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### **Mobile money access and usage: Evidence from household surveys**

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



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# Mobile money access and usage: Evidence from household surveys\*

by

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## Abstract

Using survey data from Ghana, this paper provides a microeconomic analysis of the relationship between mobile money (m-money) and overall well-being, employing both continuous and discrete models. A key feature of this paper is the computation of a well-being index, incorporating important household welfare dimensions in the areas of health, education and wealth. Using Ordinary Least Squares (OLS) and ordered probit models with inclusion of interactions of a truly exogenous variable (negative shock) with all observable covariates, we find that what actually spurs well-being at the microlevel is not access to m-money, but its frequent usage. The paper also presents alternative specifications where access to, and usage of m-money explains the variations in some important well-being indicators: food consumption, health, education and income earnings. The results from these alternative specifications suggest that there are significant welfare disparities between those who just have access to m-money and those who use it frequently. The policy implication in this paper is that when appropriate measures are put in place to encourage increased usage of m-money there will be greater scope for improvement in welfare outcomes and living standards.

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## 1. Introduction

Hitherto the early 2000s, developing countries (particularly in Africa) had been grappling with how to reach out to the unbanked and underbanked population, who are usually the poor and often marginalised groups in society (the youth and women). Banking poorer individuals was seen to come at huge costs (Narain, 2009). Agreeing with Narain (2009), Beck *et al.*, (2007) explain that poor people reside in areas with poor infrastructure, and it is expensive to set up and maintain physical branches in these areas, causing financial exclusion of the poor. They argue that the high transaction costs associated with reaching out to this segment of population form the main supply-side constraints to financial inclusion of the poor. Admittedly, this problem is particularly grave in Africa where good infrastructure to support financial outreach is lacking.

Fortunately, the rapid growth of mobile phone penetration in Africa over the last decade – from 28.5 phones per 100 inhabitants in 2007 to 64.8 phones per 100 inhabitants in 2013 – enabled the introduction of m-money on the continent. It was first introduced in South Africa in 2006, followed in Kenya as M-PESA<sup>1</sup> (Suri and Jack, 2016), emerging as a game changer in the country’s financial services landscape. Since then m-money has become ubiquitous in Africa, spreading from East Africa to West Africa and beyond. This is particularly welcoming as it is seen as an important banking innovation that can be leveraged to break barriers to financial inclusion, enabling the unbanked to be banked (Leach, Beghin, Pickens and Moran, 2007).

A survey by Financial Inclusion Insights (FII) (2015) reveals that financial exclusion reduced by 43% over the last 5 years in Ghana, and this decline was attributed to the increase in the number of mobile banking users – 20% of Ghanaians now actively use mobile banking as against virtually none in 2009, with volume of transaction tripling in the last two years. Table 1 below has been adapted from the survey to show the percentage of adult population who are financially included (have either a bank account, m-money account or account with a non-bank financial institution) and those with m-money account in four African countries where m-money has taken off: Kenya, Tanzania, Rwanda and Ghana.

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Insert Table 1

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As adduced from Table 1, the proportion of the adult population with m-money accounts far exceeds the proportion of adult population with bank account in three out of the four selected countries.

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<sup>1</sup> M is for mobile, “Pesa” is Swahili for “money”



Also, with the exception of Ghana, the vast majority of m-money account holders were rural dwellers (as seen in Table 1), justifying the potential of mobile banking in enhancing financial inclusion in rural communities. According to GSMA (2015), ‘m-money has done more to extend the reach of financial services in the last decade than traditional “bricks and mortar” banking has in the last century. The effectiveness of m-money in expanding financial services to the rural population means greater scope for poverty reduction, and improvement in welfare outcomes and living standards – at least, based on theoretical predictions.

In recent years, Global Findex has attempted to tell a comprehensive story of the progress made with regards to access to m-money services, along with barriers to m-money. What Findex does not tell us – and what this paper seeks to examine as more individuals become financially included through m-money – is whether and how m-money benefits low-income earners and disadvantaged groups in society.

Against this background, a survey questionnaire was designed and implemented in Ghana to capture the main dimensions of m-money (ownership and usage) to enable the link between m-money and well-being to be rigorously examined. To avoid what is known in the parlance of field experiment as estimating the effects of the “intent to treat”, this paper, in addition to investigating socio-economic implications of m-money using m-money account ownership as a measure of m-money, also looks at usage of m-money as an alternative measure. Allied to this, the paper seeks to investigate some of the key mechanisms through which m-money affects well-being.

## **1.1 Context and Motivation**

The survey was set in Ghana (West Africa). Over the last few years Ghana has made significant progress in terms of financial inclusion. According to the FinScope Survey (2010), a large proportion of the Ghanaian population (44.0%) was excluded from the financial services sector, but in 2015 that segment of population decreased significantly to 25% (CGAP Financial Inclusion Insight Survey, 2015). Between 2010 and 2015, the proportion of the Ghanaian population with access to non-formal banking and financial services tripled (FinScope Survey, 2010; CGAP Financial Inclusion Insight Survey, 2015). This was widely attributed to innovative channels undertaken by banks—in partnership with the telecommunication industry players—to penetrate the financial market even further. The introduction of m-money services – made possible by deep mobile phone penetration and innovation around mobile phone technology – became an effective tool to reduce the number of financially excluded individuals in the country.

For the sake of clarity and purposes of this paper, we highlight the difference between m-money and mobile payments. Mobile banking is the provision of digitised financial services that enable individuals to bank outside the precincts of conventional banking infrastructure – such as physical bank

branches and ATMs, and bank agents. Mobile payments on the other hand involves using mobile phones to initiate payments.

