Quantifying the Role of Mobile Money Services to Financial Inclusion: Evidence from EVC-PLUS in Somalia

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Abstract

This study aims to quantify the impact of mobile money services on financial inclusion, focusing on EVC-PLUS services in Somalia. Access, quality, usage, and welfare of financial services are measured in financial inclusion. A sample of 385 respondents was examined, and regression methods were employed to estimate the model parameters. The strength and stability of the model are examined to confirm the ability of the model to estimate the relationship between mobile money and the financial inclusion. This study discovered that mobile money directly and positively impacts financial inclusion in Somalia. Access, quality, usage, and welfare indicators are positively and substantially associated with financial inclusion. Mobile money facilitates access to bank accounts and enhances the quality of financial services, including savings mechanisms and loan availability. EVC-PLUS further enhanced the usability of the financial service by enabling its customers to access banking services at convenient times and regularly. The study found that mobile money usage reduced the gender gap, where women have the same financial inclusion privileges as men. This paper suggests that government institutions should adopt a policy framework encouraging financial inclusion through mobile money services.

Keywords Access · Quality · Usage · Welfare of financial services · Financial inclusion · Mobile money

Introduction

Financial inclusion is recognized as a fundamental goal that many countries made a national strategy to promote social stability, improve income equality, and reduce social exclusion (Caplan et al., 2021; Desalegn & Yemataw, 2017; Wang & Guan, 2017). Access to the financial service is linked to economic growth, poverty alleviation, investment availability, and the reduction of financial friction (Senyo et al., 2022; Ezzahid & Elouaourti, 2021; Odugbesan et al., 2020; Churchill & Marisetty, 2020). Moreover, Zins and Weill (2016) indicate that access to financial services promotes the standard of life, raises income and savings, improves cash flow management, and enables impoverished Africans to escape poverty. Nonetheless, the financial industry is unable or unwilling to serve the lowest segments of the population; hence, Africa's lack of access to financial services catalyzes poverty mitigation initiatives (David & Deng, 2017).

Somalia is among the countries in East Africa where financial inclusion is minimal, and standard banking services are uncommon. The World Bank reports indicate that only 15% of the population have bank accounts, and merely 5% actively use them. The commercial banks in Somalia provide trade financing services, car loans, and real estate investment options only in urban areas. This lack of access to financial services in rural areas exacerbates poverty and limits people's ability to cope with shocks and natural catastrophes (Mohamed & Nor, 2022). Somalia lags behind other sub-Saharan African countries, with only 7.9% of the adult population having formal accounts at financial institutions. Furthermore, only 2.8% of the population has savings at formal financial institutions, compared to 16% in sub-Saharan Africa (World Bank, 2017).

Mobile money is a tool for gaining access to financial services, enabling users to make payments and save money with minimal transaction fees (Hamdan et al., 2022; Jack & Suri, 2014; Hughes & Lonie, 2007). Empirical literature shows that mobile money service decreases reliance on the banking system and promotes financial inclusion (Della Peruta, 2017). Furthermore, mobile money extends financial services to rural areas with no formal banking system and helps

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the rural population to send and receive money (Munyegera & Matsumoto, 2016). Mobile money also alleviates the poor population's welfare, helping them access essential social services (Ahmed & Cowan, 2021). Mobile money can replace traditional banking, and the mobile money account can be a bank, while mobile phones can become means for transactions (Senyo et al., 2022).

According to a World Bank survey, mobile money can improve Somalis' financial inclusion. About 63% of mobile money users keep their savings on mobile phones and get remittances through their mobile accounts (World Bank, 2017). Hormuud Telcom's mobile money service, EVC-PLUS, is by far the most popular mobile money service in Somalia, with a 73% penetration rate and a 92% customer satisfaction score. EVC-PLUS is utilized for settling transactions, saving money, and banking the unbanked communities.

Numerous empirical studies have investigated financial inclusion in sub-Saharan Africa, as evidenced by Anarfo et al. (2020); Asuming et al. (2019); Bozkurt et al. (2018); Irankunda and Van Bergeijk (2020); Sanderson et al. (2018); and Tiwari et al. (2019). However, these studies have predominantly focused on measuring financial inclusion through indexes, neglecting its multidimensional nature. Despite utilizing various metrics to assess financial inclusion and conducting cross-country comparisons, these studies have largely overlooked vital explanatory variables, including mobile money, which has become pervasive in Africa and enabled access to financial services for many. Moreover, comparative analyses by Asuming et al. (2019), Bozkurt et al. (2018), and Wang & Guan (2017) have only concentrated on the macro-level dimension, disregarding the micro determinants of financial inclusion that are less explored and understood. Therefore, this study aims to scrutinize the determinants of financial inclusion by incorporating mobile money into these determinants and looking at how mobile money impacts factors that contribute to financial inclusion, such as access, quality, utilization, and welfare of financial services in Somalia.

This paper contributes to the literature by measuring the role of mobile money in financial inclusion in Somalia. Financial inclusion is measured to access financial services, which is the depth and outreach of financial services such as bank penetration and bank account. The usage of financial services reflects how clients use financial services, such as the duration and the regularity of the financial service over time. The quality of the financial service captures the appropriateness of the financial service to the client's needs, the options available to the clients, and the understanding of the financial products. The welfare of the financial service gauges the impact of financial service on the client's lives, including the changes in consumption, well-being, and business productivity. This study is unique in several aspects. First, the study quantifies the determinants of financial inclusion and incorporates the role of mobile money in expanding financial inclusion using econometric techniques. Second, the study examines how mobile money usage is corrected to the components of financial inclusion, such as access, quality, usage, and the welfare of financial services. Third, the paper examines the strength of mobile money in closing the gender gap and giving female users the same privileges as males.

The rest of this study is structured as follows: the second section reviews relevant literature, the third section is an analytical framework, and fourth section presents the methodology and the model of this study, the fourth section gives results and the discussion, and the fifth section provides a conclusion and recommendations.

