FINANCIAL INCLUSION UNLEASHED: MOBILE MONEY ADOPTION STRATEGIES IN THE WAEMU REGION

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Abstract

The proliferation of mobile phones in developing countries has ushered in a transformative era for financial inclusion through mobile financial technology, commonly known as mobile money. This innovative approach leverages mobile phones to facilitate financial services, including remittances, savings, loans, and limited access to bank accounts, without requiring internet connectivity. The landscape of mobile money providers varies by country, encompassing mobile operators and banks in some regions while restricted to banks in others due to regulatory frameworks.

In the West African Economic and Monetary Union (WAEMU), mobile money services are contingent upon central bank approval, involving licensed banks, microfinance institutions, and electronic money issuers. This financial innovation has extended the reach of formal financial services by capitalizing on mobile phone accessibility and an expanding network of agents.

While mobile money promises to dismantle barriers to formal financial services and integrate marginalized populations into formal financial systems, its widespread adoption remains limited. The potential of mobile financial services to drive financial inclusion is not uniform, as convenience primarily benefits individuals with existing bank accounts.

This study explores the multifaceted landscape of mobile money, its impact on financial inclusion, and the challenges associated with extending its reach to those excluded from traditional banking systems.

Keywords: Mobile money, financial inclusion, developing countries, financial services, digital finance.

1. INTRODUCTION

The growing penetration of the mobile phone in developing countries is expanding opportunities to reach large populations of people with basic financial services. Mobile financial technology, or mobile money, refers to the use of mobile phones to conduct financial services (send and receive remittances, save, apply for loans, and to some extent, access bank accounts). This technology does not rely on the Internet but uses mobile telecommunication operators' networks and short messaging systems to allow users of mobile phones to perform such transactions. The types of institutions that provide mobile money depend on each country's regulations. For instance, these institutions include mobile operators and banks in Kenya, but only banks in Uganda (Aron, 2015; Ramada-Sarasola, 2012). In the West African Economic and Monetary Union (WAEMU), only institutions that receive agreement from the central bank to launch mobile money services can stand as providers including licensed banks, microfinance institutions, and electronic money issuers (BCEAO, 2014). The financial innovation of mobile money has expanded the frontier of financial inclusion through the use of mobile phone and a growing network of agents (IGC, 2016). Mobile money appears as a solution to overcome barriers to formal financial services and to integrate poor people into formal financial systems by providing them with access to basic formal financial services.

Broader access to financial services promotes sustainable and inclusive growth and contributes in tackling poverty (Demirgüç-Kunt, Klapper, & Singer, 2013; Demirgüç-kunt et al., 2015; Munyegera & Matsumoto, 2018). However, despite the advantages of mobile money for improving access to financial services, there are only few countries where mobile money meets widespread adoption. Mobile financial services may not necessarily lead to greater financial inclusion, as these services may offer convenience in financial transactions only for individuals with bank accounts and not those without bank accounts. Moreover, Khan and Blumenstock (2017) argue that studies on the adoption of digital financial services has been dominated by macroeconomic analyses related to regulatory issues around interoperability and the logistics of mobile money agents, and very few studies have explored the adoption of mobile money from a quantitative perspective. Thus, it is important to understand what drives customers to adopt and use mobile money. In light of this, we analyze the determinants of mobile money adoption in the WAEMU.

In the WAEMU, which has eight member countries (Benin, Burkina Faso, Côte d'Ivoire, Guinea Bissau[1], Mali, Niger, Senegal, and Togo) the rate of access to banking services is estimated at around 16%, according to the central bank (BCEAO, 2017). Recently, the central bank (BCEAO) has launched an initiative to enhance financial inclusion in the WAEMU through 19 free banking services. These services include opening and closing of bank accounts, cashing checks in the WAEMU banks, cashing remittances at the national and international levels, online banking, money transfer from one account to another in the same bank, cash deposits and withdrawals, the set-up of direct debits and standards orders, credit-card payments in the WAEMU zone, and receipts of annual and monthly statements. In fact, improving access to mobile money can contribute to financial inclusion by increasing the range of financial services and lowering prices. Moreover, individuals who already have bank accounts and use mobile money can link their bank accounts to the mobile accounts, facilitating access to bank accounts in accordance with the low density of the banking infrastructures. Furthermore, there is a growing incentive for banks and microfinance institutions to attract potential users of mobile money that are currently excluded from the formal financial system by developing services that compete with/or complement mobile services. For instance, the use of the internet to execute transactions via bank websites or through applications. Microfinance institutions appear to be ineffective in promoting financial inclusion but there are opportunities to improve their efficacity (F. Fall, 2018; F. Fall, Akim, & Wassongma, 2018). Thus, mobile money appears as an opportunity that microfinance institutions can leverage to improve their efficiency by using mobile money to reach new customers and/or working as a mobile money agent (F. S. Fall & Birba, 2016; Kumar, McKay, & Rotman, 2010). Individuals without bank accounts and who are excluded from the formal financial system are now able to connect and transact securely at a lower cost and over far distances through their mobile money account. In fact, when reaching disadvantaged people with mobile money, it is found that this instrument is important for their financial management. For individuals with no bank account, accessing mobile money – inclusion effect – allows them to use various financial services such as maintaining a savings account (Dias & Mckee, 2010; Ky, Rugemintwari, & Sauviat, 2018; Munyegera & Matsumoto, 2016). Meanwhile, for those who already have bank accounts, mobile money – no inclusion effect – may appear as just an alternative channel to perform financial transactions. Poor people often need to accumulate small lumps of cash to invest into their micro-enterprises, purchase farming inputs like seeds and fertilizer, pay for school fees, or finance major life events, such as a pregnancy or wedding (Radcliffe & Voorhies, 2012).

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[1] Guinea Bissau is excluded from the sample because of the lack of survey data for this country.

This study contributes to extend the existing literature on the drivers of mobile money adoption. In this paper, we analyze drivers of mobile money adoption by distinguishing the adoption as a global state from a multistep process. Specifically, we use individual reports on *having a mobile money account* as a global state measure of mobile money adoption. These reports indicate whether the respondent has a mobile money account or not. To measure mobile money adoption as a four-step process, we use individual reports on having a mobile phone as a first step; a national ID as a second step; sending or receiving remittances, paying utility bills, receiving wage payments, making government transfers, agricultural payments, or self-employment payments through a mobile phone for the third step; and for the fourth and last step, reports on having a mobile money account. Moreover, while combining individual characteristic and macroeconomic variables, this study highlights the specific effect of mobile money regulation on its adoption in the WAEMU.

Using nationally representative survey data on 1,000 individuals from each of the seven countries of WAEMU included in this study (available from the Global Financial Inclusion Database), this study applies logistic and ordered logistic models to analyze the determinants of mobile money adoption. With regard to the adoption of mobile money as a whole state (i.e., having a mobile money account), the results show that being woman, younger, better educated, wealthier, banked, employed, and receiving domestic remittances increase the likelihood of adopting mobile money.

Moreover, being younger, better educated and banked increase the likelihood of sending money using a mobile phone, while having secondary education, having the fourth income quintile and employed increase the likelihood of receiving money using a mobile phone. Taking mobile-money adoption as a four-step process, we find that being woman, younger, better educated, wealthier, banked, employed, and receiving domestic remittances increase the likelihood of engagement in the mobile money adopting process.

Overall, the findings exhibit similarities between the determinants when considering the adoption of mobile money as a whole system or as a multi-step process. Furthermore, we take into account the particularity of each WAEMU-member country and find some disparities in the determinants of both measure of mobile money adoption. The rest of the article is organized as follows. Section 2 discusses the research framework by the mobile money in the context of WAEMU countries and the literature review. Section 3 presents the data, along with the methodology approach. Section 4 presents the empirical results and Section 5 provides the conclusions.

2. RESEARCH FRAMEWORK

2.1. The WAEMU and Mobile Money

The lack of access to formal financial services can increase inequality and lead to poverty. In reality, poverty is more than the lack of money; it entails the lack of access to the instruments and means through which people can improve their lives. Broader access to formal financial services can raise the amount of capital accumulated and thus, increase disposable funds to finance investments. The greater penetration of mobile phone services in developing countries presents alternate channels for the provision of financial services through mobile phones, that is, mobile money services. Hence, governments, central banks, international organizations, and policy makers devote their time on matters related to mobile money to enhance financial inclusion. Mobile money can be defined as an electronic wallet, which is a transactional account associated with the mobile phone number (embedded to a SIM card) that allows an individual to save and apply for credit, similar to a conventional bank account. To use mobile money services, users first need to make deposits of cash to the nearest mobile money agent who transfers the counterpart in electronic value into the client's mobile money account. Based on each country's regulations, the issuer of electronic money can be a licensed bank or a mobile phone network operator or a third-party. With mobile money, people can transfer and receive money

across long distances, store money safely, and access financial services such as savings, credit, insurance, payments (utilities, salaries).

