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Finance and well-being in developing countries: Does access to mobile money improve household well-being?

By Ahmad Hassan Ahmad, Christopher J. Green, Fei Jiang, and Carlos Sakyi-Nyarko

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Finance and Well-being in Developing Countries: Does Access to Mobile Money improve Household Well-being? *

by

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ABSTRACT

We study the relationship between mobile money (m-money) use and well-being in a country with relatively low level of financial development. We analyse the impact of m-money on different measures of household well-being in Ghana using a new survey of 1000 geographically stratified Ghanaian households. We find that m-money use *per se* does not provide significant well-being insurance in the face of negative shocks; whereas receipt of m-money remittances is associated with a significant insurance effect. However, savings provide a stronger insurance effect than either of the two m-money variables. Among individuals enjoying the highest level of well-being, savings and m-money remittances combined give almost complete insurance against shocks. Comparing savings and m-money, we find that savings provide greater support to well-being in the face of shocks whereas m-money remittances provide general support to well-being irrespective of the presence of shocks.

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1. Introduction

There is growing recognition that household access to mobile money (m-money) can contribute towards poverty-reduction in a society. In general terms, it can do this by fostering financial inclusion: allowing households to enjoy greater access to financial services at relatively low cost, without necessarily having to use a conventional bank account (Donovan, 2012). M-money consists of the stored funds held in the mobile wallets of customers of mobile network operators (MNOs); customers are not required to have an account or other relationship with a financial institution to open and operate their mobile wallet (Ahmad, *et.al*., 2020). M-money funds may be used for a wide variety of purposes, and can perform many of the same functions as a bank account at lower cost, including making payments for ordinary purchases in a shop. However, the most common use of m-money is for remittances: between family, friends and others in a particular social network (Jack and Suri, 2011, 2014).

Evidence from African household data shows that m-money can have a direct positive effect on welfare by improving household consumption-smoothing in response to unanticipated negative shocks. It does this along two main channels. The first is by increased risk-sharing through family and social networks. M-money users are more likely to send and receive remittances from family and friends than are non-users (Jack and Suri, 2011; Yenkey *et. al.*, 2014), and this helps them better to withstand negative shocks. In times of distress, users can and do more easily call on their networks to provide short-term support. In the face of negative shocks, m-money users are better insured than non-users in that their consumption tends to fall less than that of non-users; and they receive a greater increase in remittances than do non-users. This is confirmed in studies of, *inter alia*, Kenya (Jack and Suri, 2014; Mbiti and Weill, 2011), Uganda (Munyegera and Matsumoto, 2016), Tanzania (Riley, 2018) and Burkina Faso (Ky *et. al*., 2017). These studies also find that households that are not fully insured against negative shocks prioritise food consumption; cutting spending on non-food items to accommodate the shock. M-money users also tend to experience greater reciprocity in remittances (Jack, *et. al.*, 2013), suggesting that m-money strengthens family and social networks (Okello, *et. al*, 2018).

The second main channel along which m-money can improve consumption-smoothing is by fostering small savings. M-money users may save by building up balances in their mobile wallets, or by using formal bank accounts. They tend to save more than non-users and to employ these savings to cushion the impact on consumption of adverse shocks; as is found in Kenya (Mbiti and Weill, 2011; Demombynes and Thegeya, 2012; Jack and Suri, 2014; Yenkey *et. al.*, 2014), Uganda (Munyegera and Matsumoto, 2016), Burkina Faso (Ky *et. al*., 2017) and Ghana (Aker and Mbiti, 2010). Through either of these two channels, m-money can help provide consumption insurance, supplying mechanisms for families to call on emergency resources if they should suffer an unexpected loss of income, from whatever cause.

However, existing research results are not unambiguous. First, early users of m-money in Africa came mainly from the emerging middle-class, being urban, relatively wealthy, educated, and already having a formal bank account. See Aker and Mbiti (2010), Mbiti and Weill (2011) and Yenkey *et. al.* (2015) on Kenya; Munyegera and Matsumoto (2016) on Uganda; and Coulibaly (2017) on the West African Economic and Monetary Union. It is therefore not surprising that households in this group are better able to save and to insure themselves against adverse shocks than are poorer households, who may be unable to afford a mobile phone or m-money account. However, in countries such as Kenya where m-money has penetrated to most of the population including the poor and unbanked (Evans and Pirchio, 2015), this argument loses its force. Studies of Tanzania (Riley, 2018) and Burkina Faso (Ky *et. al*., 2017) suggest that m-money helps promote small savings to cushion consumption even among poorer households. In contrast though, a study of Uganda finds that m-money use has little effect in mitigating the effect of adverse shocks on household consumption (Mawejje, 2017). Second, the inference that m-money provides consumption insurance through remittances is often indirect, based on regressions that explain consumption and remittances separately rather than testing directly the relation between the two variables (eg. Jack and Suri, 2014; Munyegera and Matsumoto, 2016).

M-money was launched in Kenya and Tanzania in 2007 and, although it has spread throughout Africa and elsewhere, much of the existing literature on the role of m-money in helping provide

consumption insurance is concerned with East Africa. In this paper we turn attention to West Africa, as we study the impact of m-money on household poverty in Ghana. Specifically, we investigate if and how m-money promotes consumption insurance in Ghana. We use data and methods which permit us to test explicitly if it is remittances that provide the insurance. We study nine different measures of household poverty, including spending on food, medicine, utilities and schooling. This enables us to study in detail where any cuts in consumption may be expected to fall following a negative shock. We also compare the insurance effect of m-money with that of household savings. For this analysis, we use a new survey of a sample of 1000 geographically stratified Ghanaian households (Sakyi-Nyarko, 2018). The survey as a whole aims to identify: first, how and why individuals access different financial services, with particular emphasis on m-money; second, how these services are utilised; and third, what is their impact on financial inclusion and well-being. The survey was designed specifically to help determine if and how m-money and savings promote consumption insurance in Ghana.

M-money was introduced in Ghana by MTN in 2009, two years after M-Pesa was launched in Kenya; but m-money was slower to take off in Ghana. In Kenya, registered m-money accounts grew tenfold in the first three years after launch. Growth in Ghana was slow for the first 4 years. However, in 2013 there began a period of explosive growth with registered m-money accounts increasing by a factor of more than 4 through 2016. By 2018 the number of m-money accounts in Ghana exceeded that of the whole population[1]. Ghana has become one of Africa's top m-money markets (Mattern, 2018) but, compared to Kenya, the use and impact of m-money is under-researched. Aker and Wilson (2013) and Tobbin and Kuwornu (2011) have studied the factors determining the uptake and use of m-money in Ghana; but as far as we are aware there have been no studies that have investigated the impact of m-money use on poverty in Ghana. The purpose of this paper is to make a first step in filling this gap.

The paper is divided into 5 sections. In section 2 we summarise the survey that was carried out in Ghana and the data used in this study. For further details on the whole survey including the full questionnaire and a summary of the main findings see Sakyi-Nyarko (2018) and Jiang *et*

[1] See Bank of Ghana (2019) and International Telecommunications Union (2018).

al (2020). In section 3 we discuss the hypotheses and methodology. Section 4 reports the empirical results; and section 5 contains some concluding remarks.

2. Data

In May-June 2017, we conducted a face-to-face survey of 1000 randomly selected individuals in Ghanaian households with a geographical spread approximately equivalent to that reported in the 2010 Ghana Population and Housing Census. Within this framework, different random route procedures were used to select households; and within each household one adult (aged 18+) was randomly selected for interview using the last birthday method. For details see Sakyi-Nyarko (2018). We asked about 100 questions concerning: household characteristics, their knowledge of, access to and usage of formal and informal financial accounts including credit, ATM and pre-payment cards; their knowledge of, access to and use of m-money; their savings, loan, insurance and transactions (receipts and payments) behaviour; and their well-being, including some aspects of networking and access to emergency resources.

Table 1 about here

The main socio-economic characteristics of the sample survey respondents are shown in table 1 along with the nearest comparable data for Ghana as a whole. Evidently the survey does not precisely match the whole country but, considering the sample size we can see that it comes reasonably close to mimicking the broad characteristics of the country. This gives some confidence that any results obtained may be more generally applicable in Ghana than just to this particular sample.

Among the 1,000 people surveyed, 85.3% have a mobile phone and SIM card; and 34.9% use m-money services (tables 2 and 3). These are both at a similar level to the Kenyan rate of adoption of mobile phones and M-PESA in 2009 (Jack and Suri, 2011). Out of the 349 m-money users in our survey, 43 have multiple m-money accounts, giving 411 active m-money accounts in the sample of 1000. This is broadly in line with the data for Ghana reported by the

IMF Financial Access Survey (FAS) and by GSMA[2]. Among the 349 m-money users, 97.71% (341/349) own a mobile phone and a SIM card. Only a very small percentage of m-money users (8/349: 2.29%) do not own a mobile phone with a SIM card; but rely instead on family and friends, or on using an agent's mobile phone.

Tables 2 and 3 about here

Table 2 summarises the socio-economic characteristics of mobile phone (with SIM card) owners and non-owners. The left panel (table 2.1) reports the rate of mobile phone ownership and non-ownership in each of seven main socioeconomic groups. The right panel (table 2.2) reports the same information but from the perspective of mobile phone ownership, that is: the distribution of mobile phone owners (and non-owners) as between the same socio-economic groups. Table 3 reports the socio-economic characteristics of m-money users and non-users, with the same structure as table 2. We see that the mobile phone adoption rate is higher: in urban than rural areas; among males than females; for the employed than the unemployed, for the higher than the lower income group; and among couples more than single adults. Among different age groups mobile phone ownership is highest in the 26-35 age group; and it predominates among secondary school and undergraduate educated adults.

Like mobile phone owners, m-money users tend to be younger, more well off and better educated (table 3). In particular, the use of m-money is rather more pronounced among urban residents, males and those with some education. Just 11.41% of the uneducated use m-money, rising to over 50% for those with a university education. Overall, mobile phone ownership and m-money adoption are significantly greater among urban, male, employed people, those in the 26-35 age bracket and those with at least a primary level education. Interestingly, mobile phone ownership is significantly greater among those who are living with a spouse or partner but m-money use is greater among those living without a partner. This could be due to lesser demand

[2] IMF (2019) reported that in 2016 there were 48 active mobile money accounts per 100 adults in Ghana. GSMA (2016) reported that more than 40% of the adult population was using mobile money in Ghana.

for "secret savings" on the part of female partners in Ghana than has been reported elsewhere (Morawczynski, 2009), but possibly single females living in multi-person households have even greater need for the privacy in financial matters that m-money can bring.

Table 4 about here

There is an ongoing debate about the relationship between m-money and conventional finance. Yenkey *et. al.* (2015) report that m-money users in Kenya made less use of informal finance as they made increasing use of m-money, but they mostly eschewed any further move towards the use of more formal finance such as bank accounts. However, Mbiti and Weill (2011) report that a (different) sample of m-money users in Kenya increasingly made use of more formal finance including the banking system, as they relied less on informal finance. Our data for Ghana broadly support the hypothesis that m-money use is greater among those with greater involvement in the formal financial system (table 4). M-money users are somewhat less likely to be a member of an informal financial group, substantially more likely to have a bank account, and tend to rely more heavily on the formal financial sector to manage their cash, than do non-users. M-money users are also more likely to have a payment card of some kind. Overall therefore, a large proportion of Ghanaians who have access to formal finance also use m-money. M-money does serve those who do not use formal finance and those who use informal finance, but to a lesser extent.

Table 5 about here

In addition to socio-economic characteristics, and questions about ownership and use of financial accounts, interviewees were asked about their m-money accounts, the use of these accounts in remittances, and about their recent savings behaviour, whether through m-money or other means. Table 5 shows the responses to selected questions. Interviewees were asked if they had ever used m-money and if they currently had an m-money account. The answers to

these questions turned out to be identical for the whole sample and therefore either one could be used to represent m-money ownership and use. In addition, interviewees were asked if they had ever received money from or sent money to their family or friends using m-money. This question was asked twice: to distinguish between remittances for regular support and those for emergency assistance. Individuals were also asked separately if they had received m-money from family or friends within the last 12 months; and separately, if they had sent m-money in the same period. We asked if individuals had saved in the last 12 months and reasons for saving. Allied to this, we also asked whether and how individuals might be able to meet any emergency needs. This enabled the survey to investigate if those who saved were better placed to meet their emergency needs than non-savers.

It can be seen that a substantial proportion of the whole sample and of m-money users have saved money and have sent or received remittances from family or friends (table 5.1). Table 5.2 shows how easily and by what means individuals felt that they could meet an emergency, defined as being able to find a cash sum of 800 Cedis[3]. The majority of interviewees who felt that they could find 800 Cedis would do so either from their savings or from family and friends (Table 5.2). This suggests that in Ghana, as elsewhere in Africa, family and social networks play an important role in individual consumption insurance.