Currently, there are six Mobile Network Operators (MNOs) in Ghana including Airtel Ghana, Expresso, Ghana Telecom (Vodafone), Glo Ghana, Millicom (Tigo) and Scancom Ghana (MTN). There are four m-money players in Ghana, namely Tigo Cash, MTN M-money, Vodafone Cash and Airtel Money. MTN is the largest and the oldest m-money player in the market. Two of the largest money transfer companies, WorldRemit and Western Union, have collaborated with the MTN Group to introduce international mobile remittance services in the countries these companies operate in, allowing holders of MTN M-money accounts to send and receive money across borders using their accounts. With the total amount of remittance received standing at 5.62% of GDP as of 2015 (World Bank, 2015), a whole new opportunity has been presented to MTN m-money account holders and this perhaps could explain why the service is the most used. Also, the launch of the MTN Qwikloan which presents an instant and cost-effective way by which customers of MTN can access loans using their MTN m-money wallet makes it the most preferred m-money service.

According to the 2016 Ghana Banking Survey by PricewaterhouseCoopers (PwC), m-money has been accepted by most as a remittance/fund transfer service but using m-money for the payment of goods and services is yet to take off. As Kleijnen, Lee, and Wetzels (2009) observe, consumers become more reluctant to adopt the use of a product or service when the usage of the product or service requires them to make changes to their value systems, as well as their “established behavioural patterns, norms, habits and traditions”, but Furnham and Argyle (1998) note that consumers become less resistant to change when the product or service in question becomes more commercially acceptable. Djoko and Appiah (2014) indicate that for m-money to gain commercial acceptability, it must be able to (i) replace the functions of cash, (ii) perform additional functions based on its distinct features and (iii) legitimately serve as an alternative to fiat currency. He further adds that for potential users to cultivate positive attitudes towards the use of m-money, they would have to be able to understand how to set it up and use it as an alternative option to cash<sup>2</sup>. That notwithstanding, there has been a growing level of trust amongst users of m-money, and this is apparently contributing significantly to the growth of m-money operations over the years as seen in Figure 1.

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Insert figure 1 about here

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<sup>2</sup> Approximately 10% of urban respondents do not use m-money because they do not know how to set it up.

Prior to the introduction of m-money to the Ghanaian market in 2009, most commercial banks shied away from providing financial services to the rural poor. Narain (2009) attribute this to the huge costs associated with providing banking services to the poor. Given the lack of proper infrastructure in rural communities in Ghana, traditional banks have found it increasingly costly to set up and maintain physical bank branches in these communities and this leads to the exclusion of rural dwellers from formal finance.

But with the rapid mobile phone penetration rate in Ghana over the last decade, banks in collaboration with mobile network operators (MNOs) have been able to leverage this deep penetration of mobile technology to introduce digital financial inclusion particularly in the rural areas. This financial inclusion ecosystem that was created as a result of the intersection between telecommunication and banking has gained so much popularity primarily because of the rural-urban divide in Ghana. Many Ghanaians move from rural areas to urban areas in search of greener pastures to send money to their families back home. M-money has given these individuals a more cost-effective and efficient alternative of remitting money to their loved ones back in the rural areas. With a fee of 1% of the amount being transferred, this mode of transferring money is significantly less than the cost associated with the other conventional ways (such as delivering cash via public transport) of transferring money to rural Ghana.

Apart from the money transfer feature of m-money, it serves as a substitute and/or complement to other traditional banking services. M-money offers payment solutions; essentially serves as a current account where funds can be deposited and withdrawn from one's m-money wallet; and provides an avenue where loans can be accessed (only available on MTN m-money).

Clearly, the potential of m-money to foster financial inclusion is immense. However, what remains unclear is whether m-money is translating into the greater and ultimate goal of boosting shared prosperity and welfare outcomes as theoretically predicted. The paper therefore seeks examine the link between m-money and well-being at the household level.

Utilising the survey data from Ghana, the first part of the paper attempts to test the hypothesis that individuals who own a m-money account are more likely to experience better well-being outcomes than individuals who do not own an account. For ease of exposition the former is referred to as "m-money account owners" (represented by a dummy variable, 0), and the latter as the "m-money non-owners" (represented by a dummy variable, 1). To measure well-being, individuals were asked a couple of well-being questions, encompassing health, education, income and food consumption indicators. Respondents were asked to state how frequently – most of the time (1); often (2); sometimes (3); only a few times (4); never (5) – they have been deprived on these well-being indicators in the last 12 months.

To estimate the relationship between m-money and well-being we employed OLS, using additional interaction terms between m-money and the covariates in the spirit of Jack and Suri (2014).

We then tested the robustness of the results to another important measure of m-money (that is, extent of usage of m-money), as well as to other alternative specifications.

The remainder of this paper is structured as follows. Section 2 reviews related works on the m-money – welfare nexus. Section 3 describes the data and explains the sampling methodology. In Section 4, we discuss the various measures of the dependent variable (well-being), narrowing in on the application of Principal Component Analysis (PCA) to the computation of a well-being index. Section 5 also outlines the empirical strategy employed in this paper. In Section 6 we present the results obtained from estimating these models, while testing the robustness of the results to alternative specifications. Conclusions are then drawn in Section 7.

## **2 Related Work**

This paper was, to a large extent, informed by the extant literature on M-PESA, along with its socioeconomic implications at the household level. However, M-PESA is only peculiar to East Africa. It became imperative to extend research in this area to West Africa where m-money uptake is gaining tremendous momentum. In subsequent paragraphs we review some of these related works, which are mostly situated in Kenya.