The financial services ecosystem in WAMU is in perpetual mutation with the rise of non-bank institutions and the development of new payment uses. In fact, the use of electronic money via mobile phones, viewed as a real catalyst for financial inclusion, offers genuine opportunities for people to access digital financial services. The emergence of new actors, such as fintech providers and e-money institutions, has led to a more diverse range of electronic payment services. The Central Bank, BCEAO, is the main institution regulating financial sector activities in the region including e-money therefore implies that the regulatory framework for e-money including mobile money is the same across the eight member states of WAEMU. This is supported by Bahia and Muthiora (2019)[2] mobile money regulatory index that is a single composite indicator measuring how enabling a country's regulatory framework is. The mobile money regulation index reveals better country regulation in the Union (Table 1) that is stated between 79.74 (Guinea-Bissau) and 79.98 (Burkina Faso). Particularly, the regulation of the WAEMU mobile money system seems to be geared towards promoting innovation. Indeed, the mobile money regulation index states at 100 in each of the WAEMU countries indicates that it encourages non-banks to issue emoney, or to offer mobile money services directly or through a subsidiary thereby re-dynamizing the banking sector and improving the supply of financial services. Similarly, consumer protection is not left out of the regulation with a score of 80 (mobile money regulation index) in each WAEMU country.

Implying that (i) there are consumer protection rules in the mobile money regulatory framework; (ii) the customer protection rules in the mobile money regulatory framework require that customers are granted access to recourse and complaint procedures in order to resolve disputes; (iii) the customer protection rules in the mobile money regulatory framework require price disclosures for mobile money transactions; (iv) the customer protection rules in the mobile money regulatory provide a general disclosure requirement to make the terms of the service available to customers[4]. In fact, BCEAO issued its first regulation in 2006 specifically addressing e-money and became one of the first regulators in the world to allow issuance of e-money by nonbank institutions in partnership with banks.

Table 1. Statistics on mobile money activities in the WAEMU as of 2017

| | Index score | Eligibility | Consumer protection | Users of MM | Transaction values (billion FCFA) | Partnership | | Emoney issuers | I F S |
						Banks/Telecoms	Banks/Financial service providers		
Benin	79.93	100	80	6 569 295	1,879	2		1	1
Burkina Faso	79.98	100	80	6 968 200	3,933	2	1	1	
Côte d'Ivoire	79.82	100	80	19 147 401	6,534	2	1	3	1
GuineaBissau	79.74	100	80	373 657	3	2			

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[2] This index includes six dimensions as well as i) authorization (related to mobile money providers), ii) Consumer Protection (related to fund safeguard and protection rules), iii) account transaction Limits, iv) Know Your Customer requirements, v) agents' network and vi) infrastructure and investment environment (related to sector tax, interoperability, financial inclusion policy). For more details, please see https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2019/03/The-Mobile-Money-Regulatory-Index-1.pdf [4] Note that for the consumer protection index calculation, each of these items are awarded 25 points.

Mali	79.98	100	80	6 836 915	2,713	1		1	
Niger	79.96	100	80	2 221 745	225	3			
Senegal	79.82	100	80	5 387 731	1,262	6	5	2	
Togo	79.83	100	80	2 989 257	394	5			

Note: FSDFS stands for Digital Financial service providers.

However, in 2015 the Central Bank issued new guidelines (Instruction n°008-05-2015) highlighting the possibility for MNOs to issue e-money themselves through a separate entity for e-money issuance. This new framework requires partnership building with financial institutions to provide sophisticated products as well as savings, credit or insurance via mobile money. While all WAEMU countries share the same regulation for emoney, and most mobile money services in the zone were launched close to 2010, the ecosystem is developing unevenly across the eight markets (see Table 1). Each country market presents different dynamic, for instance the number of mobile money users is around 19 million in Cote d'Ivoire compared to 373 thousand in Guinea. Moreover, there are 5 partnerships between banks and telecom in Togo and none between banks and financial service providers while these are respectively 1 and 5 in Senegal. Furthermore, there are 8 e-money issuers[3] and 2 digital financial services (including mobile, cards or internet with limited use of traditional branch infrastructure) involved in the provision of mobile money in the WAEMU. The value of transactions involved in the mobile money scheme reach around 16,943 billion FCFA as of 2017.

2.2. Literature review

According to the literature, several studies have tried to identify the determinants of financial innovation adoption as a whole state. Allen et al. (2014), in studying determinants of financial development and inclusion in Africa, argue that technological advances, including the use of mobile phone to operate financial transactions, can facilitate financial inclusion.

After controlling for numbers of country variables, they find that the penetration of mobile telephones for receiving and sending money has been more extensive in Sub-Saharan Africa than in other developing nations. Aker and Mbiti (2010) find that although M-Pesa in Kenya has been touted as having the capacity of "banking the unbanked;" on average, M-Pesa users are wealthier, better educated, urban, and already have bank accounts. In the same vein, Demombynes and Thegeya (2012) in their analysis of the mobile savings phenomenon in Kenya, show that users of bank-integrated mobile savings systems (such as M-Kesho) remain limited and largely restricted to more privileged Kenyans, such as those who are wealthier, married, more educated, and male. Khan and Blumenstock (2017) analyze the problem of mobile money adoption in Pakistan by using a deterministic, finite automata (DFA) approach over the call detail records of a major telecom company as input. They find that network- and usage-related features are a more likely indicator of adoption for females, while mobility-related features have more predictive power for male users. Their findings show similar results for urban vs. rural and rich vs. poor districts.

Thus, mobility is the most important category of features for both urban and rural districts. Moreover, compared to rural districts, the network- and usage-related features of the users in the urban districts

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[3] It is worth to note that some terminologies have evolved in compliance with the regulations in force, hence e-money issuers include banks, financial institutions specialized in payments (or payment institutions), authorized microfinance institutions and telecoms, and other authorized nonfinancial institutions that have been authorized by BCEAO.

are not that important. Fall and Birba (2019) use survey data on 4,141 individuals to analyze the determinants of mobile banking adoption in Senegal. Using a logistic model, they find that male, level of education, employment, literacy level, and the fact of having a bank account positively influence the probability of adoption of mobile banking, while the fact of still being in school, household size, and per capita income have a negative influence. Furthermore, Zins and Weill (2016), using the World Bank's Global Findex database on 37 African countries, provide a comparative analysis of the determinants of financial inclusion for the use of mobile banking services and for the use of traditional banking services. Their results show that mobile banking adoption is driven by the same determinants as those of traditional banking in Africa, and that being a man, richer, more educated, and older favor financial inclusion, with education and income having a higher influence.

Many studies also examine factors that explain the adoption of mobile financial innovation as a multi-level process. In these studies, several theories have been used to explain the reasons behind mobile money adoption. These theories consider the features of an innovation to understand individuals' willingness to adopt mobile money. Their reasoning is built on the technology acceptance model (Davis, 1989; 1993), the theory of planned behavior (Ajzen, 1985; 1991), and the innovation diffusion theory (Rogers, 1983). These models have been expanded and used to examine the adoption of mobile financial innovation, such as mobile banking. Mobile banking refers to the use of mobile phones to perform transactions using the Internet (through websites or applications for instance). Cope et al., (2013) use survey data on mobile phone users in the United States between 2011 and 2012 and show that respondents who believe that mobile banking is unsafe, or those who do not know how safe it is, adopt mobile banking at lower rates than those who believe it is safe. Hanafizadeh et al. (2014) study factors affecting the adoption of mobile banking using data on bank clients in Iran in 2012. They find that the perceived usefulness, perceived ease of use, need for interaction, risk, cost, compatibility, credibility, and trust are factors that influence the adoption of mobile banking. Investigating demographic, attitudinal, and behavioral characteristics of online and mobile banking users in China, Laforet and Li (2005) find that users are predominantly men, and that the issue of security is the main reason for adoption; while the perception of risk, skills, and culture are the main barriers of online banking. They also find that obstacles to mobile-banking adoption include the lack of awareness and understanding of the benefits provided by mobile banking. In fact, the adoption of mobile money requires individuals to own a national identity card and a SIM card of the mobileoperator provider of mobile money. Further, Fall et al. (2015) argue that the adoption of mobile money may follow a three-phase process, namely, knowledge, possession, and use/adoption. Individuals must know what mobile money is before owning (possession) and using (adoption) it. Hence, at the first step is *knowledge*: the individual must know the product and its use. Then, he/she moves to the second step, that is, *possession*, at which stage the individual possesses an account. The last step is *adoption*, at which stage the individual starts using the product, tests it, then, adopts it. Their results suggest that age was the only factor determining the first stage of adoption; the second stage was influenced by literacy, level of education, and having access to a rotative saving and credit system. For the last stage of adoption, the key factors were education level, wages, and ownership of a business. However, it is worth noting that to experience mobile money services, it is required to own a mobile phone/SIM card of the mobile network operator that provides the mobile money services.