Reviews of the Literature

A large body of empirical literature indicated that mobile money could influence financial inclusion, economic growth, poverty, and the population's welfare. Lee et al. (2021); Aggarwal et al.(2020); Ahmed and Cowan (2021); Dalton et al. (2020); Batista & Vicente (2020); Wieser et al. (2019); Gosavi (2017), and some others studied the role of the mobile money to broader dimensions of the financial inclusion. In detail, Lee et al. (2021) studied mobile banking, poverty, and migration in Bangladesh and found that the poor population in rural areas benefited from the usage of mobile money. Aggarwal et al.(2020) studied mobile money and its effect on the cashing in and out in Malawi and stated that it assisted urban microentrepreneurs in opening accounts.

Mobile money plays an essential role in enhancing access to finance and credits, as indicated by Dalton eta al. (2020), that studied e-payment technology, business finance, and mobile money in Kenya and found that mobile money had increased credit access and driven transparency to the lenders. McKay and Pickens (2010) found that mobile money reduced the cost of banking services and made financial services accessible.

Empirical studies in rural areas revealed that mobile money assisted in the outreach of financial services in rural communities. Wieser et al. (2019) studied the impact of mobile money on the poor rural household in Uganda and found that mobile money service facilitated remittance for those far from bank branches and allowed the rural population to run non-agriculture business. Jonathan and Camilo (2008) found that mobile improves the rural population's welfare and boosts their access to financial services. Aker and Mbiti (2010) stated that mobile money enabled rural migrants to remit funds to rural areas using mobile technology and promoted the financial access of rural populations. Duncombe (2009) agrees with this

result and states that mobile money is a swift financial instrument facilitating transfers in banked and unbanked areas. Upadhyay and Jahanyan (2015) added that mobile money facilitates withdrawals and deposits of the low-income class in the sub-Saharan region. A similar result presented by Gosavi (2017) asserted that mobile money smoothed the transfer of money quickly and securely in rural communities in Uganda.

Despite the prominence of mobile money in transferring money, it also gave the saving opportunity to the users of the mobile money service. A study by Batista and Vicente (2020) examined the role of mobile money on access to saving in Mozambique and found that mobile money improved access to saving for smallholder farmers. Ouma et al. (2017) stated that mobile banking services had raised low-income individuals' savings and expanded financial inclusion. Some studies emphasized the welfare effect of mobile money, such as Ahmed and Cowan (2021), who investigated mobile money and healthcare in east Africa and found that mobile money users get more healthcare services than none users of mobile money. Kikulwe et al. (2014) discovered that mobile money improved small-scale farmers' welfare by increasing their access to financial services.

Empirical studies presented evidence that mobile money positively contributes to financial inclusion by banking in a largely unbanked community. Kasekende (2013) stated that mobile is the engine that propels economic growth and financial inclusion for the banked and unbanked communities in sub-Sahara Africa. Maurer (2012) discovered that mobile money provides access to financial services to unbanked persons in emerging and developing countries with limited banking infrastructure. Camner and Sjoblom (2009) found that mobile money has decreased financial exclusion, allowing the poor to access financial services.

Camner et al. (2010) concluded that mobile money minimized banking exclusion and expedited financial inclusion for persons in distant places that were cut off from the monetary system. Lenka and Barik (2018) discovered a positive and statistically significant correlation between the rise of mobile phone usage and the expansion of financial inclusion in SAARC nations. Donovan (2012a, b) asserted that mobile money aided in the fight against financial exclusion by resolving issues with bank fees and infrastructure. Mas and Radcliffe (2010) discovered that digitizing financial services through mobile money reduced the expenses associated with financial services and enhanced financial inclusion. A cursory look at the empirical literature shows that mobile money has contributed to financial inclusion, but the measurement of the role of mobile money in components of financial inclusion remains unexplored. This paper quantifies the contribution of mobile money to financial inclusion through the econometric methodology.

Analytical Framework

This research employs the Unified Theory of Acceptance and the Use of Technology (UTAUT) as its analytical framework. Venkatesh et al. (2002) propose this theory to explain user intents to utilize information systems and subsequent user behavior. User intents are tested against performance expectations, expected efforts, and social influence, whereas user behavior is measured against enabling conditions. Several prior studies, including Mas and Morawczynski (2009), Martin and Herrero (2012), and Okello Candiya Bongomin et al. (2018), applied this theory to measure users' intentions to adopt technology such as mobile money.

Financial inclusion is influenced by several factors, some of which vary from country to country. However, financial inclusion is defined as the low-cost availability and accessibility of financial services to a substantial proportion of the disadvantaged population (De Koker & Jentzsch, 2012; Evans & Pirchio, 2015). This study employs four standard indicators of financial inclusion: access, quality, usage, and the welfare of financial services. Several previous studies, Čihák et al. (2012), Claessens (2006), Kempson (2006), and Beck et al. (2008), measured financial inclusion to these indicators. The below Fig. 1 depicts the connection between mobile money and financial inclusion.

The paradigm proposed in this study illustrates that the adoption of mobile money services is decomposed to the intention to use mobile money and user satisfaction with mobile money services. Mobile money service reduces the obstacles to opening a bank account, enhances the physical proximity of financial services, and increases the accessibility and affordability of financial services. Additionally, mobile money services permit the creation of financial products with the features clients desire. Furthermore, mobile money service impacts the regularity, frequency, and period it takes to obtain financial services.

Research Methods and Model Specification

This study adopts a conclusive research design, particularly a casual research strategy, to determine the link between mobile money and financial inclusion in Somalia. This design is chosen to handle a vast sample that must be representative. A quantitative strategy is utilized to gather and evaluate data from the widely distributed population in Somalia.