Andrianaivo and Kpodar (2012) using the System Generalised Method of Moments (GMM) estimator to correct for endogeneity problems find that mobile phone banking development significantly impacts economic development through better financial inclusion in Africa. The experimental approach of Aker *et al.*, (2011) also confirmed a positive relationship between the use of m-money to send and receive money, and human development in Niger. The result of the experiment was that both senders and recipients saved more using m-money than using physical cash, and these cost savings enabled recipients to enjoy more balanced meals.

Jack and Suri (2014) showed through household surveys in Kenya that users of M-PESA saw an average of 6 – 10% increase in consumption as compared to non-users of M-PESA. This was because users of M-PESA were able to better manage negative shocks (loss of jobs, illnesses, and post-harvest losses) as they received more cash remittances and gained from cost savings associated with less transaction cost. Also, by conducting an ethnographic study, Morawczynski (2009) discovered M-PESA was the only medium through which indigenous habitants of Kibera, the largest slum in Nairobi, were able to access money to support their basic needs during the violence following the 2007 election in Kenya. Using the Fixed Effect-Instrumental Variable Estimation, Mbiti and Weil (2011) established a positive relationship between the use of M-PESA and employment rates in the farming sector but found no effect on non-farm employment. Using panel data from Uganda, Munyegera and Matsumoto (2014) found that individuals patronising m-money services experienced an increase in per capita consumption by 69%. They also found that users of m-money were more likely to receive remittance than non-users – value of total remittances also received by users was 33% higher than non-users. In

contrast to the above studies, Batista and Vicente (2016) found no significant impact of the use of m-money services on total consumption. Batista and Vicente were the first to introduce a randomised control trial to establish such a relationship. However, the results of the randomised control trial also showed that the treated group is able to increase consumption after a negative shock.

Despite not taking a deficit-based approach in our paper, we draw inspiration from these related works in understanding the link between m-money and well-being at the micro level. This paper follows from a recent paper by Ahmad *et al.*, (2020) who focus their research in the context of West Africa in estimating the impact of m-money on well-being in the face of negative shocks.

### **3. Data**

#### **3.1 Sampling Methodology and Selecting Respondents**

As national representation is key to most demand-side surveys, census information was used to build a sample that shares characteristics proportionate to the actual population. During the 2010 Population and Housing Census, there were 10 regions in Ghana. The survey frame was therefore stratified into these 10 administrative regions (these regions contained 216 districts altogether).

After the one-stage stratified sampling design was initiated, a multi-stage cluster sampling had to be conducted because the survey areas were still too large. The first stage involved the division of the survey areas (regional strata) into smaller distinct geographic areas (districts). As a result, each regional stratum would contain a number of districts. Next, I found the approximate population size for each district, and used the ENA software – based on the probability proportional to size software [PPS] – to randomly allocate clusters to each geographic unit (district).

To select households within these identified clusters, systematic random sampling was employed. Various random route procedures were then used to select households – interval sampling from randomly generated starting points (school, church/chapel/mosque, health facility or market) and random start (any number from 1 – 100). As a result, 1000 households were selected using the systematic randomly sampling technique. After identifying households, sample of 1000 individuals – defined as persons aged 18 and above – were randomly selected within the selected households by means of the last birthday method.

Despite the prominence of the Kish Grid as a within-household selection method in most studies, the last-birthday method was used in this study. The main reason for choosing the latter method was purely a matter of how sensitive individuals in Ghana are about disclosing their age. Bearing in mind that the modified Kish Grid method of selecting individuals requires individuals to disclose their age, the use of the last birthday was more appropriate in the Ghanaian context. Moreover, the last-birthday method is much easier in terms of training required and implementation (Salmon and Nickols, 1983). The concomitant effect is that it saves cost. Again, because it is less

time-consuming, both interviewers and interviewees would be less weary during the interviewing, thus yielding better survey results.

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Insert Table 2 about here

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Insert Table 3 about here

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#### **4. Empirical Strategy**

Data was obtained from a survey that was carried out in Ghana to understand how individuals access m-money services, as well as the specifics regarding the different aspects that encompass the extent of usage of m-money, level of satisfaction with m-money services amongst end-users, and barriers to access and use of m-money. The survey captured all these dimensions of m-money, which remain missing in most demand-side surveys.

Utilising the survey data from Ghana, the first part of the paper tests the hypothesis that individuals who own a m-money account are more likely to experience better well-being outcomes than individuals who do not own an account. For ease of exposition the former is referred to as “m-money account owners” (represented by a dummy variable, 1), and the latter as the “m-money non-owners” (represented by a dummy variable, 0). To measure well-being, individuals were asked a number of questions encompassing important well-being indicators (noted above). Respondents were asked to state how frequently – most of the time (1); often (2); sometimes (3); only a few times (4); never (5) – they have been deprived on these well-being indicators in the last 12 months. Principal Component Analysis (PCA) was then applied to compute a subjective well-being index.

In the first part of the paper, we estimate the relationship between m-money (using mobile access and usage as measures) and well-being using OLS, treating well-being as a continuous variable. However, we recognise that m-money user is correlated with unobservable factors that could affect well-being. So, in the spirit of Jack and Suri (2014), we use additional interaction terms between a truly exogenous variable (shock) and the covariates to control for possible endogeneity.

To understand the differential effects of m-money and also test the robustness of the results, we disaggregate the components of well-being index and explore the links between m-money and these individual well-being indicators using alternative specifications.

##### **4.1 Subjective Well-being**

There has not been one commonly agreed definition of well-being. The varying definitions of well-being have promoted a wave of different measures in poverty and welfare related studies, most notably the ‘multidimensional poverty index’ (MPI) (Leibbrandt and Woolard, 2009). The multi-dimensional headcount ratio and the average intensity of poverty ratio constitute the components of the MPI; an individual who is deprived in more than three of the indicators in the two components is classified as being poor (Finn *et al.*, 2013). In this measure, being poor is synonymous to experiencing a lower standard of living.