Finally, we asked about well-being and poverty in the previous 12 months, in the following questions:

1. In the last 12 months, have you or your family suffered any unexpected loss of income, assets or personal items? This could be due to: loss of a job(s), a poor harvest, damage to your property (rain/flood), theft, an illness, injury or death in the family.

And:

2. Please tell me how frequently any of these has happened to you or your family in the last 12 months:

2.1 Gone without enough food to eat

2.2 Gone without medicine or medical treatment

[3] As of June 2017 ₵800 was equivalent to about US$170 at the then-prevailing exchange rate.

2.3 Gone without clean water to drink or cook

2.4 Gone without electricity in your home (apart from power cuts)

2.5 Gone without fuel to heat your home or cook food

2.6 Gone without shelter

2.7 Felt unsafe from crime in your home

2.8 Kept a child from school (or not been to school) because of no money to pay school fees

2.9 Kept a child from school (or not been to school) because (s)he has to help with the family's business (or other work, eg. harvest)

Question 1 aims to identify any negative shock that the individual has experienced in the last 12 months, and we interpret this as a more or less exogenous input into individual well-being, reflecting income rather than consumption. For some time it has been generally agreed that poverty is best identified by studying consumption rather than income (eg. Blundell and Preston, 1995) and therefore, questions 2.1 – 2.9 are concerned with consumption outcomes posed as spending on different items as well as on basic household conditions such as freedom from crime.

These questions, along with others in the whole questionnaire, were all posed on a 5-point Likert scale. Interviewees were asked to identify if a shock (question 1) had been: Very large (coded 5); Large; Moderate; Small; or No loss was suffered (coded 1). Similarly they were asked to state if outcomes in the last 12 months had occurred: Most of the time (coded 1); Often; Sometimes; Only a few times; or Never (coded 5). In their comprehensive work on Kenya, Jack and Suri (2011) sought data on the estimated amount of consumption expenditures; and other questionnaires have asked for a binary response about shocks or consumption outcomes (Financial Inclusion Insights, 2015). The standard 5-point scale permits interviewees to judge the severity of consumption shortfalls without at the same time being asked to provide a precise answer about income or consumption outcomes. It is well-known that questions that call for undue precision can elicit spurious and often wildly inaccurate responses.

A further important point is that we code the shock 1 to 5 from small to large as would normally be expected, whereas the well-being/poverty questions are coded analogously to consumption: a better outcome (ie. greater well-being) is coded higher. This is done to facilitate comparison with existing studies which, like Jack and Suri (2011) focus on the impact of m-money on consumption, rather than on the more general well-being measures that we use.

We also argue that there is a more subtle point concerning the possible confusion of shocks and outcomes. Consider an individual who has had a minor illness and been unable to work in a certain period. This might constitute a "small loss" in #1. If on the one hand, this individual was unable to pay medical bills for treatment even if "small", the response to #2.3 should be, and is likely to be, "a few times". If on the other hand, the individual was treated and was able to pay the medical bills then the appropriate response to #2.3 is "never", but the response to #1 remains "small loss" as before. However, it is possible that an individual who was able to cope with a small loss of this kind may not in fact view it as a loss at all, and respond "no loss" to #1. In other words it is possible that individuals who, by whatever means, are relatively well-insured against shocks may interpret what economists would describe as smaller shocks as not in fact being shocks at all. For this reason, we first investigate the direct relationship between m-money and well-being outcomes controlling for socio-economic and other relevant factors but ignoring the impact of any shocks. At the next stage we carry out the more standard approach by seeking to explain the relationship between m-money and well-being, controlling for the impact of any shocks as well as for socio-economic and other factors.

3. Method

As the nine well-being outcomes (2.1 – 2.9) are each ordered on a 5-point Likert scale, they provide a natural setting for an ordered probit model. This seeks to explain the observed outcome for interviewee i (y_i) in terms of a vector of exogenous variables (x_i). The true outcome (y_i^*) is a normally distributed continuous unobserved (latent) variable, and its relationship to x_i is given by the standard linear model:

$$y_i^* = x_i'\beta + \varepsilon_i \qquad \ldots(1)$$

β is a vector of coefficients and ε_i is a random error. The observed outcome (y_i) is one of the 5 points on the Likert scale assumed to be related to y_i^* by:

$$y_i = k \text{ if } \alpha_{k-1} < y_i^* \leq \alpha_k;\ k \in [1,5] \quad \ldots(2)$$

and:

$$\Pr[y_i = k] = \Pr[\alpha_{k-1} < y_i^* \leq \alpha_k] = \Pr[\alpha_{k-1} < x_i'\beta + \varepsilon_i \leq \alpha_k] = \Pr[\alpha_{k-1} - x_i'\beta < \varepsilon_i \leq \alpha_k - x_i'\beta] \ldots(3)$$

$$\Pr[y_i = k] = F(\alpha_{k-1} - x_i'\beta) - F(\alpha_k - x_i'\beta) \quad \ldots(4)$$

Where the α_i are unknown *a priori* and $F(\cdot)$ is the standard cumulative normal.

Table 6 about here

The ordered well-being variables and all the explanatory variables are shown in table 6 along with their mnemonics, and are as discussed in section 2 above. We began by using the basic ordered probit model to explain each of the well-being variables in turn. Initially, we used as regressors, nine independent socio-economic variables as controls (excluding A35 as the normalising variable for age) and the following variables related to m-money: *mobile, mmoney, savings* and *income*. We first used *mmoney* as the direct indicator of m-money use, leaving *recmm* and *recmm12* as additional candidates to help determine exactly how m-money may provide consumption insurance, if indeed it does. Also, we did not initially include the *shock* as an explanatory variable because of the possible confusion of shock and outcome discussed above. It is important to remember that the well-being/poverty variables are measured analogously to consumption (higher integers imply increasing well-being) so as to facilitate comparison with existing studies of the impact of m-money on consumption.

The basic model (1 – 4) assumes that the regressors are exogenous. However, as noted in section 1, *mmoney*, *savings* and possibly *mobile* are likely to be determined in part by individual well-being and to be correlated with one another. People who are better able to insure against or otherwise cope with negative shocks without an undue cut in consumption are more likely

to be able to save and to afford an m-money account as well as *vice-versa*. Simple regression diagnostics tend to confirm this hypothesis for *mmoney* and *savings.* There are therefore potential endogeneity issues for each of the nine well-being outcome variables. The simple ordered probit model is only appropriate if neither *mmoney* or *savings* is correlated with the error in the outcome equation (ε_i). The *mobile* phone variable is less exposed to this argument in our sample as a high proportion of the interviewed population do own a mobile phone.

If either *mmoney* or *savings* are correlated with the outcome error, an instrumental variable-ordered probit regression model with either or both of *mmoney* and *savings* as endogenous variables is preferred. In this case equation (1) is modified to:

$$y_i^* = x_i'\beta + w_i'\varphi + \varepsilon_i \qquad \ldots(5)$$

where y_i^* and x_i are as before and now w_i is a vector of binary endogenous variables. So (3) and (4) are modified to:

$$\Pr[y_i = k] = \Pr[\alpha_{k-1} < y_i^* \le \alpha_k] = \Pr[\alpha_{k-1} < x_i'\beta + w_i'\varphi + \varepsilon_i \le \alpha_k] \qquad (6)$$

$$\Pr[y_i = k] = F(\alpha_{k-1} - x_i'\beta - w_i'\varphi) - F(\alpha_k - x_i'\beta - w_i'\varphi) \qquad \ldots(7)$$

The outcome error (ε_i) and the binary endogenous error ($\varepsilon_{b,i}$) are assumed to be multivariate normal with mean 0 and covariance: $\Sigma = \begin{bmatrix} 1 & \rho_{1,b}' \\ \rho_{1,b} & \Sigma_b \end{bmatrix}$. Standard packages like STATA and LIMDEP can estimate this model using maximum likelihood. We initially estimated a general model treating *mmoney* and *savings* as endogenous and tested the significance of Corr(ε_i, $\varepsilon_{b,i}$). If both correlations were significant, the general model was retained. If either or both were not significant, we re-estimated the model treating either *mmoney* or *savings* (or both) as exogenous, as appropriate. We only report the version of the model determined by the error correlation tests on the general model; and in a majority of cases it transpired that only savings were significantly correlated with the error in the outcome equation.

Model (5)-(7) simply asks if m-money ownership helps explain cross-sectional variations in well-being/poverty levels, ignoring any shock that an individual may have experienced. Next therefore we modify the model to use the standard difference-in-difference (DID) approach to

get a more precise estimate of the impact of m-money. We continue to control for the direct effect of m-money and savings on well-being, but we add the shock, and the interaction between shock and m-money ownership to (5) to get:

$$y_i^* = x_i'\beta^* + w_i'\varphi + \gamma shock + \lambda(shock \times mmoney) + \varepsilon_i \quad \ldots(8)$$

Shock is an ordered (Likert-scale) variable and *mmoney* is binary as shown in table 6. This specification is analogous to the basic model of Jack and Suri (2014). They acknowledge the possible endogeneity of their m-money variable (M-Pesa use in Kenya) but deal with this by using additional interaction terms between m-money and the controls (x_i). We prefer instead to check for endogeneity by instrumenting *mmoney* and *savings* as explained above. The relative efficiency of the two different procedures is likely to depend on the proliferation of nuisance variables required: controls for Jack and Suri (2014), instruments in our case. We found that a few socio-economic variables were typically adequate as common instruments for *savings* and *mmoney*[4]. We used mobile phone ownership (*mobile*) as the independent instrument for *mmoney* as this is sufficiently ubiquitous as to be unlikely to suffer from reverse causation. *Income* was used as the independent instrument for *savings*, on the grounds that, if consumption or well-being is perfectly smoothed, it will be uncorrelated with income, whereas savings are almost certain to be correlated with well-being as, in fact, we find. Overall, we believe this estimation procedure to be relatively efficient.

The expected signs of γ and λ in (8) can be explained as follows. The coefficient γ shows the impact of any shock on well-being. If γ is zero, individuals are perfectly insured against shocks irrespective of the source of the insurance. In general, we would expect $\gamma < 0$: the larger the shock the less likely it is that individuals will be fully insured against it and hence the lower will be the well-being outcome. λ shows the contribution of m-money to individual insurance. If m-money helps provide insurance, through remittances for example, $\lambda > 0$ as it attenuates the adverse effect of the shock on well-being. Complete insurance provided by m-money exists if $\gamma + \lambda = 0$.

[4] Socio-economic variables used as instruments for Mmoney were Education, Rural, Employment, Female and Marital. For Savings they were Education and Rural. See the footnotes to tables 7 through 14.

4. Results

In previous research, food and medicine have been found to be critical outcomes in the face of adverse shocks. In general, households whose consumption is imperfectly insured, try to insure food consumption and medical treatment, with other spending bearing the burden of the shocks. We have an unusually complete set of well-being measures, but we pay particular attention to food and medicine. To keep the presentation as compact as possible, in the text, we only report results for key parameters omitting all the socio-economic variables. Two representative sets of results showing all the socio-economic variables are given in the appendix. In general these variables mostly have plausible signs: individuals who are more likely to have experienced greater well-being are broadly those who are: younger, educated, male, married, urban dwellers. Correspondingly, older, less-educated, unmarried females in rural areas are more likely to have suffered poor well-being. One surprising result is that the employed are more likely to have suffered from poor well-being within the 12 months analysed by the survey, than those who report being not employed.

Tables 7, 8 about here

Models were estimated first using *mmoney* as the mobile money variable. This is a binary variable equal to unity if the respondent has ever used an m-money service[5]. In the base model (equation 5), we see that m-money use and savings have a positive effect on most well-being outcomes but that these effects are also mostly not significant (table 7). Table 8 shows the DID estimates using *mmoney* as the prospective insurance variable. In these results, neither the shock (γ) nor the interaction (λ) are significant and they sometimes have unexpected signs. There is no real evidence here that m-money use helps provide insurance against adverse shocks. In addition, since the coefficients show the sign of the effect of each explanatory variable, there is no evidence that individuals are prioritising food or medical expenses in the face of adverse shocks, by reducing other spending.

[5] All those who had ever used m-money, also had a current m-money account and *vice-versa*.

These estimates, based as they are on m-money use (ownership) do not tell either the exact source or the timing of any potential impact of m-money on well-being. On the source, the evidence from East Africa is that a main channel for consumption insurance is through the remittances that those in difficulty call upon from their social networks, although m-money use *per se* still tends to be significant in regressions like those reported in table 8. On the timing, our well-being questions refer specifically to the last 12 months.