Due to the nature of this study, the research population is infinite; therefore, the proportions' approach is utilized to calculate the sample size. This approach requires determining the degree of accuracy, the level of confidence, and
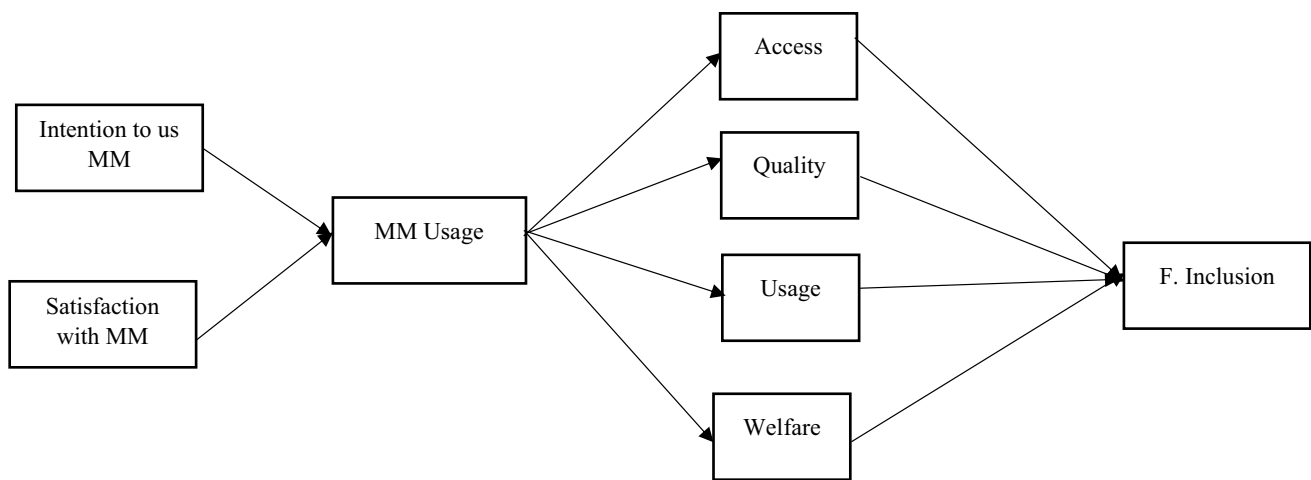
Fig. 1 Link between mobile money usage and financial inclusion

the z-value associated with the level of confidence; the sample size is then calculated using the standard error formula. This strategy yielded a sample of 385 respondents, and a convenience sampling method was used to reach these respondents. The data of this study is the primary source, and the instrument used to collect data from the respondents is a structured and self-administered Likert-scaled questionnaire.

Descriptive and inferential statistics are employed to analyze primary cross-sectional data. Each item's mean and standard deviation are calculated. Regression analysis is used to find the variables' coefficients and to assess the study's hypothesis. Ordinary least square (OLS) is used to estimate the study's model parameters, and the model's stability is examined using cumulate sums and the cumulative sum square, which detects the small shifts from the mean.

Model Specification and Variable Description

This research utilizes OLS, one of the most subtle regression algorithms. This study's model is described in the following equation:

$$InFIC_i = \beta_0 + \beta_{ACC}\ln ACC_i + \beta_{QY}\ln QY_i + \beta_{USG}\ln USG_i$$
$$+ \beta_{WLF}\ln WLF_i + \beta_{MM}\ln MM_i\theta_{GGP}GD_i + u_i$$

where; FIC is the financial inclusion, ACC is the access to the financial service, QY is the quality of the financial products, USG is the usage of the financial services, WLF is the welfare of the financial products, MM is the mobile money, GD measures the gender gap, i is the number of observations, and u is the error term.

Access to financial services (ACC) measures the depth and the outreach of financial services such as bank penetration,

bank account, or point of sales (POS) in rural areas. It also measures the barriers to access to the financial service, such as document requirements, costs, and the physical proximity of the bank service points. Access was measured on five factors: the number of financial institutions, the number of financial services, the account maintenance charge, the number of required documents, and the equity of financial services.

Usage of financial service (USG) reflects how clients use financial services, such as duration and the regularity of the financial service over time. This indicator measures the number of transactions per account, the average saving balance, and the number of payments made. The usage variable also measures the combination of the service used by individual clients or households. The usage indicator contains five items: the cost to travel to the financial institution, service quality of the financial institutions, regularity of the financial services, convenience of the financial services, and the simplicity of the financial services procedure.

The quality of the financial service (QY) measures the appropriateness of the financial service to the client's needs, the options available to the clients, and the understanding of the clients of the financial products offered by the financial institutions. The variable quality measures the nature and depth of the relationship between the financial institutions and the clients. Five factors are used to evaluate the quality of financial services: the appropriateness of the savings product, the suitability of the loan product, the user contentment with the savings product, the user satisfaction with the loan product, and the utility of the financial products.

The welfare of the financial service (WLF) indicates the impact of the financial service on the client's lives, including the changes in consumption, wellness and business activities, productivity, housing condition, and utility. Welfare comprises five items: the standard of living, the increase in

household spending, access to health care, the improvement of housing conditions, and the availability of utilities.

Mobile money (MM) measures the client's intention to use mobile devices to make payments. It also measures user satisfaction with the mobile money service and clients' intention to continue using it. The data on these variables are collected from the clients and financial service providers.

Results and Discussion

This study examines the contribution of mobile money to financial inclusion in Somalia. A sample of 385 respondents was contacted, and 370 replies were returned, making the response rate 96%. The missing data values were evaluated by the missing at completely random (MCAR) method. The MCAR hypothesis was tested using chi-square, and the null hypothesis was rejected at a significance level of 5%, indicating that missing values are random. The outliers of the data were examined using boxplots, and a single outlier was detected among the age categories of respondents.

