Mobile Money, Risk Sharing and Educational Investment: Panel Evidence from Rural Uganda

Rayner Tabetando[1] and Tomoya Matsumoto[2]

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Abstract

We examine the impact of the rapidly expanding mobile banking service "mobile money" on rural households' ability to smooth investment in schooling after a negative shock. We find that, while negative shocks induces a 12.8 percent decrease in per school-age child educational expenditure for households who do not use mobile money, the schooling investment for mobile money users is unaffected. The underlying mechanism is the increased in remittance receipt and the diversity of senders owing to the reduction in transactions cost provided by mobile money. We show that our results are robust to alternative mechanisms. We use the expansion in mobile money agent network as an exogenous variation in access to mobile money

Keywords: Risk sharing, Mobile money, Schooling, Uganda

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[1] Tabetando: National Graduate Institute for Policy Studies, 7-22-1 Roppongi, Minato-ku, Tokyo106-8677, Japan (email:doc14163@grips.ac.jp)
[2] Matsumoto: National Graduate Institute for Policy Studies, 7-22-1 Roppongi, Minato-ku, Tokyo106-8677, Japan (email: tmatsumo@grips.ac.jp)

1 Introduction

Education is fundamental to development and growth (Schultz, 1961; Becker, 1964; Bowles and Gintis, 1975; Lucas, 1988; World Bank, 1993; King, 2011). As such International organizations and governments have made tremendous efforts to realize universal education, whereby every child has access to schools. As a consequence, access to educational services has improved dramatically in developing countries, especially in the last two decades (UNESCO, 2015; African Development Bank, 2011). However, there are still many children who cannot go to school or who drop out at early stages of education such as at the primary or secondary school level (UNDP, 2015; UNICEF, 2015). It is often the case that financial constraints that parents face are the biggest obstacle to keeping their children in schools (Flug et al 1998; Chevalier and Lanot 2011).

Poor households in developing countries face substantial risk yet they have very limited access to basic formal insurance and credit markets. This restricts them from investing in business, health, and education, to smooth consumption and to escape from poverty. To bridge this gap, formal and informal institutions enabling household to pool and share resources have emerged. This paper shows how sharing resources through a mobile phone based money transfer service provides simultaneous benefits to rural households: Relaxes household credit constraint enabling households to invest in a lumpy investment such as schooling and reduces schooling investment variance by insuring against idiosyncratic shocks.

The benefit of resource sharing to insurance is well established. Pooling resources from multiple households enables consumption and investment to depend on aggregate shocks as idiosyncratic shocks are partially or completely insured. In developing countries insurance networks provide a vital means by which households share risk. The insurance provided by family and extended network is usually incomplete due to moral hazards and information asymmetry amongst others.

Families and social network in Uganda are dispersed across large distances due to rural-urban migration. Migrant workers often extend financial support to their family members and friends in villages in the form of remittances and informal loans. Before the advent of mobile money in the country, the efficiency of such informal risk sharing arrangements heavily relied 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 sender, and agents like bus and taxi drivers. Besides, such channels are often risky and involve high transaction costs in terms of transport fares and travel time incurred in sending and receiving money among family members and friends especially across geographically distant and remote locations.

Mobile technologies, however, have started changing the financial environment of developing countries recently. Rapid expansions in telecommunication networks and access to mobile phones even for the most deprived in developing countries have provided a new and cheap platform that enables the rural poor to pool and share resources in a cost effective way. Mobile banking is appealing to the poor as it overcomes many of the challenges associated with traditional banking services. Access to mobile banking services

is faster, cheaper and less procedural. The range of services offered via mobile banking has grown steadily from money transfer (remittances) to savings and deposit accounts as well as access to loans and payment of bills. Among these, money transfer service has by far been the most successful as it enables users to respond to shocks and economic opportunities in a timely and cost effective manner.

There is growing empirical evidence of the development potentials inherent in mobile banking services, in particular, so called "mobile money"[3] .Jack and Suri (2014) provide evidence of consumption smoothing associated with mobile money adoption in Kenya. In the context of rural Uganda, Munyegera and Matsumoto (2016) provide evidence of greater per capita consumption and remittance receipts associated with mobile money adoption. Mobile money adopters enjoy greater welfare as they receive remittances more frequently and in larger amounts relative to non-adopters. Apart from consumption, mobile money has been linked to agricultural investment (Kirui et al.,2013; Kikulwe et al.,2014). Both studies reveal that mobile money adoption among small holder farmers in Kenya leads to greater input use and the commercialization of produce thereby increasing market access and household income. Munyegera and Matsumoto (2017) show evidence of increased savings associated with mobile money adoption in rural Uganda. Apart from money transfer, Blumenstock et al (2016) show evidence of increased transfer of air time in response to natural disaster in Rwanda. On a whole, Jack and Suri (2016) provide evidence

[3] Mobile money is a financial service provided by mobile network operators, which allows its users to make peer-to-peer money transfers. The users can open a mobile SIM card-based mobile money account, deposit and withdraw cash on it at mobile money agents. Once the users open the account, they can make basic financial transactions such as depositing money, sending remittance, paying school fees and purchasing goods via their mobile phones

that Kenyan households which have adopted mobile money are less likely to fall into extreme poverty.

This paper contributes to the literature on risk sharing by examining the impact of mobile money adoption on insuring educational investment of rural households against idiosyncratic shocks. We examine the impact of mobile money on relaxing financial constraint there by enabling rural households to demand more of private school education relative to public school[4]. We gauge the impact of mobile money adoption on per school-age child educational expenditure[5] and choice of schooling in the context of tuition-free public education and rapid expansion in private education provision. We mainly use 3-year balanced panel data covering 711 households collected from 94 communities in rural Uganda in 2009, 2012 and 2015. Our longitudinal data covers the period prior to the establishment of mobile money and the period of rapid expansion in mobile money.

We find that, while negative shocks induces a 12.8 percent decrease in per school-age child educational expenditure for households who do not use mobile money, the schooling investment for mobile money users is unaffected. The underlying mechanism is an increased in remittance receipt and the diversity of senders owing to the reduction in transactions cost provided by mobile money

The rest of the paper is organized as follows. In section II, we provide background information about mobile money in Uganda. Section III presents a theoretical framework and testable hypothesis. Section IV discusses the data and descriptive evidence, followed

[4] Private schools in Uganda are perceived to provide better quality education compared to public schools
[5] Throughout this study per capita educational expenditure refers to educational expenditure per schooling age(5 to 16 year old) child

by the empirical strategy in section V. The Estimation results are discussed in section VI. Robustness checks are shown in section VII while section VIII concludes.

2 Background of Mobile Money services in Uganda

Following the success of Safaricom's M-PESA in Kenya, Mobile Telephone Network(MTN)-Uganda launched the MTN Mobile Money[6] service in March 2009. It was the first mobile banking service in Uganda and proved to be a viable strategy in expanding MTN's market share. Airtel Uganda established a similar mobile banking service, dubbed Airtel Money, in June of the same year. This attracted Uganda Telecom's M-Sente in March 2010, followed by Warid Pesa from Warid Telecom in December 2011, and Orange Money from Orange Telecom in the first half of 2012 (Uganda Communications Commission-UCC 2012).

From figure 1, mobile money adoption has expanded rapidly ever since its introduction in 2009. The number of subscribers has jumped from 3 million in 2011 to 12.1 million in 2013 and to 21 million in 2016, representing a sevenfold increase within 5 years. The number of mobile money agent has also increased astronomically from less than 2,000 agents in 2009 to 133,000 agents in 2016. It thus seem that the expansion in mobile money is driven by the expansion in the number of mobile money agents.

Though cash transfers remain the most widely used mobile money service, there are other services with a strong potential to induce investment. In addition to individual savings and deposit accounts, collective/group accounts for rotating savings and credit associations

[6] Given its pioneering role and dominant market share, the term mobile money is commonly used to refer to all mobile banking services in Uganda. In this paper we use the term Mobile Money and mobile banking interchangeably.

(ROSCAs) or savings and credit cooperative organizations (SACCOs), enabling group members to access credits/loans[7] are also offered.

The rapid expansion of mobile banking services is partly due to high demand for financial services in a context of very limited access to formal banking services especially among rural residents. From our data drawn from rural Uganda, only 38 out of 940 households had a bank account in 2003. Over 78.5 percent of rural dwellers live beyond 5 km to the nearest commercial bank as compared to 42.3 percent of urbanites. Apparently the 24 commercial banks alongside their 400 branches and 835 ATM's operating in Uganda leaves a sizeable proportion of the population excluded from formal financial services (Bank of Uganda, Finscope survey, 2013). Under such a financial environment in Uganda, mobile money has been disseminated at a very rapid rate even among rural households and is expected to have enormous impact on rural economies. We focus on its effect on rural households' educational investment behavior.

3. Theoretical Framework and Testable Hypothesis

Established models on risk sharing and investment have shown that consumption and investment is higher and more stable in settings where resources are pooled from various agents compared to settings where each agent rely on her individual income[8]. Consider two pairs of household with identical income process in an economy without leisure; a resource pooling pair and an autarky pair. The resource pooling pair pools resources such that

[7] In addition to loans available to ROSCA's and SACCO's, individual users of mobile money can also access "back to school" loans which are available on the mobile money platform at the beginning of the academic year. Our recent field trip however revealed that loan services are still very unpopular among rural mobile money users.

[8] See Arrow (1971), Obstfeld (1994), Kinnan and Townsend (2010).

consumption and investment depends on aggregate level of resources while the autarky pair consumes and invest base on individual resources with no possibility of transfer or exchange. Consider two investment goods; Poultry and Schooling. Schooling is more risky and lumpier compared to poultry which is more liquid and yields returns faster relative to schooling. By pooling resources, the likelihood of investing in schooling is higher relative to investment in poultry. Firstly the resource pooling pair can overcome the financial constraint associated with a lumpy investment such as schooling. An individual household in a resource pooling pair with insufficient resources may keep their child in school, buy books and other related schooling needs by relying on aggregate resources. The opportunity cost of schooling in terms of forgone earnings is lower for the connected households compared to the autarky households.

Mobile money is a resource pooling platform which enable households to transfer resources in a cost effective manner. From the above simple theoretical framework we can deduce three testable hypothesis: (i) Mobile money adopter households' better smooth investment in schooling against idiosyncratic shocks compared to non-adopter households. (ii) By reducing transaction cost mobile money induces a larger network of risk sharing households/individuals. (iii) By relaxing financial constraint, mobile money induces demand for private schooling relative to public schooling.

In addition to the above hypothesis, if remittances are sent back from migrant using mobile money then we might expect more migration once mobile money services become available in a community. In the appendix I report results relating different measures of

migration to agent location. The results suggest that out migration is more likely in communities with better access to mobile money agents.

4 Data and descriptive evidence

4.1 Data

This study principally uses household and community level data collected in rural Uganda in 2003, 2005, 2009, 2012 and 2015 by Makerere University, Foundation for Advanced Studies on International Development (FASID) and the National Graduate Institute for Policy Studies (GRIPS). The data collection was done under the Research on Poverty, Environment and Agricultural Technology (RePEAT) project. The baseline survey conducted in 2003 covered 94 local council 1 (LC1s) each of which 10 households were randomly sampled. The northern districts were not sampled due to security concerns. The 2005, 2009, 2012 and 2015 rounds of the survey successfully captured 856, 816, 866 and 770 of the original households respectively. The data is representative of rural Uganda

The survey collects information at household and community levels. The household level component captures information on demography, income, health, education, financial service usage, land tenure and migration, among others. The community survey covers information on basic community characteristics such as population, area size, road distance to the market and the district towns, the state of roads and the availability of public utilities, and the access and availability of public facilities such as schools, hospitals, and telephone networks.

4.2 Descriptive statistics

This paper mainly uses a balanced panel of 711 households obtained from the 2009, 2012 and 2015 rounds of the RePEAT survey. Table 1 presents the summary statistics of major households characteristics used in this study by survey year and by adoption status of mobile money. The adoption status is defined based on whether households have at least one member who uses mobile money at the survey time.