3. DATA AND METHODOLOGY
3.1. Data
Given the usefulness and the economic scope of mobile money, it is important to analyze the factors that determine its adoption. The purpose of this paper is to analyze the determinants of mobile money adoption in the WAEMU. We use individual-level data of 1,000 survey participants for each country of

the Union (Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal, and Togo) for the year 2017, as retrieved from the Global Financial Inclusion Database (World Bank, 2017). The database has the advantage of covering each country (except Guinea Bissau) in a nationally representative manner, with details on socio-demographic characteristics. We combine these data with macroeconomic data retrieved from World Development Indicators (World Bank Database) and mobile money regulatory index from Bahia and Muthiora (2019). We describe hereby the variables use in this study.

Mobile money adoption
We start by presenting the framework of mobile money adoption as a process of 4-steps by following Fall et al. (2015) and Afawubo et al. (2019). We assume that the adoption of mobile money first requires the possession of a national ID card. This is required particularly for the purchase of a SIM card from mobile phone operators and for all transactions.

Secondly, the subscriber identity module (SIM) card is required for subscribing for mobile money account by using the number assigned by mobile network operator (Mas & Kumar, 2008). In fact, it is the SIM card when inserted in a mobile phone allows the holder to access or install application for mobile money services. In the mobile money scheme, holder of SIM card can experience the mobile money services by receiving remittances prior to subscribing for an account[4]. Then, people could decide to adopt the mobile money account which is the ultimate step (Afawubo et al., 2019).

Individual characteristics' variables
We use several individual characteristics in identifying determinants of mobile money adoption following Zins and Weill (2016) and Allen et al., (2016) while the latter examine the determinants of formal financial account. We consider female as a binary variable that takes the value 1 for female and 0 for male. It has been argue that female are less likely to access financial services compared to male (Allen et al., 2016; Demirgüç-Kunt et al., 2013; Zins & Weill, 2016). However, given that mobile money is costless and less restrictive regarding the documents to be provided for the opening of an account, we expect this variable to have a positive sign. Age and age squared (in years) are also included as we assume that younger people are more incline to adopt rapidly an innovation with a threshold effect at which the adoption will decline. The education level is a dummy variable that takes the value 1 for completion of secondary, tertiary education or more and 0 for primary education level or less. We expect a positive relationship between high level of education and mobile money adoption. Income is a dummy variable that equals 1 if the respondent income is in the poorest 20% or second 20% income quintile, and 0 for middle 20%, fourth 20% or the richest 20% income quintile. We expect that the adoption of mobile money will increase with income and then a negative sign associated with this variable. Unbanked is a dummy variable that stands for people who have not access to banking services voluntarily or not. It has been document that mobile money have the potential to spur financial inclusion by increasing access to formal financial or banking services through mobile phone (Dermish, Kneiding, Leishman, & Mas, 2012; Jack & Suri, 2011; Kendall, 2010; Mas, 2010; Porteous, 2006). However, other studies find that mobile money users are more likely to be banked people, those with access to bank account (Aker & Mbiti, 2010; Allen et al., 2016; Zins & Weill, 2016). Hence, we expect the sign of this variable to be positive or negative. Paid activity (Employed) is a dummy variable that indicates whether respondent is in the workforce. Employed are more likely to have an account at a formal financial institution for salary payments, then we expect this variable to be positively associated with mobile money adoption. We also include Receiving domestic remittances that is a dummy variable

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[4] Note that remittances to not registered mobile money account incurs high costs for the sender that may encourage adoption of mobile money account. There is currently no cost for transfers between mobile money accounts of the same mobile money service provider.

indicating whether the respondent receives domestic remittances. We assume that receiving remittances appear as an additional source of income that may be positively related to mobile money adoption.

Macroeconomic variables

At country level, we consider an array of macroeconomic variables. Mobile Money Regulatory Index is a single composite indicator that measures how enabling a country's regulatory framework is. An enabling regulatory framework encourages competition and innovation, attracts investments from both banks and nonbanks, and allows providers to focus on operational efficiency and accelerates financial inclusion. Hence, better country's regulatory framework (associated with high value of the index) may increase mobile money adoption. We expect a positive sign associated with this variable. Gross Domestic Product Growth, the rationale behind this variable is that a well performing economy is associated with better employment and business conditions that may be positively associated with mobile money adoption. We expect a positive sign associated with this variable. Countries with lower population density may be more incline to adopt mobile money for sending or receiving remittances from relatives in remote areas compared to those countries with greater population density. Thus, we expect the variable Population Density to be negatively associated with mobile money adoption. Inflation is associated with welfare reduction and then we expect a negative association with mobile money adoption. Human Capital Index indicates the contributions of health and education to worker productivity. Therefore, full health and complete education may spur mobile money adoption. We expect a positive association between this variable and mobile money adoption. Aside these macroeconomic variables, we include alternatively a set of dummy variables for each country of our sample.

Table 2. Descriptive statistics

| Variable	Definition	Obs.	Std. Dev.	Mean (WAEMU)	Mean (SSA)
Dependent variables					
Has a mobile money account	Indicates whether respondent has a mobile money account, encoded as Yes = 1, No = 0.	7,000	0.452	0.287	0.276
Send money through mobile phone	Indicates whether the respondent has sent money through mobile phone, encoded as Yes = 1, No = 0	2,097	0.469	0.674	0.584
Received money through mobile phone	Indicates whether the respondent has received money through mobile phone, encoded as Yes = 1, No = 0	2,364	0.480	0.640	0.577
Mobile money adoption (4-steps process)	Indicates mobile money adoption as a process of 4-steps. Encoded as not having a mobile money account = 0; having a national ID = 1; having a mobile phone = 2; sending/receiving remittances via a mobile phone, or performing payments (utility bills, receive wage payments, or government transfers, or agricultural payments, or selfemployment payments) through a	7,000	1.332	2.345	2.247

	mobile phone = 3; and having a mobile money account = 4.				
Individual characteristics					
Female	Indicates the gender of respondent, encoded as Female = 1, Male = 0.	7,000	0.493	0.585	0.489
Age	Indicates the age of respondent	6,944	14.165	32.725	34.033
Education	Indicates education level of respondent, encoded as completed Primary or less = 1 (reference); Secondary = 2; completed Tertiary or more = 3.	6,936	0.490	0.391	0.476
Income	Indicates the range of income quintile of respondent, encoded as Poorest 20% = 1; Second 20% = 2; Middle 20% = 3; Fourth 20% = 4; Richest 20% = 5.	7,000	0.468	0.325	0.337
Unbanked	Indicates whether respondent has or not a bank account, encoded as not having a bank account = 1, otherwise = 0.	7,000	0.421	0.770	0.689
Paid activity (Employed)	Indicates whether respondent is in the workforce, encoded as being in the workforce = 1, otherwise = 0.	7,000	0.468	0.677	0.694
Receive domestic remittances	Indicates whether the respondent received domestic remittances, encoded as receiving domestic remittances = 1, otherwise = 0.	6,946	0.474	0.341	0.355
Macroeconomic variables					
Mobile Money Regulatory Index	A single composite indicator that measures how enabling a country's regulatory framework is. High value indicates better country's regulatory framework.	7,000	0.070	79.902	74,691
GDP Growth (annual %)	Indicates country annual percentage growth rate of Gross Domestic Product.	7,000	1.077	5.900	3.833
Population Density	Indicates midyear population divided by land area in square kilometers.	7,000	41.250	71.423	91.395
Inflation (annual %)	Indicates inflation as measured by the consumer price index.	7,000	1.087	1.262	11.095
Human Capital Index	Indicates the human capital index that calculates the contributions of health and education to worker productivity. The final index score ranges from 0 to 1, with 1 indicating full health and complete education.	7,000	0.040	0.370	0.391

Note: For our variable education level, the omitted dummy variable is the primary school or less.

Similarly, for the income quintile, the omitted dummy variable is the Poorest 20% income quintile. SSA stands for Sub-Saharan Africa. Table 2 presents the descriptive statistics for all variables included in the estimations.