The respondents' demographic information was obtained, and the result of the respondent's gender, age, education, income, and family size is provided in Table 1. Table 1 shows that 72% of the respondents were male, while 28%

Table 1 Demographic characteristics of the respondents

Factors	Percentage
Gender	
Male	72
Female	28
Age	
18–24	40
25–34	51
35–44	7
45–54	2
55 or more	0
Educational background	
Secondary level	5
Bachelor degree	64
Master degree	35
PhD	1
Monthly income	
$100–300	43.1
$301–600	20.2
$601–900	17
9001 or more	19.7
Household size	
5 or less	15.9
6–10	29.3
10 or more	25.8

were female. The age respondents were examined, and the results show that 91% of the respondents were age group 18 and 34, and only 9% were in the age group between 35 and 54. This result indicates that most Somalis are young and more likely to utilize mobile technology and engage with financial institutions. Literacy is a critical determinant in mobile money usage; hence, most of the respondents, 64%, held a bachelor's degree, and a considerable percentage held a postgraduate degree.

The monthly income data indicate that wealthy and low-income groups subscribe to mobile services and use them to access financial services. This result reveals that mobile money adds to financial inclusion and substantially assists low-income and disadvantaged people.

Descriptive Statistics of the Categories Financial Inclusion and Mobile Money Usage

The four factors that measure financial inclusion are access to financial services, the quality of financial goods, the use of financial services, and the welfare of financial products. Five items are assigned to each of these categories. The mean and standard deviation of the items are shown in Table 2. Respondents indicate that the financial institution has several branches and offers equal service to the clients. According to respondents, little paperwork is required to create an account, and the maintenance costs paid by financial institutions are reasonable. The access to financial inclusion has a grand mean of 1.75 and a standard deviation of 1.385. This result demonstrates that access to Somalia's financial institutions is quite excellent and boosts Somalia's financial inclusion.

The quality of financial services was evaluated, and the respondent agreed that the savings services offered by financial institutions are of high quality and meet their needs. In addition, respondents said that the credit products offered by financial institutions are satisfying. The quality of financial goods is characterized by a mean of 1.697 and a standard deviation of 0.11. Respondents are more content with financial institutions' savings services than financial institutions' lending services. Mobile money service is believed to have boosted savings by allowing clients to fund their bank accounts without visiting a financial institution branch.

The usability of the financial service is a crucial aspect of the community's financial inclusion. This study reveals that traveling to financial institutions is affordable and that financial services are accessible consistently at convenient hours. Respondents concurred that obtaining financial services is relatively simple with an uncomplicated process. The utilization of the financial service has a mean of 1.687 and a standard deviation of 0.475. The results demonstrate that financial products are user-friendly and accessible, and mobile money service appears to have decreased the cost of

Table 2 Descriptive statistics of financial inclusion categories

Code	Statement	Mean	STD
Access to financial services			
ACC1	The number of financial institution branches in clients' locations	1.445	0.682
ACC2	Channels financial service delivery in clients' locations	1.743	0.779
ACC3	The affordability account maintenance fee of financial institution	2.255	0.437
ACC4	The number of documents required by the financial institution to open an account	1.668	0.760
ACC5	The equality of the services provided by the financial institutions to the clients	1.647	0.787
ACCESS	**Overall access to financial services**	**1.754**	**0.385**
Quality of the financial product			
QY1	The suitability of the saving products of the financial institution to the client's needs	1.466	0.697
QY2	The aptness of the loan products of the financial institution to the client's needs	1.927	0.751
QY3	Client's satisfaction with the saving products of the financial institutions	1.644	0.733
Qy4	Client's satisfaction with the loan products of the financial institutions	1.923	0.789
QY5	The usefulness of the saving products of the financial institutions to the clients	1.529	0.691
QY	**Overall quality of the financial product**	**1.697**	**0.472**
Usage of the financial services			
USG1	The number and affordability of trips to the financial inclusion	1.752	0.811
USG2	Service quality of the financial institutions	1.643	0.704
USG3	The constancy and regularity of service financial institutions to clients	1.635	0.722
USG4	The convenience and timing of the financial institutions' financial services	1.675	0.729
USG5	The simplicity of the process of getting financial services from financial institutions	1.729	0.812
USG	**Overall usage of the financial services**	**1.687**	**0.475**
The welfare of the financial products			
WLF1	The contribution of the financial institutions' services to clients' living standard	1.477	0.686
WLF2	The contribution of the financial institutions' services to households' consumption	1.576	0.710
WLF3	The contribution of the financial institutions' services to clients' access to the health services	1.663	0.727
WLF4	The contribution of the financial institutions' services to clients' housing condition	1.728	0.710
WLF5	The contribution of the financial institutions' services to the client's access to the utility	1.564	0.704
WLF	**The overall welfare of the financial products**	**1.602**	**0.478**

traveling to financial institutions and improved the quality of financial services.

The final indicator of financial inclusion is the welfare of financial services. The findings of this study indicate that financial goods have increased the standard of living and access to social services, such as health care. Financial services also increased consumption and improved living conditions in Somalia since some funds are utilized to pay for utilities and other essentials. The financial products' welfare had a mean of 1.602 and a standard deviation of 0.478.

Table 3 Descriptive statistics of the adoption of mobile money adoption

	Intention to use mobile money		
INT1	The client intends to continue using mobile service in the upcoming months	1.423	0.656
INT2	Client's intention to extend the usage of mobile service beyond the money transfer	1.377	0.634
INT3	Client's intention to keep using mobile money services in future coming years	1.483	0.720
INT4	Clients' opinion towards the use of the mobile money services	1.453	0.700
INT5	Client's attitude towards the use of the mobile money services	1.511	0.707
INT	**Overall intention to use mobile money**	**1.450**	**0.435**
	User satisfaction with mobile money		
US1	Clients' satisfaction with mobile money transactions	1.339	0.625
US2	The ability of mobile services to meet client's financial needs	1.279	0.449
US3	The ability to mobile money meet clients' expectations towards financial services	1.612	0.714
US4	The frequency of clients' complaints about financial services of mobile money	1.697	0.768
US5	The constancy and the reliability service of the mobile money	1.515	0.7253
US	**Overall user satisfaction with mobile money**	**1.489**	**0.451**

Descriptive Statistics of the Adoption of Mobile Money Service

Two indicators measure mobile money adoption, user satisfaction, and the intention to use mobile money. The result of the adoption of mobile money is provided in Table 3.

