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How does mobile money affect the use of informal remittance channels in Sub-Saharan Africa?

Manuela NGABA*

Abstract - The use of informal remittance channels remains significant in sub-Saharan Africa. However, the importance of mobile money has been growing in the region which is not without effect on the use of informal remittance channels by individuals. Therefore, this study examines the impact of mobile money on the use of informal domestic remittance channels in Sub-Saharan Africa using data from the 2017 Global Findex. The results show that individuals who own and use a mobile money account are less likely to send remittances through an informal channel. This indicates the relevance of digitizing remittances to attract more flows and achieve greater formalization of remittances in Sub-Saharan Africa.

JEL Classification
017, O33, O12

Key-words
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* Centre d'Économie de Paris Nord (UMR CNRS 7234-CEPN), Université Sorbonne Paris Nord; ngabaaboudi@univ-paris13.fr

1. INTRODUCTION

The international movement of people is constantly increasing. It is symptomatic of the deep disparities in economic, social, and security development around the world. In Africa, the number of migrants living outside the continent increased from 17 million in 2015 to 19 million in 2019 (IOM, 2019). The size and growth of intra-African migration are even more important. During the same period, an estimated 20 million migrants lived within the region, up from 18.5 million in 2015 (ibid). Most of these movements (whether they are voluntary or forced) involve remittances from migrants to their families left behind. According to the World Bank estimates, international remittances to Sub-Saharan Africa reached US$48 billion in 2019. As shown in Figure 1 (in Appendix), which illustrates the trend of foreign capital inflows to Sub-Saharan Africa, remittances have been increasing steadily since 2016. In 2018, they were larger than foreign direct investment (FDI) and closer to official development assistance (ODA), the largest source of capital inflows for Sub-Saharan countries. In recent years, the scale and the counter-cyclical nature of these private funds have increased their attractiveness. On the one side, they are now recognized by international development agencies and policymakers as a potential lever for achieving Sustainable Development Goals (SDGs). On the other side, researchers also express great interest in remittances and their effects, as evidenced by the extensive literature on the subject[1].

It is now well-established from various empirical studies that remittances can improve development indicators such as poverty rate (Adams Jr and Page, 2005; Anyanwu and Erhijakpor, 2010; Margolis et al., 2015), financial inclusion (Aggarwal et al., 2006; Aga and Peria, 2014), and access to education and health care (Zhunio et al., 2012). However, the magnitude of these private financial flows remains poorly understood. Official statistics do not take into account the amounts from domestic and intraregional migration[2]. Also, officially recorded remittances are underestimated because they do not include informal remittances, which are inherently hard to capture. Indeed, informal remittances include money or goods that migrants send to family and friends in their home countries through transfer systems other than regulated banking and financial channels. These non-institutionalized and parallel remittances channels take many forms such as hand-carrying (through transport companies, friends, family or the migrant himself), the transfer of value with no physical movement of funds through a clearing system (hawala, hundi, Fei Ch'ien). Whatever their forms, informal remittances channels are mainly characterised by the exclusive use of cash and trust between stakeholders.

A study by Freund and Spatafora (2008) estimates that these informal remittances to developing countries represent between 35% and 75% of recorded flows, with Sub-Saharan Africa countries having one of the highest rates. Further research conducted by Mohapatra and Ratha (2011) revealed that in 2009, more than 90% of domestic remittances were sent through informal channels in Ghana, Burkina Faso, Senegal, and Uganda. At the root of the strong preference for informal channels in Sub-Saharan Africa lie an inadequate or non-existent formal financial system but also factors related to the migrants' profile (low level of literacy, illegal status) (Sander and Maimbo, 2003).

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[1] See, for example, the works of Page and Plaza (2006); Adams Jr (2011); Taylor and Castelhano (2016).

[2] Contrary to popular belief that most Sub-Saharan African migrants live in developed countries, the prevailing migration patterns in Sub-Saharan Africa are internal (mainly urban to rural) and intra-regional migration (Sander and Maimbo, 2003; Ratha and Shaw, 2007; Mercandalli and Losch, 2017). Internal migration represents about 50% of migration in Kenya and Senegal and 80% in Uganda and Nigeria (Mercandalli and Losch, 2017). Overall, migration within-country in Sub-Saharan Africa is estimated to account for 69% of the total migration from Sub-Saharan Africa (Ratha and Shaw, 2007).

Individuals' preference towards informal remittances channels in Sub-Saharan Africa is not without economic risks. According to several development agencies, a condition for migrants' remittances to be better harnessed for development is that they are channelled through formal mechanisms. Indeed, the frequent use of informal channels tends to keep people outside the formal system, constraining their ability to save and borrow money through formal institutions (OECD, 2017). It also limits the availability of economic data, and can therefore negatively affect economic policy decisions (El Qorchi et al., 2003).

Since their launch in the 2000s, by Mobile Networks Operators (MNOs), mobile financial services (MFS) have spread rapidly in Sub-Saharan Africa. At the end of 2019, 181 million mobile money accounts were active in the region[3], representing almost half of the world's mobile money accounts (GSMA, 2019). These accounts allow individuals to store their money digitally, make payments, receive and send money instantly to and from their mobile phone, without necessarily having a bank account at a financial institution. To date, mobile money transfers through domestic peer-to-peer (P2P) transfers are one of the most widely used services compared to other services. To illustrate, in December 2019, P2P transfers accounted for 91% of the circulating value (ibid). The main fallout of the market entrance of MNOs is the reduction of transfer fees from one individual to another (World Bank, 2009). Although mobile money transfer services are secure, fast, and they charge lower fees than traditional remittance service providers (RSPs)[4], their effect on the usage of informal channels is unclear.

There is a growing body of economic literature that discusses the impact of digital financial innovation such as mobile money on remittances. Recent evidence suggests that holding a mobile money account increases the frequency and amount of remittances received and sent (Jack and Suri, 2014; Darmon et al., 2016; Munyegera and Matsumoto, 2016; Aron et al., 2017). To the best of our knowledge, few studies have investigated whether mobile money leads to a shift in the use from informal to formal channels for remittances.

A descriptive analysis of a survey data carried by Mbiti and Weil (2015) reveals that following the launch of M-Pesa in Kenya, the mobile money channel became the dominant one and crowded out banks, post offices, Money Transfer Operators (MTOs), and informal channels. Nevertheless, the authors point out that despite the decline in the use of informal channels, they remained popular compared to other channels. Similar patterns were observed in rural Mozambique. The introduction of Mkesh has replaced traditional remittance channels. (Batista and Vicente, 2013). Though, as highlighted by Aron (2018), one limitation of this study is that the authors focused on transfers in an unusual direction which is from rural to urban areas. Another limitation is that their findings cannot be generalizable to all Sub-Saharan Africa countries. Given the scarcity of empirical works and the above-mentioned challenges, it is thus important to gain a better understanding of the links between the adoption of mobile money and the formalization of remittances flows.

This study aims to fill the knowledge gaps about digitalization and remittance flows. To this end, it explores whether a mobile money account reduces the use of informal remittance channels in Sub-Saharan Africa. The data used are from the World Bank's Financial Inclusion Survey that was conducted in several countries, including 35 countries in Sub-Saharan Africa (Global Findex 2017). A multinomial

[3] The terms mobile financial services (MFS) and mobile money are interchangeable terms. They refer to a range of financial services available through the mobile phone. These services generally include mobile money transfers, mobile phone payments, mobile savings, mobile loans, and mobile insurance.