We report the mean for our sample and also that of Sub-Saharan Africa[5] for comparison; thus, we have a benchmark to compare WAEMU indicators. Around 29% of individuals in WAEMU reported having a mobile money account, compared to 28% in Sub-Saharan African countries. We also show that around 67% and 64% of individuals in WAEMU use mobile phone respectively to send and receive money compared to 58% for both in Sub-Saharan African countries. In fact, Sub-Saharan Africa leads the world with regard to mobile money, especially East Africa, where the scale of mobile money adoption has been unprecedented and its impacts, considerable. Comparing individuals with an account at a financial institution versus those with a mobile money account (Figure 1a), we show that in Côte d'Ivoire, Senegal,

Figure 1a. Financial institution account minus Mobile money account (%). Female.

| -20% | -12% | -6% | 0% | 6% | 12% | 18% |
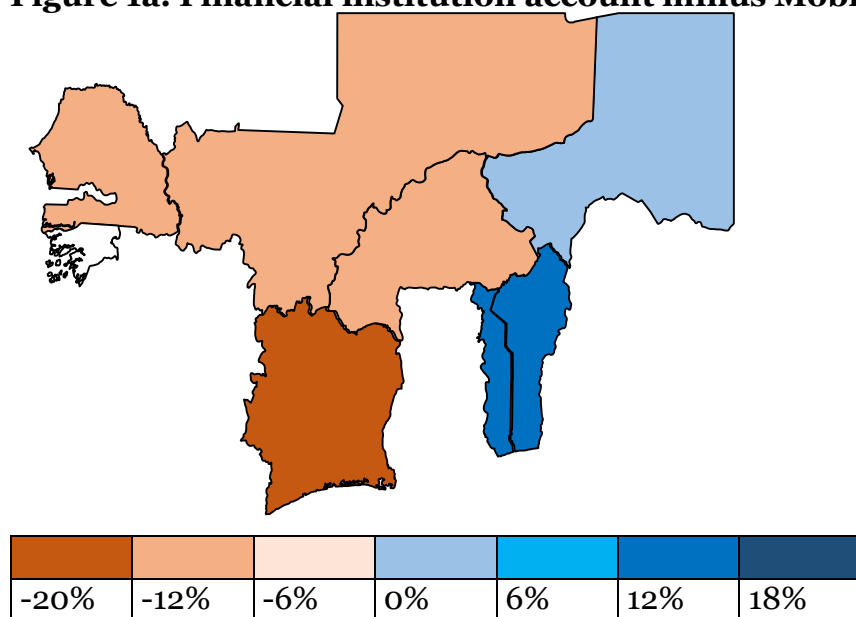
Source: Author's analysis using Global Financial Index Database, 2017.

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[5] Sub-Saharan Africa includes the following countries: Benin, Botswana, Burkina Faso, Cameroon, Central African Republic, Chad, Congo Democratic Republic, Congo Republic, Cote d'Ivoire, Ethiopia, Gabon, Ghana, Guinea, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, South Sudan, Tanzania, Togo, Uganda, Zambia, and Zimbabwe.

Figure 1b. Mobile money account (%): Male minus

| 3% | 6% | 9% | 12% | 15% | 18% |
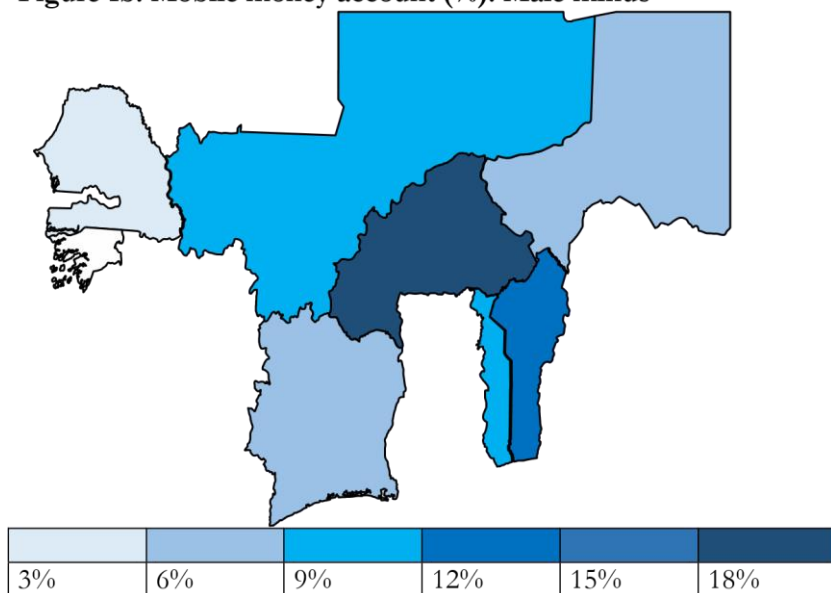
Burkina Faso, and Mali, there are more mobile money accounts than accounts at financial institutions (with a difference of 19, 11, 10, and 6 percentage points, respectively). Hence, these statistics imply that either mobile money reaches people who are excluded from the formal financial system, or that some individuals have more than one mobile money account. In WAEMU, 23% of individuals reported having a bank account, while in Sub-Saharan African countries, 31% of individuals did. Similar statistics are found in WAEMU and in SubSaharan Africa for respondents engaged in the workforce (68% and 69%, respectively) and receiving remittances (34% and 35%, respectively). Considering mobile phone ownership, 73% of WAEMU respondents indicated owning a mobile phone, compared with 68% (on average) in Sub-Saharan Africa. However, 64% of respondents in WAEMU reported having a national ID, while 71% of respondents in Sub-Saharan Africa did. Regarding individual characteristics, the sample includes 58% female, with 36% and 3% of the participants having secondary and tertiary education levels, respectively. There are 17% and 28% of the participants within the second- and fifthincome quintiles, respectively. Moreover, we report that in all WAEMU countries, the males have more advantage than the females with regard to access to mobile money accounts (Figure 1b); while the participants who are out of the labor force, have less education, and the poorest 40% have less access to mobile money accounts than those who are in the labor force, have higher education, and belonging to the richest 60% (Figure 2 in the Appendix). Furthermore, the young have less access to mobile money accounts than the adult participants, except in Benin, Mali, and Togo.
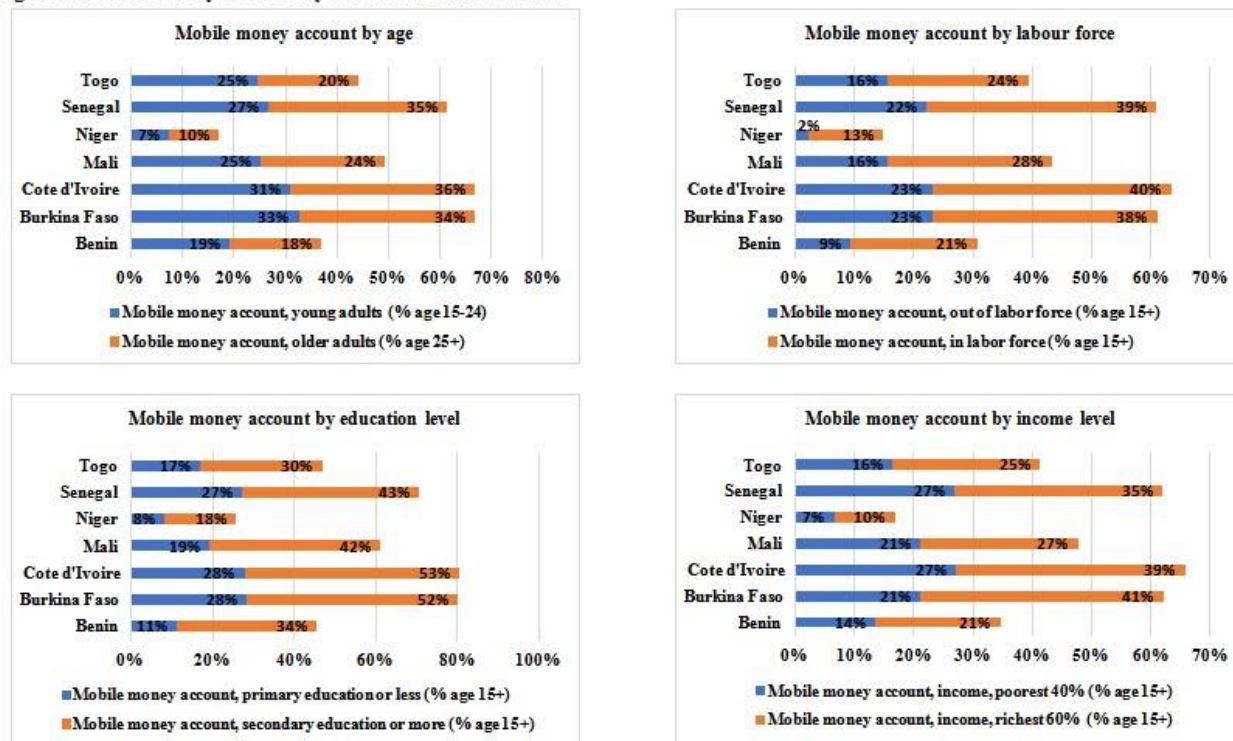
Figure 2. Mobile money account by individual characteristics

Source: Author's analysis using Global Financial Index Database, 2017.

