

Open Access article distributed in terms of the
Creative Commons Attribution License
[CC BY 4.0] (<http://creativecommons.org/licenses/by/4.0>)

The Effect of Mobile Money Uses on Rudimentary Financial Literacy in Tanzania

Regina Nyakale¹, Deogratius M.B Rugaimukamu², Rocky J. Akaro³

ABSTRACT

Understanding the relationship between mobile money financial services and rudimentary financial literacy could greatly inform strategies towards improvement of financial services. This paper examines the effect of mobile money financial services on rudimentary financial literacy of household members in Mbeya and Dodoma regions. The study specifically intended to jointly model the prevalence of mobile money financial services and rudimentary financial literacy by employing the bivariate probit regression model. A questionnaire was used to obtain data from 384 household members aged at least 18 years who were engaged in economic activities in 2018. The results show that age, education and distance to the mobile money financial service providers are among the factors that explain the joint relationship between the use of mobile money financial services and rudimentary financial literacy. Rudimentary financial illiteracy on the use of mobile money was found to be higher in rural compared to urban areas. The results further revealed that people with active mobile money accounts had a greater chance of being financially literate than those with dormant mobile money accounts. It is recommended that more education should be provided to wake up people's minds because what they know about mobile money financial services is not enough to make them financially literate on mobile money use as to facilitate their economic activities.

Key words: *Mobile Money Financial Services, Rudimentary Financial Literacy, Bivariate Probit Model, Seemingly Unrelated Bivariate Probit Model.*

INTRODUCTION

Mobile money services involve use of cell phones for a range of financial transactions such as sending and receiving money, savings, payments and borrowing money. This has increased access to financial services among the unbanked Africans as the most cost effective and economically efficient method of providing financial services to the majority of African populations (Ondiege, 2015). Mobile money services have thus facilitated financial inclusion since they are affordable to economically disadvantaged groups, including the underprivileged and low income groups thereby improving their financial literacy (Hameedu, 2014). The continuous usage of mobile phones and internet uses has shown an impact on individual financial literacy (Wamuyu, 2014, Kim et al., 2010, Yu, 2012).

Denotatively, literacy refers to a person's ability to read, write and do simple arithmetic. However, there is no universally acceptable meaning of financial literacy. In the context of this paper, financial literacy covers three areas, namely written information, documents (tabular and graphical information) and quantitative aspect (arithmetic and numerical information) (Huston, 2010). Robb and Woodyard (2011) perceive financial knowledge as an understanding of the principles and terminologies needed for effective management of personal financial issues.

1 Assistant Lecturer, Department of Mathematics, Physics & Informatics, Mkwawa University College of Education, Corresponding author's email:

2 Senior Lecturer, Department of Statistics, University of Dar es Salaam

3 Associate Professor, Department of Statistics, University of Dar es Salaam

Business Management Review: Volume 23, Number 2, Pages 89-105, ISSN 0856-2253 (eISSN 2546-213X) © July-December, 2020 UDBS. All rights of reproduction in any form are reserved.

Knowledge of relationship between the use of mobile money services and financial literacy is said to significantly contribute to improvement of financial strategies. Although different studies have been conducted on the use of mobile money services and financial literacy; and association between the same, not much has been done to jointly model the commonness of mobile money financial services and rudimentary financial literacy. Consequently, the effect of using mobile money financial services on rudimentary financial literacy of individual households is not clearly addressed in the literature. The objective of this study was to establish the effect of using mobile money financial services on rudimentary financial literacy of household members in Mbeya and Dodoma regions. Specifically, the study assessed how the use of mobile money financial services affects rudimentary financial literacy in order to enable household members to facilitate their economic activities through the services.

LITERATURE REVIEW

Penetration of mobile money financial services varies widely across regions, income groups and individual characteristics. According to (Jia et al., 2018), with the presence of 690 million registered mobile money accounts worldwide, mobile money has evolved into the leading payment platform for the digital economy in many emerging markets. N'dri & Kakinaka (2020) reported that there were 135 million live mobile money services across the Sub-Saharan Africa at the end of 2017, with live 122 million active mobile money accounts. Across Sub-Saharan Africa, mobile money plays a key role in extending financial services to people with limited access to traditional financial institutions, particularly women and rural populations (Shapshak, 2018). GSMA (2017) revealed that 66% of the combined adult populations of Kenya, Rwanda, Tanzania and Uganda use mobile money on an active basis. According to Demirguc-Kunt et al. (2018), the Global Findex Database in 2014 revealed that while mobile money had been centred in East Africa, the 2017 update revealed that it had spread to West Africa and beyond.

According to (Lashitew et al., 2019), mobile money penetration rates in Tanzania have reached 65% in urban areas and about 25% in rural areas whereas 32% of the 52 million populations uses mobile money financial services; and only 2% has active traditional bank accounts. Statistics also show that, in 2018, there were 6 mobile money providers in Tanzania with varied market shares. The services providers included Vodacom with M-Pesa (43%), Tigo with Tigo Pesa (36%), Airtel with Airtel Money (17%), Halotel with Halotel Money (3%), Zantel with Ezy Pesa (1%) and TTCL with TTCL-pesa (0.04%). Apart from mobile money financial services, mobile operators in Tanzania offer other services such as finance and micro finance as well as mobile insurance.

Financial literacy involves a wide range of daily activities that are related to funds in terms of budget preparation, purchases, insurance and investment. According to Remund (2010), financial literacy is a person's ability to recognize and use financial matters. Huston (2010) considers financial literacy as including awareness, knowledge and financial instruments and their application in economic activities and personal life. In general, these definitions show that financial literacy includes the ability to prepare budgets, save for the future and learn strategies to manage responsibility. A person is regarded as financially literate if s/he is able to manage personal finance in life and to change the society in order to enable him/her to achieve necessary perception, develop skills in financial literacy area and be able to understand the impact of individual's financial decisions on his/her own life and that of other society members and the environment (Remund, 2010). According to Chetty et al. (2018), enhanced digital skills across Europe in 2018

emphasized the need for financial literacy in order to tackle the issue of digital literacy in partnership between financial institutions and education providers. It was also insisted that, financial literacy is something to be addressed locally in environments where people feel safe to start using digital tools to manage their money.