We therefore repeat the two previous exercises, replacing *mmoney* by the remittance variable, *recmm12*, a binary variable which tells if the individual has received an m-money remittance from family or friends within the last 12 months. Remittances received by other means or at other times are not included[6]. Since the questions about well-being and shocks refer to the preceding 12 months, both the source and timing of *recmm12* are more precise than *mmoney*. It might be suggested that remittances sent could also be included to help measure the strength of an individual's social network; but it seems more reasonable to argue that remittances sent correspond more nearly to the consumption of the sender, and so reflect her well-being rather the level of insurance she has achieved. Therefore, we included only remittances received and not also remittances sent. To provide consistent estimates of the model, we begin by instrumenting *recmm12* for analogous reasons as those for instrumenting *mmoney*.

Tables 9, 10 about here

In the base model (5), we see that remittances are now mostly positive as expected and highly significant in all the well-being equations while savings are also positive and significant (table 9). This clearly suggests that recent remittances received and savings do contribute positively to well-being, as we might expect. In the DID model using *recmm12* as insurance, the shock has the expected negative sign, and there is now clearer evidence that m-money remittances have a significant insurance effect ($\lambda > 0$) for food, fuel and shelter, and more weakly for

[6] However, we did also try both versions of *recmm*, which asks if the individual received m-money remittances (for regular support or emergencies) at any time, but these too were generally not significant.

medicine and water (table 10). Once again, it is not obvious that food and medicine are prioritised by the sample individuals.

An important limitation of the analysis so far is that the estimates use *income* as the independent instrument for *savings*. There was a substantial non-response rate to the question we asked about income, the only question in the survey for which this was the case. Individuals were asked about their approximate monthly or yearly income, and were required to choose from one of several income bands which were offered as options. A relatively high proportion of respondents chose the lowest band and 30% declined to answer. Income was entered as a binary variable in the model and, as can be seen, the estimating sample was reduced from 1000 to 691. Therefore, we sought to improve the efficiency of the estimates and make better use of the survey data by employing an alternative instrument to *income*. For this purpose we chose two binary variables reflecting whether respondents had any association with an informal financial group such as a Susu or co-operative (*inform*), and those who currently had an account with a formal financial institution such as a commercial bank (*formal*). It could be argued that these variables reflect financial inclusion and may therefore be subject to reverse causation from well-being. However, in the context of the model which focusses on well-being in the preceding 12 months it could equally be argued that having an account is more like a state variable and therefore a valid instrument in this case. We repeated the four previous sets of regression using these new instruments for *savings*, and first *mmoney* and then *recmm12* as the m-money variable. To save space we report only the results of the DID models.

Tables 11 and 12 about here

We begin with the regressions using *mmoney*; where we see that the sample increases to 982 and that the two new instruments do help explain savings. The qualitative results are broadly similar to those of the smaller sample (table 11: compare with table 8). The shock is positive and mostly significant but the intervention coefficients (λ) are still not significant and often negative rather than positive as we would expect. However, when *recmm12* is used as the m-

money variable, we see that in the larger sample with financial accounts as instruments, the results are considerably sharper than before (table 12: compare with table 10). With one exception, the shock is negative and significant; and for 6 out of 9 measures of well-being the intervention coefficients (λ) are positive and significant. The insurance effect appears strong as λ is generally similar in size to the shock coefficient (γ). However, the ordered probit coefficients only give the sign of the impact of each independent variable on well-being, but do not tell the marginal effect. We report selected marginal effects below.

In summary, we argue that these results provide new and firmer evidence that m-money plays an important role in household insurance in Ghana across a wide range of well-being outcomes. We have established that it is m-money remittances received in the last 12 months that provide insurance for outcomes in the last 12 months, rather than m-money ownership in general.

However, it is clear from the results so far that savings also play an important role in the determination of well-being. *Savings* are positive and highly significant in virtually all the regressions, especially in the larger sample. It is therefore natural to use the DID approach to study the insurance effects of recent savings, to compare with those of m-money. For this purpose we modify (8) by adding (shock×savings) to get:

$$y_i^* = x_i'\beta^* + w_{b,i}'\varphi + \gamma shock + \lambda(shock \times mmoney) + \eta(shock \times savings) + \varepsilon_i \quad \ldots(9)$$

Here, η gives the effect of *savings* in mitigating the impact of any shock on well-being, and hence shows the insurance effect of savings. Savings and m-money jointly provide complete insurance if $\gamma + \lambda + \eta = 0$. Like *recmm12* and unlike *mmoney*, *savings* refers to individuals who were able to save in the last 12 months, and therefore almost certainly had potential resources to help tide over an adverse shock. We continue to control for the direct effect of *savings* and the m-money variables, as well as for any endogeneity, where we instrument *savings* and the m-money variables as suggested by the diagnostics.

To save space we report only the DID regressions using the larger sample with *inform* and *formal* as independent instruments for *savings*. Comparing m-money and savings (table 13),

we see that the interaction parameter for *mmoney* (λ) is now not significant, whereas as that for savings (η) is positive and highly significant in all the equations. The size of η is also notable and provides provisional evidence that if individuals are able to save they can be well-insured against adverse shocks. Turning to remittances (*recmm12*), when we add the *shock*×*savings* interaction (table 14), much of the insurance effect is transferred from *recmm12* to *savings*: the shock is significantly negative; the interaction with *savings* is significantly positive in all 9 well-being equations; but the interaction with *recmm12* is now smaller and less significant in all the equations. M-money remittances do have a significant insurance effect in the *nofood*, *noshelter* and *unsafe* equations, but their contribution to the overall household insurance effect is less than before. Even so, we do see evidence of joint insurance by savings and remittances for food, shelter and safety, and marginally so for medicine and fuel; as we have: $\gamma < 0$, $\lambda > 0$, and $\eta > 0$ in all these equations.[7] Here too, the results are qualitatively broadly consistent across well-being measures.

Table 13, 14 about here

Each coefficient in the ordered probit model gives the sign of the impact of the corresponding explanatory variable on any well-being measure, but it does not tell the marginal effect. We therefore cannot use the size of the estimated γ, λ and η coefficients (shock and the two interventions) to make inferences about the exact extent of well-being insurance. We can however, compute the marginal effects at each integer; and we do this in table 15 for the final set of estimates with the larger sample, using *recmm12* and *savings* as the interacted variables with the shock. Therefore, table 15 is based on the estimates in table 14. We report the marginal effects of the shock, the interactions, and the impact of *recmm12* and *savings*; but only if the effect is significant for at least one point on the ordinal scale. Each marginal effect shows the impact of a unit increase in the size of shock on the probability that a respondent reporting (for example) never going without food (y_5) would instead report going without food

[7] Although some $\gamma + \lambda + \eta > 0$, we cannot infer over-insurance, as the coefficients do not represent true marginal effects.

a few times (y_4). The calculations effectively model a lateral shift in the probability distribution, and so the marginal effects must sum to zero across outcomes.

Table 15 about here

For those who have the highest well-being ($y_i = 5$), the marginal effect of an adverse shock has the expected negative impact on well-being probability ($\gamma < 0$), irrespective of the welfare measure, whether it be food, medicine or any other. Those individuals who are able to obtain m-money remittances or who have savings are fully insured, but the predominant contribution to well-being-insurance is provided by savings rather than m-money ($\lambda + \eta \approx 0$ or $\lambda + \gamma + \eta \approx 0$). The insurance role that we find for m-money is consistent with the evidence reported from East Africa, but our results are different in that they imply a larger role for savings than previously reported (eg. Jack and Suri, 2014).

It may seem surprising that, at lower levels of well-being the marginal effect of an adverse shock is uniformly positive though mostly small. In principle, this implies that if these individuals suffer an increase in shock size, they are essentially self-insured, in that there is a small probability that they will move up a point in the self-assessed well-being scale. It should be noted first that for those at the lowest level of well-being ($y_i = 1$), the calculated marginal effect of any adverse shock is necessarily opposite in sign to those at the highest level[8]. In general, the estimates of marginal effects at points 2 through 4 on the well-being scale must be treated with some caution. Although they are all significant, the magnitude of the coefficients is very small. For example, someone who has often gone without food (point 2) and who suffers a 1 point shock has a 1.44% probability of moving up a point on the well-being scale through self-insurance. Possibly those who are less well-off are more practised in coping with adverse shocks than those who have never recently experienced going without. The results may also be attributable partly to the relatively small proportion of the sample who reported

[8] This is related to the property that the marginal effects must sum to zero across outcomes. See for example the discussion in Wooldridge (2010) p. 655 ff.

being recently at the lower levels of well-being, and the consequent difficulty of identifying the marginal effects in practise.

A further interpretation of table 15 involves a comparison between the marginal effects of either *recmm12* or *savings* on the one hand and the interaction between the shock and either *recmm12* or *savings* on the other. Here we see clearer evidence that m-money remittances in and of themselves do contribute positively to well-being for individuals who start with relatively low well-being, as almost all the marginal coefficients for *recmm12* on its own are positive and significant, whereas most of the savings coefficients are not significant. This suggests that m-money remittances are of general use in improving well-being whereas savings are most likely provide self-insurance to be used in the event of a negative shock.

5. Conclusion

The results presented in this paper come from a new survey of Ghanaian households, designed to understand how and why individuals access different financial services, with particular emphasis on m-money and savings; and the impact of m-money on financial inclusion and poverty. The results provide strong new evidence about how m-money is used and the interaction between m-money and savings. We find that in Ghana, m-money is used to help mitigate or insure against negative shocks to well-being. The mechanism by which m-money is used is through the receipt of (unrequited) remittances based on family and social networks. M-money use *per se* does not provide a significant insurance effect nor does it contribute generally to well-being. On the other hand, m-money remittances play an insurance role, but mainly for those individuals currently at the highest level of well-being. Well-off individuals are not fully self-insured, but among these individuals, m-money remittances help provide insurance against shocks. Individuals whose well-being is lower appear to be largely self-insured without the mediation of m-money.

A further important conclusion is that savings habits play a critical role in insurance, larger in fact than that played by m-money remittances. Savings and m-money remittances jointly provide almost complete well-being-insurance against negative shocks, but again mainly at the

highest level of well-being. However, it seems that the role of savings and m-money remittances are complementary in that savings support well-being in the face of shocks whereas m-money remittances provide general support to well-being irrespective of the presence of shocks.

In future research therefore, it will be important to examine further the relationship between savings and m-money use, especially remittances; with a view to establishing how far savings behaviour is connected with or fostered by m-money use, and how far it is due to more traditional factors such as income and household characteristics. It will also be interesting to investigate if these results can be generalised to other samples in Ghana or to other countries. Overall though, the results underline the importance of both savings and m-money remittances in helping to provide well-being insurance.

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Table 1. Ghana: Survey and Population Characteristics

	Survey: 2017 (% of survey: 1000 aged 18+)	Ghana Population (% of population aged 15+)	Source and date of Population Data[1]
Rural Population	39.30	44.69[2]	WDI; 2017
Urban Population	60.70	55.31[2]	WDI; 2017
Female Population	46.40	49.05	WDI; 2017
Male Population	53.60	50.95	WDI; 2017
Age 18-25	25.70	31.73	WDI; 2017[3]
Age 26-35	31.90	24.88	WDI; 2017
Age 36-45	23.10	18.23	WDI; 2017
Age 46-55	10.20	12.25	WDI; 2017
Age 56 and Over	9.10	12.90	WDI; 2017
Un-employed/Inactive	35.90	24.88	WDI; 2017
Employed	64.10	75.12	WDI; 2017
Uneducated	18.40	23.58	UNESCO; 2010
Educated to Primary School or above	81.40	76.42[4]	UNESCO; 2010

Notes: 1. WDI: World Bank (2019) World Development Indicators; UNESCO: UNESCO (2019) UIS Database.
2. The WDI data is in percent of the total population
3. The WDI data is for 15 – 25 year olds
4. Estimated literacy rate of population aged 15+

Table 2. Survey Results: Socio-economic Characteristics – Mobile Phone+SIM Card Owners/Non-owners

		Table 2.1		Table 2.2		
Group		**Own a Mobile+SIM (% of each group)**	**Don't Own a Mobile+SIM (% of each group)**	**% of Whole Sample**	**% of Mobile+ SIM Owners**	**% of Mobile+ SIM Non-owners**
	Whole Sample	85.30	14.70			
1	Rural Population	82.70	17.30	39.30	38.10	46.26
2	Urban Population	86.99	13.01	60.70	61.90	53.74
3	Female Population	82.97	17.28	46.30	44.90	54.42
4	Male Population	87.52	12.48	53.70	55.10	45.58
5	Age 18-25	80.54	19.46	25.70	24.27	34.01
6	Age 26-35	93.10	6.90	31.90	34.82	14.97
7	Age 36-45	87.88	12.12	23.10	23.80	19.05
8	Age 46-55	85.29	14.71	10.20	10.20	10.20
9	Age 56 and Over	64.84	35.16	9.10	6.92	21.77
10	Un-employed/Inactive	74.65	25.35	35.90	31.42	61.90
11	Employed	91.26	8.74	64.10	68.58	38.10
12	Yearly Income Below 12k Cedis	89.55	10.45	50.70	53.22	36.05
13	Yearly Income Over 12k Cedis	93.65	6.35	18.90	20.75	8.16
14	Uneducated	67.93	32.07	18.40	14.65	40.14
15	Primary School Educated	75.96	24.04	10.40	9.26	17.01
16	Secondary School Educated	89.58	10.42	48.00	50.41	34.01
17	Undergraduate Educated and Above	94.40	5.60	23.20	25.67	8.84
18	Living without Partner	79.62	20.38	47.60	44.43	65.99
19	Married/Living with Partner	91.93	8.07	50.80	54.75	27.89

Notes: Table 2.1 gives the socio-economic characteristics of the whole sample split between mobile phone+SIM owners versus non-owners. Table 2.2 gives the same characteristics in terms of the % of mobile+SIM owners or non-owners. Thus, 82.7% of the rural population own a phone+SIM; whereas 38.1% of mobile phone+SIM owners are located in rural areas. Percentages do not necessarily sum to 100 because they exclude interviewees who responded either "Don't Know" or "Refused to Answer".