1.1. Methodology

We turn now to the description of the empirical specifications used to analyze the adoption of mobile money services in this study. We distinguish the adoption of as a global state from the adoption as a multi-step process.

First, we use a logistic model by following Fall and Birba (2019) to analyze the adoption of mobile money as a global state by considering the following specification:

$$PROB\{MMacc_i = 1\} = \varphi(\alpha_1 + \alpha_2 X_i + \alpha_3 MC_i) \quad (1)$$

where φ is the cumulative distribution function of the logistic distribution.

In equation (1), $MMacc_i$ is the dependent variable that stands for having a mobile money account that proxy mobile money adoption as a global state. It is a binary variable that takes the value 1 if an individual has a mobile money account and 0 otherwise. We also consider sending or receiving money through mobile phone as alternative dependent variables that proxies mobile money usage.

X_i is a vector of the variable at individual level as well as gender, age, education, income, access to bank, employment and remittances. MC_i stand alternatively for country level dummy and macroeconomic variables including gross domestic product growth, inflation rate, population density and regulation framework that may also affect the adoption of mobile money.

Second, based on existing literature and the study of Afawubo et al. (2019), we identify different steps of mobile money adoption. To take these steps (η_k) into account, a novel dependent variable $MMadp_i$ is constructed as follows. This variable takes the value 1 if an individual reports having a national ID; the value 2 if he/she reports having a mobile phone; the value 3 if he/she indicates sending or receiving

$$PROB\{MMadp_i = \eta_k\} = \varphi(\beta_1 + \beta_2 X'_i + \beta_3 MC'_i)$$

remittances via a mobile phone, paying utility bills, receiving wage payments, government transfers, agricultural payments, or selfemployment payments through a mobile phone; and the value 4 is he/she reports having a mobile money account. With this novel dependent variable (with $\eta_k = 1; 2; 3; 4$), we used an ordered logistic approach to estimate the following specification:

$$\text{(2)}$$

where is the cumulative distribution function of the logistic distribution.

where is the same vector of individual characteristic variables, X' is the same vector of macroeconomic MC' variables. For the ordered logit model, we check and report the relevance[6] of the endpoints , η_k of the dependent variable *mobile money adoption* using a Wald test of coefficients associated with the endpoints of shifting from 0 to 1 ($H_0: \eta_1 = 0$), 1 to 2 ($H_0: \eta_2 = \eta_1$), 2 to 3 η_3), and from 3 to 4 ($H_0: \eta_4 = \eta_3$)

2. RESULTS

This section reports the empirical results from the logit and the ordered logit models' estimations[7] that we use to analyze mobile money adoption respectively as a global state and as a 4-steps process.

In Table 3, columns 1 to 6 present results from Logit model and in columns 7 to 8 the results from Ordered Logit. We show results including country dummy and those including macroeconomic variables abreast. Overall, the results on individual characteristics are very similar when including alternatively country dummy and macroeconomic variables, hence we only comment results reported in odd-numbered columns.

Table 3. Determinants of mobile money adoption in WAEMU (Marginal effects).

	Logit regressions (Marginal Effects)						Ordered Logit regressions (Marginal Effects)	
	Has a mobile money account		Send money through mobile phone		Received money through mobile phone		Adoption of mobile money as a 4-steps process	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Individual characteri stics								
Female	0.057***	0.057***	0.045*	0.045*	0.017	0.017	0.058***	0.057***
	(0.012)	(0.012)	(0.027)	(0.027)	(0.025)	(0.025)	(0.007)	(0.008)
Age	0.005**	0.005**	0.008**	0.008**	0.007*	0.007*	0.010***	0.007***

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[6] In addition, we also replicate our estimations using the Omodel command of Stata 14 which report an approximate likelihood-ratio test of whether the coefficients are equal across categories (it is a test of the proportional-odds assumption if logit is the requested model). Hence, a significant p-value is evidence to reject the null hypothesis that the coefficients are equal across categories, which is the case in our study. We find from equation (2) the Wald chi-square of 864.34 and 755.29 both significant at 1% when adding country dummy or macroeconomic variables respectively.

[7] The reported Wald test of coefficients associated with the endpoints reported in the tables rejects the null hypothesis of shifting from 0 to 1 ($H_0: \eta_1 = 0$), 1 to 2 ($H_0: \eta_2 = \eta_1$), 2 to 3 ($H_0: \eta_3 = \eta_2$), and from 3 to 4 ($H_0: \eta_4 = \eta_3$). Moreover, the chi-square test rejects the null hypothesis confirming the relevance of the four steps considered in the process of mobile money adoption.

	(0.002)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)	(0.001)	(0.001)
Age squared	-0.000**	-0.000**	-0.000**	-0.000**	-0.000*	-0.000*	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education Secondary	0.107***	0.106***	0.106***	0.108***	0.115***	0.119***	0.131***	0.117***
	(0.014)	(0.014)	(0.027)	(0.027)	(0.026)	(0.026)	(0.009)	(0.011)
Education Tertiary	0.155***	0.151***	0.201***	0.206***	0.118*	0.128*	0.172***	0.150***
	(0.041)	(0.041)	(0.050)	(0.049)	(0.068)	(0.067)	(0.026)	(0.032)
Income Second 20%	0.040**	0.040**	0.010	0.008	0.009	0.006	0.023*	0.019
	(0.019)	(0.019)	(0.052)	(0.052)	(0.046)	(0.046)	(0.012)	(0.013)
Income Middle 40%	0.052***	0.052***	0.066	0.065	0.038	0.036	0.020*	0.025**
	(0.019)	(0.019)	(0.050)	(0.050)	(0.044)	(0.044)	(0.011)	(0.013)
Income Fourth 20%	0.054***	0.054***	0.013	0.011	0.094**	0.091**	0.045***	0.054***
	(0.019)	(0.019)	(0.048)	(0.048)	(0.043)	(0.043)	(0.011)	(0.012)
Income Richest 20%	0.072***	0.073***	0.052	0.048	0.044	0.040	0.076***	0.069***
	(0.018)	(0.018)	(0.046)	(0.046)	(0.042)	(0.042)	(0.011)	(0.013)
Unbanked	-0.083***	-0.082***	-0.083***	-0.083***	-0.047	-0.049*	-0.093***	-0.099***
	(0.015)	(0.015)	(0.028)	(0.028)	(0.030)	(0.030)	(0.009)	(0.011)
Paid activity (Employed)	0.103***	0.103***	0.062*	0.064**	0.082***	0.084***	0.092***	0.084***
	(0.013)	(0.013)	(0.032)	(0.032)	(0.027)	(0.027)	(0.008)	(0.009)
Receive remittances	0.180***	0.180***	0.089***	0.088***	(Omitted)	(Omitted)	0.230***	0.213***
	(0.011)	(0.011)	(0.026)	(0.026)			(0.007)	(0.009)
Country dummy								
Benin	-0.033		-0.126***		-0.059		0.017	

	(0.023)		(0.044)		(0.047)		(0.013)	
Burkina Faso	0.116***		0.181***		0.124***		0.137***	
	(0.022)		(0.050)		(0.047)		(0.013)	
Côte d'Ivoire	0.124***		0.113**		0.101**		0.142***	
	(0.021)		(0.046)		(0.046)		(0.013)	
Mali	0.050**		0.108**		0.044		0.077***	
	(0.023)		(0.050)		(0.047)		(0.013)	
Niger	-0.090***		-0.286***		-0.279***		-0.078***	
	(0.028)		(0.062)		(0.054)		(0.014)	
Senegal	0.112***		-0.033		0.106**		0.109***	
	(0.022)		(0.047)		(0.046)		(0.013)	
Macroeconomic varia bles								
Mobile Money Regul atory Index	0.868***		2.632***		1.747***		0.739***	
		(0.155)		(0.359)		(0.315)		(0.105)
GDP Growth (annual %)	0.083***		0.142***		0.122***		0.069***	
		(0.008)		(0.017)		(0.015)		(0.005)
Population Density	-0.002***		-0.002**		-0.003***		-0.001***	
		(0.001)		(0.001)		(0.001)		(0.000)
Inflation (annual %)	-0.104***		-0.248***		-0.196***		-0.075***	
		(0.014)		(0.028)		(0.028)		(0.009)
Human Capital Index	0.817**		0.330		2.225***		0.494*	
		(0.367)		(0.823)		(0.775)		(0.270)
Wald test H₀: cut1=0							0.367**	422.687***
							(0.187)	(59.538)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Wald test H_0: cut2=cut1							-0.775***	-0.785***
							(0.029)	(0.035)
Wald test H_0: cut3=cut2							-2.177***	-2.058***
							(0.040)	(0.047)
Wald test H_0: cut4=cut3							-0.789***	-0.763***
							(0.025)	(0.032)
Observations	6,839	6,839	2,062	2,062	2,340	2,340	6,839	6,839
Pseudo R-square	0.164	0.164	0.117	0.117	0.0748	0.074	0.143	0.122
Wald chi2	780.9***	774.4***	156.7***	159.6***	140.6***	143.9***	2414***	1472***

Note: The columns (1) to (6) report logistic regression and columns (7) to (8) present Ordered logistic regression results. In all columns we present the corresponding marginal effects (ME). *** Significant at the 1 per cent level, ** Significant at the 5 per cent level, * Significant at the 10 per cent level.

