributions, wealth distribution around the world, details Financial Inclusion performances. The indicators are based on interviews with about 150,000 national representatives and randomly selected adults age 15 and above in more than 140 economies. The 2014 update reveals that between 2011 and 2014, 700 million adults worldwide became account holders while the unbanked population dropped by 20% to 2 billion. Globally, 62% of adults have an account, up from 51% in 2011.

The Global Findex measures the inclusion with a wide variety of variables including *account ownership*: defined as having account with either a financial institution (such as credit union, cooperative society and micro-finance institution) or through a mobile money provider (use of GSM provided service as primary financial account). The data reveals an 11% increase in ownership of accounts from 2011. 60% of adults world wide have accounts at a financial institution with 1% owning an accounts at a financial institution and another 1% own Mobile Money Accounts(MMA) only. However, MMA appears to be more prominent in Sub-Saharan Africa where 6% own only M-Money account.

Another variable is *savings*; 25% of adults reported to be saving for old age and education while 14% for business purposes. Savings are made informally across the globe using savings club or a person outside the family or formally at a financial institution. 56% of adults are recorded to have saved in 2014. The third key variable is *borrowing*: globally 42% of adults have been recorded to have borrowed with consistent share across all economies and regions of the world 27% borrow for either new home or land acquisition, 14% for health and medical purposes, and 8% borrow to fund education or business accordingly.

Many academic literatures have recorded the evidences of Mobile phone technology promoting growth and financial inclusion in Sub-Saharan Africa, for example, [Simplice et al., 2012] found a growing role of informal banking in developing countries. [Demombynes and Thegeya, 2012] found a new potential for MMA coming with the rise of interest-earning bank-integrated mobile savings systems, beginning with the launch of the M-KESHO system in March 2010 in Kenya.

However,[Simplice et al., 2012] opined that the continued growth of mobile banking cannot be effectively accessed at a macroeconomic level by traditional financial development indicators and so the growth of MMA is a wake up call for scholarly research in this sector since a sizable portion of the monetary base of developing countries is now being captured by mobile banking. Motivated by these findings, this paper sets out to answer questions such as "what factors drive ownership of Mobile Money Accounts (MMA) among the "unbanked (individuals having only MMA without an Financial Institution Account (FIA))", exploring variables such as age, level

of education, citizenry, gender and income quantile? Secondly, it seeks to predict activeness of MMA in these countries given these variables.

Chapter 2

Literature Survey

2.1 Financial Inclusion

There are a wide variety of literature on the definition of the concept "Financial Inclusion." [Leyshon and Thrift, 1995] idealizes it from a counter perspective defining *Financial Exclusion* as the exclusion of some members of the public from access to formal financial system, however, in a developed economy like UK, it is viewed by [Mitton, 2008] as the inability, difficulty or reluctance to access appropriate so called mainstream, financial services; also views FI from two dimension namely: good financial decision making (demand) and access to suitable service (supply), additionally, [Kempson and Whyley, 1999] and [Klempson and Whyley, 1999] identified access, condition, price, marketing and self exclusions as the major forms of exclusion from the financial service system of any economy whereas [Sarma et al., 2012] concludes that Financial Exclusion is a multidimensional phenomenon.

On the other hand, [Mandela et al., 2013] defines FI as universal access to a wide range of financial services at a reasonable cost and it is a prerequisite for economic development following [Aduda and Kalunda, 2012]. [Hannig and Jansen, 2010] suggests that the aim of FI is to draw the "unbanked" into formal financial system to access financial services ranging from payments, and transfers to credit and insurance. With respect to the role of Financial Inclusion in any economy, [Park and Mercado, 2015] views it as a critical element that enhances inclusive growth and helps policy makers design and implement programs that will broaden access to

financial services and reduce income inequality consistent with [van Oudheusden et al., 2015]. Additionally, [van Oudheusden et al., 2015] constructs financial inclusion indicators following the model of [Sarma, 2008] to assess the various macro-economic factors affecting degree of financial inclusion with a focus on 37 developing Asian economies and finds out that per capita income, rule of law and demographic characteristics play significant role in financial inclusiveness in Developing Asia. More discovered that financial inclusion significantly reduces poverty and overcome income inequality in this region.