The use of mobile money financial services is important as it provides consumers a safe and convenient way to make different types of transactions and increase access to credit facilities (Hernandez & Roberts, 2018; Muthiora, 2015). But these technological services are often unfamiliar to beneficiaries who predominantly live in rural areas (Rea & Nelms, 2017). The question underlying this study is that whether continuous use of mobile money financial services would improve rudimentary financial literacy of individual household members.

Although literature suggests continuous and successful use of mobile money among individuals all over the world, few studies have focused on the relationship between rudimentary financial literacy and the use of mobile money financial services. This study intended to fill this gap by establishing the effects of using mobile money financial services on rudimentary financial literacy.

METHODOLOGY

Study areas and source of data

This study was conducted in Mbeya and Dodoma regions of Mainland Tanzania. Multistage sampling was employed whereby in the first stage, Mbeya Region was selected among the wealthiest regions; and Dodoma was selected among the regions with the poorest households in the country (THDR, 2014). In the second stage, Mbeya City and Mbeya District Councils in Mbeya Region and Dodoma City and Chamwino District Councils in Dodoma Region were selected because of similarity of economic activities (agriculture, employment and business) in urban and rural areas. With the help of District Executive Officers (DEOs), two wards from each district characterized by highest revenue contribution to the district and region were selected in the third stage. On the other hand, with the help of Ward Executive Officers (WEOs) streets with high concentration of economic activities were identified in the fourth stage. In the fifth stage, systematic sampling was used to select households engaging in economic activities. Since the average household size in Tanzania is 4.9 (NBS, 2016), in every 5th selected household within the clusters, the average of 3 household members were selected, with the heads of households given priority until the sample size was reached. The survey was conducted from September to December, 2018 involving 384 randomly sampled respondents aged 18 and above. A questionnaire was used to collect data from respondents.

Description and measurement of variables

The two binary response variables used with their categories were *rudimentary financial literacy* (literate and illiterate) and *mobile money financial services* (active and dormant accounts). The explanatory variables were age (18 – 34, 35 – 44, 45 – 54, 55+), education (informal, primary, secondary, higher (college/university)), sex (male, female), marital status (single, married/cohabiting, widowed/separated/divorced), residence (rural or urban), income earned per month in (thousands) of Tanzania shillings (low-less than 250 per month; middle -250 – 750; high-above 750), distance to providers (greater than 5 kilometers, between 1 – 5 kilometers, less than 1 kilometer), employment status (employed in private or public sector, self-employed).

A set of questions on rudimentary financial literacy and use of mobile money financial services was developed to detect the perceived importance and involvement of rudimentary financial literacy in the use of mobile money financial services as well as to get self-assessment scores on the two latent response variables. Rudimentary financial literacy and the use of mobile money financial services were computed as the number of correct responses to the asked questions. A value of 1 was given to correct responses and 0 was scored in all other cases.

The use of mobile money financial services

Four questions were asked to determine the use of mobile money financial services as illustrated below.

Have you ever heard of any of the mobile money financial services in your living areas?

The question sought to find out if respondents had ever heard of any mobile money financial services available all over the country such as Tigo-Pesa, M-Pesa, Halotel money, Airtel money, Zantel (Easy-pesa) and TTCL-Pesa. Respondents were also given the chance to identify other mobile money financial services known to them apart from those mentioned by the researcher. Respondents were instructed to tick at least one mobile money financial service and to add to the list other mobile money financial service available in their living area. If a respondent ticked one or more listed mobile money financial services or ticked the added services, s/he scored 1 for correct response and 0 in all other cases.

Do you own any mobile money financial account?

The question assessed respondents' ownership of mobile money account(s). Respondents were instructed to answer **Yes** if s/he had at least one mobile money financial account in any of the listed or added mobile money financial services identified in question 1. Otherwise, the answer was No. A respondent scored 1 if the response was Yes, implying she/he had at least one mobile money financial account with at least one mobile money financial service provider. Otherwise, the score was 0.

Have you ever received/sent money through mobile money financial services?

Respondents were instructed to answer Yes, if she/he either ever received or sent money from/to another person or both receiving and sending money via mobile money financial service providers. Otherwise, the answer was No. respondents who responded 'Yes' to one or both of the services scored 1 while they scored 0 if they had never received/sent money via mobile money financial service providers.

Have you ever saved money in any mobile money financial accounts in the last 90 days?

The question aimed to identify respondents who had actively been saving in mobile money financial accounts. Saving was identified in two different ways; (1) saving own money in mobile money accounts and (2) saving the money received from different sources. Respondents were instructed to answer Yes, if saving was through either of the two means; and No, if they never saved in either of the two means. A respondent who saved in either way scored 1 and 0 if she/he did not save in any means.

The scores were established such that respondents who scored 1 in at least three questions were regarded as using the mobile money financial services by owning active mobile money financial accounts. Conversely, respondents who scored 0 in questions 3 and 4 were regarded as not using mobile money financial services and hence they were regarded as owning dormant mobile money accounts. Then the use of mobile money financial services was established such that;

$$\text{Use of mobile money} = \begin{cases} 1 = \text{Active account if a respondent score} \geq 3 \text{ ones} \\ 0 = \text{Dormant account if a respondent score } 0 \text{ in } 3 \text{ \& } 4 \text{ questions} \end{cases}$$

Rudimentary financial literacy

Three questions were asked to respondents in order to determine their rudimentary financial literacy.

Can you read, write and do simple arithmetic concerning mobile money issues through the mobile phone?