Table 3. Survey Results: Socio-economic Characteristics – Mobile Money Users and Non-users

Group		Table 3.1		Table 3.2		
		Use Mobile Money (% of each group)	Don't Use Mobile Money (% of each group)	% of Whole Sample	% of Mobile Money Users	% of Mobile Money Non-users
	Whole Sample	34.90	65.10			
1	Rural Population	28.24	71.76	39.30	31.81	43.32
2	Urban Population	39.21	60.79	60.70	68.19	56.68
3	Female Population	28.73	71.27	46.40	38.11	50.69
4	Male Population	40.22	59.78	53.60	61.89	49.31
5	Age 18-25	33.46	66.54	25.70	24.64	26.27
6	Age 26-35	41.38	58.62	31.90	37.82	28.73
7	Age 36-45	35.93	64.07	23.10	23.78	22.73
8	Age 46-55	27.45	72.55	10.20	8.02	11.37
9	Age 56 and Over	21.98	78.02	9.10	5.73	10.91
10	Un-employed/Inactive	29.53	70.47	35.90	30.37	38.86
11	Employed	37.91	62.09	64.10	69.63	61.14
12	Yearly Income Below 12k Cedis	33.33	66.67	50.80	48.42	51.92
13	Yearly Income Over 12k Cedis	43.92	56.08	18.70	23.78	16.28
14	Uneducated	11.41	88.59	18.40	6.02	25.04
15	Primary School Educated	20.19	79.81	10.40	6.02	12.75
16	Secondary School Educated	38.75	61.25	47.80	53.30	45.16
17	Undergraduate Educated and Above	52.16	47.84	23.20	34.67	17.05
18	Living without Partner	38.87	61.13	47.60	53.01	44.70
19	Married/Living with Partner	31.69	68.31	50.80	46.13	53.30

Notes: Table 3.1 gives the socio-economic characteristics of the whole sample split between mobile money users versus non-users. Table 3.2 gives the same characteristics in terms of the % of mobile money users or non-users. Thus, 28.24% of the rural population use mobile money; whereas 31.81% of mobile money users are located in rural areas. Percentages do not necessarily sum to 100 because they exclude interviewees who responded either "Don't Know" or "Refused to Answer".

Table 4. Survey Results: Account and Card Ownership – Mobile Money Users/Non-users

		Table 4.1		Table 4.2		
Group		**Use Mobile Money (% of each group)**	**Don't Use Mobile Money (% of each group)**	**% of Whole Sample**	**% of Mobile Money Users**	**% of Mobile Money Non-users**
1	Whole Sample	34.90	65.10			
2	Member of an Informal Financial Group	30.16	69.84	25.20	21.78	27.04
3	Not a Member of an Informal Financial Group	36.50	63.90	74.80	78.22	72.96
4	Have an Account with a Formal Financial Group	47.65	52.35	44.70	61.03	35.94
5	– Have a Bank Account	51.02	48.98	34.30	50.14	25.81
6	Don't have an Account with a Formal Financial Group	24.41	76.14	54.90	38.40	63.75
	Main Way to Manage Cash					
7	– Use an Informal Financial Group	26.98	73.02	18.90	14.61	21.20
8	– Use a Formal Financial Group	45.43	54.57	35.00	45.56	29.34
9	– Use Them Equally	57.63	42.37	5.90	9.74	3.84
10	Have an ATM/Debit Card	59.59	40.41	19.30	32.95	11.98
11	Don't Have an ATM/Debit Card	32.01	67.99	40.30	36.96	42.09
12	Have a Credit Card	64.29	35.71	1.40	2.58	0.77
13	Don't Have a Credit Card	40.32	59.68	56.80	65.62	52.07
14	Have a Pre-paid Card	56.32	43.68	8.70	14.04	5.84
15	Don't Have a Pre-paid Card	38.26	61.74	50.70	55.59	48.08

Notes: Table 4.1 shows the ownership and usage of financial accounts and cards as between mobile money users versus non-users. Table 4.2 gives the same characteristics in terms of the % of mobile money users or non-users. Thus, 30.16% of those who are a member of an Informal Financial Group use mobile money; whereas 21.78% of mobile money users are a member of an Informal Financial Group. Percentages do not necessarily sum to 100 because they exclude interviewees who responded either "Don't Know" or "Refused to Answer".

Table 5.1 Survey Results: Selected Mobile Money and Savings Transactions

	% of Whole Sample		% of Mobile Money Users	
	Yes	**No**	**Yes**	**No**
In the last 12 months, has:				
Saved Money	48.50	51.50	59.03	40.97
Received money from a relative or friend living in a different area in Ghana by mobile phone	29.40	70.60	56.16	43.84
Sent money to a relative or friend living in a different area in Ghana by mobile phone	30.00	70.00	53.58	46.42
Using mobile money, has:				
Received money from family members, friends, or others to help with emergencies	20.50	14.40	58.73	41.27
Received money from family members, friends, or others for regular support	17.90	17.00	51.29	48.71
Sent money to family members, friends, or others to help with emergencies	19.50	15.40	55.88	44.12
Sent money to family members, friends, or others for regular support	15.20	19.70	43.55	56.45

Table 5.2. Survey Results: Meeting Emergency Needs

	% of Mobile Money Users	% of Mobile Money Non-users
Possibility to find 800 Cedis to meet an emergency		
Very Possible	33.52	25.19
Somewhat Possible	22.92	15.67
Neutral	19.20	11.83
Not Very Possible	15.76	15.21
Impossible	8.60	32.10
Main Source of finding 800 Cedis to meet an emergency		
Savings	39.83	27.65
Family, Relatives, or Friends	37.82	36.41
Money from Working	15.76	14.75
Loan from an Employer	0.57	0.46
A Credit Card or Borrowing from a Formal Financial Institution	0.86	0.61
An Informal Private Lender or Pawn House	0.29	0.31
Some Other Source	4.87	19.82

Table 6. Survey Questions: Well-being and Poverty: Variables and Definition

Variable	Definition
Well-being (y_i); In the last 12 months, have you:	
Nofood	Gone without enough food to eat: … …
Nomedicine	Gone without medicine or medical treatment: ... ...
Nowater	Gone without clean water to drink or cook: ... ...
Nofuel	Gone without fuel to heat your home or cook food: ... ...
Nolight	Gone without electricity in your home (apart from power cuts): ... ...
Noshelter	Gone without shelter: ... ...
Unsafe	Felt unsafe from crime in your home: ... ...
Noschoolfee	Kept a child from school (or not been to school) because of no money to pay school fees: ... ...
Childwork	Kept a child from school (or not been to school) because (s)he has to help with the family's business (or other work, eg. harvest): ... ...
… …	most of time =1, often =2, sometimes =3, only few times =4, never =5
Explanatory variables (x_i)	
Shock	In the last 12 months, have you suffered any unexpected loss of income, assets or personal items: very large =5, large =4, moderate =3, small =2, no loss suffered =1
Mobile	Own a mobile phone =1, no=0
Mmoney	Has used mobile money service for any financial activity =1, otherwise =0
(Mmreg)	Has a registered account with a mobile money service = 1; otherwise = 0
Recmm12	In the last 12 months, has received money from a relative or friend living in a different area in Ghana through a mobile phone = 1; otherwise = 0
(Recmm)	Has at some time used a mobile money account to receive money from family, friends, or others, for regular support or emergencies (2 questions)
Savings	Has saved money in the last 12 months =1, otherwise = 0
Income	over12k=1, under12k=0
Inform	member of an informal financial institution =1, otherwise =0
Formal	have an account with formal financial institutions =1, otherwise =0
Socio-economic variables (x_i)	
Education	no school =1, primary =2, JSS =3, senior high =4, undergraduate/professional =5, master =6
Rural	rural=1, otherwise=0
Employment	employed (1-4) = 1, unemployed/inactive (5-10) = 0
Female	female =1, male =0
A25	18-25 =1, otherwise =0
A35	26-35 =1, otherwise =0
A45	36-45 =1, otherwise =0
A55	46-55 =1, otherwise =0
Over55	over 55 =1, otherwise =0
Marital	married/living with partner(1,4)=1, others (2,3,5)=0

Table 7. Impact on Well-being: Mobile Money

Ordered Probit using income as instrument: 691 Observations						
Y; W	**Income**	**Mobile**	**Mmoney**	**Savings**	**Corr (e_W, e_Y)**	**χ^2(N)**
Y:Nofood		0.499	0.0003	0.244		45.4***
		(1.49)	(0.00)	(0.32)		(12)
W:Savings	0.413	1.147			0.018	
	(3.36)***	(5.66)***			(0.04)	
Y:Nomedicine		-0.036	0.075	1.462		144.1***
		(0.15)	(0.76)	(4.98)***		(12)
W:Savings	0.379	1.096			-0.671	
	(3.03)***	(5.17)***			(3.61)***	
Y:Nowater		0.153	0.092	1.181		81.6***
		(0.14)	(0.84)	(0.55)		(12)
W:Savings	0.395	1.129			-0.431	
	(1.79)*	(5.18)***			(0.31)	
Y:Nofuel		0.815	-0.070	-0.070		47.5***
		(2.39)**	(0.63)	(0.07)		(12)
W:Savings	0.407	1.149			0.283	
	(3.10)***	(5.67)***			(0.48)	
Y:Nolight		-0.019	-0.133	1.393		113.3***
		(0.06)	(1.4)	(4.63)***		(12)
W:Savings	0.399	1.152			-0.598	
	(3.19)***	(5.62)***			(3.13)***	
Y:Noshelter		0.622	-0.013	0.525		60.5***
		(2.18)**	(0.10)	(0.86)		(12)
W:Savings	0.413	1.147			-0.008	
	(3.39)***	(5.65)***			(0.02)	
Y:Unsafe		0.643	0.028	-0.277		63.7***
		(3.25)***	(0.26)	(0.69)		(12)
W:Savings	0.416	1.150			0.292	
	(3.48)***	(5.72)***			(1.23)	
Y:Noschoolfee		0.788	0.058	-0.090		92.3***
		(3.27)***	(0.46)	(0.13)		(12)
W:Savings	0.413	1.153			0.393	
	(3.39)***	(5.69)***			(0.98)	
Y:Childwork		0.673	0.354	-0.317		95.6***
		(3.55)***	(2.47)**	(0.89)		(12)
W:Savings	0.432	1.140			0.436	
	(3.69)***	(5.66)***			(2.17)**	

Notes:

Table 7 shows the results of estimating: $y_i^* = x_i'\beta + w_i'\varphi + \varepsilon_i$ (equation 5) using ordered probit to explain in turn: Nofood; Nomedicine; Nowater; Nofuel; Nolight; Noshelter; Unsafe; Noschoolfee; and Childwork (the y variables). Mmoney represents general mobile money use. The w are variables which are correlated with the error in (5) and are therefore instrumented. Corr(e_W, e_Y) is the estimated correlation between each w_i and the error (ε). The w may include either or both of Mmoney and Savings, depending on the significance of the estimated error correlation, Corr(e_W, e_Y), in the general equation. The instruments for Savings include Income, Mobile and (not shown) Education, Rural; those for Mmoney include Mobile and (not shown) Education, Rural, Employment, Female, Marital. The exogenous variables (x) include Income and/or Mobile unless used as instruments, and Savings and/or Mmoney if exogenous. All equations also include the following controls which are not reported: Education, Rural, Employment, Female, A25, A35, A45, A55, Over55, and Marital. Omitted results are available from the authors.

Z statistics based on robust standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1; χ^2(N) is a combined significance test for all regressors, with N degrees of freedom.