Considering results from logit model, the results reveal a positive and significant association between having a mobile money account or sending money through mobile phone and being female. Thus, the likelihood of women having or adopting a mobile money account or sending money through mobile phone increases respectively by 6 and 5 percentage points as compared to men. These results are consistent with previous studies that describe that mobile money presents an opportunity to empower women (Morawczynski & Pickens, 2009) and reduce the gap that exist between women and men in the access of financial services (Garz, Heath, Kipchumba, & Sulaiman, 2020). The results show a positive and significant coefficient associated with age and a negative and significant coefficient associated with age squared, reflecting a hump-shape association between mobile money adoption and age. These results imply that the likelihood of having mobile money account, sending or receiving money through mobile phone is respectively 0.5, 0.8 and 0.7 percentage points higher for younger individuals compared to older individuals. In addition, the results show that the likelihood of having a mobile money account, sending or receiving money through mobile phone is respectively around 11 percentage points higher for individuals with secondary education compared to less educated individuals (primary or less, the reference group). Similarly, the likelihood of having a mobile money account, sending or receiving money through mobile phone is respectively around 16, 20 and 12 percentage points higher for individuals with tertiary education or more compared to less educated individuals. Our results are supported by previous studies (Aker & Mbiti, 2010; F. S. Fall & Birba, 2019; Zins & Weill, 2016) and suggesting that the use of mobile money requires a minimum level of education to understand the services offered and how to access and use these services through a mobile phone.

Considering the income level, for individuals with income ranging from the second 20% to the richest 20% the likelihood of having a mobile money account is respectively 4, 5, 5 and 7 percentage points higher compared to the poorest 20%. Moreover, the likelihood of receiving money through mobile phone is 9 percentage points higher for the income fourth 20% compared the poorest 20%. These

results suggest that the wealthier individuals are more likelihood to have a mobile money account than the poorest (Aker & Mbiti, 2010; Zins & Weill, 2016). Our findings show that having a bank account is associated with an increase in the likelihood of having a mobile money account or sending money through mobile phone by respectively 8 percentage points compared to individuals without a bank account. Thus, individuals who have bank accounts may consider mobile money as a new channel to conduct financial transactions. Although mobile money has been touted as "banking the unbanked" (Della Peruta, 2017; F. S. Fall & Birba, 2019; Mas & Mayer, 2011; Mbiti & David Weil, 2016), the results are consistent with those of Aker and Mbiti (2010) that individuals with bank accounts are more likely to adopt mobile money or to have a mobile money account than individuals without a bank account. Moreover, the system of mobile money allows individuals who already have a bank account to link their bank account to the mobile money account, and this may motivate them to adopt or to have a mobile money account (Aron, 2017; Munyegera & Matsumoto, 2016). Thus, individuals having both accounts can avoid long queues in a bank agency and execute a remote deposit or withdrawal from their bank account through the mobile money account. The results also show that the likelihood of having a mobile money account, sending or receiving money through mobile phone is respectively 10, 6 and 8 percentage points higher for individuals in the workforce compared to inactive people. These findings are in line with the results of Fall and Birba (2019) and support those of Blumenstock et al. (2015) suggesting that people in the workforce are more likely to use mobile money for their financial management because of the convenience it provides in performing financial operations. Furthermore, the results reveal that receiving domestic remittances increases the likelihood of individuals having mobile money account, sending money through mobile phone by respectively 18 and 10 percentage points compared to those who do not receiving domestic remittances.

Taking results from ordered logit model, our findings are consistent with those obtain using the logit model for almost the variables. We find that being a female increases the likelihood of adopting mobile money account by around 6 percentage points compared to male. The positive and significant coefficient associated with age and the negative and significant coefficient associated with age squared reflect a hump-shape association between mobile money adoption and age. Implying that the likelihood of adopting mobile money account is 1 percentage point higher for younger individuals compared to older individuals. The results also show that the likelihood of adopting a mobile money account is respectively 10 and 20 percentage points higher for individuals with secondary and tertiary education compared to less educated individuals. Moreover, we find that for individuals with income ranging from the second 20% to the richest 20% the likelihood of having a mobile money account is respectively 2, 4 and 8 percentage points higher compared to the poorest 20%. Our findings show that being unbanked is associated with a decrease in the likelihood of adopting mobile money account by 9 percentage points compared to banked individuals. In addition, our results show that the likelihood of adopting mobile money account are 9 and 20 percentage points higher for respectively individuals in the workforce and those receiving domestic remittances compared to inactive people and those who do not receiving domestic remittances.

Regarding our country dummy variables when considering mobile money adoption as a global state, we find that being in Burkina Faso and Côte d'Ivoire, people have more likelihood to have mobile money account, to send or receive money using mobile phone compared to those in Togo (the reference). Also, being in Mali people have more likelihood to have a mobile money account, to send money using mobile phone compared to those in

Table 4. Determinants of mobile money adoption as a global state by country (Marginal effects).

	Logit regressions (Marginal Effects)											
	Benin			Burkina Faso			Côte d'Ivoire			Mali		
	Has a mobile money account	Send money through mobile phone	Received money through mobile phone	Has a mobile money account	Send money through mobile phone	Received money through mobile phone	Has a mobile money account	Send money through mobile phone	Received money through mobile phone	Has a mobile money account	Send money through mobile phone	Received money through mobile phone
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Female	0.052**	0.111	-0.037	0.122***	0.110*	0.049	0.055	0.058	0.087	0.029	0.042	0.081
	(0.027)	(0.068)	(0.070)	(0.035)	(0.057)	(0.057)	(0.034)	(0.063)	(0.058)	(0.033)	(0.070)	(0.067)
Age	0.007	0.021*	0.020*	0.001	0.004	-0.002	0.009*	0.009	0.005	0.005	0.007	0.008
	(0.005)	(0.012)	(0.012)	(0.007)	(0.009)	(0.010)	(0.005)	(0.009)	(0.009)	(0.005)	(0.011)	(0.012)
Age squared	-0.000	-0.000*	-0.000**	-0.000	-0.000	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education Secondary	0.144***	0.261***	0.192**	0.142***	0.128**	0.170***	0.156***	0.129**	0.087	0.133***	0.074	0.156**
	(0.034)	(0.074)	(0.083)	(0.042)	(0.051)	(0.059)	(0.040)	(0.058)	(0.057)	(0.044)	(0.070)	(0.076)
Education Tertiary	0.195***	0.278**	0.210	0.119	(Omitted)	0.062	0.302*	0.039	(Omitted)	0.177	0.152	0.085
	(0.062)	(0.131)	(0.143)	(0.124)		(0.234)	(0.160)	(0.214)		(0.117)	(0.097)	(0.158)
Income Second 20%	0.111***	0.042	0.015	0.056	-0.159	-0.003	-0.015	0.246**	-0.165	-0.013	0.135	-0.060
	(0.040)	(0.124)	(0.121)	(0.058)	(0.103)	(0.107)	(0.056)	(0.112)	(0.106)	(0.052)	(0.117)	(0.122)
Income Middle 20%	0.082**	0.062	0.015	0.093	0.002	-0.083	0.026	0.180*	0.122	0.025	0.059	0.148
	(0.039)	(0.122)	(0.130)	(0.057)	(0.095)	(0.107)	(0.055)	(0.104)	(0.095)	(0.050)	(0.112)	(0.107)
Income Fourth 20%	0.094**	-0.019	-0.003	0.111*	-0.014	0.045	0.046	0.214**	0.224***	-0.034	0.004	0.080
	(0.043)	(0.125)	(0.127)	(0.060)	(0.085)	(0.101)	(0.053)	(0.103)	(0.086)	(0.048)	(0.122)	(0.113)
Income Richest 20%	0.077**	0.009	-0.029	0.104*	-0.018	0.103	0.077	0.151	0.032	0.006	0.070	-0.059
	(0.035)	(0.112)	(0.118)	(0.059)	(0.089)	(0.099)	(0.054)	(0.103)	(0.095)	(0.052)	(0.111)	(0.113)
Unbanked	-0.089***	-0.109	-0.130*	-0.171***	-0.077	-0.074	-0.047	-0.087	0.010	-0.092**	0.012	0.034
	(0.027)	(0.068)	(0.069)	(0.041)	(0.055)	(0.069)	(0.050)	(0.066)	(0.070)	(0.046)	(0.081)	(0.081)
Paid activity (Employed)	0.094***	-0.081	0.037	0.135***	0.081	0.159***	0.118***	0.052	0.046	0.095**	0.116	0.066
	(0.031)	(0.095)	(0.090)	(0.036)	(0.055)	(0.055)	(0.036)	(0.064)	(0.059)	(0.039)	(0.078)	(0.077)
Receive remittances	0.133***	0.097	(Omitted)	0.161***	-0.046	(Omitted)	0.234***	0.148**	(Omitted)	0.190***	0.134**	(Omitted)
	(0.026)	(0.067)		(0.034)	(0.057)		(0.030)	(0.060)		(0.028)	(0.063)	
Observations	977	319	300	970	349	404	985	386	405	984	281	320
Pseudo R-square	0.193	0.107	0.085	0.152	0.118	0.091	0.129	0.088	0.088	0.128	0.058	0.050
Wald chi2	139.2***	29.98***	24.80***	121.3***	25.39***	25.73***	113.5***	25.29**	27.25***	90.63***	12.74	13.65