The results in the table indicate that respondents intend to continue utilizing mobile money and its features. The mean of intention to use mobile money is 1.450, and the standard deviation is 0.435. This outcome suggests that users favor mobile money services and will continue using them in the following years. User satisfaction with mobile money services was also measured, and respondents revealed that they were satisfied with them and that their expectations and needs were met. Mobile money user satisfaction has a mean of 1.489, and a standard deviation is 0.451. Respondents said that they had few complaints and that the mobile money service is dependable and trustworthy.

Correlation Between Mobile Money and Components of Financial Inclusion

The correlation between mobile money and financial inclusion components is calculated, and the result is presented in Table 4. The findings indicate that a 1% increase in mobile money usage leads to a corresponding increase in access to financial services of 1.5%. Mobile money usage is also positively associated with the quality, usability, and welfare of financial services, with 1% increase in usage resulting in corresponding increases of 1%, 8%, and 3%, respectively.

Mobile money has several benefits that contribute to financial inclusion in Somalia, including increased access to bank accounts, improved quality of financial services such as savings options and loan accessibility, and enhanced usability of financial services. With mobile money, customers can access banking services conveniently, reducing the need for trips to physical bank locations. In Somalia, the EVC-PLUS mobile money service has been particularly effective in improving financial inclusion by providing a simple and secure method for conducting money transfers, consumption, and investment. Overall, mobile money has the potential to play a significant role in promoting financial inclusion and ensuring the accessibility and quality of financial services in Somalia.

Estimation of the Model Parameters

The relationship between mobile money and financial inclusion was quantified using the ordinary least squares (OLS) in the e model described in Eq. (1). The result of the model parameter is presented in Table 5. The result in Table 5 displays the model's intercept, coefficients, standard deviation, t-test, and p-value. All variables are significant at the significance level of 1% and statistically different from zero.

This study found that improved access to financial services directly impacts financial inclusion, with an increase of 1% in access leading to a corresponding increase of 0.221% in financial inclusion. Enhancements in the quality, usability, and welfare of financial products also contribute positively to financial inclusion, with 1% improvements leading to corresponding increases of 0.2%, 0.196%, and 0.222%, respectively. The use of mobile money service is particularly beneficial for financial inclusion, with a 1% increase in mobile money usability or subscribership leading to corresponding increases of 0.196% and 0.1145%, respectively. This study has established that mobile money is associated with all facets of financial inclusion.

In Somalia, mobile money has been instrumental in closing the gender gap in financial inclusion, which currently stands at 0.003443%, indicating that women in Somalia have the same access to financial services as men. Including women in financial services has significant societal benefits as women contribute to family income and improve household conditions. Women in Somalia actively participate in small businesses, entrepreneurship, and startups, so access to financial services helps them excel in their endeavors.

Promoting financial inclusion is crucial to economic and social growth in Somalia's urban and rural areas. Experts and policymakers believe that financial inclusion reduces poverty and fosters prosperity. The impoverished population

Table 4 Correlation coefficients of mobile money and financial inclusion components

	MM	ACC	QY	USG	WLF
MM	1.0				
ACC	0.015	1.0			
QY	0.010	0.220	1.0		
USG	0.080	0.180	0.130	1.0	0
WLF	0.030	0.120	0.110	0.090	1.0

Table 5 Estimation of the model parameters

Variable	Coefficient	Std. error	t-Statistic	Prob
FINC	0.034020	0.009145	3.957198	0.0001***
ACC	0.221659	0.014099	16.67918	0.0000***
QY	0.200863	0.010631	19.55371	0.0000***
USG	0.196028	0.009210	18.49340	0.0000***
WLF	0.222482	0.012214	22.19437	0.0000***
MM	0.114527	0.009201	12.03408	0.0000***
GD	−0.003443	0.005192	−0.663156	0.5080

in Somalia requires a reliable and low-cost means of sending and receiving the money to break free from the vicious cycle of poverty. A significant proportion of Somalis live in rural regions and rely on small-scale farming, so access to financial services can assist them in obtaining farm inputs and transporting their crops to urban markets. Additionally, recurring disasters such as droughts and floods cause significant harm to the rural population, and mobile money services can assist in accessing funds, managing disasters, and building resilience.

Expanding financial inclusion allows households to save a portion of their income and build financial assets, improving their quality of life. The mobile money service in Somalia, EVC-PLUS, is a suitable and effective method for promoting financial inclusion and providing banking services to unbanked Somalians. People in Somalia rely on mobile money services to send and receive money and make payments, particularly among young customers who are technologically adept and understand how to use these platforms.

Mobile money usage is more prevalent among individuals with lower to medium income levels, making it an effective tool for promoting financial inclusion among economically disadvantaged populations. Furthermore, by integrating young people's acceptance and utilization of technology, mobile money can stimulate transformative economic, social, cultural, and institutional changes. By leveraging the efficiency and cost-cutting benefits of mobile money, financial services can be extended to underprivileged individuals and help to address the gender imbalance in financial access, which currently favors males.

Although mobile money has the potential to improve financial inclusion and increase transaction convenience, it also poses several challenges, such as security, regulatory compliance, adaptability, illiteracy, and network expenses. The absence of end-to-end encryption in mobile wallet transactions raises concerns about the possibility of fraudulent activities. The regulation and supervision of these transactions are outside the jurisdiction of monetary authorities, leading to trust issues. Maintaining clients' trust, particularly those who are low-income and unfamiliar with technology, is crucial for the success of mobile money platforms (Donovan, 2012a, b). Moreover, the acquisition of technical skills required to navigate these platforms is not yet ubiquitous among all segments of the population, particularly the elderly and those with lower levels of education.

