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Adopting FinTech to promote financial inclusion: Evidence from western African economic and monetary union

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Abstract

Studies have indicated that many households living in developing countries, especially in Sub-Saharan Africa, have limited access to financial services offered by the banking system due to multiple socioeconomic barriers. This paper analyzes the impact that FinTech could have on the supply of financial services, including Western African Economic and Monetary Union. We estimate a logit model on Fintech-related variables using data from Global Findex 2017 to find variables that potentially affect financial inclusion. The analysis highlights several results. Firstly, they reveal that many major obstacles to financial inclusion, such as insufficient resources, lack of trust, and lack of official documents, cost, and religious reasons. Second, they demonstrate who is most financially excluded: women, young people under 25, the poor, and those with low levels of education. Thirdly, they also reveal that FinTech has the potential to remove many of these barriers and accelerate financial inclusion in the Western African Economic and Monetary Union. The richest 20% of people, young men, and those with tertiary education are considered to be the key factors of Fintech adoption. These results imply to involve FinTech widely in the delivery of financial services and to promote more financial literacy.

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1. Introduction

The Central Bank of West African States (BCEAO) announced the creation of a Fintech Knowledge and Monitoring Office, in April 2022. Thus, it recognizes the fact that Fintech is an essential part of the financial services. The Fintech is characterized by a multitude of providers including mobile network operators, technology companies, Fintech start-ups, among others (Alliance for Financial Inclusion, 2018; Anagnostopoulos, 2018; Llorca, 2017). Fintech is defined as financial services companies whose business model is driven by information and communication technologies. They include companies that offer a wide range of financial services such as payment services (including cryptocurrencies), investment and financing products (Weill, 2019), and even insurance and advice. In addition, they offer innovative financial products capable of complementing or substituting financial services provided by banks and microfinance. From this perspective, Fintech promises greater financial inclusion, which would enhance the resilience of individuals (G20 GPFI, 2017; Kass-Hanna, Lyons, & Liu, 2022; Lyons & Kass-Hanna, 2020). The massive use of digital financial services during Covid-19 is an inspiring example (Demirgüç-Kunt, Klapper, Singer, & Ansar, 2022).

It is argued that mobile phone and internet penetration rates have the potential to increase the number of people that have limited access to banking services. According to the Financial Inclusion Report of Global Findex 2021, 55% of adults in Sub-Saharan Africa have an account as compared to 76% globally. 33% out of the

55% of financially included adults have a mobile account, demonstrating the critical role that mobile banking plays in financial inclusion. (Demirgüç-Kunt et al., 2022). It is also well documented that financial inclusion has been a priority targeted by the World Bank through several objectives, which include access to a diversified range of affordable financial services, improve performance of financial institutions, and multiply financial service providers. This idea of financial growth acknowledges the various facets of financial inclusion, such as access, use, and quality. (Lyons & Kass-Hanna, 2020). However, it is noticed that access and use have been more of a focus for policymakers (G20 GPFI, 2017). By promoting savings and capital accumulation, financial system development can contribute to faster growth and poverty reduction, as well as ensure an optimal allocation of capital (Beck, Maimbo, Faye, & Triki, 2011). Many studies show that countries with developed financial systems have experienced higher long-term growth than countries with low financial depth (Guérineau & Jacolin, 2014). By easing enterprises' liquidity restrictions, encouraging long-term investment, and particularly by aiding in the offset of the impacts of exchange rate volatility, financial systems also lessen the unpredictability of investment and thereby economic growth. Therefore, a fundamental concern for the socioeconomic development of States, businesses, and individuals is access and usage of financial services. According to this role of Fintech as an accelerator of financial inclusion, it is important to further analyse the links between Fintech and financial inclusion in sub-Saharan countries. This paper aims to do that, by focusing specifically on the countries of the West African Economic and Monetary Union (WAEMU). These nations have only a modest level of financial inclusion, but Fintech has enormous potential for their development. (BCEAO, 2021). They have an advantage to use same currency (CFA Francs), however, their economies are almost disparate. The objective of this paper is therefore to first analyse the impact of Fintech on the barriers to financial inclusion, and then to identify the determinants of adoption of these Fintech products in WAEMU area.