The proportion of households which have at least one member who uses mobile money jumped from less than 1 percent in 2009 to 28.8 percent in 2012 and to 71.5 percent in 2015. Comparison between adopters and non-adopters of mobile money may be more meaningful in the 2012 and 2015 survey rounds since less than 1 percent of the 2009 sample households adopted mobile money. We will focus on the comparison of major household characteristics using the latest two survey rounds.

In terms of the level of asset holdings, the adopters in both survey years seem better off than the non-adopters. It thus appears that mobile money adoption may be driven by wealth, although there are no significant differences in land holdings and remittance receipts[9]. There appear to be no significant differences in the per capita food consumption among the adopters and the non-adopters. Given the rural nature of our sample, food consumption may not vary substantially across households. With regards to mobile phone possession, there are significant differences between the adopters and the non-adopters in both survey years as expected. Given that mobile money is a mobile phone base service,

[9] In our survey remittances refers to cash transfers received from relatives and/or friends with no repayment obligation. It is distinct from loans and credits.

almost all adopters possess a mobile phone[10]. There are significant differences in the years of schooling of household heads between the adopters and the non-adopters. On average, the heads of the adopter households have acquired more education than those of the non-adopter households. In line with our expectation, adopter households are significantly closer to mobile money agents than non-adopter households. In terms of self- reported negative shocks, illness shocks seems to be more rampant compared to land eviction shock with over 50 per cent of households in all survey rounds reporting an illness shock[11]

From Table 2, there seems to be significant differences in the average number of children attending school between the adopters and non-adopter households. The mobile money adopters have more children in school than the non-adopters. There are also significant differences in the number of school age children. On average adopters have more school age children than non-adopters. Enrollment seems to be higher for adopter households compared to non-adopter households. With regards to the choice of school, it appears that there are no significant differences in the number of children attending public schools between the adopters and the non-adopters. However, there are significant differences between the two groups regarding children attending private school. On average, the adopters may have more children enrolled in private schools compared to the non-adopters. The significant difference in the number of children enrolled in private school between the mobile money adopters and non-adopters can be seen through significantly

[10] There are a few cases in which respondents have mobile money account but have no mobile phone. As long as users have their own SIM card, they could open their mobile money account. They can borrow a mobile phone to conduct mobile money transactions using their SIM card.

[11] Illness shock is a binary indicator which takes the value 1 if an adult member of the household was unable to engage in any economic activity for at least 1 month due to illness.

larger per capita educational expenditure compared to the non-adopters. In 2012, the adopters spent 62 percent more on education compared to the non-adopters. This difference in educational spending further widens in 2015.

Table 3 presents information on the adoption and associated transaction cost for different financial services available to households in our samples. In terms of adoption, mobile money as expected is the most widely adopted financial service with close to 50 percent of respondents reported using mobile money service. However in terms of frequency of usage, Village bank and ROSCA/SACCO are more frequently used compared to mobile money. In line with our expectation, mobile money is predominantly used to send and receive remittances while village bank and micro-financial institutions are mostly used for saving purposes. Using distance as a proxy for transaction cost, mobile money and village bank are closest to households compared to other financial institutions. In terms of transportation fare, Mobile money agents and village bank seems more accessible compared to other financial institutions. On a whole Table 3 seems to suggest that mobile money is more accessible to households owing to lower transaction cost compared to other financial institutions.[12]

Unfortunately, in our data we do not observe detailed expenses for each child. Consequently, in constructing the per capita education expenditure we had to exclude households with no child aged 5-16 years[13]. Households with no reported educational

[12] We do not have data on the service fee associated to each of the financial services. However Jack and Suri (2014) in the context of Kenya shows evidence of lower service fee associated with mobile money compared to other financial products.

[13] Though the statutory age for enrollment into grade 1 is 6 years, it is however common for children to be enrolled earlier at the age of 5 or later at the age of 7.63 households without school age children are dropped

expenditure for a particular year but with at least one child aged 5-16 are assigned zero educational expenditure. This is possible if the child is sponsored by a non-household member.

5 Empirical strategy

In this section we are going to estimate: (i) the responsiveness of educational investment of mobile money adopter households to idiosyncratic shocks. (ii) the responsiveness of remittance receipt of mobile money adopter household to idiosyncratic shocks. (iii) The impact mobile money adoption on the proportion of remitting migrants(Remitting network)

5.1 Basic specification

In examining the impact of mobile money adoption on risk sharing, we implement a difference in differences method which compares the response of educational investment of adopters and non-adopters to a self-reported negative shock while controlling for several observable characteristics. Our specification given below closely mimics Gertler and Gruber (2002), Jack and Suri (2014):

$$Y_{ijdt} = \lambda_i + \delta_{MM} MM_{ijdt} + \delta_N N_{ijdt} + \delta_{NM}(N_{ijdt} * MM_{ijdt}) + \delta_X X_{ijdt} + \delta_S S_{jdt} + \delta_C C_{jdt} + \gamma_{dt} + \varepsilon_{ijdt}, \ldots. \quad (1)$$

Where *Y* is the per school-age child educational expenditure of household *i* in community *j* of district *d* at time *t*.-; λ_i is household fixed effects. *MM* is a binary indicator of mobile money adoption. *N* is a binary indicator taking the value 1 if the household has suffered

from illness or/and land eviction shock[14]. X is a vector of household level controls including household size, household head's age, gender, education, natural logarithm of value of household assets holding[15], land holding, a binary indicator of mobile phone possession[16] ,and a binary indicator of bank account with any financial institution. -; S is a vector of school related variables, notably the number of public and private primary schools in community j. C is a vector of community-level controls comprising of the population size of each community, average of household head's years of schooling, average land holding in the community.γ is district specific time trend.

From Eq.[1], If mobile money adopters and non-adopters have the same propensity to smooth investment in education against negative shock, then we expect δ_N and δ_{NM} not to be distinguishable from zero. If households are unable to fully insure themselves against negative shock then we expect δ_N to be negative. Failure to reject the null hypothesis:

$\delta_N + \delta_{NM} = 0$, entails that mobile money adopters are fully insured against negative shocks.

In Assessing the differences in responsiveness of remittances to negative shock between mobile money adopter and non-adopter household's we employ a similar specification as in Eq[1].

[14] Though we combine both shocks, we show evidence that our results are robust when we do not combine the shocks.
[15] Given the potential contemporaneous relationship between Asset holding and remittance receipt, asset holdings are lagged to pre-mobile money level i.e 2003, 2005 & 2009. Land holding is less responsive to remittance receipt
[16] Mobile phone possession is potentially endogenous. However as can be seen from Table 1, mobile phone possession has increased significantly for both adopters and non-adopters. 88 per cent of non-adopter households possess at least 1 mobile phone

$$R_{ijdt} = \lambda_i + \delta_{MM} MM_{ijdt} + \delta_N N_{ijdt} + \delta_{NM}(N_{ijdt} * MM_{ijdt}) + \delta_X X_{ijdt} + \delta_S S_{jdt} + \delta_C C_{jdt} + \gamma_{dt} + \varepsilon_{ijdt}, \ldots. \quad (2)$$

The above equation is identical to Eq.[1] except for the outcome variable. *R* is a measure of the remittance receipts[17] of household *i* in community *j* of district *d* at time *t*. In our data we can observe the relationship between the remitter and recipient household for each transaction. The data on remittance was collected per month for over 12 months. We admit that recall might be an issue with the remittance data. We also have information on the purpose of the remittances as well as the location of the remitter. In addition to remittance receipt, we also estimate the impact of mobile money adoption in the event of a negative shock on the proportion of remitting migrants (Hereafter "remitting network")[18]. The size of the remitting network ranges between 0 and 1.

We also test whether in the event of a shock, children from mobile money adopter households are less likely to drop out of school. In addition to enrollment we also examine school choice considering that private schools are perceived to be of higher quality compared to public schools. Negative shocks may induce households to withdraw their children from school or to demand less of private schooling as a coping strategy. We relate mobile money and negative shocks to enrollment and school choice by estimating child level regressions of the form

[17] In line with the unitary household model, migrant household members are expected to contribute to the pool of household resources through remittances. Such transfers are essentially non-refundable and are distinct from loans and credits.

[18] We admit that some households receive remittances from non-household members such as friends.

$$P_{ihjdt} = \chi_i + \partial_{MM} MM_{hjdt} + \partial_N N_{ijdt} + \partial_{NM}(N_{ijdt} * MM_{ijdt}) + \partial_X X_{hjdt} + \partial_S S_{ijdt}$$
$$+ \partial_C C_{jdt} + \partial_{Ch} Child_{ihjdt} + \gamma_{dt} + B_i + \varepsilon_{ijdt} \quad (3)$$

Where the outcome variable P_{ihjdt} is a binary indicator of either enrollment status or the public-private school choice of child *i* in household *h* in community *j* of district *d* and time *t*. It takes the value 1 if child *i* is enrolled in school otherwise 0 in estimating the enrollment equation. For the school choice equation, it takes the value 1 if child *i* is enrolled in a public school or 0 if enrolled in a private school. *Child* is a vector of child level controls such as age, gender, binary indicators of first child and orphan. *B* is birth year fixed effects, while χ_i is child fixed effects. All other controls are as defined earlier[19]. ∂_{NM} is our parameter of interest capturing the risk sharing impact of mobile money adoption on enrollment and school choice conditional on all other covariates.

Below we elaborate on the identification assumptions motivating Eq[1] and Eq[2] and how we use the agent rollout data to address potential caveats in the above specification. We also present a set of robustness checks of our main results and concerns relating to attrition

5.2 Identification

For Eq[1] to consistently estimate the causal impact of mobile money adoption on risk sharing, the interaction term of interest ($N_{ijdt} * MM_{ijdt}$) should be exogenous conditional on the other controls. The main effect of mobile money adoption is absorbed in the binary indicator of mobile money adoption likewise the main effect of a negative shock. The

[19] Birth years are dropped from child fixed effect estimations

household fixed effect controls for time invariant unobservable which may be correlated with shocks and the household ability to smooth investment in education. District by time dummies are expected to capture aggregate (district) level shocks while the community level controls are expected to account for local economic conditions that may drive agent location

Our identification is satisfied if shocks are truly exogenous. In Table 4A we present correlates of shocks. From Table 4A, overall shock and land eviction shock seems to be systematically uncorrelated with a set of household level characteristics[20]. While illness shock seems to be correlated with some household level characteristics, we note that it is uncorrelated with measures of access to mobile money agents. On a whole it seems reasonable to assume that the shocks are not systematically correlated with household observable characteristics[21]. We also note that the difference in differences specification in Eq[1] and Eq[2] allows for time variant unobservables to be correlated with mobile money adoption as long as these unobservables do not enhance or weaken household's resilience to negative shocks. Specifically unobserved household characteristic such as risk and time preferences of household heads' are likely correlated with mobile money adoption while as well affecting household's ability to smooth risk. We use two approaches to address these potential confounding mechanisms. Firstly we introduce interaction terms of the negative shocks and household observable characteristics which may enhance or weaken

[20] Overall shock is binary indicator of illness and/or land eviction shock
[21] We admit that the exogeneity of the shocks remains questionable given that they are self-reported

household's ability to smooth shocks as shown in E[q] 4. Secondly we use the access to mobile money agent data to estimate reduced form variants of Eq[1] and Eq[4].

$$Y_{ijdt} = \lambda_i + \sigma_{MM} MM_{ijdt} + \sigma_N N_{ijdt} + \sigma_{NM}(N_{ijdt} * MM_{ijdt}) + \sigma_X X_{ijdt} + \sigma_{NX}(N_{ijdt} * X_{ijdt}) + \sigma_S S_{jdt} + \sigma_C C_{jdt} + \gamma_{dt} + \varepsilon_{ijdt}, \ldots. \quad (4)$$

Eq[4] is identical to Eq[1] except for the introduction of the interaction term $(N_{ijdt} * X_{ijdt})$. All other variables are as defined earlier. Eq[4] controls for any changes in observable household characteristics such as changes in the adoption of other financial instrument(bank account) , mobile phone amongst others which may affect households ability to smooth risk[22].