Note: The table reports logistic regression results. In all columns we present the corresponding marginal effects (ME) *** Significant at the 1 per cent level, ** Significant at the 5 per cent level, * Significant at the 10 per cent level.

Togo, while being in Senegal people have more likelihood to have a mobile money account, to receive money using mobile phone compared to those in Togo. By contrast, being in Niger people have less likelihood to have mobile money account, to send or receive money using mobile phone compared to those in Togo. Being in Benin people have less likelihood to send money using mobile phone compared to those in Togo. When considering mobile money adoption as a 4-steps process we find similar results. Being in Burkina Faso, Côte d'Ivoire, Mali and Senegal people are more engaged in the mobile money adoption process than in Togo, while being in Niger people are less engaged in the mobile money adoption process. Overall, these findings may suggest that Burkina Faso and Côte d'Ivoire lead the Union in the mobile money adoption and usage, following by Senegal, Mali, Togo, Niger and Benin.

Turning now to our macroeconomic variables, we find that mobile money regulation index and GDP growth positively and significantly associated with our dependent variables. Hence, better country regulation framework or increased GDP growth rate increases the likelihood of having mobile money account, sending or receiving money using mobile phone. In the same line, we find that human capital index positively and significantly related to having mobile money account and receiving money through mobile phone. Implying that better human capital index increases the likelihood of having a mobile money account, and receiving money using mobile phone. By contrast, the results show that population density and inflation rate negatively and significantly associated with the dependents variables. Thus, lower population density or inflation rate increases the likelihood of having mobile money account,

sending or receiving money using mobile phone. All these findings suggest that better country condition may promote financial inclusion by improving access and usage of mobile money.

In a further investigation (Tables 4, 5 and 6), we take into account the particularity of each country and find disparities in the drivers of mobile money adoption. Regarding mobile money adoption as a global state (Tables 4 and 5), the findings show that only in Benin, Burkina Faso, Niger and Togo where the likelihood of woman to adopt mobile money account is higher compared to men. Regarding age, the results show that in Niger, the likelihood of younger to send money through mobile phone is higher compared to older.

While in Senegal, the likelihood of older to have mobile money account or send money through mobile phone is higher compared to younger. The results show that in all WAEMU countries except in Niger and Togo, the likelihood of having a mobile money account is higher for secondary educated compared to primary educated or less.

Table 5. Determinants of mobile money adoption as a global state in each country of WAEMU (Marginal effects). (Continued)

	Send Has a money mobile through money mobile account phone	Received money through mobile phone	Send Has a money mobile through money mobile account phone	Received money through mobile phone	Send Has a money mobile through money mobile account phone	Received money through mobile phone			
	Logit regressions (Marginal Effects)								
	Niger			Senegal			Togo		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Female	0.047**	0.142	-0.018	0.022	0.020	-0.089	0.070**	-0.062	0.053
	(0.023)	(0.104)	(0.072)	(0.034)	(0.072)	(0.059)	(0.036)	(0.074)	(0.074)
Age	0.003	-0.035***	0.020*	0.013**	0.027**	0.013	-0.003	0.016	-0.008
	(0.003)	(0.010)	(0.010)	(0.005)	(0.011)	(0.009)	(0.009)	(0.012)	(0.012)
Age squared	-0.000	0.000***	-0.000**	-0.000**	-0.000**	-0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Education Secondary	-0.021	-0.132*	-0.076	0.096***	0.099	0.071	0.061*	0.058	0.064
	(0.023)	(0.074)	(0.077)	(0.036)	(0.075)	(0.060)	(0.033)	(0.076)	(0.078)
Education Tertiary	(Omitted)	(Omitted)	(Omitted)	0.055	0.216	0.048	0.156*	0.276***	0.163
				(0.094)	(0.148)	(0.161)	(0.087)	(0.092)	(0.131)
Income Second 20%	0.004	-0.403*	0.026	0.038	-0.051	0.036	0.096*	-0.083	0.380***
	(0.033)	(0.213)	(0.098)	(0.052)	(0.145)	(0.092)	(0.055)	(0.159)	(0.137)
Income Middle 20%	0.049	-0.092	0.074	0.043	-0.083	-0.074	0.064	0.156	0.244*
	(0.039)	(0.244)	(0.127)	(0.055)	(0.151)	(0.099)	(0.055)	(0.164)	(0.132)
Income Fourth 20%	0.031	-0.378*	0.296***	0.026	-0.144	-0.143	0.101**	0.092	0.360***
	(0.035)	(0.223)	(0.111)	(0.055)	(0.144)	(0.098)	(0.051)	(0.153)	(0.131)
Income Richest 20%	0.038	-0.287	0.153	0.114**	0.103	-0.004	0.078*	0.101	0.247*
	(0.036)	(0.210)	(0.116)	(0.053)	(0.132)	(0.092)	(0.045)	(0.150)	(0.133)
Unbanked	-0.064**	-0.173**	-0.076	-0.113**	-0.065	-0.062	-0.029	-0.142**	0.023
	(0.029)	(0.086)	(0.100)	(0.045)	(0.071)	(0.072)	(0.032)	(0.068)	(0.074)
Paid activity	0.106***	0.205*	0.288***	0.080**	0.072	0.025	0.080**	-0.043	0.061
	(0.030)	(0.120)	(0.089)	(0.035)	(0.087)	(0.064)	(0.039)	(0.097)	(0.075)
Receive remittances	0.138***	0.043	(Omitted)	0.234***	0.159**	(Omitted)	0.151***	0.083	(Omitted)
	(0.020)	(0.095)		(0.028)	(0.069)		(0.029)	(0.073)	
Observations	965	145	218	975	281	385	981	288	300

			0.132			0.038			
Pseudo R-square	0.227	0.195		0.134	0.101		0.092	0.097	0.050
Wald chi2	86.21***	21.34**	22.62**	110.6***	25.15**	13.86	58.81***	25.87**	12.56

Note: The table reports logistic regression results. In all columns we present the corresponding marginal effects (ME) *** Significant at the 1 per cent level, ** Significant at the 5 per cent level, * Significant at the 10 per cent level.

We find similar results on sending or receiving money through mobile phone in Benin and Burkina Faso, on sending money through mobile phone in Côte d'Ivoire and on receiving money through mobile phone in Mali. For tertiary educated, their likelihood of having a mobile money account or sending money through mobile phone is higher compared to primary educated or less in Benin, while they are more likely to sending money through mobile phone compared to compare to primary educated or less in Togo. Our results also show that individual with income in the second quintile 20% are more likely to have a mobile money account than the poorest 20% in Benin only. While they are more likely to send money through mobile phone than the poorest 20% in Côte d'Ivoire, and to receive money through mobile phone than the poorest 20% in Togo. Individual being in the middle quintile 20% are more likely to have a mobile money account than the poorest 20% only in Benin.