[4] The main traditional remittance services providers are banks, Money Transfer Operators (such as Western Union and MoneyGram) and post offices.

logistic regression is applied to a categorical remittance channels variable taking three options: Bank, informal channel, and MTOs.

The results indicate that individuals with a mobile money account are less likely to send domestic remittances through informal channels than those without one. Overall, this paper has important implications for mobile financial inclusion and the remittance market in Sub-Saharan Africa. It highlights the relevance of including mobile financial services as part of the remittance formalization strategy to improve its economic impact.

The remaining part of the paper proceeds as follows. Section 2 provides some stylized facts on mobile money and informal remittances in Sub-Saharan Africa. Section 3 outlines the literature review on mobile money and informal remittances. Section 4 describes the data and the Multinomial logit (MNL) model used in the empirical strategy. Section 5 presents the results. Section 6 discusses the main findings and presents policy recommendations. Finally, we conclude.

2. MOBILE MONEY AND INFORMAL REMITTANCES CHANNELS IN SUB-SAHARAN AFRICA: STYLIZED FACTS

Since its launch in the 2000s, mobile money has spread rapidly in Sub-Saharan Africa. The region leads the world in the numbers of registered and active accounts. At the end of 2018, 181 million accounts were active in the region, representing almost half of the world's mobile money accounts. South Asia, the second-biggest mobile money market, lags far behind and has only half of the active accounts in Sub-Saharan Africa (GSMA, 2019). In some economies (e.g., Burkina Faso, Côte d'Ivoire, and Tanzania), there are twice as many mobile money accounts as there are bank accounts (Demirguc-Kunt et al., 2018). Another important point is that the share of mobile money transactions to GDP is also higher for the Sub-Saharan African region. In 2018, mobile money transactions accounted for 25% of the region's GDP, compared to 8% in 2014. For the rest of the world, this share was 5% of GDP in 2018 compared to 3% in 2014 (IMF, 2020).

Mobile money is a disruptive tool that changes access to financial services. Its rapid spread is driven both by the increase in the penetration rate of mobile phone and by an overall improvement of the quality of the mobile network[5]. However, it is worth noting that the uptake is not uniform in Sub-Saharan Africa.

Chironga et al. (2017) distinguish three types of markets based on the number of accounts registered: (i) "mature markets" where the penetration rate is more than 1,000 accounts per 1,000 adults; (ii) "maturing markets", with a penetration rate between 100 and 1,000 accounts per 1,000 adults and which are growing rapidly; (iii) "sleeping giants", markets with less than 100 accounts per 1,000 adults, and with huge under-exploited potential.

This typology is dynamic and evolves according to the take-up of mobile money in each country. Based on the 2018 IMF's Financial Services Access Survey, a recent snapshot can be obtained. Countries like Benin, Côte d'Ivoire, Ghana, Kenya, Rwanda and Uganda fall into the category of mature markets. In these countries, people usually have more than one mobile money account. It is not uncommon for individuals to subscribe to more than one operator at a time in Sub-Saharan Africa. It allows them to avoid the costs associated with limitations on interoperability, or to cope with network problems that might arise with another operator. The maturing mar-

[5] There are ten times as many mobile phones as landlines in Sub-Saharan Africa and 60 % of the population has mobile phone coverage while the region was scarcely connected in the 1990s (Aker and Mbiti, 2010).

kets are also characterised by a strong popularity of mobile money accounts compared to banks accounts. Countries that fall into this type include Burkina Faso, Cameroon, Senegal, and Togo. According to available data, Seychelles and Nigeria register less than 100 accounts per 1,000 adults. However, only Nigeria is considered, a sleeping giant based on the size of its population and its economic potential. Indeed, Nigeria is the most populated country in Africa with a financial inclusion rate of only 40%. Moreover, only six per cent of adults who reported using a mobile money account in 2017[6]. While other countries were adopting conducive policies for mobile money operators, Nigeria's regulatory framework has (until October 2018) limited the number of players that can provide mobile financial services, and hence hampering the development of mobile money. New reforms adopted at the end of 2018 by the Nigerian Central Bank (NCB) aim to speed up the adoption of mobile money and increase financial inclusion.

When looking at the growth in the number of active accounts[7]instead of the registered account number, a significant discrepancy within the countries exists (Figure 2, in Appendix). Between 2014 and 2018, countries such as Benin, Burkina Faso and Lesotho experienced a rapid increase in the number of active accounts, while on the other hand, the increase is less pronounced in countries like Togo and Cameroon.

Initially dominated by RSPs, the entry of MNOs has significantly changed the remittance market ecosystem, particularly domestic markets. It has increased competition in a highly uncompetitive and concentrated market structure. Deployment of mobile money agents increased from two million in 2014 to 16 million in 2018. During the same period, the number of branches for commercial banks increased from 372 to just over 4,000[8]. With regards to changes in postal agencies, their number declined from 13,067 to 11,581 between 2014 and 2018[9]. This significant roll-out of mobile money agents is a key component in facilitating cash-in-cash-out operations. Thus, at the end of 2019, P2P transfers accounted for 60% of all the value transactions in Sub-Saharan Africa (GSMA, 2019). Figure 3 (in Appendix) shows that mobile money transaction volumes increased substantially between 2014 and 2017 in Sub-Saharan Africa. The overall number of transactions increased from 88 million to 435 million.

Concerning informal transfers, there are currently no data available to approximate them. The commonly used approach is to analyse national surveys to get an approximation of these flows. The analysis of two surveys conducted in 2014 and 2017 by the World Bank in Sub-Saharan Africa reveals that reliance on informal channels to send domestic remittances has decreased. As a matter of fact, in 2014, 72% of the respondents reported having sent remittances through informal channels. In 2017, this figure fell to 64%. Although informal remittances are falling, they have attractive features. These include anonymity, flexibility, proximity and convenience for senders.

The next section will review the theoretical and empirical works concerning the link between the use of mobile money and the reliance on informal remittances channels.

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[6] See, Klapper and Popovi (2018).

[7] The number of active accounts is a more reliable measure of the mobile money's dynamic in Sub-Saharan Africa. As mentioned above, individuals often have more than one SIM card and more than one mobile money account. Quite often, some of these accounts end up turning into dormant accounts.

[8] International Monetary Fund (2020) "Financial Access Survey". Available at: http://fas.imf.org

[9] Universal Postal Union (2020)"Global or Regional Estimates". Available at: http:// pls.upu.int/pls/ap/ssp_report.main?p_choice=AGGREG&p_language=AN

3. LITERATURE REVIEW

Most work on the effects of mobile money on the remittance market has focused on its impact on the frequency and amount of remittances. According to findings by Morawczynski (2009), who conducted ethnographic fieldwork to assess the impact of the launch of M-Pesa in two locations in Kenya, urban migrants using M-Pesa increase the frequency of sending while lowering the amount of money transferred at the same time. These urban migrants recognize that with M-Pesa they are no longer forced to hold cash while waiting to make a one-off payment. They can as soon as they have funds (on a weekly or bi-weekly basis), send it to their families in rural areas. This phenomenon of sending money "in bits" leads to an overall increase in the amount remitted. In other words, the amounts frequently sent via mobile money are lower than those sent via other channels; however, when aggregated, the amounts sent via mobile money are higher overall. There are several reasons why migrants send these small regular amounts. On the one hand, MTOs charge lower remittance fees than other channels such as MTOs or banks for relatively small amounts. In addition, fees charged by the informal channels are highly volatile and can vary according to demand and the time of year. On the other hand, making regular transfers of small amounts enables urban migrants and their recipient families to better organize their finances.