5.3 Agent Rollout Data

Mobile money adoption depends on proximity to mobile money agents who provide cash in and cash out services. Households which are closer to mobile money agents are more likely to adopt the mobile money service compared to households which are far away from mobile money agents. As sown in Table 1, the distance to nearest mobile money agent has decreased considerably over time. This decrease in distance is likely driving the expansion in mobile money adoption.

5.3.1 Reduced Form

We first implement a reduced form difference in differences specification which is similar to Eq[1] and Eq[4] with distance(log Km) to the nearest mobile money agent as an

[22] Binary indicators of mobile phone ownership and bank account with any financial institution as well as household head's gender, age and education are interacted with negative shocks.

indicator of access to mobile money agent. The average distance to the nearest mobile money agent has decreased sharply from 13 Km in 2009 to 4 Km in 2012 and 3 Km in 2015. Comparatively the average distance from each community to the district head quarter[23] has reduced from 14km in 2009 to 11 km in 2012 and 10 km in 2015. The reduction in distance to mobile money agent thus represent significant reductions in transaction cost which should induce greater access to financial services and consequently investment. The reduced form specification is as follows;

$$Y_{ijdt} = \lambda_i + \vartheta_{MM} DM_{jdt} + \vartheta_N N_{ijdt} + \vartheta_{ND}(N_{ijdt} * DM_{jdt}) + \vartheta_X X_{ijdt} + \vartheta_S S_{jdt} + \vartheta_C C_{jdt} + \gamma_{dt} + \varepsilon_{ijdt}, \ldots. \quad (5)$$

Where DM_{jdt} is the distance in log Km from community j to the nearest mobile money agent. Unlike Jack and Suri (2014), we observe distance to mobile money agent at the community level. We also use the distance to mobile money agent to construct binary indicators of agent location within 1 Km and 5 Km from the village. The reduce form specification in Eq[5] relies on the assumption that agent location is uncorrelated with households unobservables which enables households to smooth risk.

We argue and provide supportive evidence that agent location is not correlated with unobservable that also help households to smooth risk. Firstly from Figure 1, we note that the number of agents have increased astronomically. Given the very high demand for

[23] Districts are the second administrative level while communities (LC1) are the last administrative level. There are four administrative layers separating LC1's from districts.

mobile money agent authorization[24], the mobile phone operators were not able to decide on the location of each agent. The objective of the mobile phone operators was to maximize their market share by granting as many licenses as possible to would be mobile money agents. The rapid increase in the number of agents is common in all our sampled communities. From Table 7A, agent placement seems to be systematically uncorrelated with a set of household and community characteristics. Furthermore during our field work in August 2016, discussion with community leaders revealed that agents were not systematically located in specific locations such as schools or community centers. Given that the licensing of agents is exclusively the preserve of mobile phone companies, political influence and lobbying as well as strategic planning for placement in specific locations, which may be correlated with schools location is ruled out. Jack and Suri (2014) in a similar study in Kenya show that distance to M-*pesa* agent is uncorrelated with unobservables that help households to smooth risk. Following Munyegera and Matsumoto (2016), we argue that most mobile money agents are traditional small shop owners who have expanded their business by providing mobile money services. Consequently a good number of the agents had already chosen their locations prior to the inception of mobile money. This is particularly true in rural Uganda[25].

5.4 Falsification test

[24] Requirements to be a licensed mobile money agent include; a completed agent agreement, a deposit of at least 384 USD per outlet in a specified bank account, a certificate of registration and a memorandum of association.

[25] It is however plausible that timing of getting into and quitting the mobile money agent business may not be random

Our first falsification test mimics the reduced form specification in Eq[4].We use our pre-mobile money survey rounds of 2003 and 2005 to compare households who later had differential access to mobile money agents. We regress educational expenditure and remittance receipt from the 2003 and 2005 survey on the 2012 distance to mobile money agent. We expect the 2012 distance to mobile money agent not to have any impact on risk sharing in 2003 and 2005. We equally implement attrition bias sensitivity analysis.

We also check for co-location of schools and mobile money agent. We use the distance to school as an instrument for mobile money adoption. If agents are systematically located close to schools, then access to school should drive mobile money adoption.

5.5 Instrumental variable

We also use the distance to mobile money agent to implement instrumental variable estimation. We use the log of distance to the nearest mobile money agent as an instrument for mobile money adoption. The rationale for such an instrument is that the decision to adopt mobile money heavily depends on the proximity to mobile money agent. Jack and Suri (2014) in a similar study in Kenya show that distance to M-*pesa* agent is a reliable instrument for mobile money adoption. However unlike Jack and Suri (2014) we observe the distance to mobile money agent only at the community level[26].

6 Results

6.1 Difference in Differences Results

[26] Though we show the instrumental variable results for school enrollment and school choice in the appendix, this results are unreliable given acute weak instrument

The estimation results of Eq.[1] are presented in Table 4B. Column 1 present OLS results with no controls except district specific time trend. Negative (Overall) shock decreases the educational investment of non-adopter households by approximately 16 percent, but mobile money adopter households are able to fully protect themselves as their schooling investment is unaffected. The results reported in column 2 are similar to the results reported in column 1. The difference in response to shocks between adopters and non-adopters in columns 1 and 2 may be due to observable differences that allow households to better smooth risk. In column 3, we control for a range of household demographic and community (village) level characteristics. The results reported in column 3 are similar to those reported in columns 1 and 2. While the educational expenditure of non-adopter households reduces by approximately 18 percent due to a negative shock, mobile money adopter households are able to insure most of the shock as their educational investment remains unaffected. To further account for observable differences in response to shocks between adopter and non-adopter households, we interact the negative shock with household demographic characteristics which may enhance household resilience to shocks. The results from this specification are reported in column 4. The results are similar to those presented in columns 1 through 3. Educational investment of mobile money adopter households is more resilient to shocks compared to non-adopter households. It thus seems that mobile money adoption provides incomplete insurance to adopter households against shocks.

[Table 4B about here]

Table 4C presents results for disaggregated shocks. Through columns 1 to 4, both illness and land eviction shock significantly depresses investment in education. The results reported in Table 4C are in support of those presented in Table 4B. The educational investment of non-adopter households is more responsive to both illness and land eviction shock compared to the educational investment of mobile money adopter households. Educational investment by mobile money adopter households is more resilient to negative shocks.

The resilience of educational investment of mobile money adopters in response to a shock may be indicative of their ability to mobilize resources notably remittances so as to cushion the impact of the shock on educational investment. Non adopter households may have limited ability in mobilizing remittances thus significantly reducing educational investment in response to a health or land eviction shock. Jack and Suri (2014) observes a similar pattern regarding consumption in Kenya. They find that non-adopter households suffer drastic reduction in consumption in view of financing the negative impact of health shocks while *M-pesa* household rather exhibit an increase in consumption.

6.2 Mechanism: Mobile money and Remittances

The results from estimating Eq[2] are reported in Table 5A. Through columns 1 to 6, we control for a range of household and community level characteristics. In addition we include interactions of negative shocks and household demographic characteristics in columns 2, 4 and 6. As expected, mobile money adoption significantly increases both the likelihood and the amount of remittance receipt. From columns 1 and 3, it seems that

negative shock increases both the likelihood and the amount of remittance received. From columns 4 and 6 mobile money adopters in the event of a negative shock receive smaller amount of remittances, but receive remittances more frequently compared to non-adopters. It thus seems that the frequency of remittance receipt enhances the resilience of mobile money adopter households to negative shocks.

[Table 5A about here]

Table 5B present results for disaggregated shocks. For brevity we show only fixed effect results with controls. As expected, mobile money adoption significantly increases both the likelihood and the amount of remittance receipt. From columns 2, 4 and 6, land eviction shock seems to increase the amount, likelihood and frequency of remittance receipt. In the event of land eviction, mobile money adopters receive remittances more frequently compared to non-adopters. Illness shock seems to decrease the amount, likelihood and frequency of remittance receipt. On a whole there is evidence that mobile money adoption is positively correlated with measures of remittance receipt, Mobile money adopter households receive remittances more frequently in the event of a negative shock compared to non-adopter households. This increase in remittance receipt most likely strengthens their resilience against negative shocks.

[Table 5B about here]

5.3 Mechanism: Mobile money and Remitting Network

From our theory, we expect mobile money adopters to receive remittances from a larger number of remitters owing to the reduction in transaction cost. We also expect

mobile money adopters to receive remittances from distant locations. From columns 1 through 3 of table 6A, mobile money adoption increases the size of the remitting network. Mobile money adoption increases the proportion of migrant household members who send remittances. In the event of a negative shock, the proportion of remitting migrants is larger for mobile money adopters compared to non-adopters. It thus appear that mobile money adoption is inducing households to participate in an insurance pool where in household transfer and share resources notably in the event of a negative shock. We do not find evidence that negative shock induces mobile money adopters to receive remittances from geographically distant remitters (remittance from other districts).

[Table 6A about here]

Table 6B presents disaggregated results by shock type. For brevity we show only the fixed effect results. On whole the disaggregated results are supportive of the results presented earlier in Table 6A.In the event of an illness shocks, mobile money adopter households are more likely to receive remittances from a lager network of active remitters. As before we do not find evidence that negative shock induces mobile money adopters to receive remittances from geographically distant remitters (remittance from other districts).

[Table 6B about here]

In the context of Kenya, Jack and Suri (2014) find evidence that *M-pesa* adopter households receive long distance travelled remittances and also tap deep into their network in case of shocks. We do not have a reliable measure of the distance travelled by remittances. In line with our results, several theoretical and empirical studies have shown

that reduction in transaction cost induces a larger network of households sharing resources[27].

6.4 Results Agent Rollout data:

6.4.1 Reduced form difference in differences

Before reporting results of the difference in differences specification in Eq[4] we first explore the correlates of agent rollout. Though we argue that agent rollout is uncorrelated with household and community characteristics, it is still possible that agent placement is endogenous. Table 7A report results of correlates of agent rollout. We find little evidence that agent rollout was systematically correlated with household and community level observables.

[Table 7A about here]

Tables 7B and 7C present reduced form difference in difference results using measures of access to mobile money agents. In addition to the distance in Km from a community centroid point to the nearest agent, we also construct two binary indicators of accessibility to agents. The first binary indicator takes 1 if an agent is within 1 Km to from the Community. The second indicator takes 1 if an agent is within 5Km from the village.

Table 7B presents results for overall shock. Columns 1, 3 and 5 present OLS results with no controls(for comparison purpose) while columns 2,4 and 6 present fixed effect results with household demographic and community level controls. Across columns,

[27] See Arrow (1971), Kochar (1995) and Morduch (1995), Chetty and Looney (2006), and Kinnan and Townsend (2010), Jack and Suri(2014) and Blumenstock et al (2016)

accessibility to mobile money agent induces educational spending. Overall shock is negatively correlated with educational spending as expected. The interaction of measures of access to agent and negative shocks is significant across columns. On whole the results presented in Table 7B indicates that household with better access to agents are less affected by negative shocks.

[Table 7B about here]

Table 7C, presents similar results for land eviction shock and illness shock. Across columns, accessibility to mobile money agent induces educational spending. The negative shock variables are negatively correlated with educational spending as expected. There is evidence that household with access to mobile money agent better smooth the negative impact of land eviction and illness shock on educational investment.