The question assessed respondents' rudimentary financial literacy concerning their ability to read, write and do simple arithmetic through mobile phones. The respondents' knowledge of words, symbols and figures on different mobile money issues was assessed. This included the ability to read, write and conduct arithmetic operations on issues related to mobile money financial services. The assessed arithmetic calculations were addition, subtraction, multiplication and division of money in their mobile money accounts. This was attained by allowing respondents calculations with or without calculators. Respondents who were able to read, write and perform different mobile money arithmetic operations scored 1; and 0 otherwise.

Can you identify mobile money messages received through your mobile phone?

This question assessed respondents' ability to identify mobile money messages received in their mobile phones. This was done by asking the respondents if they could identify normal messages from transactional messages. The assessed respondents' ability included to identify the mobile money messages received, checking balance or amount of money received or inquire her/his balance. Respondents who were able to identify mobile money messages, check balance and identify messages related to the amount of money received/sent messages correctly scored 1; and 0 in all other cases.

Can you identify deductions in different mobile money accounts such as Tigo-Pesa, M-Pesa, Halotel money, Airtel money, Zantel (Esy-pesa) and TTCL-Pesa?

This question assessed the ability to identify cost deductions on mobile money accounts when sending or withdrawing money from respective accounts. Those who were able to identify deduction costs scored 1; and scored 0 otherwise. The scores were established such that respondents who scored 1 in at least two questions were regarded as rudimentary financially literate on mobile money services. In contrast, respondents who scored 0 in at most two questions were regarded as rudimentary financially illiterate on mobile money services. Then the rudimentary financial literacy variable was established such that;

$$\text{Rudimentary financial literacy} = \begin{cases} 1 = \text{Literate if a respondent scores} \geq 2 \text{ ones} \\ 0 = \text{Illiterate if a respondent scores} < 2 \text{ ones} \end{cases}$$

Bivariate probit regression model

The bivariate probit regression model is a joint model for two binary dependent variables whose disturbances are assumed to be correlated. It generalizes the index function model from one latent variable to two latent variables that may be correlated. Let Y_1^* and Y_2^* be two latent variables such that Y_1^* = rudimentary financial literacy and Y_2^* = mobile money financial services. A latent variable is a variable that is not observable. Latent variables can be introduced into binary outcome

models as an index of an unobserved outcomes partiality for the event of interest to occur (Colin and Trivedi, 2005).

The unobserved latent variables can be defined as;

$$Y_1^* = X_1\beta_1 + \varepsilon_1 \quad (1)$$

$$Y_2^* = X_2\beta_2 + \varepsilon_2 \quad (2)$$

Where $[x_{is}, \beta_{is}]_{i=1, 2}$ are the vectors of explanatory variables and coefficients of explanatory variables respectively, ε_1 and ε_2 are joint normal with zero means, variance one and correlation ρ .

That is,

$$E(\varepsilon_1) = E(\varepsilon_2) = 0; \quad Var(\varepsilon_1) = Var(\varepsilon_2) = 1 \quad Cov(\varepsilon_1, \varepsilon_2) = \rho \quad (3)$$

The bivariate probit model specifies the observed outcomes to be

$$Y_1 = 1 \text{ if } Y_1^* > 0 \text{ and } 0, \text{ otherwise} \quad (4)$$

$$Y_2 = 1 \text{ if } Y_2^* > 0 \text{ and } 0, \text{ otherwise} \quad (5)$$

Then the bivariate regression model can be written as

$$P(y_1 = i, y_2 = j) = \Phi_2(X_1'\beta_1, X_2'\beta_2, \rho) \quad (6)$$

The estimation of parameters in equation (6) that is the coefficients (β_1, β_2 and ρ) can be estimated by using the maximum likelihood estimation method.

Seemingly unrelated bivariate probit regression model

The application of the seemingly unrelated bivariate probit regression model was considered to specify different regressors for both the equations Y_1 and Y_2 in equations (4) and (5). Seemingly unrelated bivariate probit regression model is used when two equations are to be estimated and the dependent variable of one of them is explanatory in the other variable (Sajaia, 2008). For the case of this study, a respondent was considered to be financially literate or illiterate depending on whether s/he used mobile money financial services or not. Therefore, the use of mobile money services was an explanatory variable to the dependent variable (rudimentary financial literacy). The two latent variables for the seemingly unrelated bivariate probit regression model are given as:

$$Y_1^* = X_1\beta_1 + \varepsilon_1 \quad (7)$$

$$Y_2^* = \gamma Y_1 + X_2\beta_2 + \varepsilon_2 \quad (8)$$

The estimation procedures are the same as those used in Bivariate probit regression model except for the inclusion of γY_1 in this model.

Average marginal effects

After parameter estimation, the average marginal effects of the covariates in the conditional distribution had to be considered. The average marginal effects determine the magnitude of change of the conditional probability of the outcome variable when the value of regressor is changed, holding all the regressors constant at some value. The average marginal effect for the bivariate probit regression model is given by:

$$\frac{\partial \Phi_2(X_1'\beta_1, X_2'\beta_2, \rho)}{\partial X_i} = \varphi(X_i'\beta_i)\Phi_2\left(\frac{X_2'\beta_2 - \rho X_1'\beta_1}{\sqrt{1-\rho^2}}\right)\beta_i, i = 1, 2 \quad (9)$$

The average marginal effects for categorical variables show how conditional probability change as the categorical variable changes from 0 to 1, after controlling, in some way, the other variables in the model (Bester & Hansen, 2009).

DATA ANALYSIS

Data entry was done using IBM SPSS version 20 while coding and analysis were done by using STATA statistical software version 14 whereby both descriptive and inferential analyses were involved. The descriptive statistics comprising frequency distributions and percentages of both response and explanatory variables were computed; and inferential statistics were used to draw conclusions about the study respondents based on the collected data. The inferential statistics involved the Chi-square test of association, the bivariate probit regression model and the seemingly unrelated bivariate probit regression model. Before fitting the bivariate probit regression model, the relationship between the response and the explanatory variables were checked using Pearson Chi-square test of association. The explanatory variables which showed significant association with each response variable were taken to the bivariate probit model to best fit the model; and the explanatory variables which showed significant association with both response variables were taken to the seemingly unrelated bivariate probit regression model. After that, the model that best fitted the data could be chosen.