From an institutional perspective [Mehrotra and Yetman, 2015] itemized the gains of financial inclusion Using Global Findex from three dimensions: facilitates consumption smoothing and enhances central banks' effort geared towards maintenance of price stability; the possibility of increased importance of interest rates in monetary transmission which may likely improve the use of interest rates as a tool for monetary policies nevertheless, placed a caveat on financial inclusion focusing on access to credit as one of its measurement variables. However, [Hannig and Jansen, 2010] argued based on evidence that low income savers and borrowers tend to maintain solid financial behavior throughout financial crises, keeping deposits safely and making timely repayments.

Since Islamic finance industry is beginning to steer interest among policy makers as a possible way of expanding financial inclusion [Demirguc-Kunt et al., 2013] the GFI 2011 in a sample of 65,000 adults from 64 economies representing approximately 75% of the world's Muslim population and found a significant exclusion gap greater for Muslims than non Muslims, findings also show that male Muslims tend to be more financially included than females. A survey of financial inclusion in China compared to the BRICS countries by [Fungáčová and Weill, 2015] reveals a high FI via use of formal account and formal savings. The question remains what progress has been made in SUB-Saharan Africa?

2.2 Sub-Sahara Africa

Sub-Saharan Africa has some of the lowest levels of infrastructure investment in the world. Merely 29 percent of roads are paved, barely a quarter of the population has access to electricity, and there are fewer than three landlines available per 100 people [(IBRD), 2009, Union, 2009]. Yet access to and use of mobile telephony in sub-Saharan Africa has increased dramatically over the past. Mobile telephony in sub-Saharan Africa has increased dramatically over the past decade. Early developments of mobile telephony as of 2008 revealed a growth rate of ten mobile mobile phones per landline in sub-Saharan Africa [Union, 2009], with 60 percent of the population having mobile phone coverage. Mobile phone subscriptions increased by 49 percent annually between 2002 and mobile phone subscriptions increased by 49 percent annually between 2002 and 2007, as compared with 17 percent per year in Europe [Union, 2009] as compared with 17 percent per year in Europe [Union, 2009].

More recent findings show that the story of the growth of mobile phones in Africa is one of a tectonic and unexpected change in communications technology. Furthermore, mobile phone coverage in Africa has grown at staggering rates over the past decade. In 1999, only 11% of the African population had mobile phone coverage, primarily in Northern (Algeria, Egypt, Libya, Morocco and Tunisia) and Southern Africa (Kenya and South Africa) [Aker and Mbiti, 2010]. However, by 2008, more than 286million could get a signal and an area of 11.2 million square kilometers had mobile phone coverage: equivalent to the United Sates and Argentina combined. By the turn of 2012, it is projected that most villages in Africa will have coverage with only a handful of countries relatively unconnected [Aker and Mbiti, 2010]. The most impressive country in this transformation is Kenya who according to [Demombynes and Thegeya, 2012] has undergone a remarkable information and communication technology (ICT) revolution. At the turn of the 1990s, less than 3% of Kenyan households owned a telephone and less than 1 in 1000 Kenyan adults had mobile phone service. However, by the end of 2011, 93 percent of Kenyan households owned a mobile phone. This soar is largely credited to the M-PESA mobile-banking network. [Asongu, 2015] stressed that growth and penetration rates of mobile telephones are transforming them into "pocket-banks" in Africa providing the countries on the

continent with improved means of harnessing a financially inclusive system for their populace. Three major uses of transactions on MMA was identified by [Donner and Tellez, 2008] namely; store of value with linkage of MMA to account at a financial institution if the holder has one, otherwise MMA becomes the principal account with either accessible via Mobile phones; conversion of what is stored (currency) in and out of the value store (MMA); and transferring stored value between accounts.

In Africa, a study was undertaken by [Kpodar and Andrianaivo, 2011] to examine the impact of mobile-phone roll-out on economic growth. Findings show a positive influence of mobile technology on economic growth consolidated by FI. Kenya takes the lead in this innovation (see [Morawczynski and Pickens, 2009] and [Johnson and Arnold, 2012]) consistent with Kenya has the highest share of adults with a mobile money account, at 58%, followed by Somalia, Tanzania, and Uganda with about 35% [van Oudheusden et al., 2015]. So also in recent times Côte d'Ivoire (Ivory Coast) there are significant evidences in penetration of MMA and are helping to create an equilibrium in account ownership between gender, rich and poor, and between older and younger adults.