[Table 7C about here]

6.4.2 Instrumental Variable Results:

The results of instrumental variable estimation is shown in Table 8. For brevity we do not show the first stage estimation but we report relevant first stage statistics. We instrument for mobile money adoption and its interaction with the overall negative shock using distance to mobile money agent (log-Km) and the interaction of distance and overall negative shock. As in earlier estimations, we use a set of household demographic and, community characteristics and interactions of the overall shock with household demographic characteristics. On a whole the results are in line with results earlier presented in Tables 4 and 5. Mobile money adoption induces educational investment and remittance

receipt. Households which have adopted mobile money better smooth shocks owing to the responsiveness of remittances to shocks for mobile money adopter households.

[Table 8 about here]

6.5 Mobile money Enrollment and School Choice:

The insurance provided by mobile money adoption may induce parents to send their children to school or to demand more of private schooling which is perceived to be of better quality compared to tuition free public school. Several studies have shown that fluctuation in farm income induces household to withdraw their children from school.(Glewwe and Kremmer, 2006; Sawada and Lokshin, 2009)

Table 9A present the result for school enrollment. The outcome variable is a binary indicator of enrollment. We present results for the whole sample and for boys and girls separately. As expected, negative shocks reduces the likelihood of school enrollment of both girls and boys. Mobile money adoption seems to attenuate the negative impact of shocks on enrollment. The interaction term of interest is positive and significant across columns. Mobile money adoption enables household to smooth the impact of negative shocks on enrollment. As showed earlier, it is likely that mobile money adopter households receive remittances notably in the event of a shock. This enables them to keep their children in school compared to non-adopter households.

[Table 9A about here]

The school choice results are presented in Table 9B. On whole we find strong evidence that mobile money induces private school enrollment relative to public school. However the interaction term of interest is not significant across columns.

6.7 Attrition

The non-random nature of attrition is a concern in our study. In Table 10A we directly check if households which stayed in the panel are systematically different from those which attrited. Though attrition is correlated with some household characteristics, we note that attrition is uncorrelated with distance to mobile money agents nor negative shocks. In addressing concerns related to attrition, we include district specific time trends in all our estimations. District specific time trend will help absorb some of the non-random attrition by adjusting for different attrition rates across districts.

We also generate the inverse probability of attrition from the estimation reported in Table 10A.We re-estimated Eq[1] using the inverse probability of attrition as weights. The results reported in Table 10B are qualitatively similar to those reported earlier in Table 4B.

We also conduct attrition sensitivity by categorizing our samples into high and low attrition samples. We categorize the samples base on whether the community level attrition rate was below 10 per cent. We re-estimate Eq[1] and Eq[2] for these different subsamples. The results are presented in Table 10C. On a whole, the results across sub-samples and are in line with the results earlier presented.

In a related estimation, we implemented lee bound estimates using predictors of attrition. Household head characteristics were used to tighten the bounds. On whole the

results of the lee bound estimates which are presented in the appendix are qualitatively similar to those presented earlier.

7.0 Robustness check

7.1 Using pre-mobile money data

Our agent rollout data enables us to conduct a reduced form falsification test by comparing households that later had differential access to mobile money agents. We assign the distance to mobile money agent in 2012 to corresponding households in 2003 and 2005. We test if those households that later had access to mobile money agents were able to better smooth investment in education prior to the inception of mobile money. As reported in table 11A, there is no evidence that distance to agent had an impact on households' resilience to shock or remittance receipt prior to the inception of mobile money

7.2 Mobile money, Risk sharing and Distance to School

Considering that the expansion in mobile money adoption sharply coincides with expansion in secondary education provision under the Universal Secondary School policy(USE), it is plausible that distance to mobile money agent may be correlated with distance to secondary schools especially the newly constructed schools under USE which might be located close to mobile money agents or mobile money agents especially new mobile money agents might have chosen to locate their businesses in communities hosting USE schools. Though plausible, we do not find any correlation between distance to mobile money agent and distance to secondary school. We have used the natural log of distance to the nearest secondary school as an instrument for mobile money adoption. As shown in

Table 11B, we find no evidence that mobile money adoption helps to smooth risk when we use distance to secondary school as an instrument for mobile money. We note in passing that this pseudo instrument fails all the statistical test of an IV.

In a related and complementary estimation we further test for possibility of co-location of mobile money agents and schools (primary and secondary). We also test if distance to school may be driving mobile money adoption. We relate the distance to mobile money agent and a binary indicator of mobile money adoption on the distance to school and household and community characteristics. We also include shock variables and the interaction of the shock variables with distance to school and household demographic characteristics. The results presented in table 11C seems to suggest that unlike distance to mobile money agent, distance to school does not help households' smooth shocks. On a whole we do not find evidence that that distance to school is driving agent location or mobile money adoption

8.0 Conclusion

Poor households in developing countries face substantial risk yet they have very limited access to basic formal insurance and credit markets. This restricts them from investing in business, health, and education, to smooth consumption and to escape from poverty. To bridge this gap, formal and informal institutions enabling household to pool and share resources have emerged. This paper shows how sharing resources through a mobile phone based money transfer service provides simultaneous benefits to rural households: Relaxes household credit constraint enabling households to investment in

lumpy investment such as schooling and reduces schooling investment variance by insuring against idiosyncratic shocks. We find that households who have not adopted mobile money suffer from a 12.8 percent drop in per school age child educational expenditure while the educational investment of households which have adopted mobile money remains unaffected. The mechanism behind the insurance provided by mobile money is a reduction in transaction cost leading to an increase in remittance receipt as well as the ability of mobile money adopter households to receive remittances from a wide range of remitters. When faced with shock, mobile money adopter households are more likely to receive remittances and to receive larger amount of remittances.

Though not examined in this study, the resilience of mobile money adopter households to negative shocks may also be explained by changes in saving behavior induced by mobile money. In the context of rural Uganda, Munyegera and Matsumoto (2017) show evidence of increased savings induced by mobile money adoption. Such savings may be used to offset the negative impacts of shocks on consumption and investment

In this paper we have shown that mobile money adoption provides perfect insurance against idiosyncratic shocks, however households in developing countries are still subject to large changes in consumption and investment owing to aggregate shocks such as rainfall shocks and droughts. The ability of mobile money to insure against large scale aggregate shocks stills needs to be explored. In addition, this article has focused on household level

benefits associated with mobile money usage. It would be interesting to explore intra-household allocation of the benefits accruing from mobile money adoption

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Table 1 :Summary statistics by Year and Mobile money adoption status

	2009		2012		2015	
	Non-Adopters	Adopters	Non-Adopters	Adopters	Non-Adopters	Adopters
Variables	Mean	Mean	Mean	Mean	Mean	Mean
HH characteristics						
1 if head is female	0.1	0.286	0.163	0.149	0.31	0.211***
Head education	7.099	8.286	5.11	7.103***	5.766	5.55**
Head age	47.571	51.857	51.901	52.124	53.18	51.017
Household size	9.249	11.857	10.875	12.412***	11.75	12.37
Number of Migrants	0.353	0.286	0.639	1.052***	0.866	1.035
1 if own Mobile Phone	0.528	0.572	0.645	0.979***	0.887	1.00***
Log of distance to the mobile money agent	13.8	11.55***	5.11	3.01***	4.44*	2.62
Wealth						
Land size(acres)	5.59	7.154	5.884	7.099	5.66	6.104
Total value of assets(Ush)	747.791	2,220.00	841.232	1,980.07***	653.534	1,388.806***
Proportion of Household receiving remittances	28.57	42.85	32.05*	38.07	35.00**	71.45
Total remittance(Ush)	79	760.6*	110.293	246.502	93.232	159.358
Remittance for Education(Ush)	15.67	22.44	21.75	38.03*	29.62	56.11**
Welfare						
Per Capita food expenditure (Ush)	151.315	162.554	230.19	257.964***	239.588	341.77
Negative Shocks						
illness Shock	0.56	0.51	0.54	0.48	0.53	0.6
Land Eviction Shock	0.9	0.7	0.05	0.07	0.1	0.14
No of Households	704	7	506	205	202	509

Note: Calculated by author from RePEAT 2009, 2012 and 2015. 1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively(Bank of Uganda)

2)* indicates significance in difference in means between adopters and non-adopters

3)*** p<0.01, ** p<0.05, * p<0.1

4)Monetary values are in 1000 UGX

Table 2: Mobile money, Enrollment and School Choice

	2012		2015	
	Non-Adopters	Adopters	Non-Adopters	Adopters
Variables	Mean	Mean	Mean	Mean
Enrollment				
No of school age children	4.01	4.7*	2.98	4.2
No of school age children enrolled	3.487	4.376***	2.498	3.926***
1 if schooling & Age Less than 10	0.93	0.9	0.88	0.89
1 if schooling & Age greater than 9	0.95	0.92	0.94	0.95
School choice				
No attending Private school	1.187	2.015***	0.828	1.983***
No attending Public school	2.266	2.247	1.649	1.854
School choice & Age Less than 10				
1 if attending Private school	0.34	0.58**	0.33	0.6*
1 if attending Public school	0.66	0.42	0.67	0.4
School choice & Age Greater than 9				
1 if attending Private school	0.35	0.41*	0.3	0.44*
1 if attending Public school	0.65	0.59	0.7	0.56
Per Capita Educ Exp(Ush)	215.37	365.568***	150.33	336.233***
No of Households	506	205	202	509

Note: Calculated by author from RePEAT 2012 and 2015.1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively(Bank of Uganda)

1) Sample consist of children aged 5-16 years

2)* indicates significance in difference in means between adopters and non-adopters

3)*** p<0.01, ** p<0.05, * p<0.1

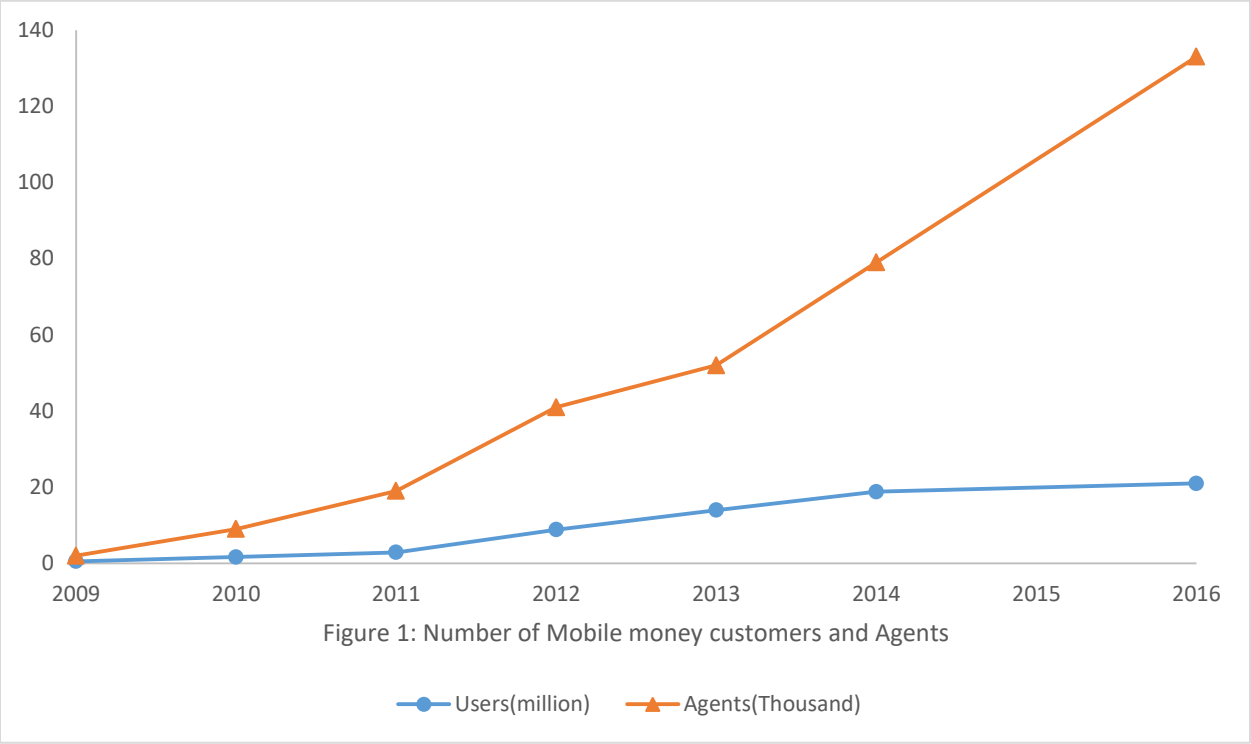

Figure 1: Number of Mobile money customers and Agents

Table 3: Financial Service Usage

	Financial Service				
	Bank	SACCO/ROSCA	Mobile Money	Micro Financial Institution	Village bank
Adoption					
1 if used in the past 12 months	0.19	0.40	0.49	0.05	0.05
frequency	4.93	7.39	6.18	4.54	7.14
Purpose					
Send/Receive remittances	0.53	0.27	0.86	0.38	0.26
Pay Utilities	0.00	0.00	0.00	0.00	0.00
Pay School fee	0.10	0.23	0.13	0.13	0.14
Save	0.33	0.23	0.20	0.61	0.84
Transaction cost					
Distance(Km) to financial Institution	26.03	4.13	3.50	6.04	3.55
Transport fare(UGX)	4000	700	500	2000	550