For this paper, the survey questionnaire that was implemented in Ghana asked some similar questions to those of FinScope surveys. These questions capture a broad representation of an individual’s well-being. As highlighted in the literature there may be unintended consequences of financial inclusion which need to be addressed before one can boldly conclude on its effectiveness as a welfare-enhancing tool. For example, access to credit (in the context of m-money, MTN Qwikloans) can mean an opportunity to expand one’s business which could require the employment of children to assist in the day-to-day activities of the business. Consequently, children may have to opt out of school to support with the business, thus resulting in a substitution effect which reduces social benefits. In view of this, two additional questions were added to the questions adapted from the FinScope surveys to generate a set of responses that aided the computation of a well-being index, capturing substitution effects between an increase in cash income of the family business contributed by the child instead of being in school and school attendance suffered because of the child’s participation in the family business.

The questions were framed as follows:

"In the last 12 months, how often have you or your family....."

- i. Gone without enough food to eat
- ii. felt unsafe from crime in your home
- iii. Gone without medicine or medical treatment
- iv. Gone without cash income
- v. Gone without clean water to drink or cook
- vi. Gone without shelter
- vii. Gone without electricity in your home (apart from power cuts)
- viii. Gone without fuel to heat your home or cook food
- ix. Kept a child from school (OR not been to school) because of no money to pay school fees
- x. Kept a child from school (OR not been to school) because he or she must help with the family’s business (or other work, e.g. harvest)

#### 4.1.1 Application of PCA to the Computation of a Well-being Index

Given the possibility of a high correlation between the various indicators of well-being, it is imperative to use PCA to condense these correlated components into one comprehensive index. The indicators of well-being used in this study include food consumption, cash income, safety from crime, healthcare access, education, access to clean water, housing/shelter, and access to electricity. The intercorrelation between these indicators are confirmed by Bartlett's test in Appendix A1, warranting the application of PCA to reduce the dimensionality of the data on well-being while keeping most of the information.

Respondents were asked to state how frequently – Most of the time (1); Often (2); Sometimes (3); Only a few times (4); Never (5) – any of the aforementioned factors have happened to them or their family in the last 12 months. Continuous data were generated from the responses, enabling the application of PCA to generate a subjective well-being index. In this study we did not assume that the responses to the questions asked had equal probability and therefore PCA is the natural method for constructing the index of well-being. This differs from the framework used by Finn, Leibbrandt and Woolard (2013), who constructed a well-being index based on the assumption that responses to the well-being questions have equal probability. Again, the Kaiser – Meyer Olkin (KMO) Test confirmed that the data on well-being was sufficient for PCA analysis to be conducted (Kaiser, 1977; Bartlett, 1937) (See Appendix A1).

Based on the assumption of unequal weightings of the questions, the index was constructed according to the linear combination:

$$WBI_i = \sum_{i=1}^n w_{ij} x_i \quad (1)$$

where;

$WBI_i$  = the well-being index for an individual

$w_{ij}$  = the regression coefficient (or weight) for the observed variable

$N$  = the number of respondents

$X$  = well-being indicators

$J$  = the number of deprivation questions asked

Table 5 shows how the regression weights from equation 1 were determined on the first principal component. In this study, only the first principal component is reported, interpreted and used in subsequent analysis. This is because the first principal component forms the most meaningful and maximal amounts of variance in the observed variables.



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Insert Table 4 here

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Insert Table 5 here

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Factor loadings (weights) of each well-being indicator derived from the principal component analysis (See Table 5) resulted in the computation of a comprehensive index for well-being as seen in equation (2):

$$WBI = 0.31x_1 + 0.29x_2 + 0.35x_3 + 0.33x_4 + 0.33x_5 + 0.29x_6 + 0.32x_7 + 0.33x_8 + 0.32x_9 + 0.28x_{10} \quad (2)$$

The observed variables (the "X" variables) are responses to the ten 10 well-being questions;  $x_1$  representing question 1,  $x_2$  representing question 2, and so forth in that order. Question 3 was assigned the largest weight, while question 10 received the smallest weight. Question 3 reflects the extent to which medical treatment has had to be used. This shows that access to medical treatment remains the most important component of well-being, thus corroborating other papers' findings that improving health of individuals should have high priority as it yields significantly positive effects on economic and welfare outcomes (Nordhaus, 2003; Murray, 2001). As the saying goes, "If you have health, you probably will be happy, and if you have health and happiness, you have all the wealth you need, even if it is not all you want. Contrary to the popular notion that wealth is the most important driver of well-being, this result suggests that health remains the number one driver, with wealth (captured by question 4) rather following closely as the second most important component of well-being". It is therefore not surprising that health ranks highly on the list of Sustainable Development Goals (SDGs). With health being such an important component of well-being, it is puzzling that the empirical literature on well-being effect of health in developing countries particularly in Ghana is scanty.

The extent to which a child is deprived of going to school because he or she must help with the family's business (or other work, e.g. harvest) received the smallest weight. Perhaps, this indicator received the smallest weight because it does not directly affect the well-being of the respondent. In any case, the child's contribution to the business of the respondent is rather likely to boost the cash income of the respondent, leading to a higher score on the deprivation question on "cash income" for the respondent.