For this analysis, we use data from the World Bank's Global Findex 2017. Then, a qualitative model is used to analyse how Fintech could fight against socio-economic barriers to financial services access, and then to identify determinants of Fintech adoption, by using essentially digital financial services, such as digital payments and money transfers. This investigation will contribute to economic literature in many ways. First, it deepens the analysis of barriers to financial inclusion in the WAEMU from a microeconomic and demand-side perspective. Similar studies are few and far between (Loaba, 2022), and those that do exist tend to be macroeconomic in nature and don't provide enough insight into human behaviour. Second, by exploring the prospects of Fintech, this analysis initiates a prospective in terms of the supply of digital financial services and their role in total or gradual suppression of barriers to financial inclusion.

The paper is organized as follows. Section 2 provides a literature review focusing on the potential and adoption's determinants of Fintech. Section 3 presents the data, the model, and the variables used. Section 4 analyzes and discusses the results obtained.

2. Literature Review

Several researches have indicated that financial exclusion is major constraint to economic and social development. (Adeola & Evans, 2017; Fuller & Mellor, 2008; Koné, 2019). There is a growing recognition that Fintech can promote access and use of financial services to customers previously excluded from the traditional banking system, due to their low cost of access and the opportunity for diversification they offer.

2.1. Financial Exclusion in Developing Countries

Most studies on financial inclusion and its impact in developing countries (DCs), have addressed its opposite, namely financial exclusion (Koné, 2019). Thus, Hariharan and Marktanner (2012) have shown that the exclusion of a large proportion of the population from access to banking services has been a major obstacle to development in recent years. After identifying several factors of financial exclusion, these authors have demonstrated that an increase in financial inclusion by 10%, could increase the average income per worker by 1.34%. According to the bottom of the pyramid theory, these excluded people experience poverty penalties because they lack access to particular services that would meet their requirements (Prahalad, 2004). From this perspective, two aspects are taken into account when analysing financial inclusion: supply and demand.

The demand of financial services are determined primarily by the socio- economic characteristics of agents and some reasons for exclusion. For instance, education and income are the microeconomic factors that have the biggest impact on a person's financial inclusion. According to Zins and Weill (2016), the probability that a person classified as the 40% poorest holding a bank account, formal savings and taking out a formal loan decreases by 21%, 10.6% and 3.70% respectively. Also, being a woman reduces the probability of having a bank account and saving formally by 3.1% and 1.3% in Sub-Saharan Africa (Zins & Weill, 2016). Several other studies have confirmed the discrimination against women, young people, least educated and poorest (Demirgüç-Kunt, Klapper, Singer, Ansar, & Hess, 2018; Kass-Hanna et al., 2022). Access to financial services is often hampered by other socioeconomic obstacles. Thus, the cost of financial products, distance from a service point, and lack of trust are cited. For example, lack of documentation is cited by about 25% of unbanked adults (Demirgüç-Kunt et al., 2018). The cost of holding a bank account depends on the various fees and commissions, particularly on means of payment. In Sub-Saharan Africa, the low concentration of banks make interest margins higher (Gowda & Chakravorty, 2021). This cost is related to the degree of competition between banks. Additionally, it is a result

of international financial organisations' expansion. (Guérineau & Jacolin, 2014). The low density of bank's agencies and the lack of communication's infrastructures increase the cost of access to financial services. Other factors such as religious reasons, are cited as barriers (Demirgüç-Kunt et al., 2018) or at least as elements of financial self-exclusion. As the Kenyan experience with Safaricom and M-Pesa demonstrates, these hurdles can now be removed or at least reduced thanks to the emergence of the internet and mobile phones. (Hove & Dubus, 2019). Moreover, the period of the COVID'19 pandemic has shown the importance that must be given to Fintech in financial transactions (Demirgüç-Kunt et al., 2022).

2.2. The Disruptive Impact of Fintech on Financial Development

As a means of payment, Fintech provides customers with several solutions: mobile payment, low-cost money transfers, and management of financial flows for online trading companies, online fundraising mobile payment terminals, etc. As an investment or financing product, Fintech allows to quickly collect savings from individual's banks to its more simplified and reassuring procedures compared to traditional banks. This is the case with crowdfunding, or the use of robo-advisors.

Fintech do not replace traditional banks, but complement them, insofar as their arrival can affect the degree of competition in banking markets (Weill, 2019). Indeed, Fintech offers banks the collection and analysis of big data, an essential decision support tool in this digital age (Bourjij, 2016; Llorca, 2017). As a result, it is a cutting-edge financial system that makes it easier to access and use financial services. It makes it possible by grafting a Fintech to each financial operation for the benefit of banks, companies, individuals, and even states.