Mbiti and Weil (2015) reached the same conclusion in their work on the economic impacts of M-Pesa. Using a balanced panel of locations in Kenya obtained from the combination of the 2006 and 2009 FinAccess surveys, they find that if M-Pesa were universally adopted, individuals would send five more remittances per annum. The main driver behind the increase in both the amount and frequency of funds transfers is the decrease in transaction costs.

Indeed, Munyegera and Matsumoto (2016) point out that, mobile phone-based financial transactions are associated with a reduction in the transaction, transport, and time costs in Ghana. As a result of this cost reduction, the authors indicate that households with at least one mobile phone subscriber are 20 percentage points more likely to receive remittances than non-using households.

These findings have been confirmed at the macroeconomic level by Darmon et al. (2016). They developed a theoretical model that integrates both the transfer decision of the senders and the consumption choices made by the beneficiaries, with and without the possibility of at least partial recourse to mobile payment. They show that mobile money has a positive effect on the aggregate level of remittances and welfare.

Overall, most studies suggest a positive effect of mobile money on remittances (amount and/or frequency). However, the extent to which this new digital financial innovation can play a role in formalizing informal remittances has received little attention both in the theoretical and empirical literature. The issue is of concern, however, given that the targeted population by mobile financial services is the one excluded or under-served by the formal system, and therefore relies mainly on informal practices (informal savings, credit, insurance and remittances).

Batista and Vicente (2013) in an impact assessment of the introduction of mobile money on various outcomes, focused on the effects on the remittance channel. They conducted a randomized control trial among 102 rural areas in Mozambique, reaching 2040 individuals. At the end of the experimentation, they observe that, when comparing the target and control group, the willingness to remit through Mkesh increased. Precisely, targeted subjects are 26% more willing to remit through Mkesh than the control group. From this result, the authors infer the Mkesh effect by asserting that at the margin, it crowds out other transfer channels. Though, as highlighted by Aron (2018), the authors focus on transfers in an unusual direction (from rural to urban areas), and their findings may not be generalizable to all Sub-Saharan Africa countries.

The same pattern of change has been observed for remittances flows within Kenya (Mbiti and Weil, 2015). In 2006, before the introduction of M-Pesa, the main channel used to remit was through friends and bus companies which are informal channels. While more than 50% of respondents reported using informal channels, only 10% transferred via bank or MTOs. In 2009, after the introduction of M-Pesa, the mobile money channel became the most widely used, crowding out other channels. However, the authors note that the crowding-out effect is greater for banks and MTOs. In other words, the introduction of M-Pesa has been more detrimental to banks and MTOs than to informal channels. One of the limitations of this study is the fact that the authors simply observe (before and after) the remittance methods used by the respondents. Therefore, factors other than the advent of mobile money may be at the root of the crowding-out of traditional remittance channels.

Similar and more robust findings were provided by Bair and Tritah (2019) for the case of Madagascar. Based on the 2015 FinScope consumer survey, they found that mobile money adoption raised the probability of sending (and receiving) as well as the amounts transferred. The authors go further in their analysis by investigating the complementary or substitute nature of mobile money compared to other channels. They regressed the number of channels used by households to send and receive remittances on the use of mobile money. After controlling for potential endogeneity using the instrumental variable approach, they show that mobile money substitutes traditional transfer channels. However, the value of the estimated parameter (very close to 1) suggests that many households continue to combine the use of different remittances channels.

These studies although drawn from specific cases in Sub-Saharan Africa, support the hypothesis that the introduction of mobile money is challenging the traditional remittance market players. However, the following section will provide empirical evidence to assess this effect for Sub-Saharan African countries.

4. DATA AND METHODOLOGY

4.1. Data and descriptive statistics

To assess the effect of the usage of mobile financial service on the informal remittances channels, this study relies on the World Bank's 2017 Global Findex database (Demirguc-Kunt et al., 2018). The database is constructed from nationally representative surveys of more than 150,000 adults, randomly selected from over 140 economies. The surveys were conducted in 2017 by Gallup, Inc., as part of its Gallup World Poll. They provide information on saving, borrowing, remittances, payment and risk management behaviours, both formally and informally. The final sample includes 35,000 respondents across 35 Sub-Saharan Africa countries (see Table 8 in Appendix for the list of countries). The database contains information on the channel used by respondents to send remittances and their use of formal and informal financial services in the past 12 months. Formal financial services use is captured by the registration of any savings or borrowing transaction carried out within a bank or regulated financial institution, while any savings or borrowing transaction that takes place outside the above-mentioned regulatory framework will be considered informal. Finally, the database also includes the individual characteristics of the respondents such as gender, age, educational attainment, and the income quintile.

To identify the channel used by the respondent to remit, they were asked the following question: *In the PAST 12 MONTHS, have you, personally, GIVEN or SENT money to a relative or friend living in a different area in any of the following ways? A. You sent money through a bank or another type of formal financial institution, B. You sent money through a mobile phone, C. You handed cash to this person or sent cash through someone you know, D. You sent money through a money transfer service.*

Table 1 reports summary statistics for the full sample and by mobile money account holding status. Column (3) shows that the mean age of respondents is 34 years, and women are more represented than men in the full sample (51% of women). Most of the respondents use the informal channel for remittances. On average, about 65% of adults in the sample reported sending domestic remittances through informal means and 12% through MTOs. Regarding financial inclusion, 64% of the respondents do not have an account in either bank or Microfinance Institution (MFI). The consequences of this low rate of bancarization are visible when looking at the share of individuals who have resorted to electronic payments. Only seven percent of the respondents paid their bills using the Internet tool. In other words, they paid directly with their credit card for various bills. Overall, 51% of the respondents have a primary school level or less while only four percent are graduated from higher education. Regarding the distribution of the sample by income, the richest quintile includes the largest share of the sample (27% of the individuals), while the poorest quintile has 16% of the sample.

Table 1. Summary statistics for the full sample, mobile money users and non-users

		Full Sample	Mobile Money users	Mobile Money non-users	
Variables	N	Mean	Mean	Mean	Difference in means
Individual characteristics					
Age	32824	34.00	32.06	34.00	−2.87***
Female	33000	0.51	0.45	0.53	−0.08***
Employment status	33000	0.68	0.79	0.66	0.13***
Financial inclusion					
No financial account	33000	0.64	0.46	0.71	-0.25***
Remittance behaviour and channels					
Sent domestic remittances	31730	0.33	0.58	0.22	0.36***
Sent through financial institution	8115	0.17	0.08	0.25	-0.17***
Sent using cash	2311	0.65	0.59	0.66	−0.07***
Sent through MTOs	2310	0.12	0.15	0.11	0.04*
Payment habits					
Pays bills electronically	32507	0.07	0.19	0.02	0.17***
Educational attainment					
Primary education or less	33000	0.51	0.34	0.57	−0.23***
Secondary education	33000	0.44	0.58	0.39	0.19***
Tertiary education or more	33000	0.04	0.08	0.03	0.05***
Income					
Income – Poorest 20%	33000	0.16	0.10	0.19	−0.09***
Income – Second 20%	33000	0.17	0.14	0.18	−0.04***
Income – Third 20%	33000	0.19	0.17	0.19	−0.02
Income – Fourth 20%	33000	0.21	0.22	0.21	0.01***
Income – Richest 20%	33000	0.27	0.37	0.23	0.14***

Source: Author's computation based on 2017 Global FINDEX.
*Notes: ***, ** and * indicate statistical difference of means significant at 1%, 5% and 10% level, respectively.*

Table 1 also shows that there are statistically significant differences between mobile money users and non-users for most variables. First, column (4) indicates that 45% of mobile money users are women, which means that there is a gender gap in the holding of a mobile financial account. In other words, men are more likely to have a financial service on their phone than women. Second, the average age of mobile money

users is lower relative to that of non-users. Not surprisingly, mobile money users remit more, less through informal channels and more through formal ones such as MTOs and Banks. Finally, considering the distribution in income quintile groups, mobile money non-users are more represented in the lower quintile. Conversely, mobile money users are more numerous when looking at the distribution in the top quintile. The latter observation suggests that there are still access barriers to mobile money for the poorest people, although they are the targeted populations.

