Banking on the Cellphone: Mobile Money and the Financial Behavior of Rural Farm Households in Uganda[1].

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Abstract

As mobile money adoption in Uganda continues to expand rapidly, over 35 percent of the adult population have used the service in just four years since its inception. Using a sample of 792 households, we examine the effect of this financial innovation/product on the financial behavior of rural households. Across all specifications, we find that a household with at least one mobile money user is significantly more likely save money and receive remittances and credit. Our preferred estimates show that mobile money adoption increases the amount of savings, remittances and credit by 60%, 42% and 71%, respectively. Our results are robust to specification checks and alternative explanations.

Key words: Mobile money, Financial inclusion, rural households, Financial services, Uganda.

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1. Introduction

Access to financial services is a crucial aspect of the development process as it shapes people's livelihoods through poverty and vulnerability reduction (Beck et al.2004; Demirguc-Kunt et al. 2008). Unfortunately though, majority of the world's population have no access to the basic financial services like savings, money transfer services, insurance and credit (Asli and Klapper, 2012). Yet the lack of access to affordable financial services limits the ability of households to venture into both formal and informal mechanisms to smooth consumption and redeem themselves from poverty (Dupas and Robinson, 2008). Mobile money, a mobile phone-based financial service that allows users to access basic financial services via the mobile phone, has come to the limelight in the financial inclusion literature over the recent years because of its potential to foster financial access especially among the financially excluded and rural poor in developing countries (Jack and Suri, 2011; Hughes and Lonie, 2007)

Mobile money has expanded rapidly over the past decade especially in the developing world where the penetration rate of formal financial services is low. The fact that mobile phone network coverage has expanded dramatically, combined with the rapid adoption of mobile phone devices in the past decade explains much of the success registered by mobile banking in low-income countries (USAID, 2010). The period between 2000 and 2011 has been dubbed the mobile revolution decade, with mobile phone subscriptions increasing from 10 percent to 80 percent in (IC4D, 2012)[2]. Approximately 79 percent of the population in developing countries had access to a mobile phone by the end of 2011. The fact that over 50 percent of the people in Africa have a mobile phone compared to 20

[2] Information and Communication for Development

percent with a formal bank account (McKinsey, 2009) implies a great potential for mobile money to increase financial access in developing countries.

There is a growing body of literature that examines the factors behind the high incidence of financial exclusion[3], ranging from socio-cultural considerations (Sarma and Pais, 2011; Susan and Zarazua, 2011), long distance to the financial institution (Pedrosa and Do, 2011) and high cost of account maintenance (Dupas and Robinson, 2013). In many developing countries, formal financial institutions like commercial banks and deposit-taking micro-finance institutions are concentrated in cities and major towns. This implies that access to formal financial services by the rural populace is complicated by the long and costly treks made to access service points in urban locations. Besides, the high cost of operating a bank account imposes a challenge to the adoption of formal financial services especially among the low-income people. An experimental study by Dupas and Robinson (2013) revealed that access to non-interest-bearing savings accounts increased savings and investments among market vendors in Kenya. The study emphasizes the importance of service cost as a critical factor in the uptake of financial services among low-income communities.

The lack of access to a formal financial institution in rural communities imposes a high cost of transferring money especially over long distances and this is often exacerbated by poor road conditions. Physical transfer of money is a common channel of remittances among the financially excluded rural communities despite the relatively high risk of theft, high transport and time cost involved in this exchange mechanism. The low cost of mobile banking relative to conventional banking implies an increase in the flow of remittances as demonstrated by Mbiti and Weil (2011) in the case of Kenya. The general lack of access to formal financial institutions partly accounts for the rapid adoption of mobile money services as an invaluable alternative for the financially excluded rural poor (WEF, 2011)[4].

[3] Financially excluded constitutes individuals who can not either access or afford to use the services offered by banks, MFIs and other formal and semi-formal financial service providers.
[4] World Economic Forum report, 2011.

Empirical research on informal insurance and risk sharing indicates that the availability of a cheap remittance channel increases the incidence of risk sharing and reduces vulnerability to income and consumption shocks (Jack and Suri 2013). This study uses panel data from Kenya to analyse the effect of mobile money adoption on the ability of households to smooth consumption and safeguard against shocks. They illustrate that households that used M-PESA - Kenya's most famous mobile money platform – were able to receive remittances to offset the effect of illness and weather shocks which accounted for a large reduction in consumption expenditure among counterpart households that never adopted M-PESA. Although most studies on mobile banking concentrate on peer-to-peer transfer services, which is the most common service offered across the mobile money platform given its infancy, mobile money supports business to person, business-to-business and government-to-person services at a relatively lower cost than conventional transfer platforms like commercial banks. A study by Aker et al. (2011) in Niger demonstrated that the use of mobile banking reduced the cost to the government and recipients of a welfare program that distributed financial assistance to the people affected by the critical drought of 2008.

Despite the increasing importance of mobile banking, there is little empirical evidence on the potential of this financial innovation with regards to services beyond money transfer. Mobile money now offers a broader range of services including an integrated access to formal bank accounts through partnerships between Mobile Network Operators (MNOs) and registered commercial banks and deposit-taking microfinance institutions (MFIs). Other services like the electronic payment of school fees and utility bills (in principle, water and electricity) are expected to reduce the size of the cash economy and increase financial efficiency. Safaricom's M-PESA in Kenya now offers extended services like credit and agricultural insurance through customized platforms like *M-KESHO* and *Kilimo Safi*. Access to an affordable savings platform can change the financial behavior of households by reducing wasteful expenditure and saving with informal platforms (Morawczynski & Pickens 2009).

Although considerable effort has been devoted to studying the developmental impact of mobile money in the areas of remittances, risk sharing and consumption smoothing, the potential of mobile money to facilitate savings, insurance and mobile payments efficiency remains largely unexploited. In the context of Uganda, mobile money studies focus on the determinants of adoption and non-adoption of this mobile money (Zarazua, 2011) while others rely on small and non-representative samples (Ndiwalana, 2010). The proposed study intends to fill the gap in the literature by analyzing the effect of mobile money on the saving behavior or rural households in Uganda. Mobile money was introduced in Uganda in March 2009 and the penetration rate had reached over 30 percent of the adult population by the end of 2013 according to the third wave of the Financial Scope survey in Uganda (FinScope III, 2013)[5]. This study contributes to the existing literature by empirically assessing the potential of mobile money to enhance financial inclusion, extending the analysis beyond peer-to-peer remittances to savings and credit. In the next sub-section, we elaborate on the evolution and current situation of the mobile money environment at the national level in the Ugandan context. The rest of the paper is organized as follows; Section 2 describes the data source and summary statistics, while the empirical strategy is outlined and detailed in section 3. We provide our results in section 4 and section 5 concludes.