RESULTS AND DISCUSSION

Descriptive statistics

Summary statistics were computed for each of the variables included in the study. The summary statistics give the overall picture of the variables. The frequencies and percentages of variables are presented in Table 1.

The results show that 68% and 75% of the respondents were financially literate and owned active mobile money accounts respectively. According to explanatory variable results, 37% of the respondents were aged 35 – 44 years, 46% had primary education, 51% and 49 were males and females respectively, 50% were married, 60% lived in urban areas, 43% earned low income per month (less than or equal to Tshs. 250,000/=), 75% were self-employed and 37% indicated a satisfactory distance of 1 – 5 kilometers from home to mobile money financial service providers.

Table 1: Distribution of Respondents' Characteristics

	Variable	Codes	Frequency and (%)
Response variables	Rudimentary financial literacy	0 = financially illiterate 1 = financially literate	124 (32) 260 (68)
	Mobile money financial accounts	0 = Dormant accounts 1 = Active accounts	95 (25) 289 (75)
Explanatory variables	Age (years)	1 = 18 – 34	123 (32)
		2 = 35 – 44	143 (37)
		3 = 45 – 54	64 (17)
		4 = 55+	54 (14)

	Education	1 = Informal education 2 = Primary 3 = Secondary and higher	76 (20) 177 (46) 131 (34)
	Sex	0 = Female 1 = Male	189 (49) 195 (51)
	Marital status	1 = Single 2 = Married 3 = Ever married	110 (29) 191 (50) 83 (21)
	Residence	0 = Rural areas 1 = Urban areas	153 (40) 231 (60)
	Income per month TShs. (in thousand)	1 = Low <= 250 2 = Middle 250 – 750 3 = High 750+	165 (43) 133 (35) 86 (22)
	Employment status	0 = Employed 1 = Self-employed	97 (25) 287 (75)
	Distance from home to mobile money financial services	1 = < 1kilometer 2 = 1 – 5 kilometer 3 = > 5kilometer	132 (34) 142 (37) 110 (29)

Source: Field Survey (2018) Analysis Results

Pearson Chi square test of association

Pearson chi-square test measured the association between each response and the explanatory variables. Pearson chi-square test results at 5% are given in Table 2. The variables, including education, sex, employment status, residence and distance show significant association with the rudimentary financial literacy. That means these are the variables that significantly affect the prevalence of rudimentary financial literacy; whether fitted alone or together with other variables. However, age, marital status and income were not associated with rudimentary financial literacy. The variables age, education, marital status, income and distance were associated with the use of mobile money financial services. The results indicate that age, education, marital status, income and distance to the mobile money financial services significantly determine the prevalence of the use of mobile money financial services. Sex, employment status and residence were not associated with the use of mobile money financial services.

With reference to residence, rudimentary financial illiteracy was higher in rural areas than in urban areas. The reason might be the absence or scarcity of mobile money service providers in rural areas. On the other hand, rudimentary financial literacy was higher in urban areas than in rural areas presumably due to conducive environment for mobile money service providers and concentrations of different economic activities in urban areas.

Table 2: Pearson Chi-square Test of Association between the Responses and the Explanatory Variables

Variable	Responses	Financial Literacy		P-Value	Mobile money financial accounts		P-Value
		Illiterate (%)	Literate (%)		Dormant (%)	Active (%)	
Age	18 – 34	46 (37)	77 (63)	0.242	26 (21)	97 (79)	0.029
	35 – 44	47 (33)	96 (67)		29 (20)	114 (80)	
	45 – 54	19 (30)	45 (70)		19 (30)	45 (70)	
	55+	12 (22)	42 (78)		21 (39)		

Sex	Female	72 (38)	117 (62)	0.017	41 (22)	148 (78)	0.173
	Male	52 (27)	143 (73)		54 (28)	141 (72)	
Education level	Informal education	39 (51)	37 (49)	0.000	11 (14)	65 (86)	0.038
	Primary	48 (27)	129 (73)		51 (30)	121 (70)	
	Secondary & above	37 (28)	94 (72)		33 (24)	103 (76)	
Marital status	Single	29 (29)	70 (71)	0.237	22 (22)	77 (78)	0.024
	Married/Cohabiting	58 (30)	133 (70)		58 (30)	133 (70)	
	Ever married	37 (39)	57 (61)		15 (16)	79 (84)	
Employment status	Employed	21 (22)	76 (78)	0.010	23 (24)	74 (76)	0.786
	Self-employed	103 (36)	184 (64)		72 (25)	215 (75)	
Residence	Rural	64 (42)	89 (58)	0.001	35 (23)	118 (77)	0.491
	Urban	60 (26)	171 (74)		60 (26)	171 (74)	
Income/ month TShs. (in thousand)	Low <= 250	58 (35)	107 (64)	0.496	44 (27)	121 (73)	0.029
	Middle 250 – 750	42 (32)	91 (68)		23 (17)	110 (83)	
	High 750+	24 (28)	62 (72)		28 (33)	58 (67)	
Distance	<= 1 kilometer	41 (31)	91 (69)	0.020	23 (17)	109 (83)	0.033
	1 – 5 kilometer	57 (40)	85 (60)		44 (31)	98 (69)	
	>5 kilometer	26 (24)	84 (76)		28 (25)	82 (75)	

Source: Field Survey (2018) Analysis Results

Bivariate analysis for rudimentary financial literacy and the use of mobile money financial services

Data was modeled first using a bivariate probit regression model and later fitted using the seemingly unrelated bivariate probit model. After that, the model which best fitted the data could be chosen. A bivariate probit regression model was used to jointly model the prevalence of rudimentary financial literacy and the use of mobile money financial services; and the results are shown in Table 3.