Individual being in the fourth 20% are more likely to have a mobile money account than the poorest 20% in Benin and Togo, to send money through mobile phone in Côte d'Ivoire, and to receive money through mobile phone in Togo. Individual being in the richest 20% are more likely to have a mobile money account than the poorest 20% in Benin and Senegal. For unbanked people, the results show that they are less likely to have a mobile money account than banked people in Benin, Burkina, Mali, Niger and Senegal, and to send money through mobile phone in Niger and Togo. For employed people (those with paid activity) we find that they are more likely to have a mobile money account in all WAEMU countries, and to receive money through mobile phone in Burkina Faso and Niger. For individual receiving domestic remittances, we find that they are more likely to have a mobile money account than those who don't receive domestic remittances in all WAEMU countries, and to send money through a mobile phone in Côte d'Ivoire, Mali and Senegal.

Taking mobile money adoption as a 4-steps process (Table 6), our results show that woman, secondary educated, employed (those with paid activity) and those receiving domestic remittances are more engaged in the mobile money adoption process than man, primary educated or less, unemployed and those not receiving domestic remittances in all WAEMU countries. We also find that younger people are more engaged in the mobile money adoption process than older particularly in Benin, Côte d'Ivoire, Mali and Senegal. Similarly, tertiary educated are more engaged in the mobile money adoption process than primary educated or less particularly in Benin, Côte d'Ivoire and Togo, while in Niger it is the opposite, primary educated or less are more engaged in the mobile money adoption process than tertiary educated. Looking at the income quintile, the results reveal that individual being in the second 20% are more engaged in the mobile money adoption process than the poorest 20% in Benin and Togo. Individual being in the fourth 20% are more engaged in the mobile money adoption process than the poorest 20% in Benin, Burkina Faso and Togo. In the same line, individual being in the richest 20% are more engaged in the mobile money adoption process than the poorest in Benin, Burkina Faso, Senegal and Togo. The results also show that unbanked people are less engaged in the mobile money adoption process than banked people.

Table 6. Determinants of mobile money adoption as a 4-steps process in each country of WAEMU (Marginal effects).

	Ordered Logit regressions (Marginal Effects)						
	Adoption of mobile money as a 4-steps process						
	Benin (1)	Burkina Faso (2)	Côte d'Ivoire (3)	Mali (4)	Niger (5)	Senegal (6)	Togo (7)
Female	0.064***	0.088***	0.059**	0.053**	0.051***	0.010	0.065**
	(0.017)	(0.028)	(0.027)	(0.021)	(0.012)	(0.024)	(0.026)
Age	0.007***	0.006	0.014***	0.008***	0.003*	0.015***	0.002
	(0.002)	(0.005)	(0.004)	(0.003)	(0.002)	(0.003)	(0.005)
Age squared	-0.000***	-0.000	-0.000***	-0.000***	-0.000***	-0.000**	-0.000***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education Secondary	0.119***	0.154***	0.200***	0.148***	0.032*	0.099***	0.068***
	(0.024)	(0.033)	(0.034)	(0.032)	(0.018)	(0.028)	(0.023)
Education Tertiary	0.157***	0.125	0.333***	0.137	-0.040**	0.051	0.138**
	(0.050)	(0.098)	(0.113)	(0.090)	(0.018)	(0.071)	(0.062)
Income Second 20%	0.052**	0.001	-0.028	-0.003	-0.011	0.003	0.096**
	(0.025)	(0.041)	(0.043)	(0.033)	(0.016)	(0.034)	(0.039)
Income Middle 40%	0.023	-0.006	0.022	0.018	-0.001	0.025	0.067*
	(0.024)	(0.042)	(0.040)	(0.032)	(0.018)	(0.037)	(0.034)
Income Fourth 20%	0.078***	0.096**	0.022	0.012	0.028	0.032	0.082**
	(0.028)	(0.044)	(0.039)	(0.029)	(0.018)	(0.037)	(0.033)
Income Richest 20%	0.065***	0.102**	0.041	0.042	0.024	0.091**	0.098***
	(0.025)	(0.041)	(0.044)	(0.033)	(0.019)	(0.037)	(0.032)
Unbanked	-0.091***	-0.174***	-0.097**	-0.070**	-0.057**	-0.124***	-0.083***
	(0.020)	(0.035)	(0.038)	(0.035)	(0.023)	(0.037)	(0.023)
Paid activity (Employed)	0.064***	0.117***	0.109***	0.072***	0.041***	0.090***	0.058**
	(0.019)	(0.029)	(0.029)	(0.023)	(0.012)	(0.024)	(0.026)
Receive remittances	0.174***	0.200***	0.244***	0.240***	0.121***	0.287***	0.191***
	(0.020)	(0.029)	(0.029)	(0.019)	(0.019)	(0.020)	(0.023)
Wald test H₀: cut1=0	0.739	-1.739***	-0.137	-0.666	0.194	-0.553	0.060
	(0.478)	(0.659)	(0.670)	(0.552)	(0.613)	(0.563)	(0.701)
Wald test H₀: cut2=cut1	-0.295***	-1.344***	-0.986***	-1.233***	-0.689***	-1.194***	-0.298***
	(0.058)	(0.153)	(0.123)	(0.117)	(0.069)	(0.115)	(0.057)
Wald test H₀: cut3=cut2	-2.759***	-1.739***	-1.840***	-2.002***	-2.637***	-1.913***	-1.857***
	(0.142)	(0.121)	(0.117)	(0.120)	(0.149)	(0.115)	(0.115)
Wald test H₀: cut4=cut3	-0.828***	-0.788***	-0.756	-0.896***	-0.456***	-0.700***	-0.854***
	(0.514)	(0.079)	(0.071)	(0.094)	(0.090)	(0.075)	
Observations	977	970	985	984	967	975	981
Pseudo R-square	0.144	0.112	0.101	0.110	0.095	0.115	0.085
Wald chi2	278.8***	198.3***	193.3***	194.4***	185.9***	184.9***	152.2***

Note: The table presents Ordered logistic regression results. In all columns we present the corresponding marginal effects (ME). *** Significant at the 1 per cent level, ** Significant at the 5 per cent level, * Significant at the 10 per cent level.

Overall, these findings contribute to the initiatives undertaken to measure the adoption of mobile money as a multi-step process by helping to understand its drivers and providing insights on how to foster access to financial services. This study considers two measures of mobile money adoption. The first, having a mobile money account, and the second, adoption of mobile money as a four-step process, that considers prerequisites for adopting mobile money services, such as owning a mobile phone, having a national ID, using at least one service of mobile money (sending or receive remittances; paying utility bills; receiving wage payments, government transfers, agricultural payments, or self-employment payments). Our findings suggest that advantaged individuals (those who have a bank account, are in the labor force, are highly educated, and are wealthier) are more likely to adopt mobile money as a global state or as a four-step process than disadvantaged people, except females, who have an advantage over males in the adoption of mobile money account.

3. CONCLUSION

Mobile money has the potential to foster financial inclusion, which in turn can help alleviate poverty and boost economic growth. Mobile money is changing the landscape of the financial system in developing countries due to the growing penetration of mobile phones. Financial inclusion is rendered possible, when people without a bank account can be reached by using affordable, accessible, and convenient financial services through a mobile phone – mobile money. Hence, understanding the

determinants of mobile money is crucial, and this study investigates this question in WAEMU based on individual-level survey data for the year 2017 from the Global Financial Inclusion Database. Our main findings can be summarized as follows.

First, considering mobile money adoption as a global state we find that being woman, younger, better educated, and wealthier, banked, employed, and receiving domestic remittances increase the likelihood of adopting mobile money. Moreover, being younger, better educated and banked increase the likelihood of sending money using a mobile phone, while having secondary education, having the fourth income quintile and employed increase the likelihood of receiving money using a mobile phone.

Taking mobile-money adoption as a four-step process, we find similar results being woman, younger, better educated, wealthier, banked, employed, and receiving domestic remittances increase the likelihood of engagement in the mobile money adopting process. Furthermore, we take into account the particularity of each WAEMU-member country and find some disparities in the determinants of both measure of mobile money adoption. This work contains findings of particular interest to the design of policies that foster financial inclusion. It stresses the role of policies that target groups of individuals, particularly those affected by financial exclusion (those without a bank account, female, less educated, and low-income individual). The study provides evidence on the determinants of mobile money adoption, which appears to be an alternative for improving financial access for disadvantaged groups or financially excluded people. However, the findings highlight that the actual design of mobile money does not benefit poor individuals with limited access to financial services in the WAEMU countries. Hence, it is necessary for mobile money providers and actors engaged in financial inclusion promotion to rethink the way mobile money is offered to foster its adoption among financially disadvantaged people.

Acknowledgement

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