Table 8. Impact on Well-being: Mobile Money – Difference in Difference

Ordered Probit using income as instrument: 691 Observations								
Y; W	**Shock**	**Shock × Mmoney**	**Income**	**Mobile**	**Mmoney**	**Savings**	**Corr (ew, eY)**	**χ^2(N)**
Y:Nofood	-0.078	0.006		0.392	-0.040	0.583		56.1***
	(1.84)*	(0.09)		(1.01)	(0.22)	(0.71)		(14)
W:Savings			0.414	1.144			-0.145	
			(3.42)***	(5.61)***			(0.29)	
Y:Nomedicine	-0.046	-0.051		-0.091	0.178	1.602		172.2***
	(1.38)	(0.93)		(1.38)	(0.93)	(5.82)***		(14)
W:Savings			0.381	1.086			-0.725	
			(3.11)***	(5.05)***			(4.40)***	
Y:Nowater	-0.025	-0.072		0.047	0.255	1.413		106.0***
	(0.68)	(1.21)		(0.68)	(1.21)	(1.29)		(12)
W:Savings			0.382	1.123			-0.553	
			(2.15)**	(5.45)***			(0.76)	
Y:Nofuel	-0.020	-0.042		0.782	0.019	0.060		50.5***
	(0.49)	(0.69)		(1.76)*	(0.11)	(0.05)		(12)
W:Savings			0.409	1.148			0.223	
			(3.10)***	(5.66)***			(0.29)	
Y:Nolight	0.027	-0.011		0.020	-0.105	1.309		108.8***
	(0.73)	(0.19)		(0.08)	(0.66)	(3.69)***		(12)
W:Savings			0.401	1.152			-0.557	
			(3.19)***	(5.62)***			(2.56)**	
Y:Noshelter	-0.010	0.034		0.622	-0.090	0.530		60.3***
	(0.23)	(0.51)		(2.16)**	(0.43)	(0.85)		(12)
W:Savings			0.413	1.147			-0.010	
			(3.39)***	(5.65)***			(0.02)	
Y:Unsafe	-0.117	-0.036			-0.301	1.740		225.7***
	(3.67)***	(0.80)			(1.14)	(8.85)***		(13)
W:Savings			0.238	0.984			-0.878	
			(1.89)*	(4.30)***			(9.11)***	
W:Mmoney				1.028			0.226	
				(3.72)***			(1.75)*	
Y:Noschoolfee	0.012	-0.086		0.780	0.258	-0.063		96.5***
	(0.28)	(1.21)		(3.27)***	(1.26)	(0.09)		(12)
W:Savings			0.414	1.153			0.382	
			(3.41)***	(5.69)***			(0.99)	
Y:Childwork	-0.050	0.033		0.660	0.267	-0.224		96.7***
	(1.08)	(0.37)		(3.42)***	(1.10)	(0.60)		(12)
W:Savings			0.429	1.141			0.406	
			(3.64)***	(5.66)***			(1.98)**	

Notes:

Table 8 shows the results of estimating: $y_i^* = x_i'\beta^* + w_i'\varphi + \gamma shock + \lambda(shock \times mmoney) + \varepsilon_i$ (equation 8) using ordered probit to explain in turn: Nofood; Nomedicine; Nowater; Nofuel; Nolight; Noshelter; Unsafe; Noschoolfee; and Childwork (the y variables). Mmoney represents general mobile money use. The w are variables which are correlated with the error in (8) and are therefore instrumented. Corr(e_W, e_Y) is the estimated correlation between each w_i and the error (ε). The w may include either or both of Mmoney and Savings, depending on the significance of the estimated error correlation, Corr(e_W, e_Y), in the general equation. The instruments for Savings include Income, Mobile and (not shown) Education, Rural; those for Mmoney include Mobile and (not shown) Education, Rural, Employment, Female, Marital. The exogenous variables (x) include Income and/or Mobile unless used as instruments, and Savings and/or Mmoney if exogenous. All equations also include the following controls which are not reported: Education, Rural, Employment, Female, A25, A35, A45, A55, Over55, and Marital. Omitted results are available from the authors.

Z statistics based on robust standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1; χ^2(N) is a combined significance test for all regressors, with N degrees of freedom.

Table 9. Impact on Well-being: Mobile Money Remittances

Ordered Probit using income as instrument: 691 Observations						
Y; W	**Income**	**Mobile**	**Recmm12**	**Savings**	**Corr (e_W, e_Y)**	**χ^2(N)**
Y:Nofood	0.018		0.971	0.247		107.9***
	(0.18)		(5.39)***	(2.79)***		(12)
W:Recmm12		1.002			-0.701	
		(4.01)***			(6.69)***	
Y:Nomedicine	-0.008		1.472	-0.078		146.0***
	(0.03)		(5.06)***	(0.87)		(12)
W:Recmm12		1.094			-0.676	
		(5.12)***			(3.67)***	
Y:Nowater	0.073		1.326	0.376		188.3***
	(0.78)		(7.34)***	(4.50)***		(12)
W:Recmm12		0.890			-0.837	
		(3.19)***			(6.91)***	
Y:Nofuel		0.790	-0.066	0.040		47.3***
		(2.28)**	(0.07)	(0.37)		(12)
W:Savings	0.407	1.150			0.280	
	(3.10)***	(5.66)***			(0.48)	
Y:Nolight		-0.044	1.417	-0.048		111.7***
		(0.19)	(4.70)***	(0.51)		(12)
W:Savings	0.396	1.150			-0.612	
	(3.14)***	(5.62)***			(3.17)***	
Y:Noshelter	0.020		1.236	0.423		163.4***
	(0.19)		(7.99)***	(4.38)***		(12)
W:Recmm12		1.002			-0.803	
		(3.97)***			(9.61)***	
Y:Unsafe			-0.954	1.507		313.3***
			(2.84)***	(11.72)***		(11)
W:Recmm12		1.019			0.422	
		(4.17)***			(2.11)**	
W:Savings	0.196	1.103			-0.806	
	(1.45)	(5.78)***			(11.7)***	
Y:Noschoolfee	-0.044		1.319	0.480		212.4***
	(0.37)		(6.55)***	(4.16)***		(12)
W:Recmm12		1.003			-0.727	
		(4.02)***			(6.21)***	
Y:Childwork	-0.187		1.433	0.322		192.9***
	(1.40)		(5.21)***	(2.58)***		(12)
W:Recmm12		0.910			-0.765	
		(3.27)***			(4.30)***	

Notes:

Table 9 shows the results of estimating: $y_i^* = x_i'\beta + w_i'\varphi + \varepsilon_i$ (equation 5) using ordered probit to explain separately: Nofood; Nomedicine; Nowater; Nofuel; Nolight; Noshelter; Unsafe; Noschoolfee; and Childwork (the y variables). Recmm12 represents mobile money use for remittances. The w are variables which are correlated with the error in (5) and are therefore instrumented. Corr(e_W, e_Y) is the estimated correlation between each w_i and the error (ε). The w may include either or both of Recmm12 and Savings, depending on the size and significance of the estimated error correlation, Corr(e_W, e_Y), in the general equation. The instruments for Savings include Income, Mobile and (not shown) Education, Rural; those for Recmm12 include Mobile and (not shown) Education, Rural, Employment, Female, Marital. The exogenous variables (x) include Income and/or Mobile unless used as instruments, and Savings and/or Recmm12 if exogenous. All equations also include the following controls which are not reported: Education, Rural, Employment, Female, A25, A35, A45, A55, Over55, and Marital. Omitted results are available from the authors.

Z statistics based on robust standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1; χ^2(N) is a combined significance test for all regressors, with N degrees of freedom.

Table 10. Impact on Well-being: Mobile Money Remittances – Difference in Difference

Ordered Probit using income as instrument: 691 Observations								
Y; W	**Shock**	**Shock × Recmm12**	**Income**	**Mobile**	**Recmm12**	**Savings**	**Corr (ew, eY)**	**χ^2(N)**
Y:Nofood	-0.105	0.119	0.037		0.691	0.308		121.7***
	(3.08)***	(2.21)**	(0.36)		(2.89)***	(3.08)***		(14)
W: Recmm12				0.979			-0.715	
				(3.87)***			(6.40)***	
Y:Nomedicine	-0.086	0.063			-1.013	1.626		272.4***
	(2.88)***	(1.25)			(2.87)***	(10.44)***		(13)
W:Savings			0.366	1.098			-0.728	
			(3.31)***	(5.34)***			(8.47)***	
W: Recmm12				0.938			0.426	
				(3.67)***			(2.18)**	
Y:Nowater	-0.062	0.069	0.088		1.190	0.405		219.2***
	(2.18)**	(1.52)	(0.98)		(5.77)***	(4.41)***		(14)
W:Recmm12				0.841			-0.864	
				(2.87)***			(7.39)***	
Y:Nofuel	-0.079	0.127	-0.011	0.634	-0.272	0.445		66.7***
	(2.07)**	(2.10)**	(0.09)	(3.71)***	(1.46)	(4.01)***		(15)
Y:Nolight	0.034	-0.017		-0.005	-0.014	1.325		107.1***
	(0.95)	(0.30)		(0.02)	(0.08)	(3.66)***		(14)
W:Savings			0.400	1.150			-0.568	
			(3.15)***	(5.62)***			(2.54)**	
Y:Noshelter	-0.040	0.139	0.005		0.900	0.436		163.8***
	(1.27)	(2.49)**	(0.05)		(4.04)***	(4.11)***		(14)
W:Recmm12				1.009			-0.793	
				(4.00)***			(9.16)***	
Y:Unsafe	-0.139	-0.015		0.589	-0.180	0.205		87.0***
	(3.39)***	(0.23)		(1.14)	(1.00)	(0.15)		(14)
W:Savings			0.413	1.147			0.098	
			(3.38)***	(5.68)***			(0.12)	
Y:Noschoolfee	-0.034	0.061	-0.041		1.180	0.497		211.0***
	(0.91)	(0.91)	(0.34)		(4.92)***	(4.01)***		(14)
W:Recmm12				0.997			-0.733	
				(4.00)***			(6.28)***	
Y:Childwork	-0.037	-0.016	-0.166		1.465	0.363		192.8***
	(0.92)	(0.22)	(1.24)		(4.46)***	(2.61)***		(14)
W:Recmm12				0.914			-0.755	
				(3.28)***			(4.10)***	

Notes:

Table 10 shows the results of estimating: $y_i^* = x_i'\beta^* + w_i'\varphi + \gamma shock + \lambda(shock \times mmoney) + \varepsilon_i$ (equation 8) using ordered probit to explain in turn: Nofood; Nomedicine; Nowater; Nofuel; Nolight; Noshelter; Unsafe; Noschoolfee; and Childwork (the y variables). Recmm12 represents mobile money use for remittances. The w are variables which are correlated with the error in (8) and are therefore instrumented. Corr(e_W, e_Y) is the estimated correlation between each w_i and the error (ε). The w may include either or both of Recmm12 and Savings, depending on the significance of the estimated error correlation, Corr(e_W, e_Y), in the general equation. The instruments for Savings include Income, Mobile and (not shown) Education, Rural; those for Recmm12 include Mobile and (not shown) Education, Rural, Employment, Female, Marital. The exogenous variables (x) include Income and/or Mobile unless used as instruments, and Savings and/or Recmm12 if exogenous. All equations also include the following controls which are not reported: Education, Rural, Employment, Female, A25, A35, A45, A55, Over55, and Marital. Omitted results are available from the authors.

Z statistics based on robust standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1; χ^2(N) is a combined significance test for all regressors, with N degrees of freedom.