1.1. Background on mobile money in Uganda.

In March 2009, Mobile Telephone Network (MTN) -Uganda established *MTN Mobile Money*, the first mobile money platform in the country, following the massive success of Safaricom's M-PESA in Kenya. Airtel Uganda, formerly known as Zain, joined the service when it rolled out its *Airtel Money* in June the same year. This new financial innovation proved to be an efficient way for telecom companies to increase their market shares by widening the range of services available to their clients. This attracted Uganda Telecom's *M-Sente* in March 2010, followed by *Warid Pesa* from Warid Telecom in December 2011

[5] FINSCOPE is a financial access project operated by Finmark in 19 countries (11 in SADC, 5 non-SADC Africa and 3 in Asia) starting from 2001. The main objective is to measure and profile the levels of access to and uptake of financial products/services (both formal and informal) in developing countries.

and *Orange Money* from Orange Telecom in the first half of 2012 (Uganda Communications Commission-UCC 2012).

Since mobile money was established in Uganda, the number of subscribers has been steadily increasing. By the end of 2012, had over 9 million Ugandans had adopted mobile money services, representing a three-fold expansion from 3 million users in 2011. The number of mobile money transactions increased from 180 million to 242 million between 2011 and 2012 while the total value exchanged through the platform increased from $1.5 billion to $4.5 billion in the same period (BoU, 2012). MTN Mobile Money alone has over 15,000 agents[6] as compared with 455 commercial bank branches with 660 Automated Teller Machines (ATMs). This rapid expansion partly owes to the high rates of both the roll-out of mobile phone network and adoption of mobile phones. In our sample, the proportion of households owning a mobile phone increased from 52 percent to 73 percent between the two survey rounds while all LC1s[7] were covered by mobile phone network in both rounds[8].

Mobile money allows users to deposit money as e-float on a SIM card-based account, called an *m-wallet*, which can be converted into cash at any mobile money agent location all over the country. In the initial stages of its establishment, the range of services offered was largely limited to person-to-person transfer. However, with the growing interest from stake-holders, coupled with competition among the mobile network operators (MNOs), service providers have gradually innovated to widen the range of services. Currently, most MNOs offer more complex functions like payment of utility bills, school fees, airtime purchase, direct purchase of goods and services and, to some extent, collection of government taxes. Recent developments in the mobile banking arena have made it possible for users to access their bank accounts using their mobile phones without having to

[6] Mobile money agents serve as outlet centers or cash points where users can exchange their e-float for cash and vice versa.
[7] LC1 is the smallest administrative unit in Uganda.
[8] One in four households reported possessing more than one mobile phone in the Mobile Money survey of 2014.

physically visit their bank branches, thanks to the partnership between MNOs and banks.[9] This is expected to raise financial inclusion especially at the lower end of the social spectrum while reducing the cost of access and use of basic financial services. With the rapid urbanization in Uganda over the past years, the number of people migrating to towns has been steadily increasing. Those who migrate to cities often extend financial support to their family members and friends in villages in the form of remittances and informal loans. The efficiency of this remittance system heavily relies on the quality of transport infrastructure as most of these transactions have traditionally been made through informal channels like physical movement of cash by the receiver, sender, and agents like bus and taxi drivers. Besides, the massive geographical dispersion between senders and receivers implies high transaction costs in terms of transport fares and travel time involved in sending and receiving money among family members and friends especially across geographically distant and remote locations. We thus postulate that mobile money lowers the transaction, time and transport costs associated with the usage of financial services, catalyzing their adoption even by rural households.

2. Data and Summary Statistics

This paper uses a combination of two data sources - the Research on Poverty, Environment and Agricultural Technology (RePEAT) and the Mobile Money Survey 2014 (MM2014). RePEAT is a panel household survey conducted jointly by the National Graduate Institute for Policy Studies (GRIPS), the Foundation for Advanced Studies on International Development (FASID) and Makerere University in four rounds between 2003 and 2012. The data collected include information on household consumption, incomes, agricultural input use and production from 940 rural households in 94 Local Council 1s (LC1s). We followed up 916 households that were interviewed in the last round of RePEAT in 2012 and conducted a MM2014 among these households between June and July 2014. We successfully interviewed 792 out of the 916 households and asked questions about the usage of mobile money, banks, SACCOs and Micro-finance Institutions (MFIs) as well as

[9] Major partnerships exist between *MTN Mobile Money* and Stanbic Bank, *M-Sente* and Standard Chartered Bank and *WaridPesa* and DFCU Bank.

financial services including savings, remittances and credit (both formal and informal). Analysis is based on 792 households that were interviewed in 2014, constructing financial access and usage variables from the MM2014 while information on household characteristics is obtained from RePEAT4[10]. The choice of rural households as our analysis sample is intended to portray the contribution of mobile money among the rural poor who are often excluded from the formal financial system.

We stratify our sample by mobile money adoption status and provide summary statistics in Table 1. Between RePEAT4 and MM2014, the proportion of households with at least on mobile money user increased almost two-fold from 38 percent to 70 percent. This reflects a rapid penetration rate within just five years since mobile money was introduced in Uganda in 2009. In the third round of RePEAT in 2009, barely one percent of the sample households had a mobile money user. The rapid adoption of mobile money services is partly attributed to the high adoption rate of mobile phones and the lack of rural coverage by formal financial institutions[11]. Over 80 percent of the households in MM2014 had at least one mobile phone with one in four households possessing more than one handset. The significantly higher rate of mobile phone possession among mobile money users is not surprising given the nature of the mobile money platform which uses the mobile phone as infrastructure for the services offered. In contrast, only 41 and 13 percent of mobile money adaptors and non-adaptors have at least one bank account, respectively. Table 1 further shows that households that adopt mobile money services have more educated heads with an average difference of two years of schooling.

Peer-to-peer remittance is the most commonly adopted function of the mobile money platform. The proportion of mobile money users who report having received remittances at least once in the 12 months before the MM2014 interview date is thus ten percent higher compared to non-users. Similarly, the amount of remittances received is twice as high at

[10] We were unable to construct a panel because financial access and usage variables are not available in RePEAT surveys except mobile money adoption and remittances.
[11] These include commercial banks and deposit-taking MFIs.

UGX 701,984 ($270) and UGX 324,883 ($ 125) for users and non-users, respectively[12]. Similarly, user households are more likely to save and borrow money and the amount saved and borrowed is notably higher. We postulate that mobile money provides a convenient channel not only for remittances but also for short-term savings mainly for school fees to be drawn at the onset of a new school term or for purchasing agricultural inputs when the planting season starts[13]. Mobile money users are generally wealthier than non-users both in terms of asset and land endowments. Heads of user households are one year younger and are less likely to be female. Regarding physical access to financial service providers, mobile money user households are located one kilometer to the mobile money agent while there are no significant differences in distance to banks because our sample is predominantly rural and majority of banks are located in the district town which is, on average, tens of kilometers away from the village center.