From an empirical perspective, several studies have established the links between Fintech and financial inclusion. For example, Sahay et al. (2020) have used data from the World Bank's Global Findex and the International Monetary Fund (IMF)'s Financial Access Survey to construct a financial inclusion index. They have shown through this index that Fintech increases financial inclusion and improves Gross Domestic Product (GDP) growth. When Fintech extends to the poorest and smallest businesses, it can also enhance their financial inclusion. Fintech and macroeconomics have been linked in studies (Anagnostopoulos, 2018; Fung, Lee, Yeh, & Yuen, 2020). According to Claessens, Frost, Turner, and Zhu (2018). On the other hand, Thakor (2020) has also found positive links amongst digital payment systems, credit markets and insurance products.

Some studies have proven positive links between Fintech and financial stability via innovations in blockchain, transparency, and reduction of information asymmetries (FSB, 2019; Kosmidou, Kousenidis, Ladas, & Negkakis, 2017; Zamani & Giaglis, 2018).

However, the factors most likely to drive demand for Fintech services were related to household characteristics and expectations (Jünger & Mietzner, 2020; Senyo & Osabutey, 2020). Using data collected from a sample of young people so familiar with Fintech, Tan, Purba, and Widjaya (2019) have proven that convenience, speed, and low cost were factors which impact Fintech products' demand.

Moreover, it has been proven that Fintech can help risk management. In Kenya, for example, some studies showed that mobile money users did not reduce their expenditures, while non-users and those with limited access to the mobile money network reduced their food and other spending around 7-10% (Jack & Suri, 2014).

Fintech can also reduce the cost of receiving payments. For example, in a five-month emergency program in Niger, beneficiaries were able to save an average of 20 hours of transportation and waiting time by making monthly government social benefit payments via mobile phone instead of cash. Using mobile banking also reduced administrative cost by 20% in the same county (Aker, Boumnijel, McClelland, & Tierney, 2016). For governments, moving from cash to digital payments help to reduce corruption make transactions more efficient. For example In India, it is shown that fraud in pension reduced by 47% when payments are transferred using Fintech rather than cash (Muralidharan, Niehaus, & Sukhtankar, 2016).

2.3. Determinants of Fintech's Adoption

Among many approaches about the determinants of Fintech adoption, like the Technology Acceptance Model (Ajzen & Fishbein, 1980), or Perceived Risks and Benefits (Tang, Ooi, & Chong, 2020), demographic and economic factors are cited in literature as an alternative approach (Fall & Birba, 2019).

In that way, many researches highlight that age is negatively related to technology's adoption (Anderson, 2015). This is how, Das and Das (2020) have shown that about 66.6 and 62.3% of people having age between 18–28 years and 29–39 years, respectively, use regularly Fintech services. This proportion is only 26.9% when talking about people belonging more than 50 years. Young people are more likely to use mobile payment (Li, Hanna, & Kim, 2020).

In terms of gender, it is proven that men are particularly the most determinant of Fintech's adoption (Das & Das, 2020; Li et al., 2020) and tend to adopt new technology and access information at a higher rate than women, even the economic impact is larger for female (Carlin, Olafsson, & Pagel, 2017).

According to other studies, adoption of innovations like fintech is correlated with a greater level of education. (Rogers, 2010). For example, the probability of using mobile payment increases with education level (Li et al., 2020). Indeed, it is shown that the person which has a post-bachelor degree had a higher predicted rate to use mobile payment than people with a lower degree. This result is confirmed by Das and Das (2020).

Other more, research related to the use of online banking shows that income has a significant impact on the Fintech adoption (Das & Das, 2020; Flavián, Guinalíu, & Torres, 2006; Mallat, 2007).

3. Method and Data

3.1. Method

To assess the impact of Fintech on financial inclusion we use a logit model. By considering a logit, the probability *Pi* of holding an account or using a digital financial service is expressed as follow:

$$P_i = Prob(Y_i = 1/X_i)$$

$$\text{Where } Y_i = \begin{cases} 1, \text{ if person has an account or use a Fintech service} \\ 0, \text{ otherway} \end{cases}$$

and Xi is the matrix of independent variables.

To facilitate the interpretation of estimated results, we report marginal effects which give at the same time the sensitivity and the sign of the evolution of the independent variable. The maximum likelihood method was used to estimate the parameters. The quality of the estimates is assessed using several criteria such as the Wald Chi-square test, the R^2, the percentage of correctly classified cases and the area under the ROC curve (Receiver Operating Characteristic).