MMA possibly satisfies usage, access, quality and impact as measures of financial inclusion proposed by [Hannig and Jansen, 2010] and adopted by many literatures, for example [Bappaditya, 2016] emphasized that the objectives of FI is to boost the usage of financial accounts MMA provides convenient and affordable financial service reach to the unbanked that are traditionally excluded from the from the formal financial system-such as women, poor people, young people and rural dwellers etc. For clarity, Global Findex 2014 documented adults holding MMA simultaneously with account at a financial institution as having a Financial Institution Account (FIA) separate from adults owning solely MMA as the only medium of financial transactions. Therefore the gap of account ownership can possibly be explored within the economies of this region since ownership of MMA which is not linked to an account at a financial institution is the largest compared to other parts of the world which is the crux of this paper.

Chapter 3

Methodology

A significant fact revealed in the 2014 Global Findex is the Penetration of "Mobile Money Accounts (MMA)" in Sub-Saharan Africa. MMA holder is defined by the 2014 Global Findex as one having an account with a GSM service provider not *linked* to a financial institution. A third of account holders are reported to have a MMA with equal share of with-/out ownership of account at a financial institution. Kenya takes the lead with about with 58% of her adults having MMA, followed by Somalia's, Tanzania and Uganda each with 35%. To this end, this work seeks to achieve two aims: 1) To explore financial inclusion among the unbanked Sub-Saharan countries controlling for age, gender, level of education and income quantile using an active mobile account as a proxy. 2) To predict activeness of the MMA accounts in the respective countries.

3.1 The Model

Due to the dichotomous nature of the problem at hand, that is, MMA being either active or not, the Logistic regression becomes the readily available tool since it is used to describe and to explain the relationship between one dependent binary variable and one or more nominal, ordinal, interval or ratio-level independent variables. The question simply formulated reads: "what are the (log) odds of a person being financially included/having an active MMA given

his/her country, age, gender, income quantile and level of education?", estimated via

$$y = \beta_0 + age\beta_1 + Income\beta_2 + Gender\beta_3 + Education\beta_4 + Country\beta_5 \quad (3.1.1)$$

Active Mobile Money accounts (y)

Roughly 35% MMA of the owned by the observed 4,575 candidates in the region are active; Namibia has a total of 240 active accounts out of 286 whereas Somalia has the most active MMA rate of 67%. The sample size constitutes about 35% of adults surveyed by the world bank as reported in 2014 Global Findex. The question asked the respondents who had MMA if they had made transactions on their mobile phone within the immediate past 12 months meaning "No" equals owning a dormant mobile account and "Yes" an active one. Common transactions on MMA include but not limited to: payment of school fees, saving, utility bills, transfer of money to and from family members, government transfers and receiving agricultural payments. Hence since there no standard index for measurement of FI, ownership of an active (if transaction is made on the account in recent time) Mobile Money Account is as proxy for measurement of financial inclusion within the unbanked in Sub-Saharan Africa For the purpose of this study, this variable is coded binary values 0 if dormant and 1 if active.

Age

In Uganda and Tanzania for example Global Findex database documented an ownership of MMA being more likely for older adults. The data used in this work reveals an average age bound of roughly 40 and 32 for Ghana and Kenya with respect to ownership of MMA respectively. The age distribution vary widely thus the whole age bracket 15-90 in the regression.

Income

Income seem to be a driving factor for ownership of MMA with varying patterns per country. In Kenya and Uganda, the likelihood of ownership of MMA is higher for adults within the poorest 40% of households than for those in the richest 60%, while the reverse is the case in Tanzania, and Uganda. therefore, Income takes a numeric values of range 1 (poorest households)-5 (richest households).For this reason the income variable is chosen to be numerical with all the five income groups included in the regression.

Gender

Gender refers to whether the holder of MMA is male or female. It take value 0 if an MMA owner is male and 1 if female.

Country

To enhance a comparative study of the odds of how MMA has penetrated the unbanked in Sub-Saharan Africa on country basis, each country takes a factor level 1 to 13.

Education

The level of education spans level 1 (basic education) to 5 (Highly educated). Majority of MMA owners either to either elementary or secondary level of education. Whereas higher level of education is poorly represented, a multicollinearity algorithm was applied and using this class in the estimates was found to be variance inflating. Therefore, The level of education employed in the logistic regression was is the combination of level 2 and 3, interpreted as "secondary education level".