Table 11. Impact on Well-being: Mobile Money – Difference in Difference

Ordered Probit using accounts as instruments: 982 Observations									
Y; W	**Shock**	**Shock × Mmoney**	**Inform**	**Formal**	**Mobile**	**Mmoney**	**Savings**	**Corr (ew, eY)**	**χ^2(N)**
Y:Nofood	-0.115	-0.008			0.093	-0.046	0.759		88.1***
	(3.32)***	(0.15)			(0.64)	(0.29)	(3.29)***		(14)
W:Savings			0.881	0.903	1.058			-0.267	
			(7.90)***	(8.57)***	(6.19)***			(1.86)*	
Y:Nomedicine	-0.084	-0.028			0.043	0.103	1.030		155.8***
	(2.52)**	(0.50)			(0.31)	(0.66)	(5.27)***		(14)
W:Savings			0.880	0.911	1.056			-0.356	
			(7.94)***	(8.84)***	(6.11)***			(2.82)***	
Y:Nowater	-0.078	-0.008			-0.123	0.017	1.384		169.0***
	(2.45)**	(0.16)			(0.94)	(0.11)	(8.92)***		(14)
W:Savings			0.916	0.885	1.046			-0.594	
			(8.64)***	(8.61)***	(6.10)***			(6.40)***	
Y:Nofuel	-0.060	-0.019			0.237	-0.147	0.758		69.6***
	(1.83)*	(0.35)			(1.49)	(0.95)	(3.04)***		(14)
W:Savings			0.872	0.911	1.067			-0.230	
			(7.78)***	(8.79)***	(6.19)***			(1.47)	
Y:Nolight	-0.010	0.013				-0.846	0.918		98.4***
	(0.31)	(0.29)				(2.57)**	(6.09)***		(13)
W:Savings			0.883	0.864	1.111			-0.356	
			(8.00)***	(8.11)***	(6.28)***			(3.75)***	
W:Mmoney					1.032			0.385	
					(5.00)***			(2.22)**	
Y:Noshelter	-0.075	0.045			0.035	-0.189	1.419		168.7***
	(2.07)**	(0.79)			(0.21)	(1.10)	(7.31)***		(14)
W:Savings			0.879	0.931	0.996			-0.628	
			(8.06)***	(9.22)***	(5.89)***			(5.85)***	
Y:Unsafe	-0.203	-0.014			0.096	-0.008	0.819		140.9***
	(5.74)***	(0.26)			(0.61)	(0.05)	(3.14)***		(14)
W:Savings			0.884	0.906	1.071			-0.261	
			(7.85)***	(8.59)***	(6.23)***			(1.55)	
Y:Noschoolfee	-0.019	-0.111			0.200	0.283	0.894		137.7***
	(0.51)	(1.82)*			(1.29)	(1.55)	(3.88)***		(14)
W:Savings			0.891	0.898	1.062			-0.258	
			(7.92)***	(8.50)***	(6.13)***			(1.84)*	
Y:Childwork	-0.053	-0.095	0.350	-0.131		0.322	0.159		99.4***
	(1.38)	(1.39)	(2.30)**	(0.93)		(2.36)**	(0.39)		(15)
W:Mmoney					1.099			0.198	
					(5.56)***			(1.00)	

Notes:

Table 11 shows the results of estimating: $y_i^* = x_i'\beta^* + w_i'\varphi + \gamma shock + \lambda(shock \times mmoney) + \varepsilon_i$ (equation 8) using ordered probit to explain in turn: Nofood; Nomedicine; Nowater; Nofuel; Nolight; Noshelter; Unsafe; Noschoolfee; and Childwork (the y variables). Mmoney represents general mobile money use. The w are variables which are correlated with the error in (8) and are therefore instrumented. Corr(e_W, e_Y) is the estimated correlation between each w_i and the error (ε). The w may include either or both of Mmoney and Savings, depending on the significance of the estimated error correlation, Corr(e_W, e_Y), in the general equation. The instruments for Savings include Inform, Formal, Mobile and (not shown) Education, Rural; those for Mmoney include Mobile and (not shown) Education, Rural, Employment, Female, Marital. The exogenous variables (x) include Income and/or Mobile unless used as instruments, and Savings and/or Mmoney if exogenous. All equations also include the following controls which are not reported: Education, Rural, Employment, Female, A25, A35, A45, A55, Over55, and Marital. Omitted results are available from the authors.

Z statistics based on robust standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1; χ^2(N) is a combined significance test for all regressors, with N degrees of freedom.

Table 12. Impact on Well-being: Mobile Money Remittances – Difference in Difference

Ordered Probit using accounts as instruments: 982 Observations									
Y; W	**Shock**	**Shock × Recmm12**	**Inform**	**Formal**	**Mobile**	**Recmm12**	**Savings**	**Corr (ew, eY)**	**χ^2(N)**
Y:Nofood	-0.175	0.160			0.122	-0.615	0.813		100.2***
	(5.36)***	(2.85)***			(0.81)	(3.88)***	(3.33)***		(14)
W:Savings			0.879	0.903	1.056			-0.288	
			(7.91)***	(8.56)***	(6.18)***			(1.88)*	
Y:Nomedicine	-0.134	0.114			0.066	-0.388	1.083		171.7***
	(4.32)***	(2.01)**			(0.46)	(2.50)**	(5.48)***		(14)
W:Savings			0.879	0.911	1.053			-0.382	
			(7.95)***	(8.85)***	(6.08)***			(2.97)***	
Y:Nowater	-0.133	0.152			-0.120	-0.423	1.426		187.1***
	(4.29)***	(3.00)***			(0.91)	(2.81)***	(9.32)***		(14)
W:Savings			0.915	0.885	1.041			-0.616	
			(8.65)***	(8.64)***	(6.06)***			(6.81)***	
Y:Nofuel	-0.101	0.114			0.212	-0.281	0.721		65.3***
	(3.12)***	(2.15)**			(1.35)	(1.78)*	(2.80)***		(14)
W:Savings			0.872	0.912	1.067			-0.210	
			(7.77)***	(8.79)***	(6.19)***			(1.30)	
Y:Nolight	-0.010	0.038			-0.033	-0.201	0.858		75.9***
	(0.31)	(0.76)			(0.23)	(1.33)	(4.22)***		(14)
W:Savings			0.893	0.890	1.079			-0.325	
			(8.03)***	(8.36)***	(6.12)***			(2.53)**	
Y:Noshelter	-0.131	0.214			0.031	-0.626	1.463		201.0***
	(3.82)***	(3.67)***			(0.19)	(3.64)***	(8.27)***		(14)
W:Savings			0.881	0.931	0.988			-0.652	
			(8.14)***	(9.27)***	(5.85)***			(6.86)***	
Y:Unsafe	-0.245	0.106			0.124	-0.464	0.873		151.7***
	(7.19)***	(1.98)**			(0.76)	(3.00)***	(3.20)***		(14)
W:Savings			0.883	0.905	1.069			-0.286	
			(7.87)***	(8.57)***	(6.23)***			(1.62)	
Y:Noschoolfee	-0.082	0.080			0.197	-0.117	0.886		136.7***
	(2.22)**	(1.27)			(1.28)	(0.63)	(3.88)***		(14)
W:Savings			0.890	0.899	1.061			-0.254	
			(7.91)***	(8.50)***	(6.12)***			(1.83)*	
Y:Childwork	-0.089	-0.009	0.341	-0.148	0.204	0.227	0.298		103.9***
	(2.20)**	(0.14)	(2.24)**	(1.04)	(1.51)	(1.09)	(2.14)**		(16)

Notes:

Table 12 shows the results of estimating: $y_i^* = x_i'\beta^* + w_i'\varphi + \gamma shock + \lambda(shock \times mmoney) + \varepsilon_i$ (equation 8) using ordered probit to explain in turn: Nofood; Nomedicine; Nowater; Nofuel; Nolight; Noshelter; Unsafe; Noschoolfee; and Childwork (the y variables). Recmm12 represents mobile money use for remittances. The w are variables which are correlated with the error in (8) and are therefore instrumented. Corr(e_W, e_Y) is the estimated correlation between each w_i and the error (ε). The w may include either or both of Recmm12 and Savings, depending on the significance of the estimated error correlation, Corr(e_W, e_Y), in the general equation. The instruments for Savings include Inform, Formal, Mobile and (not shown) Education, Rural; those for Recmm12 include Mobile and (not shown) Education, Rural, Employment, Female, Marital. The exogenous variables (x) include Income and/or Mobile unless used as instruments, and Savings and/or Recmm12 if exogenous. All equations also include the following controls which are not reported: Education, Rural, Employment, Female, A25, A35, A45, A55, Over55, and Marital. Omitted results are available from the authors.
Z statistics based on robust standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1; χ^2(N) is a combined significance test for all regressors, with N degrees of freedom.

Table 13. Impact on Well-being: Mobile Money and Savings – Difference in Difference

Ordered Probit using accounts as instruments: 982 Observations										
Y; W	**Shock**	**Shock × Mmoney**	**Shock × Savings**	**Inform**	**Formal**	**Mobile**	**Mmoney**	**Savings**	**Corr (ew, eY)**	**χ^2(N)**
Y:Nofood	-0.346	-0.061	0.414			0.098	0.112	-0.287		123.3***
	(6.74)***	(1.02)	(6.66)***			(0.65)	(0.70)	(0.96)		(15)
W:Savings				0.881	0.905	1.061			-0.245	
				(7.88)***	(8.56)***	(6.20)***			(1.60)	
Y:Nomedicine	-0.241	-0.064	0.292			0.044	0.214	0.295		174.8***
	(4.97)***	(1.09)	(4.92)***			(0.31)	(1.37)	(1.11)		(15)
W:Savings				0.880	0.911	1.057			-0.343	
				(7.92)***	(8.81)***	(6.12)***			(2.57)**	
Y:Nowater	-0.214	-0.034	0.255			-0.127	0.097	0.760		197.5***
	(4.56)***	(0.65)	(4.58)***			(0.95)	(0.65)	(3.45)***		(15)
W:Savings				0.916	0.886	1.048			-0.593	
				(8.63)***	(8.60)***	(6.12)***			(6.17)***	
Y:Nofuel	-0.223	-0.062	0.309			0.242	-0.020	-0.014		92.4***
	(4.56)***	(1.11)	(5.37)***			(1.49)	(0.13)	(0.05)		(15)
W:Savings				0.871	0.913	1.069			-0.216	
				(7.77)***	(8.81)***	(6.21)***			(1.33)	
Y:Nolight	-0.167	-0.017	0.280				-0.766	0.256		132.3***
	(3.81)***	(0.35)	(5.24)***				(2.16)**	(1.21)		(14)
W:Savings				0.882	0.867	1.113			-0.345	
				(7.97)***	(8.12)***	(6.28)***			(3.53)***	
W:Mmoney						1.029			0.390	
						(4.94)***			(2.06)**	
Y:Noshelter	-0.198	0.014	0.257			0.042	-0.101	0.752		197.2***
	(4.19)***	(0.22)	(4.28)***			(0.26)	(0.57)	(2.88)***		(15)
W:Savings				0.882	0.935	1.005			-0.608	
				(8.09)***	(9.31)***	(5.91)***			(5.69)***	
Y:Unsafe	-0.415	-0.056	0.372			0.112	0.125	-0.158		177.6***
	(8.20)***	(1.00)	(6.17)***			(0.68)	(0.79)	(0.47)		(15)
W:Savings				0.882	0.908	1.071			-0.232	
				(7.80)***	(8.62)***	(6.24)***			(1.26)	
Y:Noschoolfee	-0.116	-0.141	0.206			0.199	0.364	0.368		159.6***
	(2.31)**	(2.22)**	(3.30)***			(1.27)	(2.00)**	(1.26)		(15)
W:Savings				0.891	0.899	1.062			-0.257	
				(7.92)***	(8.51)***	(6.13)***			(1.85)*	
Y:Childwork	-0.156	-0.121	0.204	0.327	-0.144		0.246	-0.197		119.0***
	(3.12)***	(1.69)*	(3.04)***	(2.16)**	(1.01)		(0.57)	(0.97)		(16)
W:Mmoney						1.099			0.193	
						(5.55)***			(0.92)	

Notes:

Table 13 shows the results of estimating: $y_i^* = x_i'\beta^* + w_i'\varphi + \gamma shock + \lambda(shock \times mmoney) + \eta(shock \times savings) + \varepsilon_i$ (equation 9) using ordered probit to explain in turn: Nofood; Nomedicine; Nowater; Nofuel; Nolight; Noshelter; Unsafe; Noschoolfee; and Childwork (the y variables). Mmoney represents general mobile money use. The w are variables which are correlated with the error in (9) and are therefore instrumented. Corr(e_W, e_Y) is the estimated correlation between each w_i and the error (ε). The w may include either or both of Recmm12 and Savings, depending on the significance of the estimated error correlation, Corr(e_W, e_Y), in the general equation. The instruments for Savings include Inform, Formal, Mobile and (not shown) Education, Rural; those for Mmoney include Mobile and (not shown) Education, Rural, Employment, Female, Marital. The exogenous variables (x) include Income and/or Mobile unless used as instruments, and Savings and/or Recmm12 if exogenous. All equations also include the following controls which are not reported: Education, Rural, Employment, Female, A25, A35, A45, A55, Over55, and Marital. Omitted results are available from the authors.

Z statistics based on robust standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1; χ^2(N) is a combined significance test for all regressors, with N degrees of freedom.