Note: Constructed by author from RePEAT 2015. 1$=2,857 UGX in 2015(Bank of Uganda)

Table 4A : Correlates of Negative Shocks

	Illness Shock	Land Eviction Shock	Overall Shock
	1	2	3
Distance to Agent(log km)	-0.0258	-0.0283	-0.0352
	[0.0317]	[0.0191]	[0.0317]
Agent within 1 km	-0.0941	-0.0138	-0.0934
	[0.0681]	[0.0229]	[0.0781]
Agent within 5km	0.0492	-0.0112	0.0414
	[0.0455]	[0.0274]	[0.0455]
1 if Own Mobile Phone	-0.00464	-0.00963	-0.0157
	[0.0276]	[0.016]	[0.027]
1 if Bank account holder	-0.00647	0.0172	0.00243
	[0.0244]	[0.0147]	[0.0245]
Number of Boys	-0.0246*	0.0184**	-0.017
	[0.0136]	[0.0082]	[0.0136]
Number of Girls	-0.00056	0.00851	-0.00118
	[0.0134]	[0.008]	[0.0134]
1 if Female Headed	0.0512*	0.0388**	0.0720**
	[0.031]	[0.0187]	[0.0311]
1 if Head is married	-0.0687	0.0384	-0.0328
	[0.0421]	[0.025]	[0.042]
Head's years of schooling	-0.00518**	-0.00161	-0.00534**
	[0.0026]	[0.0015]	[0.002]
Head's age in years	0.00270***	-0.00044	0.00229***
	[0.0006]	[0.0003]	[0.0006]
Household Size	0.0402	-0.0345	0.0175
	[0.0439]	[0.0265]	[0.044]
Land holding(log Acres)	-0.0145	0.00852	-0.0111
	[0.0117]	[0.007]	[0.0117]
Total Asset Value	0.000659	3.36E-05	0.00405
	[0.0091]	[0.0055]	[0.0091]
Number of Schools in Community	0.0481**	-0.00659	0.0347
	[0.0234]	[0.014]	[0.0234]
Observations	2,133	2,133	2,133
R-squared	0.334	0.1	0.35

Notes:Standard errors are clustered at the community(village) level. Illness shock takes the value 1 if an adult household member was not able to participate in any economic activity for at least 1 month due to illness. Land eviction shock takes the value 1 if the household has been evicted from a land it had access to. Overall shock is an indicator of land eviction and/or illness shock. 1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively(Bank of Uganda). *,**&*** indicates significance at 10 , 5 & 1 percent level

Table 4B: Basic Difference in Differences Results

Per school Age child Educational Expenditure				
	OLS	Panel	Panel	Panel
	1	2	3	4
1 if Mobile money User	0.4040***	0.2666***	0.2048***	0.1903***
	[0.0339]	[0.0321]	[0.0341]	[0.0356]
Overall shock	-0.1689***	-0.1414***	-0.1823***	-0.0798
	[0.0261]	[0.0305]	[0.0268]	[0.1156]
User X Overall shock	0.0823*	0.1009**	0.1440***	0.1948***
	[0.0431]	[0.0427]	[0.0408]	[0.0470]
Household FE		YES	YES	YES
Demographic Controls			YES	YES
Controls + Interactions				YES
District specific time trend	YES	YES	YES	YES
Observations	2133	2133	2133	2133
R-Square	0.25	0.22	0.27	0.28
Negative Shock Effect	-0.1410***	-0.1073***	-0.1333***	-0.1156***
Negative Shock Users	-0.0865	-0.040	-0.0385	-0.0156
Negative Shock Non-Users	-0.1689***	-0.1414***	-0.1823***	-0.1288***
Mean of Shock	0.4162	0.4162	0.4169	0.4169

Notes: Dependent variable is the log of per school-age child educational expenditure. Standard errors are clustered at the community (Village) level. Overall shock is a binary indicator of illness shock, or/and land eviction shock which occurred at most 2 years to the survey date .Additional controls include: Household head's education, gender, age.Household land and asset holding, Household composition by age group. Binary indicators of mobile phone ownership and bank account ownership. Community(village) population size, average land holding and number of schools are also included. Interactions refers to interactions of the household level controls and the shock. When interactions are included the overall effect of a shock is evaluated at the means of the covariates. The effects of the shock for users(non-users) are evaluated at the means of the covariates for the user(non-user).1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively(Bank of Uganda). *,**&*** indicates significance at 10 , 5 & 1 percent level

Table 4C: Basic Difference in Differences Results(Disaggregated Shocks)

Per school Age child Educational Expenditure				
	OLS	Panel	Panel	Panel
	1	2	3	4
1 if Mobile money User	0.4053***	0.2640***	0.2024***	0.1869***
	[0.0325]	[0.0312]	[0.0328]	[0.0352]
Illness Shock	-0.1523***	-0.1283***	-0.1643***	-0.1062
	[0.0262]	[0.0309]	[0.0273]	[0.1146]
Land eviction Shock	-0.1509**	-0.1682***	-0.2009***	0.1555
	[0.0612]	[0.0582]	[0.0594]	[0.2092]
User X Illness Shock	0.0559	0.0878**	0.1233***	0.1807***
	[0.0388]	[0.0418]	[0.0378]	[0.0441]
User X Land eviction Shock	0.1714**	0.1640**	0.2116***	0.2371***
	[0.0730]	[0.0694]	[0.0709]	[0.0881]
Household FE		YES	YES	YES
Demographic Controls			YES	YES
Controls + Interactions				YES
District specific time trend	YES	YES	YES	YES
Observations	2,133	2,133	2,133	2,133
R-squared	0.258	0.224	0.278	0.295

Notes: Standard errors are clustered at the community (village) level. Additional controls include: Household head's age, gender and years of schooling. Household composition by age group, household land and asset holding. Indicators of mobile phone and bank account ownership. Community population size, average land holding and numbers of schools are also included. Interactions refers to interactions of the shock with household demographic characteristics. When interactions are included, the overall effect of a shock is evaluated at the means of the covariates. The effect of the shock for adopters (non-adopters) are evaluated at the means of the covariates for the adopters (non-adopters). $=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively (Bank of Uganda). *,**&*** indicates significance at 10 , 5 & 1 percent level

Table 5A: Mechanism

	Pr[Receive]		Log[Amount]		Frequency	
	1	2	3	4	5	6
1 if Mobile money User	0.1292**	0.145***	0.6538***	0.766***	0.0233	0.039
	[0.0497]	[0.048]	[0.2329]	[0.236]	[0.0777]	[0.077]
Overall shock	0.0688*	-0.147	0.3813**	-0.642	-0.0115	0.159
	[0.0350]	[0.1160]	[0.1631]	[0.531]	[0.0586]	[0.168]
User X Overall shock	-0.0146	-0.039	-0.1513	-0.346***	0.0333	0.048***
	[0.0561]	[0.055]	[0.2659]	[0.266]	[0.0817]	[0.0911]
Household FE	YES	YES	YES	YES	YES	YES
Demographic Controls	YES	YES	YES	YES	YES	YES
Controls + Interactions		YES		YES		YES
District specific time trend	YES	YES	YES	YES	YES	YES
Observations	2,133	2,133	2,133	2,133	2,133	2,133
R-squared	0.151	0.293	0.145	0.293	0.208	0.293
Negative Shock Effect	0.0639	0.083*	0.329	0.503**	-0.0044	-0.038
Negative Shock Users	0.0542	0.063	0.229	-0.306	-0.0127	0.009
Negative Shock Non-Users	0.0688	-0.067	-0.381	-0.384**	-0.0001	-0.024
Mean of Shock	0.4169	0.4169	0.4169	0.4169	0.4169	0.4169

Notes: Standard errors are clustered at the community (village) level. Overall shock is an indicator of land eviction and/or illness shock which occurred at most 2 years to the survey date. Additional controls include: Household head's age, gender and years of schooling. Household composition by age group, household land and asset holding. Indicators of mobile phone and bank account ownership. Community population size, average land holding and numbers of schools are also included. Interactions refers to interactions of the shock with household demographic characteristics. When interactions are included, the overall effect of a shock is evaluated at the means of the covariates. The effect of the shock for adopters (non-adopters) are evaluated at the means of the covariates for the adopters (non-adopters). $=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively (Bank of Uganda). *,**&*** indicates significance at 10 , 5 & 1 percent level

Table 5B: Mechanism (Disaggregated shocks)

	Pr[Receive]		Log[Amount]		Frequency	
	1	2	3	4	5	6
1 if Mobile money User	0.1506***	0.1614***	0.7364***	0.8196***	0.0525	0.0408
	[0.0481]	[0.0471]	[0.2234]	[0.2262]	[0.0762]	[0.0752]
Illness Shock	0.0754**	-0.1868	0.3853**	-0.9495*	-0.0037	-0.0124
	[0.0369]	[0.1169]	[0.1692]	[0.5304]	[0.0566]	[0.1734]
Land eviction Shock	0.0264	0.4018*	0.3273	2.8133**	-0.0078	1.2590**
	[0.0723]	[0.2294]	[0.3585]	[1.3368]	[0.1106]	[0.4965]
User X Illness Shock	-0.0459	-0.0606	-0.2375	-0.3895	-0.0192	-0.0055
	[0.0557]	[0.0550]	[0.2654]	[0.2727]	[0.0745]	[0.0808]
User X Land eviction Shock	-0.0517	-0.0617	-0.4503	-0.4605	0.0103	0.0418
	[0.0963]	[0.1060]	[0.5036]	[0.5109]	[0.1655]	[0.1689]
Household FE	YES	YES	YES	YES	YES	YES
Demographic Controls	YES	YES	YES	YES	YES	YES
Controls + Interactions		YES		YES		YES
District specific time trend	YES	YES	YES	YES	YES	YES
Observations	2,133	2,133	2,133	2,133	2,133	2,133
R-squared	0.151	0.162	0.145	0.159	0.208	0.222

Notes: Standard errors are clustered at the community (village) level. Additional controls include: Household head's age, gender and years of schooling. Household composition by age group, household land and asset holding. Indicators of mobile phone and bank account ownership. Community population size, average land holding and numbers of schools are also included. Interactions refers to interactions of the shock with household demographic characteristics. When interactions are included, the overall effect of a shock is evaluated at the means of the covariates. The effect of the shock for adopters (non-adopters) are evaluated at the means of the covariates for the adopters (non-adopters). $=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively (Bank of Uganda). *,**&*** indicates significance at 10 , 5 & 1 percent level