Overall, Table 1 shows that there is a difference in remittance behaviour between mobile money users and non-users. Specifically, individuals with a mobile financial service are less likely to send remittances through informal channels. However, before concluding that holding a mobile money account reduces the likelihood of using informal transfer channels, a more thorough econometric analysis needs to be carried.

4.2. Empirical methodology

The purpose of this study is to examine whether mobile financial services reduce the reliance on informal remittances channels in Sub-Saharan Africa. Survey respondents were asked whether in the past 12 months they sent money through a mobile money account, a bank or another type of formal financial institution, an MTO or if they handed or sent cash through someone they know within the country. Individual *i* will choose transfer channel *j*, if this channel is associated with a higher level of utility than any other channel (*j*=1 for banks, *j*=2 for informal channels, *j*=3 for MTOs)[10]. Since the dependent variable is a polytomous and unordered categorical variable, a multinomial logit (MNL) specification is most suitable for this study. The approach is similar to the one used by Amuedo-Dorantes and Pozo (2005) Siegel and Luecke (2013), and Kosse and Vermeulen (2014) in their works on the determinants of migrants' choice of remittance channels.

Let assume that the utility of individual *i* derived from the choice of a transfer channel *j* is as follows:

$$U_{ij} = \beta_j' \mathrm{X}_i + \alpha_j' \mathrm{Z}_i + \varepsilon_{ij} \quad (1)$$

With *X* the binary variable *mobile money account*, *Z* a vector of other observed attributes. β and α are vectors of unknown parameters. ε is the error term.

Since individuals choose the channel that best maximizes their utility and assuming that J^{th} is this channel, the probability that individual i choose J^{th} channel is:

$$\begin{aligned} Prob(Y_i = j) &= Prob\left(U_{ij} > U_{ik}\right) \\ &= Prob\left[\varepsilon_{ij} - \varepsilon_{ik} < \left(\beta_j \mathrm{X}_i + \alpha_j \mathrm{Z}_i\right) - \left(\beta_k \mathrm{X}_i + \alpha_k \mathrm{Z}_i\right)\right] \end{aligned} \quad (2)$$

where $k = 1...4$, $k \neq j$.

[10] To avoid potential endogeneity bias, the study of the impact of the mobile money account on individuals' choice of remittance channels requires excluding the mobile money channel from the set of remittance channels. Fact, while it is expected that holding a mobile money account will lead to the choice of mobile money as a money transfer channel, it is also possible that holding a mobile money account may be influenced by wanting to remit using this channel. To correct the endogeneity issue in a discrete choice model with an endogenous binary regressor, Lewbel (2000) proposed the special regressor estimators. This approach requires one exogenous regressor that has to be conditionally independent of ε, appear additively to ε in the model, and be conditionally continuously distributed with large support (Lewbel, 2000). Unfortunately, the survey design does not allow us to obtain such a variable that can be used as a special regressor. Other approaches exist to correct the endogeneity issue in a discrete choice model such as the control function approach (Wooldridge, 1997; Heckman and Navarro-Lozano, 2004). However, this method requires that the endogenous variable be continuous whereas the endogenous variable in this study is discrete.

Under the assumption that errors are independent and identically distributed (iid), with type I extreme value distribution (Gumbel distribution), McFadden (1978) showed that Equation 2 leads to the multinomial logit model (MNL). This model specifies the probability that individual *i*, chooses a channel *j* as follows:

$$\boldsymbol{Prob(Y_i = j) = P_{ij} = \frac{\exp(\beta_j' \chi_i + \alpha_j' z_i)}{1 + \sum_{k=1}^{j} \exp(\beta_k' \chi_i + \alpha_k' z_i)}} \quad (3)$$

β and α are easily estimated using maximum likelihood estimation.

For a clearer interpretation of the estimates, the marginal effects instead of coefficients are computed. The marginal effects measure the change in predicted probabilities of each outcome as a result of a change in a particular predictor variable while leaving the other explanatory variables constant. The marginal effect on channel *j* of a change in mobile money usage (from 0 to 1) is defined by:

$$\frac{\partial P_{ij}}{\partial x_i} = P_{ij}\left[\beta_j - \sum_{k=0}^{j} P_{ik}\beta_k\right] \quad (4)$$

From Equation (4), we can see that unlike an interpretation based on the estimated coefficients, marginal effects in MNL models are not relative to a baseline channel. It depends on the specific values of the $x_i's$ where the change is computed (Long and Freese, 2006, p.240).

The implementation of the MNL approach is structured under one important underlying assumption, the independence of irrelevant alternatives (IIA). This assumption states that an alternative's likelihood is not dependent on other available alternatives. Say differently, the odds of adding or removing an alternative does not affect the odds among the remaining alternatives (Long and Freese, 2006, p.407). Three tests are commonly applied to confirm or invalidate the IIA assumption: The Hausman-McFadden test (Hausman and McFadden, 1984), the Suest-based Hausman test, and the Small-Hsiao test (Small and Hsiao, 1985). To examine the validity of the IIA assumption, we performed the three tests using Stata software. The Hausman test produces negative chi-squares which are very common with this test as mentioned by Long and Freese (2006, p.409). Hausman and McFadden (1984, 1226) argue that a negative test statistic is evidence that IIA property is not violated. The Suest-based Hausman test and the Small-Hsiao test support the evidence that IIA property is not violated as none of the tests is significant. We also compute an LR test for combining alternatives which revealed that the alternatives cannot be combined. The result of the IIA and LR test are reported in Table 5 and 6 in Appendix.

The choice of the control variables is based on the existing literature and the availability of the data in the survey. However, as reported by Siegel and Luecke (2013), most papers informally discuss the determinants of the choice of a transfer channel. Empirical works are scarce and give us very little guidance in terms of the variables to be integrated as explanatory variables for the choice of a transfer channel. Based on the works of Siegel and Luecke (2013) and Kosse and Vermeulen (2014), control variables used in this paper are personal characteristics of the sender such as gender, age, employment status, and educational attainment. Additional factors like the characteristics of the different channels are also taken into account. Unfortunately, the dataset does not provide us with alternative specific variables.