## 4.2 Model Specification

Acknowledging the threat of endogeneity, we use OLS including interactions of the exogenous shock variable with all observable covariates to account for this, using the following specification:

$$Y_{ijt} = \alpha + \gamma MMuser_{ijt} + \phi MMuser_{ijt} * shock + \eta X_{ijt} + \varphi X_{ijt} * shock + \epsilon_{ijt} \quad (3)$$

In equation (3), the subscript  $i$  denotes each individual.  $Y_{ijt}$  is a well-being index of individual  $i$  in region  $j$  and at time  $t$ . The main independent variable  $MMuser_{ijt}$  is the dummy variable where “m-money account owners” is represented by 1 and “m-money account non-owners” is represented by 0.  $X$  is a matrix of additional co-variates that controls for socio-economic characteristics of individuals: age, education, income, employment status, phone ownership, marital status, gender, savings attitude and negative shocks (See Table 2 for a list of these co-variates). The error term is denoted by  $\epsilon$  and  $\gamma$  and  $\eta$  are parameters to be estimated.

### 4.3 Alternative model specification

Here, we explore the link between m-money and key well-being indicators (food consumption, cash income, medical treatment and school attendance). This way we show the differential effects of m-money on basic household needs considering that the impact of m-money is context specific and can yield unintended consequences. These particular variables are selected because they are equivalent to the components of HDI, i.e., education, income and health.

All four well-being outcomes are each ordered on a 5-point Likert scale, so we naturally gravitate towards using ordered probit model including interactions of the shock with measures of all covariates, akin to the strategy by Jack and Suri (2014). This seeks to explain the observed outcome for individual  $i$  ( $y_i$ ) with respect to a vector of exogenous variables ( $x_i$ ), controlling for possible endogeneity issues – the direction of the relationship may be moving from m-money to well-being, but also from well-being to m-money account ownership. 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:

$$y_i^* = x_i' \varphi + \varepsilon_i \quad \dots (4)$$

$\varphi$  a vector of coefficients and  $\varepsilon_i$  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:

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

and:

$$\begin{aligned} \Pr[y_i = k] &= \Pr[\alpha_{k-1} < y_i^* \leq \alpha_k] = \Pr[\alpha_{k-1} < x_i' \varphi + \varepsilon_i \leq \alpha_k] \\ &= \Pr[\alpha_{k-1} - x_i' \varphi < \varepsilon_i \leq \alpha_k - x_i' \varphi] \quad \dots (6) \end{aligned}$$

$$\Pr[y_i = k] = F(\alpha_{k-1} - x_i' \varphi) - F(\alpha_k - x_i' \varphi) \quad \dots (7)$$

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

## 5 Results

### 5.1 What is the link between access to m-money and well-being?

Table 6 provides an OLS (including interaction terms between shock and the other regressors) estimation of equation (3) vis-à-vis a number of household socio-economic characteristics. We report robust standard errors throughout. The results show that access to m-money does not have a positive association with well-being. While this may be surprising, the measure of access to m-money (represented by a dummy variable that indicates m-money ownership and no m-money account ownership) does not necessarily tell us about how frequently these accounts are used. It might be the case that those who own an account rarely use it, in which case we cannot expect any significant welfare benefits from ownership of dormant accounts. It is important to note that in this situation, dormant m-money accounts will still be subject to fees and other maintenance charges, which may have negative welfare implications.

Regarding the other covariates, we find phone ownership, age, gender, education, savings and shock to be significantly and positively linked to well-being. The strong and positive relationship between savings and well-being. Savings – even at 1% significant level – is consistent with theoretical predictions that savings help individuals to smooth consumption in the event of adverse economic shocks, securing their well-being at all times. The significant correlation between gender and well-being is particularly interesting: being a female improves one's chance of being better off. This result is neither expected nor unexpected as there was no stated expectation with respect to the effect of one's gender status on well-being. But perhaps, the life expectancy for women and men (62.51 years and 60.52 years respectively) in Ghana is somehow linked to this result. Possibly, women tend to live longer because they have a higher well-being index than men or vice versa.

Of the other notable result shown by IV model, we find that individuals who live in the rural areas are more likely to experience better living conditions. On the surface, this is an unexpected result given that rural communities are often deprived of basic social amenities. But there is evidence to the fact that rural residents are healthier and less prone to the risk of obesity than people in urban areas because those in the urban areas normally resort to vehicles as a mode of transportation – even for short trips – instead of walking or cycling. There is also the issue of increased air pollution as a result of over-congestion usually associated with urban areas. This poses serious health threats and are likely to affect living conditions. Lastly, factors such as high crime rates and high cost of living in the urban areas may have collectively contributed to this astonishing result. While it is acknowledged that urban areas are homes to greater job opportunities, better social amenities and infrastructure, the results tend to suggest that on balance individuals are better off living in rural areas. This may explain why individuals usually move to the rural areas during the weekends to relax and blow off steam and return to the urban areas to continue with their work commitments during weekdays.

It is worthy to point out that although shock is positive and significant in the well-being equation, shock is a variable set on a 5-point Likert scale. Interviewees were asked to identify if a

shock had been: Very large (coded 1); Large (coded 2); Moderate (coded 3); Small (coded 4); or No loss was suffered (coded 5). The positive and strong relationship with shock and well-being therefore implies that the lesser the extent of the shock the higher the well-being. In other words, an adverse shock negatively affects well-being.

Turning to education, we see that individuals with at least some primary education are more likely to have a better well-being. The finding that education plays an important role in promoting well-being is consistent with results from several empirical studies (Breierova and Duflo, 2004; Hammond, 2003). The results from this paper clearly have direct policy relevance and implications. More funding and alternative models of funding should be made available to encourage educational progression. The introduction of the free Senior High School education in Ghana is therefore a step in the right direction – quality education should however not be comprised as a result.