****************************TABLE 1 HERE**

3. Empirical Strategy

3.1. Adoption of Financial Service Providers

A household's decision to adopt a particular financial service provider depends on household and community characteristics in the form

$$Provider^{h}_{ijd} = 1\{\beta_1 X_{ij} + \beta_2 V_j + \eta_d + \varepsilon_{ijd} > 0\}, \quad (1)$$

$Provider^{h}_{ijd}$ is a dummy variable equal to one if household *i* living in village *j* in district *d* has at least one member who uses *h-th* service provider, where *h* comprises of Mobile Money Agent, bank, SACCO and micro-finance institutions. η_d captures district fixed effects and X_{ij} is a vector of household characteristics which include household size, log of asset value and land endowments, age, gender and education level of the household head

[12] The average exchange rate during the survey period was $1:UGX 2,600 (Bank of Uganda, 2014).

[13] Based on data and Focus Group Discussions, the two main purposes of receiving remittances, saving and borrowing money in the sample are to raise school fees and make farm investments which include hiring labor and buying inputs.

and a dummy for household mobile phone possession. V_j is a vector of observed village characteristics that could potentially influence service provider adoption. These include distance in kilometers from the village center to the nearest district town and distances to the nearest respective service provider location. Although we estimate (1) as a Probit model given the binary nature of our outcome variables, we also estimate it as a system of seemingly unrelated regressions (SUR) because the household's adoption decisions regarding these four service providers are possibly interdependent.

3.2 Frequency of Using Financial Service Providers.

The relative urban concentration of formal financial service providers (banks and MFIs) implies that physical access to financial institutions remains one of the major challenges for rural households to adopt financial services. Bringing these services closer to the rural households implies increased adoption power for households whose main adoption barrier is long distance to financial institutions[14]. We therefore examine whether physical distance to the service provider is associated with the frequency of using the respective service providers as households benefit from the convenience and time-and cost-saving benefits of service provider availability within close proximity to their villages. Since the variables capturing the usage frequency of financial service providers are left-censored, we modify equation (1) and adopt the following Tobit model approach

$$Freq_{ijd} = \{0, \gamma_1 X_{ij} + \gamma_2 V_j + \mu_d + u_{ijd}\} \qquad (2)$$ where;

$$u_{ijd} \mid X_{ij}, \gamma_2 V_j \sim N(0, \sigma^2)$$

The frequency of using a financial service provider is only observed if the household used the service provider at all while the outcome remains unobserved for non-user households such that OLS estimates may suffer from attenuation bias. The Tobit approach allows us to consistently estimate the frequency of using financial service providers by considering the outcome variable for non-users as censored at zero as the lower limit. Because the

[14] About 20 and 24 percent of the sample households who have never used banks and MFIs, respectively site long distance to service provider as the principal barrier.

households that decide to use mobile money, bank, SACCO and MFIs could systematically differ from their non-adopting counterparts, we also adopt a Heckman two-step procedure to jointly estimate the frequency of service provider usage and the selection of households into adopting these respective service providers.

$$\text{Outcome equation: } Freq_{ijd} = \begin{cases} \alpha_1 X_{ij} + \alpha_2 V_j + \kappa_d + e_{ijd} & if\ Adopt^*_{ijd} > 0 \\ - & if\ Adopt^*_{ijd} \leq 0 \end{cases} \quad (3)$$

$$\text{Selection Equation: } Adopt^*_{ijd} = \pi W_{ijd} + v_{ijd} \text{ and } Adopt_{ijd} = \begin{cases} 1\ if & Adopt^*_{ijd} > 0 \\ 0\ if & Adopt^*_{ijd} \leq 0 \end{cases}$$

The vector W is constituted by variables that are critical to the household's decision to adopt the respective service provider. It is generally assumed that errors in both the selection and outcome equations are normally distributed with zero mean and a constant variance σ^2. A further assumption underlying the Heckman Two-step procedure is that both v_{ijd} and e_{ijd} are independent of the explanatory variables (Wooldridge 2003, p562). In other words, the explanatory variables included in both the selection and outcome equations should be exogenous. Additionally, it is imperative to include an additional variable in the selection equation which is strongly correlated with the selection variables and does not appear in the outcome equations, otherwise the estimation of the frequency of service provider usage would be imprecise (see Wooldridge 2003, p565). We therefore include the log of distance in kilometers to the nearest mobile money agent, bank, SACCO and MFI in our selection equations to consistently estimate the frequency of using mobile money, banks, SACCOs and MFIs, respectively.

3.3. Usage of Financial Services

Financial services are broadly defined to include savings, credit, insurance and payment systems including remittances. Although supply-side factors like distance to the service provider may be important, demand-side factors like income, education and other critical household characteristics may deter a household from using financial services despite its close proximity to service providers. It is a general consensus in the literature that financial

inclusion is not only a matter of physical access to service providers but the available services should be affordable and convenient to use by the average. For mobile money services to complete this dual component, it must be true that mobile money agents are located closer to the villages which are generally un-served by formal financial institutions and that the services offered should be relatively cheaper. We are able to estimate the household's decision to save money, receive credit and remittances but we are unable to estimate the decision to adopt insurance services because our sample comprises of predominantly rural household members who either do not understand how insurance operates or they cannot afford the operational and transport costs associated with the service.

We estimate Probit versions of equation (1) in which the outcome variables take one if a household has at least one person who saved money, borrowed money or received any remittance in the past 12 months preceding the survey date. We then turn to the amount of savings made, credit and remittances received by all household members in the same period. Similar to the frequency of financial service provider usage described in section 3.2, the transaction amount of the respective services is only observed if a household used the service at all within the one-year period prior to the survey. We thus estimate Tobit and Heckman-type models (2) and (3) to cater for the censored nature of service amounts and control for potential selection bias where households that decide to save, borrow or receive remittances could systematically differ from their counterparts that do not use these services. The selection equation in this case is a probability that a household had at least one member who used a particular service and the outcome variable is the total amount of the service transacted within a period of one year prior to the interview date. In both regressions for adoption decision and service amounts, we add a dummy variable taking one if any member of the household is a user of mobile money to the vector of household characteristics.

4. Results

4.1 Adoption of Financial Service Providers

We present results for household adoption of the four financial service providers – mobile money agents, banks, SACCOs and MFIs in Table 2. Columns one through four report Probit results. A one percent increase in the distance from the village center to the nearest mobile money agent reduces the probability that a household adopts mobile money services by five percentage points. Distances to the nearest bank, SACCO and MFI do not significantly enter into the household decision to adopt these institutions. One possible explanation in the case of bank adoption is that no matter how close the household may be to the bank premises, sign-up documentation as well as actual and/or perceived cost of account opening and maintenance may impose additional restrictions to the up-take of bank accounts. The significantly positive coefficient on log of asset value rather stresses the relative importance of household wealth, implying that asset-wealthy households can afford to use bank services despite the long distances they have to travel to access these services.