To establish whether mobile financial services lower the likelihood of using informal remittances channels, this study first considers all the 35 countries in the sample. Then, countries are grouped based on the development level of financial institutions. The choice of clustering according to the level of financial institutions'

development is motivated by the existing literature. Indeed, according to Buencamino and Gorbunov (2003), informal financial systems thrive in economies for several reasons, including when the conventional financial system fails to fulfil its function. This failure can be reflected in either a mismatch between the available products and the needs of populations as well as a geographical coverage limited to major cities. Some regions such as Western Africa have a well-established informal transfer system (Genesis, 2003; Mohapatra and Ratha, 2011) and a low level of financial development compared to the Sub-Saharan average[11]. Data on the sub-index that measures the level of financial institutions' development are drawn from the final overall index "Financial Development Index", developed by the International Monetary Fund (IMF, 2018). This sub-index, ranging from 0 (low developed) to 1 (highly developed), measures the depth, access, and efficiency of financial institutions (Svirydzenka, 2016).

5. RESULTS

This section summarizes the main findings of the study. Estimates for the full sample are first reported, before presenting the results for the sub-samples.

5.1. Results for the full sample

Table 2 shows findings on the relationship between the use of a mobile money account and the likelihood of sending money through various remittances channels. For a clearer interpretation, average marginal effects (A.M.E) are computed instead of the coefficients, less intuitive in the MNL estimation. Column (3) indicates that mobile money users are less likely to send remittances through an informal channel. Specifically, on average, individuals who use a mobile financial account are 5.9% less likely to send money through an informal channel than individuals who do not use one, keeping other variables constant.

As expected, not having an account at a financial institution (such as a bank or a microfinance institution) lowers the probability of sending money through a bank by 35%. Conversely, individuals who do not have an account at a financial institution are 3% more likely to use an informal remittances channel than individuals who have a financial account.

Estimates also show that paying bills through the Internet lowers the likelihood of using informal channels. Simultaneously, doing so increases the likelihood of sending money through banking channels by 13%. This result is consistent with that reported by Kosse and Vermeulen (2014). They argue that general payments habits play a role in the migrant's choice of remittance channel. Individuals accustomed to paying bills online using a credit card will be more inclined to use the banking channel to transfer money. Meanwhile, people who do not use financial accounts and who prefer cash are more likely to use informal remittances channels as results showed. Turning to the employment status, results show that it also impacts the likelihood of using an informal remittance channel. Individuals who work are 6.5% more likely to remit informally than those out of the workforce. In addition, working individuals are less likely to use the MTO channel than those who are not employed. Moreover, using an informal channel is not related to age or even gender.

Concerning the sender's educational level, the results are more intuitive. Compared to individuals with a primary schooling level or less, individuals with secondary and tertiary schooling are less likely to use informal channels. As noticed by Alhassan et al. (2019), the use of informal channels is more important among those

[11] In 2017, the financial development index for western Africa was 0.15, while it was 0.16 and 0.27 for eastern and southern Africa respectively. The African average was 0.16.

with a low level of education mainly due to minimal paperwork. Alternatively, the probability that an individual with a secondary or tertiary level of education uses a banking channel is more than 10%.

Table 2. Multinomial logit estimations of the impact of mobile money account on informal remittances

Variables	Financial Institution	Informal channel	Money Transfer Operators
Female	0.005	0.008	-0.013
	(0.019)	(0.020)	(0.013)
Age	0.003	-0.003	0.001
	(0.003)	(0.003)	(0.002)
Age squared	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)
Employment	-0.029	0.065**	-0.036**
	(0.026)	(0.026)	(0.017)
Mobile Money account	0.036	-0.059**	0.023
	(0.026)	(0.027)	(0.018)
No financial account	-0.311***	0.300***	0.011
	(0.022)	(0.022)	(0.013)
Pay bills electronically	0.136***	-0.171***	0.034
	(0.045)	(0.049)	(0.034)
Secondary Education	0.124***	-0.115***	-0.009
	(0.020)	(0.020)	(0.013)
Tertiary Education	0.155***	-0.158***	-0.004
	(0.041)	(0.044)	(0.027)
Income: Second 20%	-0.000	0.009	-0.009
	(0.040)	(0.040)	(0.025)
Income: Third 20%	0.028	-0.035	0.007
	(0.038)	(0.037)	(0.023)
Income: Fourth 20%	0.045	-0.043	-0.002
	(0.037)	(0.037)	(0.024)
Income: Richest 20%	0.042	-0.033	-0.009
	(0.036)	(0.036)	(0.023)
Log-likelihood	-2265.9531		
R-squared	0.1388		
N	3,155		

*Notes: Estimations allow for country fixed effect. Average Marginal effects are reported. superscripts ***, ** and * indicate statistical significance at 1%, 5% and 10% level, respectively. Standard errors are in parentheses. Omitted variables are the income poorest 20% and primary education.*

5.2. Results by the level of development of financial institutions

In this section, countries of the full sample are separated into four subsamples. These sub-samples include countries classified by quartile of financial development index (see Table 9 in Appendix). The estimations results are reported in Table 3 in Appendix.

These results show that holding a mobile money account reduces the likelihood of sending remittances through an informal channel in countries with relatively undeveloped financial institutions. Another interesting finding that should be highlighted is that the use of mobile money is also associated with a lower likelihood of sending cash in countries with a well-developed financial sector. Similar to the whole-sample result, not holding an account at a financial institution reduces the likelihood of sending money through an informal channel regardless of the development level of financial institutions in Sub-Saharan Africa. Intuitively, compared to the poorest, the richest are much more reluctant to use an informal channel. The

influence of general payment habits advanced by Kosse and Vermeulen (2014) can be observed even though the result is significant only for the second and the fourth quartile. In countries identified as having the highest financial level, (such as Côte d'Ivoire, Kenya, Senegal, and South Africa), regular use of a bank account for bill payment discourages the use of informal remittance channels (-20%).

To test the hypothesis of coefficient stability across sub-groups, we run the likelihood-ratio Chow test between the full model and the stratified models. The likelihood-ratio Chow test is appropriate for hypotheses that specify that all coefficients of a model do not vary between disjointed subsets of the data. The results presented in Table 7 in Appendix show that the MNL regression model applies to each of the quartiles. Therefore, regressions (and coefficients) are the same across subgroups.

5.3. Robustness checks

To ensure the robustness of the reported result for the full sample, a robustness check has been done. As the alternatives of our outcome are independent, we run two separate binary logistic regression with the informal channel as the baseline category. Results reported in table 4 (in Appendix) show no significant change in our results. Column 1 represents the estimation results of a logistic regression of our independent variables on the variable channel (Informal channel vs banks). The use of the informal channel instead of the banking channel decreases by 5% as soon as the individual starts using a mobile money account. The same finding can be made regarding the shift from the MTO channel to the informal channel. In fact, the use of mobile money reduces the likelihood by 5.4% of using an informal channel for individuals who used the MTO channel.

6. DISCUSSION AND POLICY RECOMMENDATIONS

Improving the developmental impact of remittances is an international policy priority. To this end, several commitments have been made including facilitating productive domestic investment, reducing the remittance costs to an overall average of 3% of the amount transferred by 2030, and increasing the volume of remittances through official remittance channels. Indeed, the persistence of informal remittance channels is harmful to both households and the overall economy.