The result of this study is consistent with numerous studies conducted in Africa that highlighted the importance of mobile money services to financial inclusion. Senyo et al. (2022), Hamdan et al. (2022), Ahmed and Cowan (2021), Donovan (2012a, b) and Kasekende (2013), Gosavi (2017), Aker and Mbiti (2010), Upadhyay and Jahanyan (2015), and Maurer (2012) found that that mobile money usage has a positive and substantial impact to the financial inclusion and expanded the banking services in sub-Sahara Africa.

Table 6 Diagnostic tests of the model

Diagnostics test		
R^2	0.84	
Adjusted R^2	0.79	
Durbin Watson	2.72	
F statistics	0.00	
Serial correlation	1.67	0.48
Heteroskedastic	0.61	0.57
Normality	0.77	0.81

Diagnostic Test

The model strength and diagnostic tests are presented in Table 6. The table shows that R-square is 84%, indicating that the independent variables explain 84% of the variations of the dependent variable. The F-statistic is significant, indicating that the variables are jointly significant. Using Jarque–Bera procedures, the data's normality was evaluated, and the null hypothesis could not be rejected at a significance level of 5%, meaning that the data followed a normal distribution. The heteroscedasticity test is insignificant, showing that model is homoscedastic. Using a variance inflation vector (VIF), the multicollinearity between the independent variables was assessed, and all variables had a VIF of less than 10. The model has no serial correlation as Lagrange multiplier (LM) test fails to reject the null hypothesis of the no serial correlation.
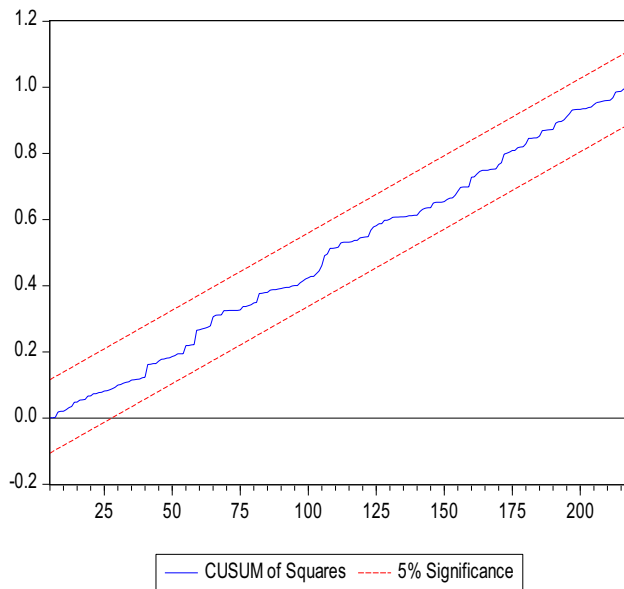
Stability of the Model

The contribution of mobile money to financial inclusion is essential to the policy that targets the expansion of financial
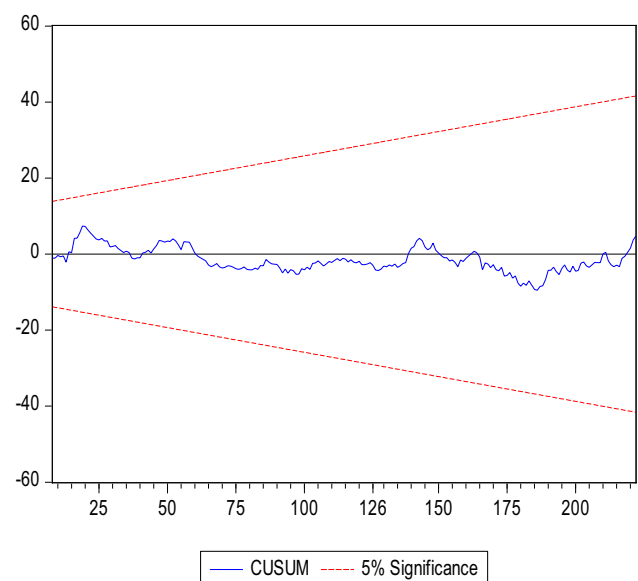
Fig. 2 CUSUM test

Fig. 3 CUSUM square test

inclusion and poverty reduction. Through the structural tests, this study examined the stability of the study coefficients. The recursive residuals cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) are used to detect the stability of the model coefficient. Figures 2, and 3 show that the model coefficients are under the critical bound, indicating that the model is stable and the relationship between the variables is predictable.

Conclusion and Recommendation

This study aims to quantify the impact of mobile money services on financial inclusion, focusing on EVC-PLUS services in Somalia. Financial inclusion measures financial services' access, quality, usage, and welfare. A sample of 385 respondents was contacted, and regression methods were employed to estimate the model parameters. The strength and stability model is examined to confirm the ability of the model to estimate the relationship between mobile money and financial inclusion.

The main findings of this study are that mobile money positively impacts financial inclusion in Somalia. Access, quality, usage, and welfare factors are positively and considerably associated with financial inclusion. Mobile money facilitates access to bank accounts and enhances the quality of financial services by increasing savings options and fund availability. Mobile money improved the usability of the financial service by enabling its customers to access banking services conveniently and regularly. We found that mobile money usage empowered women's financial inclusion and reduced the gender gap, giving women the same financial inclusion privileges as men. This study found evidence that mobile money is an effective tool for promoting financial inclusion; hence, microfinance programs can use mobile money technology to deliver financial services since it can help them reach more individuals cheaply per transaction.

Policy Implications

The findings of this study offer valuable insights for policymakers in Somalia seeking to promote financial inclusion. Policy initiatives aimed at increasing financial inclusion and driving technological innovation in the financial sector should focus on low to middle-income groups, particularly young people. While the study highlights the influence of economic and non-economic factors such as income, education, age, and gender on mobile money usage decisions, it advocates for a targeted and comprehensive approach to poverty reduction through financial inclusion.