************************************TABLE 2 HERE**********************************

In columns five through nine, we re-estimate the adoption decisions as an SUR system because the decisions made by the household to adopt any single service provider may depend on whether or not they have access to and can afford alternative service providers. In other words, these adoption decisions are possibly interdependent. Estimation results highly corroborate the Probit results both qualitatively and quantitatively. Across both specifications, the education level of the household head is positively associated with a higher likelihood of using mobile money and banks, which may reflect the literacy role in shaping financial behavior.

4.2. Frequency of Using Financial Service Providers

Table 3A presents results for the usage frequency of financial service providers. Conditional on adoption of service providers, the number of times household members use a particular service provider may differ depending on distance to service points and household characteristics. OLS estimates in Column 1 show that a one percent reduction in distance to the nearest mobile money agent translates into a 34 percent increase in the

number of times household members use mobile money services in a year. This is not surprising because the services offered through the mobile money platform are generally cheaper and bringing these services closer gives a high incentive for rural households to use them more frequently. OLS coefficients are however likely to be downwardly biased because the frequency of using financial service providers is only observed for those households who used them at least once in the 12 months before the interview date and a large fraction of households have censored observations for these frequency variables. In order to correct for this bias, we estimate Tobit models where zero is the lower limit for each outcome variable and report the results in even-numbered columns in Table 3A. The coefficient on the distance to the mobile money agent increases to 47 percent in Column 2. Having a migrant worker[15] increases the frequency of using mobile money by 60 percent, which represents additional 33 times in a year for each additional kilometer closer to the mobile money agent as evaluated at the mean annual frequency of mobile money usage of 65 times. Regarding the role of gender of household heads, female headed households use mobile money more frequently than male-headed counterparts. A possible reason for the positive coefficient on the previous two variables is that husbands leave villages in search for jobs in cities and towns and these use mobile money to remit part of their wage proceeds to their wives back in the villages who temporarily act as household heads in the absence of their husbands[16].

****************************TABLE 3A HERE******************************

Similar to the probability of service provider usage reported earlier, education of the household head and asset holding value increase the frequency of using mobile money but again, the distance to bank, SACCO and MFI does not significantly influence use frequency. An additional concern is that the households that select into using financial service providers could be systematically different along critical characteristics and this

[15] We define a migrant worker as a household member who lived in the household for less than 12 months in the past 12 months that preceded the interview date because they went to search for jobs outside their villages.

[16] We confirm from the data and through focus group discussions that majority of remittance senders and recipients are spouses.

may bias the observed negative relationship between distance and frequency of usage of financial service providers. We therefore estimate equation (2) in a Heckman Two-step approach in which the selection equation is estimated as a probit model for the adoption of service providers while the dependent variables in the outcome equations are the log of the number of times household members used the service provider in a year. The results reported in Table 3B[17] remain qualitatively similar to those reported previously and the inverse mills ratio is not significant in the bank, SACCO and MFI regressions, implying that selection bias is not a credible threat to our estimates. However, the significance of the mills ratio indicates potential downward selection bias in our OLS estimates of the frequency of using mobile money. The inclusion of the Inverse Mills ratio in the outcome regressions controls for potential selection bias in estimating the frequency of mobile money usage.

****************************TABLE 3B HERE********************************

4.3. Determinants of Financial Service Usage.

We now turn the attention to analyzing the determinants of household financial service adoption. We first estimate the decision of the household to save money, receive remittances and credit. Odd-numbered and even-numbered columns of Table 4 use, respectively, a dummy variable taking one if any household member uses mobile money and the distance from the household's village to the nearest mobile money agent as mobile money access measures in estimating equation (1). The dependent variables take one if any member of the household made any form of saving or received any credit or remittance within 12 months prior to the interview date. Having a mobile money user in the household increases the probability of saving, borrowing and receiving remittance by 25, 22 and 81 percentage points, respectively. Assets play a significant role in stimulating remittance receipt but do not systematically explain saving and credit patterns. Distance to the nearest

[17] We exclude selection equations in the Heckman results because the probability of using service providers has already been estimated in previous sections. The full Heckman results with selection questions are available upon request.

mobile money agent seems to matter strictly for remittances with no significant effect on the likelihoods of saving and borrowing money.

**************************TABLE 4 HERE*****************************

Estimating the likelihood of adopting financial services using binary outcome variables does not disclose the extent to which mobile money stimulates service financial transactions and conceals any possible heterogeneity in service amounts transacted across households. We thus estimate the amount of savings made and credit and remittances received 12 months before the interview date. In addition to the OLS estimates in the odd-numbered columns of Table 5, we present results from Tobit estimation of equation (2) in even-numbered columns since the amount of these financial services is left-censored for a significant proportion of our sample households. The dependent variables are the log of savings made, credit and remittances received by all household members in the previous 12 months. Both OLS and Tobit results show that the presence of a mobile money user in the household more than doubles the amount of money a household saves, borrows or receives in remittances in a one-year span, with just slight differences in coefficient sizes. As discussed in previous sections, we presuppose that rural households use mobile money to make temporary savings especially for school fees and financing agricultural investments like input purchase, labor hiring and land preparation. For similar purposes, households could use mobile money as a channel through which they solicit informal soft loans and remittances from family members and friends especially those working outside the village. Household size does not significantly affect credit and remittance amounts but reduces the amount of money saved, which could be partly attributed to the huge expenditures needs associated with large families that strain the saving ability of these households. Asset wealth plays an integral role in facilitating household savings; the elasticity of savings to asset value is averagely 21 percent. As previously argued, asset-rich household could use their assets as collateral to obtain larger amounts of credit relative to their asset-poor counterparts.

**************************TABLE 5 HERE*****************************

There is however a concern that households who save, borrow and receive remittances could be systematically different along critical characteristics from those who don't. To rule out the possibility of selection bias, we also estimate Heckman two-step models from equation (3) and present the results in Table 6. In order to increase precision in estimating the outcome variables, we include log of distance to the nearest mobile money agent in our selection models. This variable has a strong correlation with the household decision to adopt mobile money services but has no direct relationship with the amount of savings made, credit and remittances received by a household. Column 1 indicates that having a mobile money user in the household increases the amount of money saved by 60 percent while the amount of money borrowed and received as remittances increases by 72 percent and 62 percent, respectively, when a household changes from non-adoption to adoption status (Columns 3 and 5). The positive and significant coefficients on the mobile money dummy in the selection equations (even-numbered columns in Table 6) corroborate previously presented Probit results that mobile money adoption facilitates the up-take of financial services. Education of the household head augments financial service amounts although its coefficient is marginally significant in the remittance equation and insignificant in the savings equation. It is noteworthy that households headed by more educated members are either more financially literate or are more likely to have salary earners who may use their salaries as collateral to obtain formal credit from banks and MFIs. The saving and credit amounts increase by 17 percent and 20 percent, respectively for a percentage change in asset value. This is quite expected because wealthy households possibly have a larger disposable income that can be saved and use their asset base as collateral to obtain formal credit from banks and MFIs.