This paper examines the impact of mobile money on the use of informal remittance channels in Sub-Saharan Africa. The results show that a mobile money account is associated with a lower probability of sending domestic remittances through informal means. This finding is consistent with the results of earlier country-level studies (Batista and Vicente, 2013; Mbiti and Weil, 2015; Bair and Tritah, 2019). Therefore, it is agreed that mobile money helps to fill the gaps in informal remittances channels. First, sending money through an informal channel requires that the supply of remittances (expressed by the intermediate) and its demand (expressed by the sender) match. Indeed, several reasons can delay the sending and receiving of remittances through an informal channel: the intermediary may not have cash available when the migrant wants to transfer money, the bus company that carries remittances may not have a scheduled trip when the migrant wants to send money, and lastly the sender may not be able to find anyone willing to carry the cash to the recipient's home. Secondly, the use of informal channels involves risks such as loss, theft or fraud of the funds. Thirdly, entry of the MNOs in the remittances market has to some extent reduced the transaction costs for both the receiver and the sender, who previously relied on the informal channels.

The result also shows that other factors such as regular use of a bank account to pay bills online and higher educational attainment are associated with less use of the cash-based channels for remittances.

Hence, individuals who have regular use of a bank account are more integrated into the banking system and are sceptical or unaware of how such informal alternatives work. This is explained by the existence of a trust relationship with the bank which results in a reluctance of using informal operators.

Regarding the link between educational attainment and the use of the informal channel, a low general education (limited literacy as well as numeracy skills) can hinder the understanding of financial terms and lead to an exclusion from the traditional financial sector (Atkinson and Messy, 2013; Zins and Weill, 2016). Thus, the migration of less-educated individuals not only hinders the migrant's integration at the destination, but it also encourages the continued flow of remittances through informal channels.

Lack of a financial account increases the likelihood of using informal channels. However, findings revealed that an unbanked individual is more likely to transfer funds through an informal channel. This result confirms that inclusive banking services help to reduce the share of informal remittance systems. It also reinforces the idea that mobile money can draw into the financial system those excluded from the traditional banking system. According to Klapper et al. (2019), 340 million people in Sub-Saharan Africa were unbanked in 2017. This represents a third of the adults in the world who remain unbanked. Improving mobile money services, especially money transfer services, could result in a greater impact in the long term.

Concerning employment status, the results reveal that those who reported being in the labour force are more likely to make internal remittances by informal means. This result, which may seem surprising, can be explained by the fact that the majority of jobs in Africa are informal. On average, informal employment represents 60% of total non-agricultural employment (Allard, 2017). Individuals do not always have the necessary documents to prove their identity or income. Moreover, payment in the informal sector is exclusively in cash. This liquidity preference may contribute to maintaining individuals in the informal sector for other transactions such as remittances. Finally, age, gender, and income have no significant effect on the likelihood of sending remittances through informal means. Holding a mobile money account increases the likelihood of sending money via a bank account and MTOs, although the result is not significant.

The results also indicate holding a mobile money account reduces the likelihood of sending remittances through an informal channel for the first and fourth quartile.
The relevance of the former result lies in that in the literature, a low development level of financial institutions is associated with a high use of informal financial systems (Sander and Maimbo, 2003). In countries belonging to the first quartile, access to financial institutions is limited. Indeed, countries such as Uganda and Guinea had fewer than three commercial bank branches per 100,000 adults in 2017 (compared to 5.2 in Côte d'Ivoire and 10.5 in Namibia). This weakness in the financial institutions' architecture is conducive to a major recourse to new, faster, easier and more secure payment systems such as mobile money. On the other hand, the results show that in countries with stronger financial institutions such as Kenya, Senegal and Côte d'Ivoire, mobile money helps to reduce the use of the informal channel. The persistence of informal remittances channels reveals the mismatch between the needs for payments and transfers and the products and services offered by financial institutions. Mobile money thus appears to be an alternative to the various banking products and services.

Overall, the entrance of mobile money as a new player in the remittance market has several implications for the developmental impact of remittances, for the financial inclusion policy, and poverty reduction in Sub-Saharan Africa. Indeed, unlike international remittances, domestic remittances most benefit the poorest households. They can account for a significant share of the recipient household's income (Housen et al., 2013). Several studies have shown that internal transfers have an impact on poverty

reduction in some Sub-Saharan African countries (Maitra and Ray, 2003; Adams et al., 2008; Chiwuzulum Odozi et al., 2010). By attracting more remittances mobile money services could help increase the income of the migrant's family. They can also provide beneficiary households with the appropriate tools to manage this additional income and be a gateway to financial inclusion for the migrant and his family left behind.

The mobile money technology can be used as a tool to achieve the remittance cost target of less than 3% of the amount remitted, one of the three commitments of the Valetta Summit on Migration in 2015. Mobile money can also make it easier to identify areas of high emigration through the monitoring of remittance patterns. Identify these areas will enable the implementation of local policies aimed at limiting massive emigration flows from rural to urban areas. Finally, the development of various services (loans, savings, insurance, merchant payments) by MNOs and the multiplication of partnerships between MNOs and local banks ensure that the adoption of a mobile account by the migrant and his family who are accustomed to informal channels.

Yet, as the transition from informal to formal channels needs time and adaptation costs, MNOs need to adopt effective communication and financial education strategies aimed at migrant workers and their families with a focus on the less-educated. MNOs also need to improve the existing network infrastructure through investments, to ensure broad and high-quality network coverage for the population. Regarding the role of governments and banking regulators, they must ensure a regulatory environment conducive to the adoption of mobile money. This involves the adoption of legislation relating to the activity of MNOs but also, measures to improve access to electricity and the penetration rate of mobile phones.

7. CONCLUSION

This study investigates the effect of mobile financial services on the usage of informal remittances channels in Sub-Saharan Africa. Specifically, it has focused on mobile money innovation, given its leading role in the financial inclusion strategy in Sub-Saharan Africa. The results show that holding a mobile money account lowers the probability of sending domestic remittances through an informal channel. This paper is a contribution to the growing body of research that examines the potential of digitalization in the remittance market in sub-Saharan Africa. It confirms that the advent of mobile money is reshaping the remittance market landscape and access to financial services in sub-Saharan Africa. While previous studies have mainly focused on the impact that this new player could have on the frequency and amounts of formal remittances, issues related to informal remittances, given their scale and the challenges they raise, need to be addressed.

However, this study has some limitations. First, the survey design did not allow to correct the identified endogeneity issue. Secondly, the study was limited by the unavailability of some data on the amounts remitted, the frequency and the cost of the remittances sent, which are key variables in the choice of a remittance channel. The availability of a Sub-Saharan Africa-wide data set that includes a larger number of variables, especially instrumental variables, would better capture the effects of the interest variable on the likelihood of using informal channels. The emergence of mobile money as a driver of financial inclusion and a player in the remittance market has opened up several avenues of research. Empirical research could investigate the behaviour of other actors such as MTOs and postal offices and how they respond to the advent of mobile financial services. Other studies could further explore the impact of mobile money and remittances on the development of income-generating activities in Sub-Saharan Africa. Finally, this study provides a basis for exploring the impact of other digital innovations such as crowdfunding platforms and other fintech on the remittance market.