Sachs (2008) notes that “mobile phones and wireless internet end isolation and will therefore prove to be the most transformative technology of economic development of our time”. It is therefore not surprising that we find a positive and significant relationship between phone ownership and well-being. Turning to age, we find that the older one gets the better or higher his or her well-being. This might suggest that the older one gets the more financially secure he or she becomes, resulting in the attainment of higher levels of well-being. To save space, we do not comment on the results on the interaction terms. Nonetheless, we do report these results in the tables.

## **5.2 What is the link between usage of m-money and well-being?**

Next, we ran the OLS regression using usage of m-money as an alternative measure, where we see a strong and positive relationship between usage and well-being. The direct interpretation of the result is that those who use m-money often or very often stand a better chance of living a better life compared to those who rarely use it. To capture this m-money variable, interviewees were asked to recall how often they used the services of a m-money agent in the past 12 months: very often (coded 1); often (coded 2); sometimes (coded 3); only a few times (coded 4); or never (coded 5). A dummy variable was then created to indicate those who use the services of a m-money agent often or very often (frequent user) and those who rarely or never use the services of a m-money agent (non-frequent user). This line of question gives an indication of how often or otherwise individuals use m-money services to send and/or receive remittances because the primary use of m-money agents is to send and/or receive remittances on behalf of their clients. The usage measure in this context therefore highlights an important mechanism through which m-money affects well-being: remittances received and/or sent. Another plausible channel through which frequent usage of m-money directly affects well-being is the provision of microloans for m-money users. A key criterion for accessing for example, the MTN Qwikloan, is regular use of the MTN m-money service. It is therefore safe to

argue that frequent users of m-money will be in a better position to access the microcredit which can then be used to support basic needs and necessities – in line with the empirical results.

By repeating the previous model estimation but replacing access variable with usage, the link between m-money and well-being becomes strong and positive, suggesting that what significantly contributes to the determination of well-being is not access but usage of m-money.

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Insert Table 6 here

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While m-money has been widely heralded as a silver bullet to bridging the inequality gap, the extent of actual usage may minimise or maximise its intended welfare benefits. The extent of usage of m-money signals the strength of an individual’s social network (Okello *et al.*, 2018), which can serve as a source of support in times of distress and difficulty. Those who receive remittance more frequently will be in a better position to weather effects of adverse shocks and also meet emergency needs compared to those who rarely or never receive remittances. It also stands to reason that those who frequently send remittances are in a better place financially and therefore more likely to have better living conditions. Either way the results confirm these theoretical predictions. Of the other regressors, we find that the coefficients are starkly similar to those reported in model (1), with the magnitudes of the relationships also being largely consistent with results produced in model (1).

### **5.3 Robustness Test – Using disaggregated components of well-being**

To understand how m-money affects key well-being outcomes and to test the results to alternative specifications, we disaggregate the components of well-being index and explore the links between m-money and these individual well-being outcomes using ordered probit models. We use both access and usage as the measures of m-money, omitting the results for the other regressors to save space. For ease of exposition we compute and report the marginal effects for the two main m-money variables: access and usage.

Throughout all the specifications, the regressors showed the expected signs. Phone owners, employed, educated, rural dwellers, females and savers are all more likely to experience better welfare outcomes. These results are broadly consistent with those produced by the continuous models in table 5. The ordered probit model estimates show clearly that individuals who use m-money more often (also interpreted as those who receive and send remittances more often) are more likely to experience better well-being outcomes. More specifically, frequent users of m-money are 18% more likely to attain the highest point of food consumption measure; 22.9% more likely to never go without medicine or medical treatment; 18.2% more likely to never go without cash income; 22.6% more likely to never go without clean water to drink or cook; 12.3% more probable to never go without fuel

to heat their home or cook food; 25.2% more likely to never go without electricity; 9.2% more likely to never go without shelter; 20.2% more likely to never feel unsafe in their homes; 12% more likely to never miss school because of no money to pay school fees; and 12.5% more likely to never be kept away from school because they have to help with the family's business (or other work).

Frequent usage of m-money has a significant effect on all but 2 of the well-being outcomes. The two well-being outcomes that are not significantly impacted by m-money usage are housing (shelter) and absenteeism from school (arising from the need to help with family business or other work). The insignificant coefficients of the usage variable with respect to these outcome variables suggest that m-money remittances go only as far as helping to significantly meet short-term needs (food consumption, medicine, emergency cash, utilities, school fees and safety). The results imply that m-money remittances perhaps are not large enough to provide long-term support for housing or shelter, neither is it large enough to be used as a substitute for an individual's source of livelihood so that children do not have to sacrifice their schooling to work on family business or other work.

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Please insert table 7 here

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On the other hand, the probit model results show that effect of access on all the well-being outcomes are insignificant. Nonetheless, the coefficient of access throughout all but three specifications suggests that those who have access to m-money are more likely (albeit insignificantly) to attain the highest points in the applicable well-being outcomes. Individuals with access to m-money stand a 5.7% chance of never going without food. In terms of never going without medicine and cash income, those with access to m-money stand a 3.2% and 2.2% chance respectively.

However, we see from the results that those with access to m-money are 4.6% less likely to never go without clean drinking water to drink or cook. We cannot read too much meaning into this result as we are unable to distinguish between those with access to active m-money accounts and those with access to dormant accounts. Even if we work on the assumption that all m-money accounts are active, the provision of clean water is more a function of location or residence (rural or urban). The disparity in the provision of clean water and sanitation infrastructure between rural and urban dwelling in Ghana is still significant. Similarly, whether or not individuals go without electricity is directly a consequence of one's locality, and hardly to do with m-money account ownership. The Rural Electrification project -- which aims to boost electricity coverage to all rural areas -- ensures an uninterrupted supply of electricity to most rural areas. This is not always the case in urban areas. In fact, the energy crisis that bedevilled the country a few years ago hardly affected the rural areas as the Electricity Company was instructed to ration electricity in the urban and not the rural areas.