Table 6A: Where do remittances come from

	Network[Proportion of remitting migrant]			Long Distance Remittance[Remit from another District]		
	1	2	3	4	5	6
1 if Mobile money User	0.1487***	0.0871*	0.068	-0.0033	-0.0039	-0.0025
	[0.0526]	[0.0512]	[0.0516]	[0.0053]	[0.0055]	[0.0066]
Overall Shock	0.0881**	0.054	0.1267	-0.0034	-0.0027	0.0039
	[0.0430]	[0.0433]	[0.1329]	[0.0031]	[0.0032]	[0.0177]
User X Overall Shock	0.4679***	0.4862***	0.5231***	0.005	0.0057	0.0016
	[0.0684]	[0.0670]	[0.0708]	[0.0060]	[0.0062]	[0.0088]
Household FE	YES	YES	YES	YES	YES	YES
Demographic Controls		YES	YES		YES	YES
Controls + Interactions			YES			YES
District specific time trend	YES	YES	YES	YES	YES	YES
Observations	2,133	2,133	2,133	2,133	2,133	2,133
R-squared	0.397	0.419	0.422	0.054	0.064	0.066
Negative Shock Effect	0.2463***	0.2194***	0.227***	-0.0017	-0.0008	-0.0074
Negative Shock Users	0.556***	0.5402***	0.572***	0.0016	0.0029	0.0082
Negative Shock Non-Users	0.0881**	-0.0540	-0.0902*	-0.0034	-0.0027	-0.0012
Mean of User	0.3382	0.3403	0.3403	0.3382	0.3403	0.3403
Mean of Shock	0.4162	0.4169	0.4169	0.4162	0.4169	0.4169

Notes: Standard errors are clustered at the community (village) level. Overall shock is an indicator of land eviction and/or illness shock which occurred at most 2 years to the survey date. Additional controls include: Household head's age, gender and years of schooling. Household composition by age group, household land and asset holding. Indicators of mobile phone and bank account ownership. Community population size, average land holding and numbers of schools are also included. Interactions refers to interactions of the shock with household demographic characteristics. When interactions are included, the overall effect of a shock is evaluated at the means of the covariates. The effect of the shock for adopters (non-adopters) are evaluated at the means of the covariates for the adopters (non-adopters). $=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively (Bank of Uganda). *,**&*** indicates significance at 10 , 5 & 1 percent level

Table 6B: Where do remittances come from

	Network[Proportion of remitting migrant]			Long Distance Remittance[Remit from another District]		
	1	2	3	4	5	6
1 if Mobile money User	0.2045***	0.1445***	0.1222**	-0.0028	-0.0033	-0.0023
	[0.0503]	[0.0485]	[0.0491]	[0.0050]	[0.0052]	[0.0062]
Illness Shock	0.0859*	0.0592	0.1369	-0.0035	-0.0024	0.0038
	[0.0446]	[0.0433]	[0.1464]	[0.0033]	[0.0034]	[0.0180]
Land eviction Shock	0.127	0.1031	0.0894	0.0024	0.0016	0.0035
	[0.0920]	[0.0861]	[0.2702]	[0.0028]	[0.0038]	[0.0117]
User X Illness Shock	0.3772***	0.3861***	0.4398***	0.0041	0.0042	0.0002
	[0.0645]	[0.0618]	[0.0688]	[0.0058]	[0.0057]	[0.0087]
User X Land eviction Shock	0.1658	0.1918*	0.1563	0.0018	0.004	0.0053
	[0.1194]	[0.1102]	[0.1299]	[0.0044]	[0.0060]	[0.0064]
Household FE	YES	YES	YES	YES	YES	YES
Demographic Controls		YES	YES		YES	YES
Controls + Interactions			YES			YES
District specific time trend	YES	YES	YES	YES	YES	YES
Observations	2,133	2,133	2,133	2,133	2,133	2,133
R-squared	0.385	0.407	0.412	0.054	0.064	0.067

Notes: Standard errors are clustered at the community (village) level. Additional controls include: Household head's age, gender and years of schooling. Household composition by age group, household land and asset holding. Indicators of mobile phone and bank account ownership. Community population size, average land holding and numbers of schools are also included. Interactions refers to interactions of the shock with household demographic characteristics. When interactions are included, the overall effect of a shock is evaluated at the means of the covariates. The effect of the shock for adopters (non-adopters) are evaluated at the means of the covariates for the adopters (non-adopters). $=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively (Bank of Uganda). *,**&*** indicates significance at 10 , 5 & 1 percent level

Table 7A: Correlates of Agent Rollout

	Distance to Agent(Log Km)	Agent within 1km	Agent within 5Km
	1	2	3
1 If owns Mobile Phone	0.0715*	-0.0380*	-0.0440**
	[0.0369]	[0.0217]	[0.021]
Illness Shock	-0.0462	-0.0189	0.0365
	[0.09]	[0.056]	[0.0546]
Land Eviction Shock	-0.105	0.0293	0.036
	[0.068]	[0.040]	[0.039]
Negative(Overall Shock)	0.0253	-0.0169	-0.00326
	[0.099]	[0.058]	[0.056]
I if bank account holder	0.0251	-0.0316	0.0021
	[0.0327]	[0.0193]	[0.018]
Number of Boys	0.00807	-0.0183*	0.00329
	[0.0183]	[0.0108]	[0.010]
Number of Girls	0.00543	-0.0149	0.0124
	[0.018]	[0.010]	[0.0103]
1 if female Headed	0.0211	-0.00259	-0.022
	[0.041]	[0.024]	[0.023]
1 if Head is Married	0.0247	0.0266	-0.0604*
	[0.0565]	[0.033]	[0.032]
Head's Years of Schooling	-0.00478	0.00281	0.00236
	[0.003]	[0.002]	[0.002]
Head's age in Years	-0.00014	7.03E-05	-0.00033
	[0.0008]	[0.000]	[0.0004]
Household size	0.00652	-0.0448	0.0107
	[0.0589]	[0.0347]	[0.0338]
Land Holding (log acres)	-0.0129	0.000866	0.0112
	[0.0156]	[0.009]	[0.008]
Asset Value(log)	0.0109	0.00174	0.00217
	[0.0123]	[0.0072]	[0.007]
Number of Schools in Community	-0.00614	0.00176	-0.0365
	[0.0313]	[0.018]	[0.038]
Observations	2,133	2,133	2,133
R-squared	0.614	0.492	0.604

Notes: Standard errors are clustered at the community level .1$=2028 UGX, 1$=2557 UGX,1$=2857 UGX, in 2009, 2015 & 2015 respectively(Bank of uganda). *,**&*** indicates significance at 1 , 5 & 10 percent level

Table 7B: Reduced form using Agent data

Dependent Variable: Log of Per School Age Child Educational Expenditure						
	Distance to Agent[log Km]		Agent within 1 Km		Agent within 5 Km	
	1	2	3	4	5	6
Agent	-0.0982***	-0.0401**	0.154***	0.00763	0.168***	0.0874***
	[0.0137]	[0.0159]	[0.0308]	[0.0373]	[0.0271]	[0.0261]
Overall Shock	-0.0215	-0.0285	-0.0724***	-0.131***	-0.106***	-0.150***
	[0.0464]	[0.0483]	[0.0245]	[0.0261]	[0.0331]	[0.0408]
Overall Shock X Agent	-0.0474*	-0.0563*	0.0122	0.0828*	0.0229	0.0466
	[0.028]	[0.028]	[0.043]	[0.0481]	[0.041]	[0.045]
Household FE		YES		YES		YES
Demographic Controls		YES		YES		YES
District specific time trend	YES	YES	YES	YES	YES	YES
Observations	2,133	2,133	2,133	2,133	2,133	2,133
R-squared	0.114	0.207	0.099	0.2	0.106	0.207

Notes: Standard errors are clustered at the community (Village) level. Overall shock is an indicator of land eviction and/or illness shock which occurred at most 2 years to survey date. Additional controls include: Household head's education, gender, age, Household land and asset holding, Household's composition by age group. Binary indicators of mobile phone ownership and bank account ownership. Community (village) population size, average land holding are also included. 1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively (Bank of Uganda). *,**&*** indicates significance at 1 , 5 & 10 percent level

Table 7C: Reduced form using Agent data(Disaggregated Shocks)

Dependent Variable: Log of Per School Age Child Educational Expenditure						
	Distance to Agent[log Km]		Agent within 1 Km		Agent within 5 Km	
	1	2	3	4	5	6
Agent	-0.0974***	-0.0384**	0.1542***	0.0088	0.1676***	0.0818***
	[0.0137]	[0.0156]	[0.0298]	[0.0364]	[0.0271]	[0.0249]
Illness Shock	-0.037	-0.0259	-0.0648***	-0.1165***	-0.0943***	-0.1395***
	[0.0498]	[0.0482]	[0.0230]	[0.0261]	[0.0343]	[0.0422]
Land Eviction Shock	0.1163	0.0503	-0.0713	-0.1205***	-0.1699**	-0.2183***
	[0.0846]	[0.0925]	[0.0517]	[0.0428]	[0.0702]	[0.0828]
Agent X Illness Shock	-0.039	-0.0528*	-0.0132	0.0659	0.0009	0.0423
	[0.0296]	[0.0294]	[0.0449]	[0.0485]	[0.0435]	[0.0458]
Agent X Land Eviction Shock	-0.1110**	-0.1002*	0.1222	0.1115	0.1758**	0.1648*
	[0.0543]	[0.0585]	[0.0770]	[0.0776]	[0.0816]	[0.0957]
Household FE		YES		YES		YES
Demographic Controls		YES		YES		YES
District specific time trend	YES	YES	YES	YES	YES	YES
Observations	2,133	2,133	2,133	2,133	2,133	2,133
R-squared	0.116	0.209	0.101	0.201	0.109	0.209

Notes: Standard errors are clustered at the community (Village) level. Additional controls include: Household head's education, gender, age, Household land and asset holding, Household's composition by age group. Binary indicators of mobile phone ownership and bank account ownership. Community (village) population size, average land holding are also included. 1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively (Bank of Uganda). *,**&*** indicates significance at 1 , 5 & 10 percent level

Table 8: Instrumental Variable Estimation

	Log of Educational Expenditure			Log of Total Remittance Received		
	1	2	3	4	5	6
1 if Mobile money adopter	0.1711***	0.1414***	0.1070*	0.2348***	0.2164*	0.2285*
	[0.0405]	[0.0546]	[0.0578]	[0.0844]	[0.1196]	[0.1267]
Overall shock	-0.0939***	-0.0964***	-0.0357	0.0224	0.0178	-0.1024
	[0.0271]	[0.0248]	[0.0447]	[0.0582]	[0.0567]	[0.0884]
Adopter X Overall shock	0.0959	0.1029*	0.1800**	0.0294	0.0503	0.0421
	[0.0592]	[0.0564]	[0.0813]	[0.1297]	[0.1311]	[0.1894]
Household FE	YES	YES	YES	YES	YES	YES
Demographic Controls		YES	YES		YES	YES
Controls + Interactions			YES			YES
District specific time trend	YES	YES	YES	YES	YES	YES
Observations	2,133	2,133	2,133	2,133	2,133	2,133
R-squared	0.125	0.204	0.201	0.085	0.113	0.117
Cragg-Donald F-stat	47.9	26.86	27.6	47.9	26.86	27.6
Negative Shock Effect	-0.061***	-0.0614***	-0.0601***	0.0323*	0.0349	0.062
Negative Shock Users	0.002	0.0065	0.062	0.0518	0.0681	0.0951
Negative Shock Non-Users	-0.0939***	-0.0964***	-0.073	0.0224	0.0178	0.044
Mean of User	0.3382	0.3403	0.3403	0.3382	0.3403	0.3403
Mean of Shock	0.4162	0.4169	0.4169	0.4162	0.4169	0.4169