3.2. Data

Data from the World Bank's Global Findex 2017 were used. This database that contains highly relevant information on digital financial services. Indeed, the World Bank collected cross-sectional data in 2017, with the support of Gallup World Poll, from more than 150,000 adults over the age of 15 in over 140 countries. For each country, a representative sample of at least 1,000 households was randomly selected and surveyed to gather in-depth information about how individuals save, borrow, make payments, and manage financial risk. These results highlight potential to expand the usage of digital financial services and to improve access to financial services for those who are financially excluded.

Data from seven of the eight WAEMU member countries (Guinea-Bissau excluded) were extracted from the overall sample Table 1. In each country, about 1000 observations are collected.

Table 1. Sample by country.

Variables	Benin	Burkina Faso	Côte d'Ivoire	Mali	Niger	Senegal	Togo	WAEMU
Gender								
Male	544	659	685	535	557	509	609	5854
Female	456	341	315	465	443	491	381	4146
Level of education								
Primary or less	546	587	583	736	830	586	421	6127
Secondary	398	394	406	233	168	392	532	3604
Tertiary	56	19	11	310	2	22	47	268
Quintiles of income								
The poorest 20%	154	151	161	159	170	159	150	1577
The poorest 40%	174	155	176	168	164	179	156	1674
Middle class – 50%	193	170	188	193	174	180	190	184
The richest 40%	205	218	204	211	207	210	228	2118
The richest 20%	274	306	271	269	285	272	276	279
Sample	1000	1000	1000	1000	1000	1000	1000	7000

3.3. Variables

The literature on the determinants of financial inclusion has revealed that a number of variables could explain the development of financial inclusion or act as barriers. We have considered the same variables reported in Zins and Weill (2016) and Demirgüc-Kunt, Klapper, and Singer (2013), while taking care to add or modify some of them, deemed relevant for the specific case of WAEMU countries. Five dependent variables are explained. These variables are described as follow:

1. *Having an account in a financial institution* (account-fin), i.e. having either a bank account or an account in a microfinance institution or other financial institutions.
2. *Having a mobile account* (account_mob) means having an account linked to a cell phone number, intended to receive deposits and carry out financial transactions, such as bill payments, transfers to parents, payment of phone call credit, recharging electricity meters, etc.
3. *Digital payment* (pay_byfintech), i.e., having made at least one payment using financial technology. This variable is constructed using three other variables:

- Have made at least one online bill payment (via the Internet);
- Have purchased online;
- Have paid regular bills (water, electricity, credit, etc.) from a mobile account.

4. *Digital transfer issued* (transf_byfintech), represents positive responses from respondents stating:

- Have made a transfer using a mobile account or ;
- Have sent money via an MTO (Money Transfers Organization).

5. *Digital transfer received* (reveiv_byfintech), reflects positive responses from respondents reporting that they received:

- Transfers from an individual via a mobile account;
- Transfers from an individual via an MTO;
- Transfers from the government via a mobile account;
- Salaries via a mobile account;
- Payments for agricultural products via a mobile account;
- Self-employment wages via a mobile account.

Possible double counting of respondents is removed for variables 3) to 5) that present this risk.

The most common independent variables discussed in the literature mainly concern the socioeconomic and demographic characteristics of the respondents. These are gender, age, education level, income level (Demirgüç-Kunt et al., 2018; Kass-Hanna et al., 2022; Loaba, 2022; Zins & Weill, 2016).

For these variables, we also considered the different barriers to financial inclusion as expressed in the 2017 Global Findex survey. For these variables, a single respondent may cite multiple barriers, but this does not present a risk of double counting since they are each dichotomous. Two other control variables that we considered important were included: having a valid identity (ID) and being employed (active) at the time of the survey.

Table 2 summarize descriptive statistics of all these variables.

Table 2. Statistics of variables.

Variables	Observations	Proportion	Standard error	Min	Max
Dependent variables					
account_fin	1794	0.256	0.437	0	1
account_mob	2007	0.287	0.452	0	1
pay_byfintech	757	0.109	0.311	0	1
transf_byfintech	1564	0.224	0.417	0	1
receiv_byfintech	1711	0.253	0.435	0	1
Barriers to financial inclusion					
Too far	1356	0.261	0.439	0	1
Too expensive	1570	0.314	0.464	0	1
Lack of documentation	1480	0.281	0.450	0	1
Lack of trust	901	0.173	0.378	0	1
Religious reasons	521	0.099	0.299	0	1
Lack of money	3921	0.735	0.441	0	1
A parent has an account	487	0.095	0.293	0	1
No need for financial services	813	0.155	0.362	0	1
Level of education					
Primary or less	4225	0.609	0.488	0	1
Secondary	2523	0.364	0.481	0	1
Tertiary	188	0.027	0.162	0	1
Gender					
Male	4098	0.585	0.493	0	1
Female	2902	0.415	0.493	0	1
Age groups					
15-25	2677	0.327	0.142	0	1
26-35	1933	0.382	0.486	0	1
36-45	1109	0.276	0.447	0	1
Over than 46	1223	0.158	0.365	0	1
Income level					
The poorest 20%	1104	0.158	0.364	0	1
Middle class – 50%	1288	0.184	0.388	0	1
The richest 20%	1983	0.279	0.449	0	1
Have a valid identification	4481	0.640	0.480	0	1
The person is active	4741	0.677	0.468	0	1