Access to m-money appears to only have positive effects at points 1 through 4 of the shelter (housing), safety and school attendance outcomes. In other words, access to m-money does not guarantee the highest points of well-being with respect to housing, safety and school attendance (impacted by not being able to pay school fees). The results clearly show differential impacts on the well-being outcomes, providing some justification for exploring how m-money relates to the individual constituents of well-being.

## **6 Conclusion**

The literature on digital financial development in Africa has been preoccupied with the theoretical proposition that expanding access to m-money has implications for welfare enhancement at the household level. Yet, the empirical investigation and conclusion to that proposition are rather scanty. The few studies examining the relationship between m-money and well-being have done so by simply looking at how m-money account ownership relates to well-being. There have been concerns in the literature that ownership of m-money accounts does not always translate to usage, hence minimising the welfare effect of m-money. Others also argue that there are a group of individuals who do not have a m-money account but are still able to engage the services of a m-money agent to perform financial transactions. In view of this, using account ownership as the only measure of m-money may only yield partial results.

This paper therefore uses two measures of m-money – account ownership and usage – to gauge the link between m-money and well-being. By employing OLS (with interaction terms), we showed that the usage dimension of m-money is a more important and significant (as opposed to access) factor in explaining the variations in well-being and its constituents.

Overall, our conclusions reemphasize the importance of m-money in bridging the financing gap between the rich and poor, generating significant welfare gains to particularly its users. Given the cross-sectional nature of the data used and thus our inability to include individual fixed effects to address unobserved heterogeneity, the results are interpreted conservatively as associations and not causal effects. Nonetheless, these findings offer an original contribution to existing literature -- providing robust results on the association between m-money and well-being while highlighting channels through which m-money may affect well-being. In terms of policy implications, the findings provide an empirical basis for the implementation of a Financial Inclusion Strategy for African countries. This will go a long way to ensure that the overall vision of making available and accessible a wide range of quality and affordable financial services to the vulnerable and economically excluded segment of the population a reality. Once this goal has been achieved, we can expect to see an improvement in the quality of lives of the people.

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Table 1. Percentage of Financially Included Adults in Selected African Countries

Countries	% of Adults Financially Included	% of Adults with Bank Accounts	% of Adults with M-money Accounts	% of Rural Dwellers with M-money Accounts
Kenya	65%	28%	58%	56%
Tanzania	50%	21%	34%	55%
Rwanda	37%	16%	23%	61%
Ghana	48%	34%	20%	40%

Source: Compiled by author from the Financial Inclusion Insights (FII) (2015) survey

Table 2. Definition of Variables

Variable	Definition
Well-being index	This is a subjective well-being index constructed using PCA on a host of welfare indicators
MM owners (0/1)	Dummy variable where an individual that owns a MM account = 0 An individual that does not own a MM account represented by 1
Frequent MM users (0/1)	Dummy variable where an individual that uses MM often or most of the time = 0 An individual that has never used MM or used it only a few times or used it sometimes in the past 12 months = 1
Gender (0/1)	Gender is a dummy variable, where male = 0; female = 1
Urban (0/1)	Urban is a dummy variable, where urban = 0; rural = 1
Older (0/1)	Dummy variable, where older = 0 if individual is above the youth age group; younger = 1
Income Quantile 1	Individuals who earn between GhC 0 - GHC 12,000 per annum
Income Quantile 2	Individuals who earn between GhC 12,001 - GHC 24,000 per annum
Income Quantile 3	Individuals who earn between GhC 24,001 - GHC 36,000 per annum
Income Quantile 4	Individuals who earn between GhC 36,001 and over

No Formal	Individuals with no formal education
Primary Education	Individuals who have attained primary education
Junior High	Individuals who have attained junior secondary education
Senior High	Individuals who have attained senior high education
Tertiary	Individuals who have attained at least a bachelor's degree
Smartphone Owner (0/1)	Dummy variable, where having a smartphone = 0; not having a smartphone = 1
Saver (0/1)	Dummy variable, where an individual who has saved in the last 12 months = 0, and 1 otherwise
Loan recipient (0/1)	Dummy variable, where an individual who has taken out a loan in the last 12 months = 0
Marital Status (0/1)	Marital status is a dummy variable, where married = 0; not married = 1
Employment type (0/1)	Dummy variable where an individual who is employed in the public sector = 0, and 1 otherwise

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Table 3. Ghana: Survey and Population Characteristics

	Survey: 2017 (% of survey: 1000 aged 18+)	Ghana Population (% of population aged 15+)	Source and date of Population Data <sup>1</sup>
Rural Population	39.30	44.69 <sup>2</sup>	WDI; 2017
Urban Population	60.70	55.31 <sup>2</sup>	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 <sup>3</sup>
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 <sup>4</sup>	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+

Author's calculation

Table 4. Principal components/correlation for well-being index

Principal Component	Eigen Values	Proportion	Cumulative
1	5.39513	0.5395	0.5395
2	1.04113	0.1041	0.6436
3	0.702372	0.0702	0.7139
4	0.654594	0.0655	0.7793
5	0.510752	0.0511	0.8304
6	0.46265	0.0463	0.8767
7	0.3707768	0.0337	0.9137