Youths in Somalia possess significant potential to become more productive by acquiring relevant technical skills necessary for success in the technology era, leading to increased income levels and reduced poverty. Therefore, the government should establish programs to assist young people. Government institutions are also suggested to create a policy framework encouraging financial inclusion and supporting mobile money services to strengthen the financial sector and foster the growth of small business enterprises.

Declarations

References

Aggarwal, S., Brailovskaya, V., & Robinson, J. (2020). Cashing in (and out): Experimental evidence on the effects of mobile money in Malawi. *AEA Papers and Proceedings, 110*, 599–604. https://doi.org/10.1257/pandp.20201087

Ahmed, H., & Cowan, B. (2021). Mobile money and healthcare use: Evidence from East Africa. World Development, *141*, 105392.https://doi.org/10.1016/j.worlddev.2021.105392

Aker, J., & Mbiti, I. (2010). Mobile phones and economic development in Africa. *Journal of Economic Perspectives, 24*(3), 207–232. https://doi.org/10.1257/jep.24.3.207

Anarfo, E. B., Abor, J. Y., & Ose, K. A. (2020). Financial regulation and inclusion in sub-Saharan Africa: Does financial stability

play a moderating role? *Research inInternational Business and Finance, 51*, 101070.

Asuming, P. O., Osei-Agyei, L. G., & Mohammed, J. I. (2019). Financial inclusion in sub-Saharan Africa: Recent trends and determinants. *Journal of African Business, 20*(1), 112134.

Batista, C., & Vicente, P. C. (2020). Improving access to savings through mobile money: Experimental evidence from African smallholder farmers. World Development, *129*, 104905. https://doi.org/10.1016/j.worlddev.2020.104905

Beck, T., & Demirguc-Kunt., A., & Martinez Peria, M. S. (2008). Banking services for everyone? Barriers to bank access and use around the world. *World Bank Economic Review, 22*(3), 397–430. https://doi.org/10.1093/wber/lhn020

Bozkurt, İ, Karakuş, R., & Yildiz, M. (2018). Spatial determinants of financial inclusion over time. *Journal of International Development, 30*(8), 1474–1504.

Camner, G., & Sjöblom, E. (2009). Can the success of M-Pesa be repeated? A review of implementations in Kenya and Tanzania. Nairobi: Valuable Bits.

Camner, G., C. Pulver, & Sjoblom, E. (2010). "What makes a successful mobile money implementation? Learnings from MPESA in Kenya and Tanzania." GSMA – MobileMoney for the Unbanked.

Caplan, M. A., Birkenmaier, J., & Bae, J. (2021). Financial exclusion in OECD countries: A scoping review. *International Journal of Social Welfare, 30*(1), 58–71.

Churchill, S. A., & Marisetty, V. B. (2020). Financial inclusion and poverty: A tale of forty-five thousand households. *Applied Economics, 52*(16), 1777–1788.

Čihák, M., Demirgüç-Kunt, A., Erik, F., & Levine, R. (2012). Benchmarking financial systems around the world. The World Bank Policy Research Working Paper 6175. Washington,DC: The World Bank.

Claessens, S. (2006). Access to financial services: Review the issues and public policy objectives. *Oxford Journals, 21*, 207–240.

Dalton, P. S., Pamuk, H., Ramrattan, R., van Soest, D., & Uras, B. (2020). E-payment technology and business finance: A randomized control trial with mobile money (Working Paper). Retrieved 1 December 2020, from https://drive.google.com/file/d/1kC7PH8aiHr7nSRGtoXLOH32wrtLiAe-Y/view

David L. K. Ch., & Deng. R. H (2017). Handbook of Blockchain, Digital Finance, and Inclusion, Volume 1: *Cryptocurrency, FinTech, InsurTech, and Regulation (1st. ed.). Academic Press, Inc., USA.*

De Koker, L., & Jentzsch, N. (2012). Financial inclusion and financial integrity: Aligned incentives? *World Development, 44*, 267–280.

Della Peruta, M. (2017). Adoption of mobile money and financial inclusion: A macroeconomic approach through cluster analysis. *Economics of Innovation and New Technology*. https://doi.org/10.1080/10438599.2017.1322234

Desalegn, G., & Yemataw, G. (2017). Financial inclusion in Ethiopia: Using lsms (Ethiopia socio-economic survey) data. *Ethiopian Journal of Economics*, *26*(2), 31–58.

Donovan, K. (2012a). Mobile money for financial inclusion. In T. Kelly, N. Friederici, M. Minges, & M. Yamamichi (Eds.), *2012 Information and communications for development – Maximizing mobile* (pp. 61–74). The World Bank Group.

Donovan, K. (2012b). Mobile money for financial inclusion. *Information and Communications for Development, 61*, 61–73.

Duncombe, R. (2009). Assessing the potential for mobile payments in Africa: *Approaches and evidence from Uganda. Development Informatics Working Paper Series Paper No. 41*. Centre for Development Informatics, Institute for Development Policy and Management, University of Manchester.

Evans, D. S., & Pirchio, A. (2015). An empirical examination of why mobile money schemes ignite in some developing countries but flounder in most. *Review of NetworkEconomics, 3*(4), 397–451.

Ezzahid, E., & Elouaourti, Z. (2021). Financial inclusion, financial frictions, and economic growth: Evidence from Africa. *Journal of African Business*, 1–26. https://doi.org/10.1080/15228916.2021.1926856

Gosavi, A. (2017). Can mobile money help firms mitigate the problem of access to finance in Eastern sub-Saharan Africa? *Journal of African Business, 19*(1), 1–18. https://doi.org/10.1080/15228916.2017.1396791

Hughes, N., & Lonie, S. (2007). M-PESA: Mobile money for the "unbanked" turning cellphones into 24-hour tellers in Kenya. Innovations, *2*(1–2), 63–81. https://doi.org/10.1162/itgg.2007.2.1-2.63

Irankunda, D., & Van Bergeijk, P. A. (2020). Financial inclusion of urban street vendors in Kigali. *Journal of African Business, 21*(4), 529–543.