****************************TABLE 6 HERE********************************

4.4. Robustness checks.

4.4.1. Endogeneity of mobile money adoption.

In all previous results, we treated mobile money adoption as exogenous to the household. However, this is unlikely because households who normally save or borrow money and receive remittances may adopt mobile money services to ease the flow of these services. In this case, causation runs in the reverse direction and this implies potential endogeneity of mobile money adoption due to simultaneous effects. The default approach in this case would be to run instrumental variable regressions in a 2SLS framework using distance to the mobile money agent as an instrument for mobile money adoption. This variable satisfies both conditions of a valid instrument because it is strongly associated with a household's decision to adopt mobile money but has no direct effect on the amounts of savings, credit and remittances. We however do not take this approach and instead add a control function approach to our Tobit models[18] to establish a causal link between mobile money adoption and financial service amounts while taking into account the corner solution problem in our outcome variables. In the first step, we run probit models for mobile money adoption on all exogenous variables including log of distance to the nearest mobile money agent (results not shown) and obtain predicted residuals which we add as an extra covariate in the second-step outcome regressions. Table 7 presents these results with and without the predicted residuals as a control and the mobile money coefficient remains strongly significant across all specifications.

The positive coefficient on the predicted residuals in savings and credit regressions indicates that the endogenneity of mobile money imposed an upward bias on our Tobit estimates of these variables. Luckily, the inclusion of auxiliary residuals in our Tobit-CF results not only indicates proof of endogeneity of the mobile money variable but also alleviates its confounding power (Wooldridge, 2003; Mason, 2013). We therefore take Tobit-CF results as preferred to the standard Tobit results in this case. Since there is no evidence that endogeneity is a serious threat to our remittance results in Column 6, we continue to treat Column 5 results as equally meaningful.

4.4.2. Alternative Explanations.

[18] From this point throughout the analysis that follows, we refer to this as Tobit-CF.

We have so far assumed that the distance to the mobile money agent is independent of household and village characteristics because mobile money agents were, in most cases, already established shop keepers in the villages selling household merchandize and airtime cards, who later took on mobile money as an additional service on their service menus when this financial platform was introduced in the country in 2009. This differs from the case where non-resident mobile money entrepreneurs self-select into the villages they perceive to be profitable. Nonetheless, we appreciate the possibility that resident or already established shop keepers could decide whether or not to extend their range of services to cover mobile money, basing on the local economic potential of villages, which could be a reflection of potential demand from the residents. A profit-oriented mobile money agent would consider the local economic potential of the village and locate in the village town, which is often closer to the district headquarters (district town). We therefore include distance to the nearest district town to capture such effects in our Tobit and Heckman regressions in Table 7 and Table 8, respectively which does not change our results. Moreover, capturing villages fixed effects using village dummies does not change our results. The second concern relates to the possibility that banks, SACCOs and MFIs could have mobilized savings and credit during or prior to our study period. If this was the case, our estimates would be capturing the spurious correlation between mobile money adoption and the up-take of financial services. However, for 90 percent of our sample villages, the nearest banks and MFIs are available in the district town and controlling for this distance provides a remedy to this problem. It is important to note, however, that SACCOs are available in most villages and the distance to the district town does not necessarily affect their power to infiltrate and mobilize financial service up-take among rural households. We therefore control for the distance to the nearest SACCO, a dummy variable for household membership to SACCOs and binary indicators for whether a SACCO is present in the village in Tables 7 and 8 and our results remain highly robust[19].

[19] We control for these variables separately due to collinearity. However, we report only results with distance to SACCO to save space because results were qualitatively similar across all specifications. Since our

****************************TABLE 7 HERE********************************

****************************TABLE 8 HERE********************************

5. Conclusion

As lack of access to financial services remains a key challenge to many people in developing countries, the event of mobile phone-based financial platforms is expected to change the financial livelihoods of the rural poor. Mobile money – a financial innovation that allows the user to deposit, exchange and withdraw money using their mobile phone – is a cheap and convenient option for majority of the financially excluded rural populace. We explore the role of this financial product in shaping the financial behavior of rural households in Uganda using a randomly selected sample of 792 households. We provide empirical evidence that mobile money leverages the financial access constraint of rural households and stimulates their uptake of financial services. Accounting for possible selection bias, endogeneity of mobile money adoption at the household level and the influence local economic conditions at the village level, we provide robust evidence that the amounts of remittances, credit and savings made by mobile money users is significantly higher than that of non-users. Our results feed into existing literature in two ways; first, by profiling the potential of mobile money to drive remittance flow and second, by illustrating that reducing service cost and distance to service points improves the saving behavior of rural households. This paper uniquely contributes to the literature by extending the analysis of the potential of mobile money beyond the traditional peer-to-peer remittances to credit and saving services. We illustrate that the main mechanism of this observed effect is the reduction of distance to service points, as mobile money agents are located in almost all the sub-counties in our study areas. We therefore postulate that access to mobile money services reduces the burden in terms of transport and time cost associated with remittance and informal credit exchange among family members and friends and boosts temporary savings to facilitate school fees and farm investments. The policy implication of this article

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Tobit and Heckman results in tables 7 and 8 are robust to endogeneity and alternative explanations, they constitute our preferred results.

is that designing cheap and pro-poor financial products has a great potential to foster financial inclusion especially among the rural poor who are often underserved or un-served by the largely urban-based formal financial institutions.

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Table 1: Descriptive Statistics by Mobile Money Adoption Status

VARIABLES	Non-adopters		Adopters	
	Mean	SD	Mean	SD
1 if saved money in 12 months	0.5583	0.4976	0.8042	0.3972
1 if borrowed money in 12 months	0.4793	0.5006	0.6889	0.4633
Total amount saved in 12 months	195,765	430,581	664,167	1,414,663
Total amount borrowed in 12 months	137,582	305,433	619,167	1,247,654
1 if owns bank account	0.1208	0.3266	0.4120	0.4926
1 if belongs to SACCO	0.5372	0.4996	0.6543	0.4760
1 if used an MFI	0.0207	0.1425	0.1063	0.3407
1 if owns any mobile phone	0.5443	0.4991	0.8914	0.3114
Total value of assets	680,615	1,344,015	1,235,559	2,125,649
Land size (hectare)	5.0227	5.5172	6.9086	8.7537
Total value of remittances	324,883	825,660	701,984	1,350,213
1 if received remittance	0.6303	0.4838	0.7271	0.4458
Household size	6.2614	3.2955	7.3293	3.4789
Age of household head	52.8326	15.3233	51.6442	13.5700

1 if female head	0.1743	0.3801	0.1429	0.3502
Education of household head	4.4052	3.4964	6.4794	3.8450
1 if bank available in LC1	0.0586	0.2353	0.1162	0.3207
1 if mobile money agent available in LC1	0.3515	0.4784	0.4754	0.4998
1 if MFI available in LC1	0.0753	0.2645	0.0986	0.2984
1 if SACCO available in LC1	0.5607	0.4973	0.6056	0.4891
Dsitance from LC1 to nearest bank	54.8450	87.7279	53.1988	85.8864
Dsitance from LC1 to nearest MM Agent (km)	4.7339	4.1089	3.7618	3.8808
Dsitance from LC1 to nearest MFI (km)	27.3117	29.2859	23.8446	27.5284
Dsitance from LC1 to nearest SACCO (km)	5.8575	10.7604	6.1781	11.6443
Observations	242		574	

Note: Authors' Compilation based on RePEAT 2012 and Mobile Money Survey 2014.