Notes: First stage result is not shown due to limited space. Excluded instruments are the distance to mobile money agent and its interaction with the shock. Dependent variable is the log of per school age child educational expenditure. Standard errors are clustered at the Community (village) level. Overall shock is an indicator of land eviction or/and illness shock which occurred at most 2 years to the survey date. Additional controls include: Household head's age, gender and years of schooling. Household composition by age group, household land and asset holding. Indicators of mobile phone and bank account ownership. Community population size, average land holding and numbers of schools are also included. Interactions refers to interactions of the shock with household demographic characteristics. When interactions are included, the overall effect of a shock is evaluated at the means of the covariates. The effect of the shock for adopters (non-adopters) are evaluated at the means of the covariates for the adopters (non-adopters). $=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively (Bank of Uganda). *,**&*** indicates significance at 10 , 5 & 1 percent level

Table 9A: Mobile money and School Enrollment

	Dependent Variable: Enrollment=1					
	All Sample		BOYS		GIRLS	
	OLS	FE	OLS	FE	OLS	FE
	1	2	3	4	5	6
1 if Mobile money User	-0.0384	-0.0149	-0.0811**	-0.0782	0.0183	0.0849
	[0.0337]	[0.0368]	[0.04]	[0.0508]	[0.0409]	[0.0556]
Overall shock	-0.159***	-0.146***	-0.157***	-0.147***	-0.168***	-0.144***
	[0.0249]	[0.0304]	[0.0332]	[0.0423]	[0.034]	[0.0463]
User X Overall shock	0.203***	0.190***	0.237***	0.231***	0.147***	0.118*
	[0.036]	[0.042]	[0.048]	[0.0595]	[0.049]	[0.064]
Observations	2,935	2,935	1,547	1,547	1,388	1,388
R-squared	0.421	0.313	0.431	0.366	0.47	0.358
Year of Birth FE	YES		YES		YES	
District by time	YES	YES	YES	YES	YES	YES
Child FE		YES		YES		YES

Notes: Sample is composed of children aged 5 to 16. Standard errors are clustered at the community level. Overall shock is an indicator of land eviction and/or illness shock which occurred at most 2 years to the survey date. Additional controls include: Child's gender and age, indicators of first child and orphan hood. Household head's age, gender and years of schooling. Household composition by age group, household asset and land holding. Indicators Of bank account and mobile phone ownership. Community population size, average land holding and numbers of schools are also included. 1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively (Bank of Uganda). *,**&*** indicates significance at 10 , 5 & 1 percent level

Table 9B: Mobile money and School Choice

	Dependent Variable: Public School=1					
	All Sample		BOYS		GIRLS	
	OLS	FE	OLS	FE	OLS	FE
	1	2	3	4	5	6
1 if Mobile money User	-0.132***	-0.0869*	-0.125**	-0.104	-0.132**	-0.105
	[0.0405]	[0.0501]	[0.0561]	[0.0697]	[0.0607]	[0.0793]
Overall shock	-0.0291	-0.0248	-0.0302	-0.0249	-0.0238	-0.0138
	[0.0363]	[0.043]	[0.049]	[0.062]	[0.056]	[0.068]
User X Overall shock	-0.047	-0.0465	-0.0667	-0.0609	0.01	-0.0328
	[0.049]	[0.058]	[0.067]	[0.082]	[0.074]	[0.091]
Observations	2,024	2,024	1,043	1,043	981	981
R-squared	0.207	0.182	0.292	0.25	0.247	0.272
Year of Birth FE	YES		YES		YES	
District by time	YES	YES	YES	YES	YES	YES
Child FE		YES		YES		YES

Notes: Sample is composed of children aged 5 to 16 who attend school. Standard errors are clustered at the community level. Overall shock is an indicator of land eviction and/or illness shock which occurred at most 2 years to the survey date. Additional controls include: Child's gender and age, indicators of first child and orphan hood. Household head's age, gender and years of schooling. Household composition by age group, household asset and land holding. Indicators Of bank account and mobile phone ownership. Community population size, average land holding and numbers of schools are also included. 1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively(Bank of Uganda). *,**&*** indicates significance at 10 , 5 & 1 percent level

Table 10A: Correlates of Attrition

1 if Household attrited between 2003 to 2015		
	Probit	OLS
Log of Distance to Nearest Agent	-0.00622	-0.0029
	[0.038]	[0.013]
Overall Shock	3.454	0.0762
	[161.8]	[0.485]
Head's years of Schooling	0.0253*	0.00889*
	[0.0136]	[0.0045]
1 if Head is migrant worker	-0.625	-0.14
	[0.542]	[0.152]
Head's age in years	-0.00813***	-0.00301***
	[0.0030]	[0.001]
1 if head is female	0.206*	0.0719*
	[0.118]	[0.0404]
Value of total asset	-2.06E-08	-5.29E-09
	[2.27E-08]	[6.20E-09]
Land holding in acres	-0.0103	-0.0034
	[0.007]	[0.0021]
Households size	-0.0922***	-0.0278***
	[0.0107]	[0.0030]
Average land holding in the Community	0.0154	0.00524
	[0.0126]	[0.004]
Community Average of head's years of schooling	0.0184	0.00654
	[0.029]	[0.010]
Community population size	0.0103***	0.00350***
	[0.0011]	[0.0003]
Constant		0.208**
		-0.0997
Observations	940	940
R-squared		0.157

Note: 170 Households attrited between the baseline(2003) to 2015 .1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively(Bank of Uganda). Standard errors are clustered at the community level

Table 10B: Weighted Basic Difference in Differences Results

	Per school Age child Educational Expenditure			
	OLS	Panel	Panel	Panel
	1	2	3	4
1 if Mobile money User	0.2997***	0.3009***	0.0244	-0.0232
	[0.0292]	[0.0066]	[0.0232]	[0.0218]
Overall shock	-0.0995*	-0.1684***	-0.0578**	-0.1546*
	[0.0543]	[0.0017]	[0.0245]	[0.0892]
User X Overall shock	0.2103**	0.1272***	0.1340***	0.3304***
	[0.0958]	[0.0023]	[0.0190]	[0.0332]
Household FE		YES	YES	YES
Demographic Controls			YES	YES
Controls + Interactions				YES
District specific time trend	YES	YES	YES	YES
Observations	2,133	2,133	2,133	2,133
R-Square	0.727	0.94	0.996	0.997

Notes: Estimation is weighted using the inverse probability of attrition. Standard errors are clustered at the community (Village) level. Overall shock is a binary indicator of illness shock and/or land eviction shock which occurred at most 2 years to the survey date .Additional controls include: Household head's education, gender, age, Household land and asset holding, Household composition by age group. Binary indicators of mobile phone ownership and bank account ownership. Community (village) population size, average land holding are also included. 1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively (Bank of Uganda). Interactions refer to interaction of the controls and the shock.

*,**&*** indicates significance at 1 , 5 & 10 percent level

Table 10C: Attrition Sensitivity Analysis

	Attrition Greater than 10%			Attrition is Less and equal to 10 %		
	Educ. Exp	Pr[receive remittance]	Newtork	Educ. Exp	Pr[receive remittance]	Network
	1	2	3	4	5	6
1 if Mobile money User	0.203***	0.177***	0.096	0.196** *	0.104	0.092
	[0.0422]	[0.0526]	[0.0711]	[0.0562]	[0.074]	[0.096]
Overall Shock	0.147	-0.123	0.0953	0.0372	-0.124	0.0104
	[0.126]	[0.157]	[0.213]	[0.15]	[0.199]	[0.257]
User X Overall shock	0.0777*	-0.0719	0.0328*	0.164**	0.0016	-0.0446
	[0.033]	[0.0699]	[0.015]	[0.076]	[0.101]	[0.13]
Household FE	YES	YES	YES	YES	YES	YES
Demographic Controls	YES	YES	YES	YES	YES	YES
Controls + Interactions	YES	YES	YES	YES	YES	YES
District specific time trend	YES	YES	YES	YES	YES	YES
Observations	1,303	1,303	1,303	830	830	830
R-squared	0.321	0.206	0.257	0.356	0.197	0.25

Notes: Standard errors are clustered at the community (village) level. Overall shock is an indicator of land eviction or/and illness shock which occurred at most 2 years to the survey date. Additional controls include: Household head's age, gender and years of schooling. Household composition by age group, household land and asset holding. Indicators of mobile phone and bank account ownership. Community population size, average land holding and numbers of schools are also included. Interactions refers to interactions of the shock with household demographic characteristics. When interactions are included, the overall effect of a shock is evaluated at the means of the covariates. The effect of the shock for adopters (non-adopters) are evaluated at the means of the covariates for the adopters (non-adopters). $=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively (Bank of Uganda). *,**&*** indicates significance at 10 , 5 & 1 percent level

Table 11A: Falsification Test using 2003-2005 data

	Log of Educational Expenditure		1 if received Remittance	
	1	2	3	4
Log of Distance to Agent	-0.0254	-0.0242	-0.029	-0.0286
	[0.0168]	[0.0172]	[0.0214]	[0.0217]
Overall Shock	-0.201	-0.0381	-0.103	-0.0806
	[0.242]	[0.217]	[0.279]	[0.273]
Distance X Overall Shock	-0.00421	-0.0161	0.0381	0.0333
	[0.028]	[0.025]	[0.03]	[0.028]
Constant	-3.028***	-2.840***	-1.119	-1.014
	[0.732]	[0.73]	[0.826]	[0.833]
Observations	1200	1200	1200	1200
R-squared	0.337		0.131	
District by time	YES	YES	YES	YES
Number of Household		600		600

Notes: Columns 2 & 4 are random effect estimates. Standard errors are clustered at the community (Village) level. Overall shock is a binary indicator of illness shock or/and land eviction shock which occurred at most 2 years to the survey date .Additional controls include: Household head's education, gender, age, Household land and asset holding. Household composition by age group. Binary indicators of mobile phone ownership and bank account ownership. Community (village) population size, average land holding are also included. 1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively(Bank of Uganda) *,**&*** indicates significance at 10 , 5 & 1 percent level

Table 11B: Instrumental Variable Estimation using Distance to School as Instrument for Mobile money

	Log of Per School Age child Educational Exp.			Log of Total Remittance Received		
	1	2	3	4	5	6
1 if Mobile money User	1.198	1.956	3.882	1.02	1.496	3.355
	[0.911]	[2.273]	[9.372]	[0.654]	[1.946]	[8.289]
Overall Shock	-0.188*	-0.278	-0.21	-0.104	-0.159	-0.132
	[0.113]	[0.323]	[0.465]	[0.122]	[0.277]	[0.411]
User X Overall Shock		-0.0253	0.000125		0.0381	0.0449
		[0.153]	[0.244]		[0.122]	[0.208]
Controls			YES			YES
Observations	2,133	2,133	2,133	2,133	2,133	2,133
R-squared	0.129	0.727	0.51	0.159	0.845	0.463
Crag Donald F-stat	3.32	0.17	0.66	3.32	0.17	0.66
Household FE	YES	YES	YES	YES	YES	YES
District by time	YES	YES	YES	YES	YES	YES

Notes: First stage results are not shown due limited space. Excluded instruments are distant to nearest Secondary school and its interaction with the Shock. The average distance to secondary school was 14.1Km, 11.6 Km & 7.7 Km in 2009, 2012 and 2015 respectively. Standard errors are clustered at the community level. Additional controls include: Household head's education, gender, age .Household land and asset holding, Household composition by age group. Binary indicators of mobile phone ownership and bank account ownership. Community population size and average land holding are also included.1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively (Bank of Uganda)*,**&*** indicates significance at 10 , 5 & 1 percent level

Table 11C: Co-location between Agents and Schools

	Distance to Agent(log km)		1 if Mobile money Adopter	
	OLS	FE	OLS	FE
Distance to School(Log Km)	0.0209	0.0131	0.0164	0.0183
	[0.017]	[0.017]	[0.010]	[0.012]
Observations	2,133	2,133	2,133	2,133
R-squared	0.518	0.698	0.407	0.501
District by time	YES	YES	YES	YES
Household FE		YES		YES