Table 14. Impact on Well-being: Mobile Money Remittances and Savings – Difference in Difference

Ordered Probit using accounts as instruments: 982 Observations										
Y; W	**Shock**	**Shock × Recmm12**	**Shock × Savings**	**Inform**	**Formal**	**Mobile**	**Recmm12**	**Savings**	**Corr (e_W, e_Y)**	**χ^2(N)**
Y:Nofood	-0.390	0.109	0.388			0.126	-0.464	-0.168		131.7***
	(7.66)***	(1.80)*	(6.32)***			(0.81)	(2.92)***	(0.53)		(15)
W:Savings				0.879	0.905	1.059			-0.267	
				(7.89)***	(8.55)***	(6.20)***			(1.64)	
Y:Nomedicine	-0.277	0.076	0.268			0.068	-0.280	0.408		183.5***
	(5.74)***	(1.28)	(4.62)***			(0.46)	(1.80)*	(1.54)		(15)
W:Savings				0.878	0.911	1.055			-0.368	
				(7.92)***	(8.81)***	(6.09)***			(2.74)***	
Y:Nowater	-0.256	0.125	0.234			-0.125	-0.341	0.854		208.0***
	(5.58)***	(2.34)**	(4.26)***			(0.93)	(2.27)**	(3.94)***		(15)
W:Savings				0.914	0.884	1.044			-0.615	
				(8.62)***	(8.61)***	(6.09)***			(6.55)***	
Y:Nofuel	-0.263	0.079	0.297			0.217	-0.170	-0.020		84.9***
	(5.35)***	(1.41)	(5.14)***			(1.34)	(1.09)	(0.06)		(15)
W:Savings				0.871	0.913	1.069			-0.197	
				(7.76)***	(8.81)***	(6.21)***			(1.18)	
Y:Nolight	-0.175	-0.003	0.298			-0.031	-0.092	0.145		104.0***
	(3.87)***	(0.06)	(5.47)***			(0.21)	(0.60)	(0.56)		(15)
W:Savings				0.891	0.893	1.081			-0.309	
				(7.99)***	(8.38)***	(6.14)***			(2.37)**	
Y:Noshelter	-0.242	0.187	0.232			0.034	-0.543	0.866		217.5***
	(4.96)***	(3.04)***	(4.04)***			(0.20)	(3.23)***	(3.63)***		(15)
W:Savings				0.882	0.934	0.998			-0.638	
				(8.15)***	(9.34)***	(5.89)***			(6.61)***	
Y:Unsafe	-0.446	0.064	0.354			0.140	-0.337	-0.057		183.2***
	(8.80)***	(1.13)	(5.92)***			(0.81)	(2.18)**	(0.16)		(15)
W:Savings				0.882	0.908	1.070			-0.259	
				(7.84)***	(8.59)***	(6.24)***			(1.33)	
Y:Noschoolfee	-0.171	0.061	0.180			0.196	-0.059	0.424		150.0***
	(3.36)***	(0.92)	(2.87)***			(1.25)	(0.31)	(1.47)		(15)
W:Savings				0.890	0.899	1.062			-0.252	
				(7.91)***	(8.51)***	(6.13)***			(1.81)*	
Y:Childwork	-0.186	-0.035	0.191	0.204	0.319	-0.160	0.296	-0.186		118.9***
	(3.62)***	(0.49)	(2.83)***	(1.49)	(2.09)**	(1.12)	(1.38)	(0.91)		(17)

Notes:

Table 14 shows the results of estimating: $y_i^* = x_i'\beta^* + w_i'\varphi + \gamma shock + \lambda(shock \times mmoney) + \eta(shock \times savings) + \varepsilon_i$ (equation 9) using ordered probit to explain in turn: Nofood; Nomedicine; Nowater; Nofuel; Nolight; Noshelter; Unsafe; Noschoolfee; and Childwork (the y variables). Recmm12 represents mobile money use for remittances. The w are variables which are correlated with the error in (9) and are therefore instrumented. Corr(e_W, e_Y) is the estimated correlation between each W_i and the error (ε). The w may include either or both of Recmm12 and Savings, depending on the significance of the estimated error correlation, Corr(e_W, e_Y), in the general equation. The instruments for Savings include Inform, Formal, Mobile and (not shown) Education, Rural; those for Recmm12 include Mobile and (not shown) Education, Rural, Employment, Female, Marital. The exogenous variables (x) include Income and/or Mobile unless used as instruments, and Savings and/or Recmm12 if exogenous. All equations also include the following controls which are not reported: Education, Rural, Employment, Female, A25, A35, A45, A55, Over55, and Marital. Omitted results are shown in appendix tables A1-A3 and are also available from the authors.

Z statistics based on robust standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1; χ^2(N) is a combined significance test for all regressors, with N degrees of freedom.

Table 15. Marginal Effects: Mobile Money Remittances and Savings – Difference in Difference

	most of time = 1	often = 2	sometimes = 3	only few times = 4	never = 5
Gone without enough food in the last 12 months (from Table 14)					
Shock	0.00918	0.01444	0.05371	0.04619	-0.12352
	3.13***	4.64***	6.89***	6.55***	8.16***
Shock×Recmm12	-0.00255	-0.00402	-0.01496	-0.01286	0.03439
	1.68*	1.74*	1.78*	1.78*	1.81*
Shock×Savings	-0.00911	-0.01435	-0.05336	-0.04589	0.12272
	3.18***	4.30***	5.89***	5.52***	6.65***
Recmm12	0.01091	0.01717	0.06387	0.05492	-0.14687
	2.30**	2.60***	2.86***	2.86***	2.96***
Savings	0.02189	0.02545	0.07795	0.06131	-0.18660
	1.71*	1.92*	2.19**	2.26**	2.17**
Gone without medicine or medical treatment in the last 12 months (from Table 14)					
Shock	0.00477	0.01411	0.04605	0.02781	-0.09274
	2.54**	4.26***	5.49***	4.84***	5.91***
Shock×Savings	-0.00462	-0.01367	-0.04460	-0.02693	0.08981
	2.52**	3.86***	4.50***	4.03***	4.75***
Recmm12	0.00482	0.01427	0.04655	0.02811	-0.09374
	1.58	1.73*	1.80*	1.75*	1.81*
Gone without clean water to drink or cook in the last 12 months (from Table 14)					
Shock	0.00537	0.00786	0.03721	0.03605	-0.08649
	2.41**	3.43***	5.38***	4.99***	5.77***
Shock×Recmm12	-0.00263	-0.00385	-0.01820	-0.01764	0.04232
	1.73*	1.97**	2.34**	2.31**	2.35**
Shock×Savings	-0.00489	-0.00716	-0.03390	-0.03285	0.07881
	2.41**	3.13***	4.23***	3.87***	4.39***
Recmm12	0.00713	0.01044	0.04942	0.04789	-0.11488
	1.68*	1.92*	2.26**	2.25**	2.27**

Gone without fuel to heat your home or cook food in the last 12 months (from Table 14)					
Shock	0.00284	0.00588	0.03587	0.03421	-0.07880
	1.92*	2.92***	5.08***	5.02***	5.46***
Shock×Savings	-0.00321	-0.00663	-0.04047	-0.03859	0.08890
	1.99**	3.03***	4.80***	4.76***	5.25***
Gone without electricity in your home (except power cuts) in the last 12 months (from Table 14)					
Shock	0.00459	0.01701	0.03161	0.01083	-0.06404
	2.55**	3.66***	3.81***	3.44***	3.94***
Shock×Savings	-0.00781	-0.02895	-0.05382	-0.01845	0.10903
	2.96***	4.88***	5.17***	4.50***	5.63***
Gone without shelter in the last 12 months (from Table 14)					
Shock	0.00122	0.00397	0.02430	0.02960	-0.05909
	1.19	2.49**	4.74***	4.61***	5.16***
Shock×Recmm12	-0.00094	-0.00306	-0.01875	-0.02284	0.04560
	1.15	1.99**	3.03***	2.95***	3.09***
Shock×Savings	-0.00117	-0.00381	-0.02332	-0.02840	0.05670
	1.20	2.36**	3.98***	3.86***	4.22***
Recmm12	0.00274	0.00892	0.05459	0.06648	-0.13273
	1.21	1.98**	3.22***	3.09***	3.27***
Felt unsafe from crime in your home in the last 12 months (from Table 14)					
Shock	0.00523	0.01664	0.07741	0.04539	-0.14467
	2.28**	4.21***	8.25***	7.27***	9.39***
Shock×Savings	-0.00415	-0.01320	-0.06141	-0.03601	0.11477
	2.25**	3.96***	5.78***	5.13***	6.14***
Recmm12	0.00396	0.01259	0.05854	0.03433	-0.10941
	1.64	1.94*	2.18**	2.15**	2.19**
Kept a child from school (or not been to school) because of no money to pay school fees in the last 12 months (from Table 14)					
Shock	0.00127	0.00282	0.02019	0.01477	-0.03907
	1.58	2.27**	3.22***	3.22***	3.36***
Shock×Savings	-0.00134	-0.00298	-0.02129	-0.01557	0.04118
	1.55	2.11**	2.80***	2.78***	2.89***

Kept a child from school (or not been to school) because (s)he has to help with the family's business (or other work) in the last 12 months (from Table 14)					
Shock	0.00191	0.00222	0.02177	0.01255	-0.03845
	1.87*	2.12**	3.41***	3.49***	3.59***
Shock×Savings	-0.00197	-0.00229	-0.02244	-0.01293	0.03962
	1.79*	1.85*	2.76***	2.72***	2.81***

Notes: Table 15 shows the calculated marginal effects based on the ordered probit estimates of table 14. Each marginal effect shows the impact of a unit increase in x_i or w_i on the probability that a respondent reporting (for example) y_5 would instead report y_4. In general, this is given by $\partial \Pr[y_i = k \mid z] / \partial z_i = [F(\alpha_{k-1} - z_i'\delta_i) - F(\alpha_k - z_i'\delta_i)]\delta_i$; with $z' = (x', w'); \delta' = (\beta', \varphi')$. Marginal effects are shown only if the underlying ordered probit coefficient is significant. Z statistics based on robust standard errors are shown below each marginal effect; *** p<0.01, ** p<0.05, * p<0.1.

Appendix: Selected Results Including Control Variables

Table A1.1 Impact on Well-being: Mobile Money Remittances – Difference in Difference

Ordered Probit using accounts as instruments: 982 Observations								
	coefficient	Z stat	coefficient	Z stat	coefficient	Z stat	coefficient	Z stat
Y	**Nofood**				**NoMedicine**			
W			**Savings**				**Savings**	
Education	0.035	0.97	0.059	1.58	0.042	1.22	0.055	1.51
rural	-0.345	3.13***	0.038	0.31	-0.242	2.45**	0.046	0.39
employment	-0.112	1.04			-0.121	1.26		
female	0.062	0.79			0.161	2.10**		
A18_25	0.368	2.80***			0.512	4.17***		
A36_45	0.186	1.70*			0.172	1.59		
A46_55	-0.115	0.81			-0.115	0.83		
Over55	0.260	1.45			0.040	0.26		
marital	0.146	1.46			0.050	0.52		
Inform			0.879	7.91***			0.879	7.95***
Formal			0.903	8.56***			0.911	8.85***
mobile	0.122	0.81	1.056	6.18***	0.066	0.46	1.053	6.08***
shock	-0.175	5.36***			-0.134	4.32***		
Shock × Recmm12	0.160	2.85***			0.114	2.01**		
Recmm12	-0.615	3.88***			-0.388	2.50**		
Savings	0.813	3.33***			1.083	5.48***		
Corr(ew, eY)	-0.288	1.88*			-0.382	2.97***		
χ^2(N)	100.2	(14)			171.7	(14)		
Y	**NoWater**				**NoFuel**			
W			**Savings**				**Savings**	
Education	0.035	1.10	0.066	1.87*	0.050	1.40	0.055	1.51
rural	-0.119	1.12	0.088	0.75	-0.023	0.21	0.025	0.21
employment	-0.251	2.54**			-0.218	2.05**		
female	0.124	1.61			-0.006	0.07		
A18_25	0.379	3.22***			0.503	3.72***		
A36_45	-0.075	0.72			0.045	0.41		
A46_55	-0.126	1.01			0.015	0.11		
Over55	0.043	0.30			0.041	0.24		
marital	0.122	1.37			0.232	2.30**		
Inform			0.915	8.65***			0.872	7.77***
Formal			0.885	8.64***			0.912	8.79***
mobile	-0.120	0.91	1.041	6.06***	0.212	1.35	1.067	6.19***
shock	-0.133	4.29***			-0.101	3.12***		
Shock × Recmm12	0.152	3.00***			0.114	2.15**		
Recmm12	-0.423	2.81***			-0.281	1.78*		
Savings	1.426	9.32***			0.721	2.80***		
Corr(ew, eY)	-0.616	6.81***			-0.210	1.30		
χ^2(N)	187.1	(14)			65.3	(14)		

Notes:

Table A1 shows the results of estimating: $y_i^* = x_i'\beta^* + w_{b,i}'\varphi + \gamma shock + \lambda(shock \times mmoney) + \varepsilon_i$ (equation 8) using ordered probit to explain in turn: Nofood; Nomedicine; Nowater; Nofuel (y variables). Recmm12 represents mobile money use for remittances. Savings are estimated to be correlated with the error in (8) and are therefore instrumented. Corr(e_W, e_Y) is the estimated correlation between each w_i and the error (ε).

Z statistics based on robust standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1; χ^2(N) is a combined significance test for all regressors, with N degrees of freedom.