Jack, W., & Suri, T. (2014). Risk sharing and transactions costs: Evidence from Kenya's mobile money revolution. *American Economic Review, 104*(1), 183–223.

Hamdan, J. S., Lehmann-Uschner, K., & Menkhoff, L. (2022). Mobile money, financial inclusion, and unmet opportunities: evidence from Uganda. *The Journal of Development Studies*, *58*(4), 671–691. https://doi.org/10.1080/00220388.2021.1988078

Jonathan, D., & Camilo, T. (2008). Mobile banking and economic development: Linking adoption, impact, and use. *Asian Journal of Communication, 18*(4), 318–322.

Kasekende, L. (2013). "*Improving rural access to finance in Uganda: Opening remarks at the official launch of the Uganda rural challenge fund*," NBER Working Paper No. 20135, Kampala, 19 April.

Kempson, E. (2006). *Policy level response to financial exclusion in developed economies: Lessons for developing countries. Paper presented at the conference, Access to Finance:* Building Inclusive Financial Systems, World Bank, Washington, DC.

Kikulwe, E. M., Fischer, E., & Qaim, M. (2014). Mobile money, smallholder farmers, and household welfare in Kenya. *PLoS ONE, 9*(10), 1–13.

Lee, J. N., Morduch, J., Ravindran, S., Shonchoy, A., & Zaman, H. (2021). Poverty and migration in the digital age: Experimental evidence on mobile banking in Bangladesh. *American Economic Journal: Applied Economics, 13*(1), 38–71.

Lenka, S.K., Barik, R.(2018). Has expanding mobile phone and internet use spurred financial inclusion in the SAARC countries? Finance Innov, *4*(5). https://doi.org/10.1186/s40854018-0089-x

Martín, H. S., & Herrero, Á. (2012). Influence of the user's psychological factors on the online purchase intention in rural tourism: Integrating innovativeness to the UTAUT framework. *Tourism Management, 33*(2012), 341–350. https://doi.org/10.1016/j.tourman.2011.04.003

Mas. I., & Morawczynski, O. (2009). Designing mobile money services lessons from M-PESA. *Innovations: Technology, Governance, Globalization, 4*(2), 77–91. https://doi.org/10.1162/itgg.2009.4.2.77

Mas, I., & Radcliffe, D. (2010). Scaling mobile money. *Journal of Payments Strategy and Systems, 5*(3), 298–315.

Maurer, B. (2012). Mobile money: Communication, consumption, and change in the payments space. *Journal of Development Studies, 48*(5), 589–604.

McKay, C., & Pickens, M. (2010). *Branchless banking 2010: Who is served? At what price? What is next? CGAP focus note 66*. World Bank Group.

Mohamed, A. A., & Nor, M. I. (2022). "The macroeconomic impacts of the mobile money: Empirical evidence from EVC plus in Somalia," *Journal of Financial EconomicPolicy*, Vol. ahead-of-print No.ahead-of-print. https://doi.org/10.1108/JFEP-062022-0152

Munyegera, G. K., & Matsumoto, T. (2016). Mobile money, remittances, and household welfare: Panel evidence from rural Uganda. *World Development, 79*, 127–137. https://doi.org/10.1016/j.worlddev.2015.11.006

Odugbesan, J. A., Ike, G., Olowu, G., & Adeleye, B. N. (2020). I am investigating the causality between financial inclusion, financial development, and sustainable development in sub-Saharan Africa economies: The mediating role of foreign direct investment. *Journal of Public Affairs*, e2569. https://doi.org/10.1002/pa.2569

Okello Candiya Bongomin, G., Ntayi, J. M., Munene, J. C., & Malinga, C. A. (2018) Mobile money and financial inclusion in Sub-Saharan Africa: the moderating role of social networks. *Journal of African Business*, *19*(3), 361–384. https://doi.org/10.1080/15228916.2017.1416214

Ouma, S. A., Odongo, T. M., & Were, M. (2017). Mobile financial services and financial inclusion: Is it a boon for savings mobilization? *Review of Development Finance, 7*(1), 29–35.

Sanderson, A., Mutandwa, L., & Le Roux, P. (2018). A review of determinants of financial inclusion. *International Journal of Economics and Financial Issues, 8*(3), 1.

Senyo, P. K., Karanasios, S., Gozman, D., & Baba, M. (2022). Fin-Tech ecosystem practices shaping financial inclusion: The case of mobile money in Ghana. *European Journal of Information Systems, 31*(1), 112–127. https://doi.org/10.1080/0960085X.2021.1978342

Tiwari, J., Schaub, E., & Sultana, N. (2019). Barriers to "last mile" financial inclusion: Cases from Northern Kenya. *Development in Practice, 29*(8), 988–1000.

Upadhyay, P., & Jahanyan, S. (2015). Analyzing user perspective on the factors affecting mobile-based transfer payment use intention. *Internet Research*, *26*(1), 38–56. 2016. https://doi.org/10.1108/IntR-05-2014-0143

Venkatesh, V., Morris, M., Davis, G., & Davis, F. (2002). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425. https://doi.org/10.2307/30036540

Wang, X., & Guan, J. (2017). Financial inclusion: Measurement, spatial effects and influencing factors. *Applied Economics*, *49*(18), 1751–1762.

Wieser, C., Bruhn, M., Kinzinger, J., Ruckteschler, C., & Heitmann, S. (2019). The impact of mobile money on poor rural households: Experimental evidence from Uganda. *Policy Research Working Paper No. WPS 8913*, World Bank, Washington, DC.

World Bank. (2017). *Mobile money in Somalia*: Household survey and market analysis. https://www.mfw4a.org/sites/default/files/resources/MobileMoneyinSomaliaWBank.pdf

Zins, A., & Weill, L. (2016) The determinants of financial inclusion in Africa. Rev. Dev. Finance. https://doi.org/10.1016/j.rdf.2016.05.001