3.2 The Predictive Model

Given that the expected outcome of the prediction is 0 (Dormant MMA) or 1 (Active MMA) A slight modification is made to the model. Instead of a cross sectional explanatory model, prediction is made handling each country individually. The question simply formulated reads: "How person is financially included/has a active MMA given age, gender, income quantile and level of education in each Sub-Saharan African country? " The corresponding regression equation is formulated thus:

$$\hat{y}_i = \beta_0 + age\beta_1 + Income\beta_2 + Gender\beta_3 + Education\beta_4 \qquad i = 1, \ldots, 13. \tag{3.2.1}$$

Country ($\hat{y}_i$)

To predict financial inclusiveness of the unbanked in each of the 13 Sub-Saharan economy, the countries are subset with each having its own portion of active and dormant MMA. Of the 4,575 candidates in the prediction Namibia has the largest population where 12% of this population has either made deposits or withdrawal from their MMA in recent times whereas Kenya has the most representative proportion of active MMA of about 43% of her 534 candidates. I employed a 70:30, training/validation sample splitting technique.

Chapter 4

Empirical Analysis

A logistic regression to determine financial inclusion was carried out on 13 Sub-Saharan African countries with country, age, gender, household income quantile and level of education as independent variables with a sample size of 4,575. Empirically its observed that for every unit change in income quantile and education level the log odds of being financially included (or having an active MMA) versus being excluded(or owning a dormant MMA) in Sub-Saharan Africa increases by 0.22 and 0.67 respectively while being female reduces the log odds by 0.21 implying in terms of percentage change, the odds for a female being financially included is about 19.3% lower than odd for males. Being a citizen of Botswana versus being a citizen of Ivory Coast changes the log odds of possessing an active MMA by -0.211. More so,the chi-squared test statistic of 187.6, with 14 degrees of freedom is associated with a p-value of 0.0 indicating that the overall effect of citizenry on Activeness of MMA is statistically significant. Moreover, controlling for all other factors, the odds of an MMA being active increases by proximately 95% for a unit increase in level of education (see [Bruin, 2011]). For overall test of statistical significance, an ANOVA test is carried out to compare the performance of the regression against a model with only the intercept (null model) displayed in Table 2. It is observed comparing the null deviance to the residual deviance that the inclusion of age, income quantile, sex and Country reduces the deviance at a 99% significant level each having very low p-value. Hence all variables are relevant for determining Financial Inclusion within this framework.

Table 3 presents the prediction outcomes of number of Active MMA in each country on a total

validation sample of 1,326 candidates across the 13 Sub-Saharan countries using regression equation (3.2.1). With an average accuracy of about 64%, the model predicts relatively low proportion of activeness of MMA across the region. While South Africa own the largest proportion of Mobile Money Accounts, only 35% of these are active in the validation sample out of which 18% are predicted active; Countries like Ghana (> 80% accuracy), Mali (> 75% accuracy) and Namibia (≈ 75% accuracy) record 0 predicted Financial Inclusiveness within unbanked respectively. The forecast of transactions being made on a Mobile Money Account is to be the highest in Botswana, where transactions are likely to be made on 3 out of every 10 MMA.

Chapter 5

Conclusion

In order to predict Financial Inclusiveness among the unbaked in Sub-Saharan Africa, this paper used active Mobile Money Accounts as a proxy for measurement of Financial Inclusion while exploring what drives the ownership and usage of these MMA accordingly. The Logit Model was used to establish the relationships whose estimates showed statistically significant relationships between education level, age, gender , household income quantile, citizenry (in Sub-Saharan Africa) and Activeness of MMA across the region. Further, with an approximate average accuracy of 64%, the model outputs predicted rate of 8.2% active accounts out of the studied 1,326 candidates in the validation sample. This would probably translate to low financial inclusion rate which the 13 countries that make up the Sub-Saharan region of Africa.

Borrowing a leaf from [Bappaditya, 2016] and based on the findings here, it is the suggestion of the author that efforts geared towards financial inclusion by policy makers in this region should incorporate the promotion of usage of Mobile Money Accounts for payment of salaries and other government subsidies.

Secondly, since MMAs are increasingly extending financial services to the populace beyond the reach of the formal banking systems, there is statistical evidence of this being a growing future trend among individuals within the Mid level educated groups and the poorest 40% households in Sub-Saharan Africa thus, suggested area of further research would be development of more holistic econometric models that capture both the formal and informal banking systems which may serve the purpose assessing the complementary roles of financial service sectors.

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