The bivariate probit regression model results show that adult respondents aged 55 years and above (p -value = 0.032) show significant rudimentary financial literacy. Similar association obtains in respondents with primary, secondary and higher (colleges/universities) education (p -value = 0.001 and 0.032), male (p -value = 0.004), ever married (p -value = 0.035), urban dwellers (p -value = 0.002), self-employed (p -value = 0.012) and respondents located 1 – 5 kilometer from mobile money financial services (p -value = 0.032). These results suggest that, as age increases and people get more educated, they become financially literate. Males and ever married (separated, divorced, widowed) respondents seem to be financially literate compared to females, single and married respondents. Urban dwellers and self-employed respondents were more financially literate compared to rural dwellers and employed respondents. Furthermore, respondents who live near mobile money financial services seem to be more financially literate compared to those who live far away from the mobile money services.

Also, adult respondents aged 55 years and above (p -value = 0.007), primary school leavers (p -value = 0.013) significantly use mobile money financial services. This also applies to respondents with middle income per month (p -value = 0.023) and those located 1 – 5 kilometer from mobile money services providers (p -value = 0.011). This means that adults, primary school leavers and

middle income respondents own more active mobile money financial accounts. It seems that respondents who live near mobile money financial services use the services more (own active mobile money accounts) compared to those who live far from the services.

The average marginal effect was also calculated and the results show that, respondents aged 35 – 44 years have the highest chance (47.14%) of being financially literate in mobile money compared to those aged 45 – 54 and 55 years and above (6.4% and 16.1% respectively). Primary school leaver respondents have the highest (21.01%) chance of being financially literate compared to respondents with secondary education and higher (15.7%). Males and urban dweller respondents have 13.31% and 15.9% higher chances of having rudimentary financial literacy on mobile money compared to females and rural dwellers respectively. But self-employed respondents have 13.3% lower chance of being financially literate on mobile money compared to employed respondents.

Findings show further that respondents with middle income have the greater chance (11.2%) of using mobile money financial services and thus own active mobile money accounts as compared to high income earners (0.009%). This means middle income respondents are the most users of mobile money financial services compared to low and high income respondents. Moreover, respondents who have ever married (widowed, separated, divorced) have 63.2% higher chance of using mobile money financial services, thereby owning active mobile money accounts, compared to married respondents with 8.7% lower chance. Respondents with secondary education and above have greater percentage (8.3%) of lower chances of using mobile money financial services compared to respondents with primary education with 14.7% lower chance. The result means that the use of mobile money financial services (ownership of active mobile money accounts) increases as people become more educated. Males and self-employed respondents have 4.6% and 0.13% lower chances respectively of using mobile money financial services compared to females and employed respondents. This implies that females and employed respondents are the most users of mobile money financial services. Respondents who live near mobile money financial services, about 1 – 5 km, have greater percent (13.6%) lower chance of using the services compared to respondents who live far (more than 5km) from mobile money financial services with 79.3% lower chance. Moreover, urban dwellers have 0.74% higher chance of using mobile money financial services, thereby owning active mobile money accounts, compared to rural dwellers. This could be due to more availability of mobile money financial services in urban areas compared to rural areas.

The overall fit of the model was checked by the Wald test [Wald $\chi^2(28) = 80.57$, p -value = 0.0000] and it is shown that the model was significant. It was also checked for the presence of correlation, and the likelihood ratio test rejects the null hypothesis of zero correlation [$\chi^2(1) = 6.5542$, p -value = 0.0105]. This means the correlation between the commonness of rudimentary financial literacy and the use of mobile money financial services is significant. In the absence of this evidence of correlation between the error terms, separate probit models would have been used instead of bivariate probit regression model (Neill & Lee, 2001).

Table 3: Bivariate Probit Regression Model

Response variables	Explanatory variables	Parameter estimate	Standard error	Z-Statistic	P-Value	Marginal effects
Financial literacy	<i>Age (years)</i> 35 – 44	0.1533	0.1740	0.88	0.379	0.4714
	45 – 54	0.2104	0.2259	0.93	0.352	0.0644
	55+	0.5264	0.2455	2.14	0.032	0.1608
	<i>Education</i> Primary	0.6219	0.1922	3.24	0.001	0.2101
	Secondary+	0.4552	0.2117	2.15	0.032	0.1569
	<i>Sex</i> Male	0.4187	0.1466	2.86	0.004	0.1331
	<i>Marital status</i> Married	-0.1139	0.1778	0.64	0.522	-0.0353
	Ever married	-0.4415	0.2092	-2.11	0.035	-0.1452
	<i>Residence</i> Urban areas	0.4885	0.1589	3.07	0.002	0.1587
	<i>Income</i> Middle income	-0.4252	0.1695	-0.25	0.802	-0.0139
	High income	-0.0828	0.2088	-0.40	0.692	-0.0280
	<i>Employment</i> Self-employed	-0.4333	0.1589	-2.51	0.012	-0.1329
Mobile money	<i>Age (years)</i> 35 – 44	0.0016	0.1872	0.01	0.993	0.0002
	45 – 54	-0.1461	0.2296	-0.64	0.524	-0.00416
	55+	-0.6407	0.2367	-2.71	0.007	-0.2077
	<i>Education</i> Primary	-0.3426	0.2188	-2.48	0.013	-0.1473
	Secondary+	-0.2892	0.2484	-1.38	0.168	-0.0839
	<i>Sex</i> Male	0.1602	0.1506	-1.06	0.287	-0.0458
	<i>Marital status</i> Married	-0.2892	0.1821	-1.59	0.112	-0.0870
	Ever married	-0.2574	0.2276	1.13	0.258	0.6318
	<i>Residence</i> Urban areas	0.0262	0.1632	0.16	0.873	0.0074
	<i>Income</i> Middle income	0.4158	0.1828	2.27	0.023	0.1119
	High income	0.0133	0.2123	0.06	0.950	0.0009
	<i>Employment</i> Self-employed	0.0028	0.1689	0.02	0.987	-0.0013
<i>Distance</i> 1- 5 kilometer	-0.4691	0.1834	-2.56	0.011	-0.1356	
> 5 kilometer	-0.3013	0.2057	-1.46	0.143	-0.7933	