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APPENDIX

Table 3. Results by quartile of the financial development index

Banking Channel	Q1	Q2	Q3	Q4
Female	0.060	0.019	-0.067*	-0.032
	(0.039)	(0.018)	(0.036)	(0.043)
Age	-0.011*	0.004	0.010	0.002
	(0.006)	(0.008)	(0.006)	(0.007)
Age squared	0.000*	-0.000	-0.000**	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Employment status	0.029	-0.136**	-0.036	0.049
	(0.048)	(0.058)	(0.048)	(0.051)
Mobile Money account	-0.155**	-0.036	-0.075*	0.071
	(0.063)	(0.077)	(0.046)	(0.052)
No financial account	-0.175***	-0.302***	-0.250***	-0.256***
	(0.051)	(0.087)	(0.042)	(0.055)
Pay bills online	-0.042	0.430***	0.057	0.087
	(0.085)	(0.055)	(0.068)	(0.075)
Secondary Education	0.134***	0.075*	0.120***	0.073
	(0.040)	(0.042)	(0.038)	(0.049)
Tertiary Education	0.182***	-0.056	0.554***	0.268**
	(0.066)	(0.105)	(0.116)	(0.106)
Income: Second 20%	0.115	-0.036	-0.045	0.068
	(0.072)	(0.073)	(0.076)	(0.075)
Income: Third 20%	0.124*	0.017	-0.021	0.066
	(0.065)	(0.085)	(0.073)	0.066
Income: Fourth 20%	0.095	-0.020	0.016	0.155**
	(0.070)	(0.076)	(0.070)	(0.066)
Income: Richest 20%	0.120***	0.007	0.048	0.156**
	(0.060)	(0.079)	(0.072)	(0.065)

Table 3. continued from previous page

Informal channel	Q1	Q2	Q3	Q4
Female	-0.039	0.000	0.081**	0.020
	(0.043)	(0.022)	(0.038)	(0.044)
Age	-0.011*	-0.005	-0.013**	-0.001
	(0.006)	(0.006)	(0.006)	(0.007)
Age squared	0.000*	0.000	0.000**	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Employment status	0.046	0.161***	0.032	-0.006
	(0.053)	(0.052)	(0.048)	(0.052)
Mobile Money account	-0.119**	0.024	-0.052	-0.087*
	(0.061)	(0.071)	(0.056)	(0.051)
No financial account	0.206***	0.330***	0.227***	0.242***
	(0.051)	(0.077)	(0.043)	(0.055)
Pay bills online	- 0.068	-0.450***	-0.010	-0.201***
	(0.098)	(0.066)	(0.072)	(0.068)
Secondary Education	-0.137***	-0.048	-0.108***	-0.056
	(0.040)	(0.051)	(0.041)	(0.051)
Tertiary Education	-0.196***	0.017	0.319**	-0.243**
	(0.068)	(0.099)	(0.139)	(0.123)
Income: Second 20%	-0.070	0.040	0.062	-0.052
	(0.078)	(0.084)	(0.076)	(0.074)
Income: Third 20%	-0.084	0.004	0.005	-0.088
	(0.070)	(0.099)	(0.073)	(0.072)
Income: Fourth 20%	-0.051	0.031	0.021	-0.161**
	(0.075)	(0.074)	(0.072)	(0.069)
Income: Richest 20%	-0.045	-0.002	-0.045	-0.119*
	(0.069)	(0.079)	(0.072)	(0.068)
Money Transfer Operators	Q1	Q2	Q3	Q4
Female	-0.021	-0.019	-0.014	0.012
	(0.039)	(0.022)	(0.021)	(0.027)
Age	-0.001	0.001	0.003	-0.000
	(0.005)	(0.006)	(0.003)	(0.004)
Age squared	0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Employment status	-0.075	-0.024	0.004	-0.043
	(0.047)	(0.020)	(0.022)	(0.033)
Mobile Money account	-0.035	0.012	0.127***	0.016
	(0.054)	(0.026)	(0.048)	(0.030)
No financial account	-0.032	-0.028	0.023	0.013
	(0.043)	(0.025)	(0.022)	(0.025)
Pay bills online	0.110	0.019	-0.047**	0.114
	(0.104)	(0.036)	(0.022)	(0.075)
Secondary Education	0.003	-0.028	-0.012	-0.017
	(0.039)	(0.020)	(0.025)	(0.026)
Tertiary Education	0.014	0.038*	-0.874***	-0.025
	(0.060)	(0.023)	(0.126)	(0.064)
Income: Second 20%	-0.045	-0.005	-0.017	-0.016
	(0.072)	(0.030)	(0.037)	(0.052)
Income: Third 20%	-0.040	-0.021	0.015	0.023
	(0.066)	(0.042)	(0.036)	(0.045)
Income: Fourth 20%	-0.044	-0.011	-0.037	0.005
	(0.068)	(0.010)	(0.041)	(0.047)
Income: Richest 20%	-0.074	-0.005	-0.003	-0.037
	(0.068)	(0.032)	(0.035)	(0.050)
Log-likelihood	-412.93	-405.37	644.22	-500.56
Pseudo R^2	0.2184	0.1593	0.1469	0.1965
N	626	720	951	661

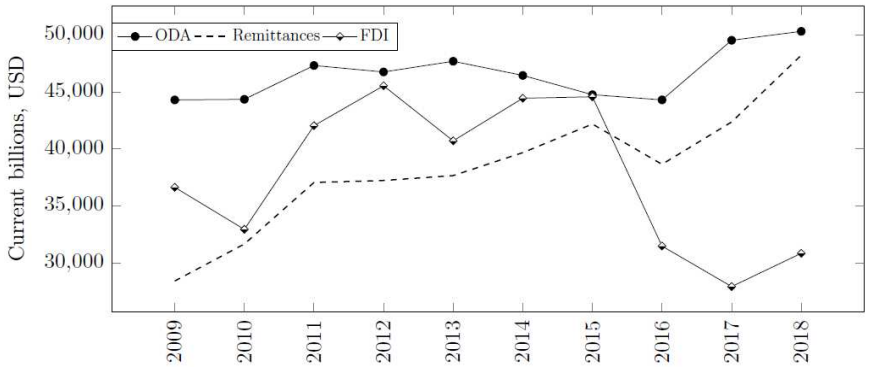
*Notes: Estimations allow for country fixed effect. Marginal effects are reported. Superscripts ***, ** and * indicate statistical significance at 1%, 5% and 10% level, respectively. Standard errors are in parentheses. Omitted variables are the income poorest 20% and primary education.*

Table 4. logit estimations of the impact of mobile money on informal remittances

Variables	(1)	(2)
Female	0.001	0.020
	(0.020)	(0.021)
Age	-0.004	-0.001
	(0.003)	(0.003)
Age squared	0.000	0.000
	(0.000)	(0.000)
Employment	0.046*	0.059**
	(0.027))	(0.027)
Mobile Money account	-0.050*	-0.054*
	(0.028)	(0.030)
No financial account	0.334***	0.057**
	(0.023)	(0.023)
Pay bills electronically	-0.170***	-0.171***
	(0.049)	-0.106
Secondary Education	-0.133***	-0.024
	(0.020)	(0.020)
Tertiary Education	-0.171***	-0.056
	(0.043)	(0.044)
Income: Second 20%	0.010	0.015
	(0.041)	(0.038)
Income: Third 20%	-0.024	-0.024
	(0.039)	(0.035)
Income: Fourth 20%	-0.034	-0.016
	(0.038)	(0.036)
Income: Richest 20%	-0.033	-0.004
	(0.037)	(0.034)
Log-likelihood	-656.19	-1448.47
R-squared	0.1014	0.1787
N	1,756	2,886