Table 2: Determinants of Financial Service Provider Usage

VARIABLES	(1) MM Agent	(2) Bank	(3) SACCO	(4) MFI	MM Agent	Bank	SACCO	MFI
Log(distance to MM Agent)	-0.0523*				-0.0495*			
	(0.0286)				(0.0258)			
Education of household head	0.0205***	0.0282***	0.000335	0.00423	0.0181***	0.0240***	-0.000343	0.00492
	(0.00500)	(0.00537)	(0.00539)	(0.00295)	(0.00451)	(0.00455)	(0.00492)	(0.00308)
Age of household head	-0.000402	-0.0131	0.0101	-0.00612	0.000603	-0.0112	0.00817	-0.00525
	(0.00793)	(0.00868)	(0.00859)	(0.00478)	(0.00713)	(0.00718)	(0.00779)	(0.00489)
Log(land size)	0.0589**	0.0489*	0.0449	0.00940	0.0433*	0.0427*	0.0502*	0.00859
	(0.0291)	(0.0296)	(0.0310)	(0.0150)	(0.0253)	(0.0255)	(0.0276)	(0.0173)
Household size	0.0152***	0.000404	0.00350	0.00473	0.0129***	-0.000912	0.00353	0.00732**
	(0.00567)	(0.00590)	(0.00618)	(0.00303)	(0.00500)	(0.00504)	(0.00546)	(0.00343)
1 if female head	0.0312	0.0377	-0.0294	-0.0270	0.0248	0.0426	-0.0273	-0.0225
	(0.0450)	(0.0573)	(0.0548)	(0.0220)	(0.0452)	(0.0455)	(0.0494)	(0.0309)
Log value of total assets	0.0452**	0.0959***	-0.0147	0.00531	0.0447***	0.0898***	-0.0158	-0.00136
	(0.0186)	(0.0199)	(0.0189)	(0.0109)	(0.0162)	(0.0163)	(0.0177)	(0.0111)
Log(distance to bank)		0.00920				-0.00791		
		(0.0168)				(0.0150)		
Log(distance to SACCO)			0.00537				0.00315	
			(0.0215)				(0.0195)	
Log(distance to MFI)				-0.00514				-0.00648
				(0.00955)				(0.0110)
Constant					-0.174	-0.677**	0.700**	0.132
					(0.269)	(0.274)	(0.297)	(0.187)
Observations	773	767	780	606	769	769	769	769
R-squared					0.171	0.188	0.123	0.103

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Columns (1)-(4) represent Probit results while columns (5)-(8) represent results from Seemingly Unrelated Regression (SUR) estimation. Included controls not shown in the table

include district dummies and a squared term of age of the household head

Table 3A: Frequency of Financial Institution Usage: OLS and Tobit

	Mobile Money		Bank		SACCO		MFI	
	OLS	Tobit	OLS	Tobit	OLS	Tobit	OLS	Tobit
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log(distance to MM Agent)	-0.345***	-0.471***						
	(0.0776)	(0.110)						
1 if migrant worker present	0.467***	0.603***	0.0703	0.205	-0.0858	-0.0873	0.131**	1.421**
	(0.140)	(0.193)	(0.0948)	(0.269)	(0.140)	(0.222)	(0.0641)	(0.680)
Education of household head	0.0830***	0.124***	0.0561***	0.173***	-0.0112	-0.0181	0.00346	0.0555
	(0.0160)	(0.0224)	(0.0114)	(0.0307)	(0.0167)	(0.0266)	(0.00624)	(0.0796)
Age of household head	0.0101	0.0181	-0.0215	-0.0656	0.0274	0.0513	-0.00770	-0.114
	(0.0312)	(0.0468)	(0.0195)	(0.0609)	(0.0291)	(0.0482)	(0.0136)	(0.146)
Household size	0.0306	0.0520**	-0.00126	-0.00716	0.00508	0.00325	0.0133	0.133
	(0.0191)	(0.0259)	(0.0140)	(0.0378)	(0.0199)	(0.0323)	(0.00937)	(0.0908)
1 if female head	0.379**	0.461*	0.0308	0.0357	-0.236	-0.368	-0.0316	-0.456
	(0.180)	(0.256)	(0.111)	(0.376)	(0.175)	(0.289)	(0.0612)	(0.994)
Log value of total assets	0.310***	0.424***	0.217***	0.670***	-0.0440	-0.0429	0.0385*	0.482
	(0.0622)	(0.0871)	(0.0432)	(0.121)	(0.0614)	(0.0986)	(0.0227)	(0.297)
Log(distance to bank)			0.0263	0.0851				
			(0.0331)	(0.0927)				
Log(distance to SACCO)					-0.0317	-0.0529		
					(0.0599)	(0.0935)		
Log(distance to MFI)							-0.00652	0.0722
							(0.0210)	(0.259)
Constant	-2.392**	-4.830***	-2.067***	-10.05***	2.163**	1.044	-0.289	-13.36**
	(1.048)	(1.554)	(0.707)	(2.165)	(1.025)	(1.681)	(0.474)	(5.302)
Observations	762	762	776	776	773	773	771	771
R-squared	0.163		0.107		0.018		0.024	

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Included controls not shown in the table include district dummies, a squared term of age of the household head and log of land holding size

Table 3B: Frequency of Using Financial Service Providers: Heckman Two-step Model

VARIABLES	(1) Mobile Money	(2) Bank	(3) SACCO	(4) MFI
Log(distance to MM Agent)	-0.174**			
	(0.0791)			
Education of household head	0.00495	0.00504	-0.00689	-0.0236
	(0.0176)	(0.0164)	(0.0116)	(0.0501)
Age of household head	-0.00981	-0.0208	-0.0153	-0.0176
	(0.0281)	(0.0265)	(0.0196)	(0.0690)
Age of household head 2	5.23e-05	0.000180	9.73e-05	7.19e-05
	(0.000255)	(0.000233)	(0.000181)	(0.000603)
Log(land size)	-0.138	-0.0942	-0.0669	-0.445**
	(0.0916)	(0.0773)	(0.0633)	(0.219)
Household size	-0.0120	0.0120	0.0152	-0.0237
	(0.0183)	(0.0161)	(0.0138)	(0.0426)
1 if female head	0.267	0.0578	-0.0737	-0.111
	(0.173)	(0.176)	(0.123)	(0.445)
Log value of total assets	0.171***	0.0446	-0.114***	0.314*
	(0.0603)	(0.0595)	(0.0422)	(0.171)
Log(distance to bank)		-0.0209		
		(0.0435)		
Log(distance to SACCO)			-0.0127	
			(0.0386)	
Log(distance to MFI)				-0.243*
				(0.138)
Inverse Mills Ratio	-0.742***	0.161	-0.187	-0.130
	(0.266)	(0.173)	(0.126)	(0.559)
Constant	2.004*	2.173*	5.383***	0.802
	(1.067)	(1.112)	(0.710)	(2.484)
Observations	756	775	770	789