Source: Field Survey (2018) Analysis Results

Seemingly unrelated bivariate probit model

In this model, we included only the significant variables for both the response variables, which are age, education and distance. Also, the use of mobile money financial services becomes the explanatory variable for rudimentary financial literacy response variable. The results for seemingly unrelated bivariate probit model are shown in Table 4. The variables mobile money, age, sex, education, marital status, residence, employment status and distance also have an impact on the rudimentary financial literacy. For instance, age, education and distance significantly explain the prevalence of the use of mobile money financial services.

The average marginal effect results for rudimentary financial literacy show that, respondents with active mobile money financial accounts have 14.2% higher chance of being financially literate compared to respondents with dormant mobile money financial accounts. This means that the more people become active in using mobile money financial services the more financially literate they become. Respondents aged 35 – 44, 45 – 54, 55 and above have 5.1, 6.1 and 13.3% higher chances of being rudimentary financially literate respectively than those aged 18 – 34. Respondents with primary, secondary education and above have 18.7 and 14.26% higher chances of being rudimentary financially literate respectively compared to those with informal education. Additionally, married respondents have 4.6% lower chance while ever married (widowed, separated, divorced) have 13.1% higher chance of being financially literate compared to single respondents. Males and urban dwellers have 12.7% and 16.1% higher chances of being financially literate compared to females and rural dwellers. As for employment, self-employed respondents have 13.3% lower chance of having rudimentary financial literacy compared to employed respondents. Similarly, respondents with middle income have 0.3% higher chance while those with high income have 2.6% lower chance of having rudimentary financial literacy compared to those with low income. Respondents who live far from mobile money financial services (1- 5km and above) have 15.9 and 0.4% lower chances of being financially literate compared to those who live near (less than 1km) mobile money financial services. This reveals that those who live near mobile money financial services have more rudimentary financial literacy than those who live far from the services.

The average marginal effects for mobile money show that, respondents aged 35 – 44 year have 1.6% higher chance while those ages 45 – 54 years and above have 4.2 and 18.8% lower chances of owning active mobile money accounts respectively compared to respondents in the age group 18 – 34. In terms of education, primary leavers have 14.7% lower chance while those with secondary education and above have 7.4% higher chance of owning active mobile money accounts compared to those with informal education. As regards distance, respondents who live far from mobile money financial services (1- 5 and above) have 13.7% and 6.4% lower chances of using the mobile money financial services compared to those who live near (less than 1Km) the services. This means those who live near mobile money financial services own more active mobile money financial accounts compared to those who live far from the services.

The overall fit of the model was significant with Wald $\chi^2(22) = 113.16$, p -value = 0.0000. The likelihood ratio test fails to reject the null hypothesis of zero correlation [$\chi^2(1) = 0.7094$, p -value = 0.3996]. This means the correlation between the commonness of financial literacy and mobile money is not significant. This implies that a seemingly unrelated bivariate probit model does not fit the data.

Table 4: Seemingly Unrelated Bivariate Probit Model for Financial Literacy and Mobile Money

Response variables	Explanatory variables	Parameter estimate	Standard error	Z-Statistic	P-Value	Marginal effects
Financial literacy	<i>Mobile money</i> Active account	-1.3937	0.7275	-1.92	0.005	0.1422
	<i>Age (years)</i> 35 – 44 45 – 54 55+	0.1598	0.1679	0.95	0.341	0.0505
		0.1237	0.2312	0.53	0.593	0.0607
		0.2073	0.3486	0.59	0.013	0.1330
	<i>Education</i> Primary Secondary+	0.3659	0.3014	1.21	0.007	0.1870
		0.3067	0.2471	1.24	0.214	0.1426
	<i>Sex</i> Male	0.3657	0.1560	2.34	0.019	0.1267
		<i>Marital status</i> Married Ever married	-0.1412	0.1643	-0.86	0.390
	-0.3715		0.2088	-1.78	0.046	0.1305
	<i>Residence</i> Urban areas	0.4481	0.1759	2.55	0.011	0.1605
	<i>Income</i> Middle income High income	0.0108	0.1559	0.07	0.945	0.0026
		-0.0704	0.1915	-0.37	0.713	-0.0261
<i>Employment</i> Self-employed	-0.3962	0.1875	-2.11	0.035	-0.1327	
<i>Distance</i> 1- 5 Km > 5Km	-0.5902	0.1729	-3.41	0.001	-0.1592	
	-0.08129	0.2010	-0.40	0.686	-0.0043	
Mobile money	<i>Age (years)</i> 35 – 44 45 – 54 55+	0.0434	0.1794	0.24	0.809	0.0159
		-0.1458	0.2156	-0.68	0.499	-0.0416
		-0.5790	0.2233	-2.59	0.010	-0.1884
	<i>Education</i> Primary Secondary+	-0.5266	0.2088	-2.52	0.012	-0.1471
		-0.2455	0.1983	-1.20	0.232	0.0738
	<i>Distance</i> 1- 5 kilometer > 5 kilometer	-0.4793	0.1746	-2.74	0.006	-0.1367
-0.2455		0.1983	-1.24	0.216	-0.0642	

Source: Field Survey (2018) Analysis Results

DISCUSSION

The chi-square test of association results showed that, education, gender, employment status residence and distance were significant determinants of rudimentary financial literacy. These results are consistent with other studies such as Sarigül (2014), who found that sex and education were significant in general knowledge of financial matters; and Hira and Loibl (2005) who found that employment status was significant in determining financial literacy levels. Moreover, Lalrinmawia and Gupta (2015) found that residential area and education were significant in determining financial literacy levels. In this study, the variables age, education, marital status, income and distance were significant in determining the use of mobile money financial services. Maradung (2013) also observed that, in the use of mobile money services, gross income and

education of an individual appeared to be insignificant but age seemed to be significant in determining the use of mobile money financial services.