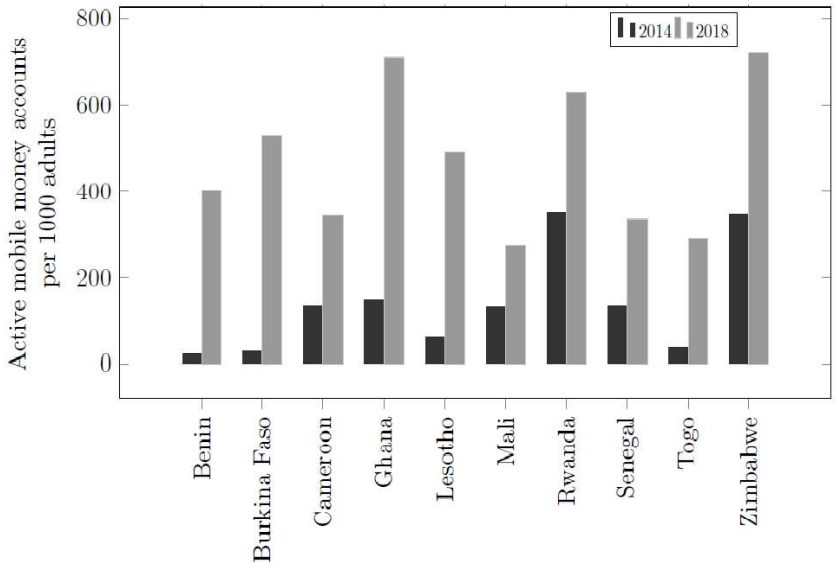
*Notes: Estimations allow for the country fixed effect. Average Marginal effects are reported. Superscripts ***, ** and * indicate statistical significance at 1%, 5% and 10% level, respectively. Standard errors are in parentheses. Omitted variables are the income poorest 20% and primary education.*

Figure 1. Trend of financial inflows in sub-Saharan Africa



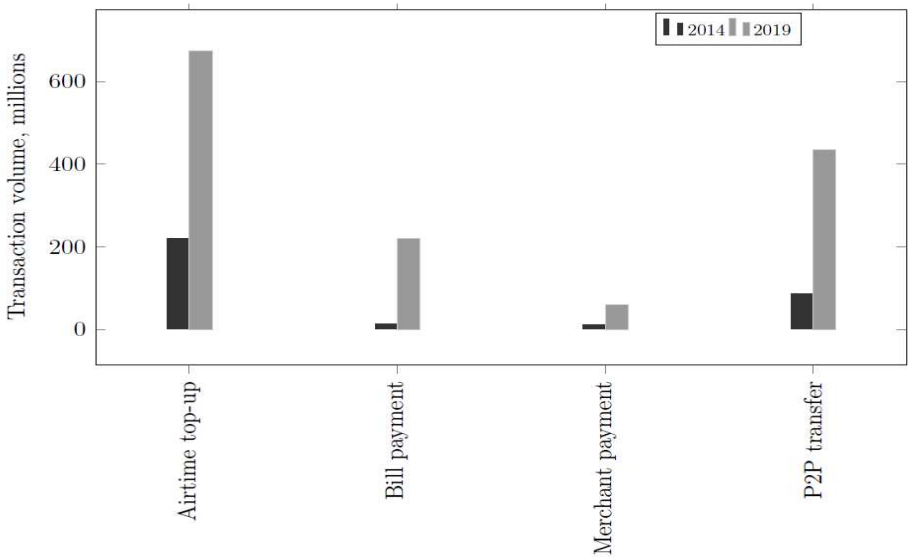
Source: Author, based on World Development Indicators, 2020.

Figure 2. Evolution of active mobile money accounts in selected countries



Source: Author's calculations based on IMF's Financial Access Survey, 2020.
Note: The selection of the countries was constrained by the availability of the data.

Figure 3. Trend of mobile money transaction in sub-Saharan Africa



Source: Author, based on Global Mobile Money Dataset, 2019.

Table 5. Tests of IIA assumption

	Hausman			Suest-based Hausman			Small-Hsiao		
Remittances channels	χ^2	df	P> chi²	χ^2	df	P> chi ²	χ^2	df	P> chi²
Banks	-4.204	13	.	13.06	14	0.522	12.198	14	0.59
Informal channel	-6.389	13	.	20.315	14	0.121	15.557	14	0.341
MTO	5.826	13	0.952	4.697	14	0.99	9.416	14	0.804

Ho: Odds(Outcome-J vs Outcome-K) are independent of other alternatives. A significant test is evidence against Ho.

Table 6. LR Test for combining alternatives

Remittances Channels	χ^2	df	P> chi²
Banks & informal channels	546.223	13	0
Banks & MTO	109.618	13	0
Informal channels & Banks	61.956	13	0

Ho: All coefficients except intercepts associated with a given pair of alternatives are 0 (i.e., alternatives can be combined).

Table 7. Likelihood-ratio Chow test

Likelihood-ratio test	LR chi2(88) = 676.04 Prob > chi2 = 0.0000

Assumption: (Full) nested in (Q1, Q2, Q3, Q4)

Akaike's information criterion and Bayesian information criterion

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
Full	3,155	-2918.559	-2498.323	32	5060.646	5254.462
Q1	626	-626.6667	-493.2477	30	1046.495	1179.676
Q2	720	-551.8863	-451.5341	28	959.0682	1087.287
Q3	951	-847.0912	-717.5223	32	1499.045	1654.485
Q4	667	-587.3715	-498.0008	30	1056.002	1191.085

Note: N=obs. used in calculating BIC.

Table 8. List of countries in the sample (35)

Benin	Guinea	Nigeria
Botswana	Kenya	Rwanda
Burkina Faso	Lesotho	Senegal
Cameroon	Liberia	Sierra Leone
Central African Republic	Madagascar	South Africa
Chad	Malawi	South Sudan
Congo Republic	Mali	Tanzania
Congo, Dem. Rep.	Mauritania	Togo
Ivory Coast	Mauritius	Uganda
Ethiopia	Mozambique	Zambia
Gabon	Namibia	Zimbabwe
Ghana	Niger	

Table 9. List of countries ranked by quartile of financial development level

Quartile 1	Quartile 2	Quartile 3	Quartile 4
Central African Republic	Ethiopia	Benin	Botswana
Chad	Ghana	Burkina Faso	Ivory Coast
Congo, Dem. Rep.	Liberia	Cameroon	Kenya
Congo Republic	Madagascar	Gabon	Mauritius
Guinea	Mozambique	Lesotho	Namibia
Malawi	Rwanda	Mali	Senegal
Sierra Leone	Tanzania	Niger	Togo
South Sudan	Zambia	Nigeria	South Africa
Uganda			

Source: Author's compilations based on IMF's Financial Access Survey, 2020.

Comment le paiement mobile affecte-t-il l'utilisation des canaux de transferts de fonds informels en Afrique subsaharienne ?

Résumé **–** L'utilisation des canaux informels de transfert de fonds par les migrants reste importante en Afrique subsaharienne. Cependant, l'usage accru du paiement mobile (*mobile money*) peut avoir un effet sur le recours aux canaux informels de transfert par les particuliers. En ce sens, cette étude examine l'impact du paiement mobile sur l'utilisation des différents canaux de transferts de fonds domestiques en Afrique subsaharienne, en utilisant les données du Global Findex 2017. Les résultats montrent que les individus qui possèdent et utilisent un compte de paiement mobile sont moins susceptibles d'envoyer des fonds par un canal informel. Ce résultat montre la pertinence de la digitalisation pour amener davantage de transferts et une plus grande formalisation de ces fonds en Afrique subsaharienne.

Mots-clés
Mobile Money
Transferts de fonds informels des migrants
Afrique subsaharienne