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Included controls not shown in the table include district dummies

Table 3C: Frequency of Using Financial Service Providers: Tobit and Heckman

VARIABLES	Mobile Money		Bank		SACCO		MFI	
	Tobit	Heckman	Tobit	Heckman	Tobit	Heckman	Tobit	Heckman
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log(distance to MM Agent)	-0.471***	-0.174**						
	(0.110)	(0.0791)						
1 if migrant worker present	0.603***	0.00495	0.205	0.00504	-0.0873	-0.00689	1.421**	-0.0236
	(0.193)	(0.0176)	(0.269)	(0.0164)	(0.222)	(0.0116)	(0.680)	(0.0501)
Education of household head	0.124***	-0.00981	0.173***	-0.0208	-0.0181	-0.0153	0.0555	-0.0176
	(0.0224)	(0.0281)	(0.0307)	(0.0265)	(0.0266)	(0.0196)	(0.0796)	(0.0690)
Age of household head	0.0181	5.23e-05	-0.0656	0.000180	0.0513	9.73e-05	-0.114	7.19e-05
	(0.0468)	(0.000255)	(0.0609)	(0.000233)	(0.0482)	(0.000181)	(0.146)	(0.000603)
Household size	0.0520**	0.267	-0.00716	0.0578	0.00325	-0.0737	0.133	-0.111
	(0.0259)	(0.173)	(0.0378)	(0.176)	(0.0323)	(0.123)	(0.0908)	(0.445)
1 if female head	0.461*	0.171***	0.0357	0.0446	-0.368	-0.114***	-0.456	0.314*
	(0.256)	(0.0603)	(0.376)	(0.0595)	(0.289)	(0.0422)	(0.994)	(0.171)
Log value of total assets	0.424***		0.670***	-0.0209	-0.0429		0.482	
	(0.0871)		(0.121)	(0.0435)	(0.0986)		(0.297)	
Log(distance to bank)			0.0851			-0.0127		
			(0.0927)			(0.0386)		
Log(distance to SACCO)					-0.0529			-0.243*
					(0.0935)			(0.138)
Log(distance to MFI)		2.004*		2.173*		5.383***	0.0722	0.802
		(1.067)		(1.112)		(0.710)	(0.259)	(2.484)
Constant	-4.830***		-10.05***		1.044		-13.36**	
	(1.554)	756	(2.165)	775	(1.681)	770	(5.302)	789
Observations	762		776		773		771	

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Included controls not shown in the table include district dummies, a squared term of age of the household head and log of land holding size

Table 4: Determinants of Financial Service Usage

	Pr(Savings=1)		Pr(Credit=1)		Pr(Remittance=1)	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
1 if used mobile money	0.249***		0.220***		0.815***	
	(0.0407)		(0.0426)		(0.0298)	
Education of household head	0.00671	0.0112**	0.00472	0.00994*	0.000236	0.0176***
	(0.00500)	(0.00486)	(0.00538)	(0.00530)	(0.00595)	(0.00508)
Age of household head	0.00523	0.00631	0.0118	0.0106	-0.0154**	-0.0105
	(0.00763)	(0.00748)	(0.00882)	(0.00904)	(0.00723)	(0.00753)
Age of household head 2	-7.03e-05	-7.96e-05	-0.000126	-0.000114	0.000137**	9.32e-05
	(6.81e-05)	(6.75e-05)	(8.01e-05)	(8.27e-05)	(6.21e-05)	(6.91e-05)
Log(land size)	0.00452	0.0174	-0.00422	0.00852	0.0267	0.0589**
	(0.0282)	(0.0275)	(0.0306)	(0.0299)	(0.0336)	(0.0283)
Household size	-0.00525	-0.00210	0.00118	0.00405	0.0133**	0.0186***
	(0.00535)	(0.00535)	(0.00592)	(0.00591)	(0.00569)	(0.00585)
1 if female head	0.0149	0.0248	-0.0517	-0.0409	-0.0577	-0.0127
	(0.0464)	(0.0450)	(0.0539)	(0.0530)	(0.0472)	(0.0475)
Log value of total assets	0.0249	0.0345*	-0.0109	-0.000317	0.0494**	0.0655***
	(0.0181)	(0.0178)	(0.0191)	(0.0187)	(0.0194)	(0.0179)
Log(distance to MM Agent)		-0.0213		0.0284		-0.0457*
		(0.0273)		(0.0306)		(0.0272)
Observations	772	779	780	787	748	755

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Included controls not shown in the table include district dummies.

Table 5: Mobile Money and the Amount of Remittances, Credit and Savings: OLS Vs Tobit

	Savings		Credit		Remittance	
VARIABLES	OLS	Tobit	OLS	Tobit	OLS	Tobit
1 if used mobile money	1.492***	1.699***	1.108***	0.954***	1.727***	1.537***
	(0.200)	(0.227)	(0.146)	(0.133)	(0.182)	(0.160)
1 if migrant worker present	0.0174	0.0848	-0.244	-0.210	-0.0724	-0.0644
	(0.210)	(0.225)	(0.167)	(0.134)	(0.193)	(0.162)
Education of household head	0.0397	0.0415	0.0361	0.0310*	0.0383	0.0341
	(0.0273)	(0.0288)	(0.0221)	(0.0172)	(0.0250)	(0.0208)
Age of household head	0.00539	0.0112	0.00152	0.00131	-0.00386	-0.00343
	(0.0415)	(0.0455)	(0.0346)	(0.0268)	(0.0331)	(0.0325)
Age of household head 2	-0.000223	-0.000300	-5.34e-05	-4.59e-05	0.000140	0.000125
	(0.000373)	(0.000413)	(0.000318)	(0.000242)	(0.000299)	(0.000294)
Log(land size)	0.0251	0.00205	0.0139	0.0120	0.0948	0.0843
	(0.156)	(0.158)	(0.125)	(0.0944)	(0.140)	(0.114)
Household size	-0.0604*	-0.0640**	-0.00563	-0.00484	0.0161	0.0144
	(0.0308)	(0.0318)	(0.0225)	(0.0188)	(0.0274)	(0.0228)
1 if female head	-0.280	-0.307	-0.227	-0.195	0.379	0.338
	(0.266)	(0.289)	(0.193)	(0.170)	(0.236)	(0.206)
Log value of total assets	0.202**	0.218**	0.128*	0.110*	0.0761	0.0678
	(0.0998)	(0.102)	(0.0749)	(0.0604)	(0.0860)	(0.0733)
Constant	8.495***		9.455***		6.240***	
	(1.667)		(1.312)		(1.381)	
Observations	785	785	785	785	785	785
R-squared	0.184		0.180		0.231	

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Included controls not shown in the table include district dummies.