Table A1.2 Impact on Well-being: Mobile Money Remittances – Difference in Difference

Ordered Probit using accounts as instruments: 982 Observations								
	coefficient	Z stat	coefficient	Z stat	coefficient	Z stat	coefficient	Z stat
Y	**Nolight**				**Noshelter**			
W			**Savings**				**Savings**	
Education	0.086	2.83***	0.060	1.64	-0.030	0.85	0.051	1.41
rural	0.062	0.58	0.028	0.24	-0.366	3.10***	0.066	0.56
employment	-0.190	1.84*			-0.378	3.39***		
female	0.044	0.58			0.164	1.95*		
A18_25	0.420	3.32***			0.318	2.27**		
A36_45	0.104	1.06			-0.077	0.65		
A46_55	0.134	1.08			-0.054	0.38		
Over55	0.153	0.96			-0.171	1.09		
marital	0.184	1.96**			0.097	0.95		
Inform			0.893	8.03***			0.881	8.14***
Formal			0.890	8.36***			0.931	9.27***
Mobile	-0.033	0.23	1.079	6.12***	0.031	0.19	0.988	5.85***
Shock	-0.010	0.31			-0.131	3.82***		
Shock × Recmm12	0.038	0.76			0.214	3.67***		
Recmm12	-0.201	1.33			-0.626	3.64***		
Savings	0.858	4.22***			1.463	8.27***		
Corr(e_W, e_Y)	-0.325	2.53**			-0.652	6.86***		
χ^2(N)	75.9	(14)			201.0	(14)		
Y	**Unsafe**				**Noschoolfee**			
W			**Savings**				**Savings**	
Education	0.032	0.87	0.056	1.52	0.121	3.17***	0.059	1.60
rural	-0.338	3.34***	0.029	0.24	-0.451	3.98***	0.031	0.26
employment	-0.125	1.29			0.046	0.36		
Female	0.216	2.66***			-0.055	0.57		
A18_25	0.374	3.19***			0.492	2.98***		
A36_45	0.120	1.10			-0.098	0.77		
A46_55	-0.070	0.49			-0.105	0.68		
Over55	0.263	1.58			0.259	1.36		
Marital	0.122	1.29			0.162	1.40		
Inform			0.883	7.87***			0.890	7.91***
Formal			0.905	8.57***			0.899	8.50***
mobile	0.124	0.76	1.069	6.23***	0.197	1.28	1.061	6.12***
shock	-0.245	7.19***			-0.082	2.22**		
Shock × Recmm12	0.106	1.98**			0.080	1.27		
Recmm12	-0.464	3.00***			-0.117	0.63		
Savings	0.873	3.20***			0.886	3.88***		
Corr(e_W, e_Y)	-0.286	1.62			-0.254	1.83*		
χ^2(N)	151.7	(14)			136.7	(14)		

Notes:

Table A2 shows the results of estimating: $y_i^* = x_i'\beta^* + w_{b,i}'\varphi + \gamma shock + \lambda(shock \times mmoney) + \varepsilon_i$ (equation 8) using ordered probit to explain in turn: Nolight; Noshelter; Unsafe; Noschoolfee (y variables). Recmm12 represents mobile money use for remittances. Savings are estimated to be correlated with the error in (8) and are therefore instrumented. Corr(e_W, e_Y) is the estimated correlation between each w_i and the error (ε).

Z statistics based on robust standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1; χ^2(N) is a combined significance test for all regressors, with N degrees of freedom.

Table A1.3 Impact on Well-being: Mobile Money Remittances – Difference in Difference

Ordered Probit using accounts: 982 Observations		
	coefficient	**Z stat**
	Childwork	
Education	0.187	4.28***
rural	-0.561	4.86***
employment	0.018	0.14
female	0.024	0.24
A18_25	0.267	1.58
A36_45	0.076	0.57
A46_55	-0.028	0.17
Over55	0.299	1.54
marital	0.248	1.98**
Inform	0.341	2.24**
Formal	-0.148	1.04
mobile	0.204	1.51
shock	-0.089	2.20**
Shock × Recmm12	-0.009	0.14
Recmm12	0.227	1.09
Savings	0.298	2.14**
χ^2(N)	103.9	(16)

Notes:

Table A2 shows the results of estimating: $y_i^* = x_i'\beta^* + w_{b,i}'\varphi + \gamma shock + \lambda(shock \times mmoney) + \varepsilon_i$ (equation 8) using ordered probit to explain Childwork. Recmm12 represents mobile money use for remittances. For *Childwork*, the estimated correlation between w_i and the error (ε) is not significant.

Z statistics based on robust standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1; χ^2(N) is a combined significance test for all regressors, with N degrees of freedom.

Table A2.1 Impact on Well-being: Mobile Money Remittances and Savings – Difference in Difference

Ordered Probit using accounts as instruments: 982 Observations								
	coefficient	Z stat	coefficient	Z stat	coefficient	Z stat	coefficient	Z stat
Y	**Nofood**				**NoMedicine**			
W			**Savings**				**Savings**	
Education	0.037	1.01	0.059	1.57	0.045	1.27	0.055	1.52
rural	-0.297	2.63***	0.035	0.28	-0.201	1.98**	0.043	0.35
employment	-0.044	0.39			-0.077	0.78		
female	0.057	0.72			0.156	2.02**		
A18_25	0.329	2.48**			0.480	3.87***		
A36_45	0.205	1.88*			0.190	1.76*		
A46_55	-0.083	0.57			-0.096	0.68		
Over55	0.244	1.28			0.014	0.09		
marital	0.063	0.62			-0.010	0.11		
Inform			0.879	7.89***			0.878	7.92***
Formal			0.905	8.55***			0.911	8.81***
mobile	0.126	0.81	1.059	6.20***	0.068	0.46	1.055	6.09***
shock	-0.390	7.66***			-0.277	5.74***		
Shock × Recmm12	0.109	1.80*			0.076	1.28		
Shock × Savings	0.388	6.32***			0.268	4.62***		
Recmm12	-0.464	2.92***			-0.280	1.80*		
Savings	-0.168	0.53			0.408	1.54		
Corr(e_W, e_Y)	-0.267	1.64			-0.368	2.74***		
χ^2(N)	131.7	(15)			183.5	(15)		
Y	**NoWater**				**NoFuel**			
W			**Savings**				**Savings**	
Education	0.036	1.12	0.068	1.93*	0.052	1.43	0.055	1.50
rural	-0.076	0.70	0.087	0.74	0.026	0.24	0.022	0.19
employment	-0.217	2.15**			-0.165	1.50		
female	0.121	1.56			-0.013	0.15		
A18_25	0.356	3.02***			0.470	3.47***		
A36_45	-0.067	0.64			0.057	0.51		
A46_55	-0.107	0.85			0.044	0.31		
Over55	0.017	0.12			0.017	0.10		
marital	0.074	0.82			0.169	1.64		
Inform			0.914	8.62***			0.871	7.76***
Formal			0.884	8.61***			0.913	8.81***
mobile	-0.125	0.93	1.044	6.09***	0.217	1.34	1.069	6.21***
shock	-0.256	5.58***			-0.263	5.35***		
Shock × Recmm12	0.125	2.34**			0.079	1.41		
Shock × Savings	0.234	4.26***			0.297	5.14***		
Recmm12	-0.341	2.27**			-0.170	1.09		
Savings	0.854	3.94***			-0.020	0.06		
Corr(e_W, e_Y)	-0.615	6.55***			-0.197	1.18		
χ^2(N)	208.0	(15)			84.9	(15)		

Notes:

Table A4 shows the results of estimating: $y_i^* = x_i'\beta^* + w_{b,i}'\varphi + \gamma shock + \lambda(shock \times mmoney) + \eta(shock \times savings) + \varepsilon_i$ (equation 9) using ordered probit to explain in turn: Nofood; Nomedicine; Nowater; Nofuel (y variables). Recmm12 represents mobile money use for remittances. Savings are estimated to be correlated with the error in (9) and are therefore instrumented. Corr(e_W, e_Y) is the estimated correlation between each w_i and the error (ε).

Z statistics based on robust standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1; χ^2(N) is a combined significance test for all regressors, with N degrees of freedom.

Table A2.2 Impact on Well-being: Mobile Money Remittances and Savings – Difference in Difference

Ordered Probit using accounts as instruments: 982 Observations								
	coefficient	Z stat	coefficient	Z stat	coefficient	Z stat	coefficient	Z stat
Y	**Nolight**				**Noshelter**			
W			**Savings**				**Savings**	
Education	0.089	2.89***	0.060	1.63	-0.028	0.80	0.051	1.42
rural	0.107	0.96	0.024	0.20	-0.334	2.83***	0.064	0.54
employment	-0.141	1.33			-0.341	2.97***		
female	0.039	0.50			0.154	1.80*		
A18_25	0.392	3.09***			0.293	2.08**		
A36_45	0.121	1.23			-0.068	0.57		
A46_55	0.156	1.23			-0.019	0.13		
Over55	0.133	0.81			-0.192	1.16		
marital	0.125	1.31			0.052	0.49		
Inform			0.891	7.99***			0.882	8.15***
Formal			0.893	8.38***			0.934	9.34***
Mobile	-0.031	0.21	1.081	6.14***	0.034	0.20	0.998	5.89***
Shock	-0.175	3.87***			-0.242	4.96***		
Shock × Recmm12	-0.003	0.06			0.187	3.04***		
Shock × Savings	0.298	5.47***			0.232	4.04***		
Recmm12	-0.092	0.60			-0.543	3.23***		
Savings	0.145	0.56			0.866	3.63***		
Corr(e_W, e_Y)	-0.309	2.37**			-0.638	6.61***		
χ^2(N)	104.0	(15)			217.5	(15)		
Y	**Unsafe**				**Noschoolfee**			
W			**Savings**				**Savings**	
Education	0.036	0.95	0.056	1.51	0.122	3.19***	0.059	1.59
rural	-0.293	2.84***	0.026	0.21	-0.427	3.71***	0.030	0.25
employment	-0.060	0.59			0.084	0.65		
Female	0.213	2.59***			-0.064	0.66		
A18_25	0.340	2.89***			0.475	2.90***		
A36_45	0.139	1.25			-0.096	0.76		
A46_55	-0.033	0.23			-0.083	0.52		
Over55	0.254	1.43			0.249	1.29		
Marital	0.045	0.46			0.121	1.04		
Inform			0.882	7.84***			0.890	7.91***
Formal			0.908	8.59***			0.899	8.51***
mobile	0.140	0.81	1.070	6.24***	0.196	1.25	1.062	6.13***
shock	-0.446	8.80***			-0.171	3.36***		
Shock × Recmm12	0.064	1.13			0.061	0.92		
Shock × Savings	0.354	5.92***			0.180	2.87***		
Recmm12	-0.337	2.18**			-0.059	0.31		
Savings	-0.057	0.16			0.424	1.47		
Corr(e_W, e_Y)	-0.258	1.33			-0.252	1.81*		
χ^2(N)	183.2	(15)			149.8	(15)		

Notes:

Table A5 shows the results of estimating: $y_i^* = x_i'\beta^* + w_{b,i}'\varphi + \gamma shock + \lambda(shock \times mmoney) + \eta(shock \times savings) + \varepsilon_i$ (equation 9) using ordered probit to explain in turn: Nolight; Noshelter; Unsafe; Noschoolfee (y variables). Recmm12 represents mobile money use for remittances. Savings are estimated to be correlated with the error in (9) and are therefore instrumented. Corr(e_W, e_Y) is the estimated correlation between each w_i and the error (ε).

Z statistics based on robust standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1; χ^2(N) is a combined significance test for all regressors, with N degrees of freedom.

Table A2.3 Impact on Well-being: Mobile Money Remittances and Savings – Difference in Difference

Ordered Probit using accounts: 982 Observations		
	coefficient	**Z stat**
	Childwork	
Education	0.191	4.37***
rural	-0.537	4.61***
employment	0.068	0.52
female	0.023	0.23
A18_25	0.254	1.51
A36_45	0.084	0.63
A46_55	0.006	0.03
Over55	0.295	1.50
marital	0.205	1.60
Inform	0.319	2.09**
Formal	-0.160	1.12
mobile	0.204	1.49
shock	-0.186	3.62***
Shock × Recmm12	-0.035	0.49
Shock × Savings	0.191	2.83***
Recmm12	0.296	1.38
Savings	-0.186	0.91
χ^2(N)	118.9	(17)

Notes:

Table A6 shows the results of estimating: $y_i^* = x_i'\beta^* + w_{b,i}'\varphi + \gamma shock + \lambda(shock \times mmoney) + \eta(shock \times savings) + \varepsilon_i$ (equation 9) using ordered probit to explain Childwork. Recmm12 represents mobile money use for remittances. For *Childwork*, the estimated correlation between w_i and the error (ε) is not significant.

Z statistics based on robust standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1; χ^2(N) is a combined significance test for all regressors, with N degrees of freedom.