Notes: Standard errors are clustered at the community level. controls include: Household head's education, gender, age Household land and asset holding, Household composition by age group. Binary indicators of mobile phone ownership and bank account ownership. Community population size and average land holding are also included.1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively(Bank of Uganda)

*,**&*** indicates significance at 10 , 5 & 1 percent level

Appendix

Table A1: Basic Difference in Differences Results(Only Households above median Per Capita Consumption)

	Per school Age child Educational Expenditure			
	OLS	Panel	Panel	Panel
	1	2	3	4
1 if Mobile money User	0.3629***	0.2022***	0.1802***	0.173***
	[0.0502]	[0.0437]	[0.0520]	-0.0566
Overall shock	-0.2052***	-0.1873***	-0.2207***	0.108
	[0.0428]	[0.0515]	[0.0473]	-0.191
User X Overall shock	0.1521**	0.1675***	0.2120***	0.255***
	[0.0607]	[0.0618]	[0.0635]	-0.0753
Household FE		YES	YES	YES
Demographic Controls			YES	YES
Controls + Interactions				YES
District specific time trend	YES	YES	YES	YES
Observations	927	927	920	920
R-Square	0.285	0.215	0.292	0.311

Notes: Dependent variable is the log of per school age child educational expenditure. Standard errors are clustered at the Community (village) level. Overall shock is an indicator of land eviction or/and illness shock which occurred at most 2 years to the survey date. Additional controls include: Household head's age, gender and years of schooling. Household composition by age group, household land and asset holding. Indicators of mobile phone and bank account ownership. Community population size, average land holding and numbers of schools are also included. Interactions refers to interactions of the shock with household demographic characteristics. When interactions are included, the overall effect of a shock is evaluated at the means of the covariates. The effect of the shock for adopters(non-adopters) are evaluated at the means of the covariates for the adopters(non-adopters). $=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively(Bank of Uganda). *,**&*** indicates significance at 10 , 5 & 1 percent level

Table A2: Basic Difference in Differences Results(Only Households below median Per Capita Consumption)

Per school Age child Educational Expenditure				
	OLS	Panel	Panel	Panel
	1	2	3	4
1 if Mobile money User	0.3973***	0.2467***	0.1910***	0.170***
	[0.0417]	[0.0401]	[0.0434]	[0.0459]
Overall shock	-0.1742***	-0.1426***	-0.1774***	0.0478
	[0.0294]	[0.0372]	[0.0343]	[0.147]
User X Overall shock	0.0872*	0.1063*	0.1490***	0.208***
	[0.0486]	[0.0535]	[0.0524]	[0.0611]
Household FE		YES	YES	YES
Demographic Controls			YES	YES
Controls + Interactions				YES
District specific time trend	YES	YES	YES	YES
Observations	1,206	1,206	1,206	1,206
R-Square	0.265	0.212	0.276	0.286

Notes: Dependent variable is the log of per school age child educational expenditure. Standard errors are clustered at the Community (village) level. Overall shock is an indicator of land eviction or/and illness shock which occurred at most 2 years to the survey date. Additional controls include: Household head's age, gender and years of schooling. Household composition by age group, household land and asset holding. Indicators of mobile phone and bank account ownership. Community population size, average land holding and numbers of schools are also included. Interactions refers to interactions of the shock with household demographic characterictics. When interactions are included, the overall effect of a shock is evaluated at the means of the covariates. The effect of the shock for adopters(non-adopters) are evaluated at the means of the covariates for the adopters(non-adopters). $=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively(Bank of Uganda). *,**&*** indicates significance at 10 , 5 & 1 percent level

Table A3: Mobile money , Enrollment and School Choice(restricted sample)

	Enrollment=1		Private School=1	
	OLS	FE	OLS	FE
	1	2	3	4
1 if Mobile money User	0.116***	0.100***	0.536***	0.541***
	[0.021]	[0.024]	[0.049]	[0.064]
Overall Shock	0.00815	0.0167	-0.0375	0.0236
	[0.019]	[0.022]	[0.059]	[0.064]
User X Overall Shock	-0.0163	-0.0289	0.0658	0.0258
	[0.026]	[0.029]	[0.063]	[0.081]
Constant	2.954***	2.905***	0.136	-1.423
	[0.386]	[0.606]	[0.868]	[1.596]
Observations	4,527	4,527	683	683
R-squared	0.279	0.46	0.535	0.812
District by time Trend	YES	YES	YES	YES
BIRTH YEAR FE	YES		YES	

Notes: Sample is restricted to Secondary-School-age (14-22) children. Standard errors are clustered at the community level. Additional controls include: Child's gender and age, indicators of first child and orphan hood. Household head's age, gender and years of schooling. Household composition by age group, household asset and land holding. Indicators Of bank account and mobile phone ownership. Community population size, average land holding and numbers of schools are also included. 1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively (Bank of Uganda). *,**&*** indicates significance at 10 , 5 & 1 percent level

Table A4: Instrumental Variable Estimates. Mobile money Enrollment and School Choice

	Schooling=1			Public School=1		
	All	Boys	Girls	All	Boys	Girls
	1	2	3	4	5	6
1 If Mobile money User	53.09	-1.347	-0.28	-2.359	-21.12	-0.681
	[9,936]	[3.98]	[3.24]	[4.947]	[714.9]	[4.359]
Overall Shock	-0.777	-0.497	0.643	-0.612	-9.019	0.186
	[104.7]	[0.838]	[1.924]	[1.516]	[316.1]	[2.471]
User X Overall Shock	5.326	0.893	-1.515	1.073	17.14	-0.39
	[930.3]	[1.531]	[4.017]	[2.902]	[605]	[4.532]
Observations	2,935	1,547	1,388	1,826	934	892
R-squared	0.05	0.1	0.09	0.68	0.77	0.03
Crag-Donald F-stat	0.01	0.1	0.04	0.14	0.01	0.015
District by time	YES	YES	YES	YES	YES	YES
Child FE	YES	YES	YES	YES	YES	YES

Notes:First stage results are shown due to limited space. Excluded instruments are distance to mobile money agent and its interaction with the shock. Overall shock is an indicator of land eviction and/or illness shock which occurred at most 2 years to the survey date. Additional controls include: Child's gender, age, indicators of first child and orphanhood. Head's age gender and years of schooling. Household composition by age groups, household asset and land holding, indicators of mobile phone and bank account ownership. Community population size, average land holding and number of schools are also included. 1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively(Bank of Uganda). *,**&*** indicates significance at 10 , 5 & 1 percent level

Table A5: Tightened Lee bound Estimates of the Impact of Mobile money on Education Expenditure

Dependent Variable : Log of Per School Age Child Educational Expenditure

		Confidence Interval	
Lower	0.322	0.155	0.49
	(0.085)		
Upper	0.451	0.275	0.627
	(0.089)		
Number of Observations	940		
Number of Selected Observation	748		
Number of Cells	8		
Overall Trimming Portion	0.1		

NB: Predictors of attrition used to tightened the estimates are; Head's age, Head's education and Household size. . 1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively(Bank of Uganda)

Table A6: Agent Rollout and Migration

	1 if Migrant Household	1 if Head is Migrant worker	Number of Migrants
	1	2	3
Agent within 1Km	0.118**	0.0198**	0.223
	[0.047]	[0.009]	[0.172]
Agent within 5Km	0.137**	0.000429	0.211
	[0.0652]	[0.010]	[0.17]
1 if owns mobile phone	0.0585*	0.0103	0.0252
	[0.033]	[0.012]	[0.088]
Observations	2,133	2,133	2,133
R-squared	0.381	0.069	0.185
Household FE	YES	YES	YES
District by time	YES	YES	YES

Notes: .Additional controls include: Household head's education, gender, age
Household land and asset holding, Household composition by age group. Community (village) population size, average land holding and number of schools are also included. . 1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively(Bank of Uganda) . *,**&*** indicates significance at 10 , 5 & 1 percent level

Table A7: Basic Difference in Differences Results(trimmed sample)

Per school Age child Educational Expenditure				
	OLS	Panel	Panel	Panel
	1	2	3	4
1 if Mobile money User	0.3652***	0.2308***	0.1748***	0.1629***
	[0.0334]	[0.0320]	[0.0347]	[0.0362]
Overall shock	-0.1765***	-0.1481***	-0.1880***	-0.0805
	[0.0263]	[0.0309]	[0.0272]	[0.1181]
User X Overall shock	0.1250***	0.1381***	0.1817***	0.2269***
	[0.0433]	[0.0435]	[0.0414]	[0.0477]
Household FE		YES	YES	YES
Demographic Controls			YES	YES
Controls + Interactions				YES
District specific time trend	YES	YES	YES	YES
Observations	2061	2061	2061	2061
R-Square	0.248	0.212	0.265	0.275
Negative Shock Effect	-0.1343***	-0.1013***	-0.1262***	-0.1262***
Negative Shock Users	-0.0515	-0.0099	-0.0063	-0.0063
Negative Shock Non-Users	-0.1765***	-0.1481***	-0.188***	-0.188***
Mean of User	0.3382	0.3382	0.3403	0.3403
Mean of Shock	0.4162	0.4162	0.4169	0.4169

Notes: Upper 10 percent of educational expenditure has been trimmed off. Standard errors are clustered at the community (Village) level. Negative shock is a binary indicator of illness shock, land eviction shock and dead of elderly household member at most 2 years to the survey date .Additional controls include: Household head's education, gender, age Household land and asset holding, Household composition by age group. Binary indicators of mobile phone and bank account ownership. Community(village) population size, average land holding are also included. Interactions refer to interaction of the controls and the shock. 1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively(Bank of Uganda)*,**&*** indicates significance at 1 , 5 & 10 percent level

Table A8: Mechanism(Trimmed sample)

	Pr[Receive]		Log[Amount]		Frequency	
	1	2	3	4	5	6
1 if Mobile money User	0.1255**	0.1402***	0.6208***	0.7315***	0.0159	0.003
	[0.0495]	[0.0484]	[0.2298]	[0.2326]	[0.0768]	[0.0763]
Negative shock	0.0704**	-0.1586	0.3904**	-0.6928	-0.0136	0.1423
	[0.0352]	[0.1151]	[0.1642]	[0.5280]	[0.0589]	[0.1697]
User X negative shock	-0.0137	-0.0347	-0.1182	-0.304	0.0335	0.0543
	[0.0551]	[0.0530]	[0.2616]	[0.2577]	[0.0809]	[0.0900]
Household FE	YES	YES	YES	YES	YES	YES
Demographic Controls	YES	YES	YES	YES	YES	YES
Controls + Interactions		YES		YES		YES
District specific time trend	YES	YES	YES	YES	YES	YES
Observations	2,063	2,063	2,063	2,063	2,063	2,063
R-squared	0.152	0.157	0.146	0.151	0.207	0.209
Negative Shock Effect	0.0658***	-0.0022	0.3502**	-0.0022	-0.0022	-0.0022
Negative Shock Users	0.0567	0.0199	0.2722	0.0199	0.0199	0.0199
Negative Shock Non-Users	0.0704*	-0.0136	0.3904*	-0.0136	-0.0136	-0.0136
Mean of User	0.3403	0.3403	0.3403	0.3403	0.3403	0.3403
Mean of Shock	0.4169	0.4169	0.4169	0.4169	0.4169	0.4169

Notes: Trimmed sample of only households below 90th percentile of remittance distribution. Standard errors are clustered at the community (Village) level. Negative shock is a binary indicator of illness shock, land eviction shock and dead of elderly household member at most 2 years to the survey date .Additional controls include: Household head's education, gender, age, Household land and asset holding, Household composition by age group. Binary indicators of mobile phone and bank account ownership. Community (village) population size, average land holding are also included. Interactions refer to interaction of the controls and the shock. 1$=2028UGX, 1$=2557UGX and 1$=2857UGX in 2009, 2012 and 2015 respectively(Bank of Uganda) *,**&*** indicates significance at 1 , 5 & 10 percent level