Table 6: Mobile Money and the Amount of Remittances, Credit and Savings: Heckman Two-step Model

	Savings		Credit		Remittance	
VARIABLES	Log(Amount)	Pr(S=1)	Log(Amount)	Pr(C=1)	Log(Amount)	Pr(R=1)
1 if used mobile money	0.607***	0.733***	0.720***	0.570***	0.622***	0.249*
	(0.146)	(0.128)	(0.131)	(0.124)	(0.175)	(0.132)
Education of household head	0.0156	0.00808	0.0493***	0.0141	0.0297*	-0.00893
	(0.0142)	(0.0169)	(0.0141)	(0.0160)	(0.0165)	(0.0173)
Age of household head	-0.00844	-0.00862	-0.0211	0.00134	0.0235	-0.0268
	(0.0231)	(0.0256)	(0.0232)	(0.0248)	(0.0254)	(0.0273)
Log(land size)	0.111	-0.0158	0.0633	0.0191	0.129	0.288***
	(0.0782)	(0.0954)	(0.0773)	(0.0908)	(0.0877)	(0.103)
Household size	-0.0179	-0.0355**	-0.0141	-0.000807	0.0121	-0.0227
	(0.0166)	(0.0179)	(0.0158)	(0.0171)	(0.0172)	(0.0188)
1 if female head	-0.123	-0.125	-0.119	-0.167	-0.168	0.537***
	(0.149)	(0.159)	(0.150)	(0.151)	(0.155)	(0.178)
Log value of total assets	0.167***	0.145**	0.199***	-0.0121	0.105*	0.280***
	(0.0536)	(0.0610)	(0.0501)	(0.0577)	(0.0573)	(0.0632)
Constant	10.83***	-1.214	10.31***	0.404	8.756***	-3.141***
	(0.927)	(1.179)	(0.885)	(1.153)	(0.993)	(1.207)
Observations	781	781	780	780	785	776

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Included controls not shown in the table include district dummies and a squared term of age of household head

Table 7: Mobile Money and the Amount of Remittances, Credit and Savings: Tobit Model with CF

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Log(Saving Amount)		Log(Credit Amount)		Log(Remittance Amount)	
1 if used mobile money	1.731***	1.529***	0.965***	0.890***	0.766**	0.840**
	(0.234)	(0.251)	(0.123)	(0.133)	(0.364)	(0.387)
Fitted values		1.517**		0.650*		-0.604
		(0.671)		(0.368)		(1.044)
Log(Distance to district town)	-0.0554	-0.0509	-0.0277	-0.0205	-0.170	-0.138
	(0.154)	(0.154)	(0.0964)	(0.0969)	(0.284)	(0.284)
1 if migrant worker present	0.0620	0.00338	-0.217	-0.236*	0.750**	0.775**
	(0.235)	(0.236)	(0.142)	(0.142)	(0.355)	(0.361)
1 if SACCO available in LC1	0.117	0.127	0.0110	0.0135	0.377	0.421
	(0.267)	(0.268)	(0.160)	(0.161)	(0.413)	(0.414)
Education of household head	0.0329	0.00728	0.0308*	0.0191	0.0351	0.0461
	(0.0292)	(0.0310)	(0.0184)	(0.0197)	(0.0448)	(0.0478)
Age of household head	0.0129	0.0127	-0.00335	-0.00220	-0.0160	-0.00632
	(0.0473)	(0.0475)	(0.0290)	(0.0291)	(0.0690)	(0.0691)
Log value of land currently held	0.0674	-0.00721	0.0348	-0.00304	0.491*	0.527*
	(0.170)	(0.174)	(0.106)	(0.107)	(0.265)	(0.271)
Household size	-0.0664*	-0.0854**	-0.00351	-0.0140	-0.0392	-0.0321
	(0.0346)	(0.0361)	(0.0188)	(0.0196)	(0.0507)	(0.0519)
1 if female head	-0.311	-0.327	-0.211	-0.222	1.122***	1.101***
	(0.306)	(0.308)	(0.163)	(0.164)	(0.411)	(0.412)
Log value of total assets	0.190*	0.140	0.114*	0.0937	0.993***	1.011***
	(0.112)	(0.113)	(0.0633)	(0.0652)	(0.158)	(0.160)
Observations	770	765	770	765	767	762

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Included controls not shown in the table include district dummies and a squared term of age of household head.

Table 8: Mobile Money and the Amount of Remittances, Credit and Savings: Heckman (with full controls)

	Savings		Credit		Remittance	
VARIABLES	Log(Amount)	Pr(S=1)	Log(Amount)	Pr(C=1)	Log(Amount)	Pr(R=1)
1 if used mobile money	0.605***	0.742***	0.718***	0.581***	0.422***	0.233*
	(0.152)	(0.128)	(0.133)	(0.125)	(0.154)	(0.133)
Log(Distance to district town)	-0.00168	0.129	0.000736	0.756	-0.0343	-1.590
	(0.0835)	(1.029)	(0.0787)	(1.019)	(0.113)	(1.308)
1 if SACCO available in LC1	-0.0794	-0.413	-0.00648	-1.138	0.294*	-0.576
	(0.134)	(1.197)	(0.131)	(1.201)	(0.166)	(1.394)
Education of household head	0.0157	0.00368	0.0494***	0.0138	0.0328*	-0.00886
	(0.0144)	(0.0170)	(0.0142)	(0.0161)	(0.0184)	(0.0174)
Age of household head	-0.0101	-0.00639	-0.0218	-0.000615	0.0248	-0.0233
	(0.0234)	(0.0257)	(0.0234)	(0.0250)	(0.0298)	(0.0274)
Log value of land currently held	0.120	-0.00342	0.0625	0.0257	0.0386	0.291***
	(0.0806)	(0.0959)	(0.0795)	(0.0913)	(0.104)	(0.104)
Household size	-0.0191	-0.0354**	-0.0144	-0.000207	-0.0215	-0.0229
	(0.0169)	(0.0180)	(0.0159)	(0.0172)	(0.0206)	(0.0189)
1 if female head	-0.138	-0.111	-0.127	-0.166	-0.00524	0.549***
	(0.151)	(0.160)	(0.152)	(0.152)	(0.190)	(0.180)
Log value of total assets	0.160***	0.129**	0.197***	-0.0101	0.547***	0.271***
	(0.0545)	(0.0613)	(0.0506)	(0.0583)	(0.0736)	(0.0637)
Constant	11.00***	-0.792	10.35***	-1.192	4.175***	0.965
	(0.965)	(2.558)	(0.906)	(2.498)	(1.308)	(3.103)
Observations	766	766	765	765	762	762

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Included controls not shown in the table include district dummies and a squared term of age of household head.