The p -value results from the bivariate probit regression model indicated the categories of variables which significantly determine rudimentary financial literacy and the use of mobile money financial services. In that case, the bivariate probit regression model results indicated that, as age increases, people become more financially literate on the use of mobile money financial services by owning active mobile money accounts. This reveals that, as people continue to own active mobile money accounts at their old ages, they improve their rudimentary financial literacy levels on the use of mobile money financial services. This is compatible with Lusardi (2019), who concluded that financial literacy is low among the youth. According to Worthington (2006), financial literacy level is highest for persons aged between 50 and 60 years; and for those with high education levels. As the level of education increases, people become more financially literate although those in primary education were the best users of mobile money financial services by owning active mobile money accounts compared to those with higher education levels. Although males, ever married, urban dwellers and self-employed respondents show significance in explaining the rudimentary financial literacy, the same variables lack significance in explaining the prevalence of the use of mobile money financial services in the context of this study. The observation that males are more financially literate than females is consistent with Lusardi (2019) who found that, women are less likely than men to answer financial literacy questions correctly. The reason might be overconfidence among men and lack of knowledge among women. Sarigiül (2014) reported that sex was significant in general knowledge of financial services. In case of employment, Worthington (2006) found that financial literacy level was higher among business people (self-employed) and farm owners. On the other hand, middle income earners and respondents living 1 - 5 km away from mobile money financial service providers are the best users of mobile money financial services and owned active mobile money financial accounts. The bivariate probit regression model p -value result also identifies the variables which show significance in explaining the prevalence of both rudimentary financial literacy and the use of mobile money financial services; which are age, education and distance.

The bivariate probit regression model average marginal effect results indicated the variable categories with higher and lower chances of leading to rudimentary financial literacy and the use of mobile money financial services (active mobile money accounts) compared to other variable categories. Accordingly, respondents in age group 35 – 44 had higher chances of being both financially literate and own active mobile money accounts. Similarly, primary school leavers had higher chance of being financially literate than those with higher education. This is compatible with the p -value results that primary school leavers own active mobile money financial accounts compared to those with higher education levels. Along the same lines, males and urban dwellers had higher chances of being financially literate. The study findings have also revealed that middle income earners and those who had ever married (separated, widowed, divorced) had higher chances of owning active mobile money accounts. Based on the p -value results, such respondents did not show significant ownership of active mobile money accounts; but the average marginal effect results reveal that the same group has higher chances of owning active mobile money accounts. Also, the average marginal effect for income results is compatible with that of p -value that middle income earners own more active mobile money financial accounts compared to other income groups.

The overall results reveal that, people with active mobile money financial accounts had higher chances of having rudimentary financial literacy compared to those with dormant accounts. This means that the more people become active in using mobile money financial services, the more financially literate they become. Likewise, as age and education levels increase, people tend to have higher chances of being literate on the use of mobile money financial services. It has also been shown that males, urban dwellers, ever married and middle income respondents have higher chances of being literate on the use of mobile money financial services compared to females, rural dwellers, single and married and low as well as higher income earners. Similarly, people who live near mobile money financial services have higher chances of developing rudimentary financial literacy on the use of the services compared to those who live far from the services.

CONCLUSION AND RECOMMENDATIONS

This study aimed to establish the effect of using mobile money financial services on rudimentary financial literacy of household members and facilitation of economic activities. The findings are based on the characteristics of respondents, chi-square test of association, bivariate probit regression model. It has been found that there are factors that contribute to the joint relationship between the use of mobile money financial services and rudimentary financial literacy by household members. Specifically, age, education and distance to the mobile money financial service providers are among the factors that explain the joint relationship between the use of mobile money financial services and rudimentary financial literacy. Moreover, gender, residence and income are significant in both rudimentary financial literacy and owning active mobile money accounts. The overall results reveal that people with active mobile money accounts have a greater chance of being financially literate compared to those with dormant mobile money accounts.

Similarly, there is a strong relationship between rudimentary financial illiteracy or literacy on the use of mobile money financial services and rural and urban residence such that in urban areas rudimentary financial literacy on the use of mobile money financial services is found to be higher compared to rural areas and rudimentary financial illiteracy is found to be higher in rural compared to urban areas. Therefore, the introduction and continuous usage of mobile money financial services has helped the present generation of mobile money users to move from very little knowledge of digital financial literacy to at least rudimentary financial literacy on the use of mobile money through the mobile phone. Moreover, the continuous usage of mobile money financial services through own telephone among household members has enabled users to develop rudimentary financial literacy especially in rural areas where digital financial challenges are perhaps more likely to bring hardship than in urban areas. People have also shifted from depending on mobile money financial services providers' agents to performing the arithmetic operations on their own. This was evidenced by the analysis attempted in this study whereby majority of respondents were able to identify the financial messages from other messages in their mobile phones, although primary education seems to be the basic education for the use of mobile money financial services. In secondary and higher level of education, it is recommended that financial policy makers should emphasize that mobile money service provider companies should include the features which enable users to move from rudimentary financial literacy to advanced financial literacy such as knowledge of interest rates, compound interest, inflation, risk and improvement of their financial behavior towards retirement planning, budgeting, short-terms and long-terms plans. Boosting financial literacy skills from rudimentary to advanced financial literacy may be critically important for economic and social welfare especially in the facilitation of economic activities not only for this generation but for the future one.

Although the scope of this study was limited to rudimentary financial literacy and the use of mobile money financial services, it was noticed during the survey that people are unaware of interest rates, compound interest, budgeting, planning for future and short term plans. Therefore, more education is required for advanced financial literacy in order to wake up the minds of people because what they know about reading, writing and use of mobile money financial services is not enough to be financially literate on mobile money use in facilitating economic activities.