8	0.337256	0.0337	0.9475
9	0.305381	0.0305	0.9780
10	0.219972	0.0220	1.0000

Table 5. Component Score Coefficient of well-being indicators

Indicators	Component 1
1	0.3144
2	0.2899
3	0.3493
4	0.3342
5	0.3326
6	0.2887
7	0.3163

8	0.3285
9	0.3205
10	0.2806

Table 6. M-money and Well-being: OLS regressions including interactions terms

Variable	Dummy variable	
	Access to M-money (1)	Usage of M-money (2)
M-money	-0.002 (0.960)	0.109*** (0.004)
Mobile	0.063*** (0.004)	0.063*** (0.004)
Employment	0.021 (0.548)	0.026 (0.447)
Female	0.070** (0.019)	0.072** (0.016)
Age	0.051*** (0.000)	0.049*** (0.001)

Educated	0.139*** (0.000)	0.138*** 0.000
Rural	0.053 (0.102)	0.078** (0.026)
Savings	0.362*** (0.000)	0.362*** (0.000)
Shock	0.115*** (0.000)	0.123*** (0.000)
Female*shock	-0.015** (0.036)	-0.015** (0.034)
Age*shock	-0.014*** (0.000)	-0.014*** (0.000)
Rural*shock	-0.020*** (0.010)	-0.025*** (0.002)
Employment*shock	-0.009 (0.265)	-0.010 (0.212)
Educated*shock	-0.002* (0.085)	-0.003* (0.062)
Savings*shock	-0.073*** (0.000)	-0.072*** (0.000)
MobileMoney*shock	0.001 (0.876)	-0.027*** (0.003)
Constant	0.152** (0.043)	0.152** (0.043)
Adjusted R-squared	0.280	0.286
Observations	998	998

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Robust standard errors are shown in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.



Table 7. Marginal Effects: Access to M-money and Usage of M-money – Ordered Probit Model including interaction terms

	most of time = 1	often = 2	sometimes = 3	only few times = 4	never = 5
Gone without enough food in the last 12 months					
Usage	-0.016* (0.059)	-0.021* (0.065)	-0.082* (0.051)	-0.068** (0.050)	0.187** (0.049)
Access	-0.005 (0.437)	-0.007 (0.437)	-0.025 (0.432)	-0.021 (0.431)	0.057 (0.431)
Gone without medicine or medical treatment in the last 12 months					
Usage	-0.013** (0.033)	-0.034** (0.026)	-0.112** (0.015)	-0.069** (0.014)	0.229** (0.013)
Access	0.002 (0.675)	0.005 (0.673)	0.016 (0.672)	0.010 (0.672)	0.032 (0.672)
Gone without cash income in the last 12 months					
Usage	-0.044** (0.040)	-0.050** (0.038)	-0.064** (0.035)	-0.023** (0.036)	0.182** (0.034)
Access	-0.005 (0.754)	-0.006 (0.754)	-0.008 (0.754)	-0.003 (0.754)	0.003 (0.754)
Gone without clean water to drink or cook in the last 12 months					
Usage	-0.013* (0.055)	-0.022** (0.024)	-0.097*** (0.010)	-0.094** (0.011)	0.226*** (0.010)
Access	0.003 (0.550)	0.004 (0.536)	0.020 (0.530)	0.019 (0.532)	-0.046 (0.531)

Gone without fuel to heat your home or cook food in the last 12 months						
Usage	-0.005 (0.208)	-0.010 (0.199)	-0.055 (0.193)	-0.053 (0.191)	0.123 (0.187)	
Access	-0.00006 (0.949)	-0.00014 (0.949)	-0.00077 (0.949)	-0.00074 (0.949)	0.00170 (0.949)	
Gone without electricity in your home (except power cuts) in the last 12 months						
Usage	-0.020** (0.016)	-0.066*** (0.004)	-0.123*** (0.003)	-0.041*** (0.003)	0.252*** (0.002)	
Access	0.003 (0.267)	0.009 (0.239)	0.017 (0.232)	0.006 (0.232)	-0.035 (0.233)	
Gone without shelter in the last 12 months						
Usage	-0.001 (0.387)	-0.006 (0.243)	-0.039 (0.200)	-0.045 (0.206)	0.092 (0.201)	
Access	0.001 (0.438)	0.005 (0.251)	0.031 (0.211)	0.036 (0.206)	-0.074 (0.208)	
Felt unsafe from crime in your home in the last 12 months						
Usage	-0.008* (0.070)	-0.025** (0.035)	-0.106** (0.015)	-0.063** (0.018)	0.202** (0.016)	
Access	0.004 (0.253)	0.012 (0.193)	0.052 (0.186)	0.031 (0.185)	-0.098 (0.184)	
Kept a child from school (or not been to school) because of no money to pay school fees in the last 12 months						
Usage	0.004 (0.219)	0.010 (0.126)	-0.062* (0.080)	-0.045* (0.081)	0.120* (0.078)	
Access	0.0002 (0.916)	0.0005 (0.917)	0.0029 (0.917)	0.0021 (0.917)	-0.0056 (0.917)	

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					
Usage	-0.006 (0.159)	-0.008 (0.214)	-0.069 (0.158)	-0.041 (0.163)	0.125 (0.154)
Access	-0.003 (0.348)	-0.004 (0.269)	-0.036 (0.264)	-0.021 (0.270)	0.065 (0.264)

Notes: Marginal effects are shown for only the two main dimensions of m-money: usage and access. Robust standard errors are shown in parentheses; \*\*\*

p<0.01, \*\* p<0.05, \* p<0.1.

## Appendix

### A1 KMO and Bartlett's Test – Well-being index

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.904
Bartlett's Test of Sphericity	Approx. Chi-Square	9.55e+05
	df	45
	Sig.	0.000