Furthermore, research should be done from rudimentary financial literacy on the use of mobile money to advanced financial literacy in order to facilitate economic activities through mobile money financial services to avoid queues in banks and other difficult procedures in formal and informal financial services. Indeed, much remains to be done to enhance financial literacy particularly for women, rural population, low income earners and the least educated. Without increased literacy from rudimentary to advanced financial literacy, people may increasingly be at the risk of making poor financial decisions which may make them confront financial hardships in the facilitation of their economic activities.

REFERENCES

- Bester, C. A., & Hansen, C. (2009). Identification of marginal effects in a nonparametric correlated random effects model. *Journal of Business & Economic Statistics*, 27(2), 235-250.
- Chetty, K., Qigui, L., Gcora, N., Josie, J., Wenwei, L., & Fang, C. (2018). Bridging the digital divide: measuring digital literacy. *Economics: The Open-Access, Open-Assessment E-Journal*, 12(2018-23), 1-20.
- Colin Cameron, A. & Trivedi, P.K. (2005). *Micro econometrics: methods and applications*. Cambridge University Press, Cambridge.
- Demirguc-Kunt, A., Klapper, L., Singer, D., Ansar, S., & Hess, J. (2018). *The Global Findex Database 2017: Measuring financial inclusion and the fintech revolution*. The World Bank.
- Hernandez, K. and Roberts, T. (2018). *Leaving No One Behind in a Digital World*. K4D Emerging Issues Report. Brighton, UK: Institute of Development Studies.
- Hira, T. K., & Loibl, C. (2005). Understanding the impact of employer-provided financial education on workplace satisfaction. *Journal of Consumer Affairs*, 39(1), 173-194.
- Huston, S. J. (2010). Measuring financial literacy. *Journal of consumer affairs*, 44(2), 296-316.
- Jia, J., Durrani, T. S., & Chen, J. (2018). The innovation waves in mobile telecommunication industry. *IEEE Engineering Management Review*, 46(3), 63-74.
- Kim, C., Mirusmonov, M., & Lee, I. (2010). An empirical examination of factors influencing the intention to use mobile payment. *Computers in Human Behavior*, 26(3), 310-322.
- Lalrinmawia, M., & Gupta, H. (2015). Literacy and Knowledge: Farmers' Financial Inclusion Feasibility. *SCMS Journal of Indian Management*, 12(3), 17-24.
- Lashitew, A. A., van Tulder, R., & Liasse, Y. (2019). Mobile phones for financial inclusion: What explains the diffusion of mobile money innovations? *Research Policy*, 48(5), 1201-1215.
- Lusardi, A. (2019). Financial literacy and the need for financial education: evidence and implications. *Swiss Journal of Economics and Statistics*, 155(1), 1-8.
- Maradung, P. (2013). *Factors affecting the adoption of mobile money services in the banking and financial industries of Botswana* (Doctoral dissertation).

- Muthiora, B. (2015). Enabling mobile money policies in Kenya: Fostering a digital financial revolution. *GSMA*. 64 di Castri S. and Gidvani, I.
- Neill, S. P., & Lee, D. R. (2001). Explaining the adoption and disadoption of sustainable agriculture: the case of cover crops in northern Honduras. *Economic development and cultural change*, 49(4), 793-820.
- N'dri, L. M., & Kakinaka, M. (2020). Financial inclusion, mobile money, and individual welfare: The case of Burkina Faso. *Telecommunications Policy*, 44(3), 101926.
- Ondiege, P. E. T. E. R. (2015). Regulatory Impact on Mobile Money and Financial Inclusion in African Countries-Kenya, Nigeria, Tanzania and Uganda. *Center for Global Development (CGD)*, 50.
- Rea, S. C., & Nelms, T. C. (2017). Mobile money: The First Decade Working Paper 2017/1, *Institute for Money, Technology and Financial Inclusion*.
- Remund, D. L. (2010). Financial literacy explicated: The case for a clearer definition in an increasingly complex economy. *Journal of consumer affairs*, 44(2), 276-295.
- Robb, C. A., & Woodyard, A. S. (2011). Financial knowledge and best practice behavior. *Journal of financial counseling and planning*, 22(1), 60-70.
- Sajaia, Z. (2008). Maximum likelihood estimation of a bivariate ordered probit model: implementation and Monte Carlo simulations. *The Stata Journal*, 4(2), 1-18.
- Sarigül, H. (2014). A Survey of Financial Literacy Among University Students. *Journal of Accounting & Finance*, (64).
- Hameedu, S.M. (2014). Financial inclusion-issues in measurement and analysis. *International Journal of Current Research and Academic Review*, 2(2), 116-124.
- Shapshak, T. (2018). Liberty hack the 'biggest breach yet,'. *Financial Mail*.
- Tanzania Human Development Report (THDR), (2014). *Economic Transformation for Human Development*. UNDP and United Republic of Tanzania, pg. 37-102.
- National Bureau of Statistics (NBS). (2016). Tanzania Demographic and Health Survey and Malaria Indicator Survey (TDHS-MIS) 2015-16. Dar es Salaam, Tanzania, and Rockville, Maryland, USA: MoHCDGEC, MoH, NBS, OCGS, and ICF.
- Wamuyu, P. K. (2014). The role of contextual factors in the uptake and continuance of mobile money usage in Kenya. *The Electronic Journal of Information Systems in Developing Countries*, 64(1), 1-19.
- Worthington, A. C. (2006). Predicting financial literacy in Australia. *International IJC* 36 (5). DOI: [10.1111/j.1470-6431.2012.01118.x](https://doi.org/10.1111/j.1470-6431.2012.01118.x)
- Yu, C. S. (2012). Factors affecting individuals to adopt mobile banking: Empirical evidence from the UTAUT model. *Journal of electronic commerce research*, 13(2), 104-121.