4. Results and Discussion

Descriptive analysis shows at first many characteristics of financial inclusion in the WAEMU. Furthermore, econometric results demonstrate that Fintech could play an important role to this financial development in this area.

4.1. Scope of Fintech in Financial Inclusion

Table 3 summarizes the percentages of bank and mobile account holders and digital financial services users in WAEMU. These statistics are declined by individuals 'characteristics.

Table 3. Status of financial inclusion and fintech in the WAEMU in 2017 (%).

Variables	Having an account in financial institution	Having a mobile account	Financial inclusion level	Digital payment	Digital transfer issued	Digital transfer received
Gender						
Male	30.4	33.4	49.1	13.2	26.5	27.6
Female	18.8	22.0	33.8	7.5	16.5	22.2
Education level						
Primary or less	17.2	20.2	31.4	6.50	15.2	18.2
Secondary	35.8	41.2	58.8	16.7	32.1	36.3
Tertiary	78.2	54.8	87.2	28.2	55.6	43.3
Age groups						
15-25	19.0	26.6	36.3	11.0	18.0	25.4
26-35	31.0	35.1	50.8	12.2	28.6	27.8
36-45	29.1	29.7	45.5	11.7	26.8	26.5
Over than 46	28.5	22.9	42.1	7.5	18.9	20.8
Income quintiles						
The poorest 20%	14.3	18.2	37.8	6.7	12.3	16.4
Middle class	20.3	25.9	57.4	7.8	18.3	23.3
The richest 20%	38.8	38.5	57.4	11.9	34.7	33.8
WAEMU countries						
Benin	35.7	22.7	52.7	6.0	18.9	19.4
Burkina Faso	29.6	41.0	49.5	9.3	32.3	34.6
Ivory coast	19.6	40.9	38.9	17.5	33.2	35.3
Mali	19.6	27.2	18.9	7.6	22.7	22.6
Niger	13.1	8.9	46.4	6.7	6.9	10.6
Senegal	25.8	35.3	49.0	17.5	21.7	32.0
Togo	37.3	24.7	27.6	10.4	20.9	23.3
WAEMU	25.6	28.7	42.8	10.8	22.4	25.3

The level of financial inclusion is estimated at 42.8% in 2017, which remains lower than the estimated global average rate of 63% in the world at the same year. However, there are disparities by country and by socio-demographic characteristics of individuals. While the majority of nations exhibit a rate that is in line with the regional average, Benin, Senegal, and Burkina Faso stand out as having a higher prevalence. But Niger is far behind with less than 19% of adults having an account in a financial institution and/or mobile.

In terms of gender, the findings show that more adult men (49% versus 34%) than women (44%), have accounts. This result is related to the difficulties of social integration of women and their higher level of poverty as compared to men. The level of education shows a clear difference between individuals with a higher level of education (87.2% financially included) and those with barely a primary level (31.4%). This gap is explained by human capital given the requirements for opening an account in the WAEMU zone. The other factor in financial inclusion is obviously the level of wealth. Indeed, while the financial inclusion rate for the 20% poorest is only 27.6%, this reaches 57.4% for the 20% richest.

It should be noted that this level of financial inclusion is largely dependent on mobile banking. Indeed, the ownership rate of mobile accounts is higher than that of financial institutions in most cases. The rate increases from 19% to over 26% for financial institutions and mobile banking, respectively, among those under the age of 25, making this gap even more noticeable. However, Niger is still an exception, where only 9% had a mobile

account in 2017, while the WAEMU average was 28.7%. Those data reveals that digital financial services are widely used in the WAEMU. A significant number of respondents claim to have carried out a digital financial transaction. Burkina Faso, Ivory Coast and Senegal are the most prominent in this area, but it is also the preserve of the wealthiest, the young and those with higher level of education.

However, financial inclusion in the WAEMU is often hampered by human, institutional and economic factors. Above all, the lack of financial resources excludes more than 70% of adults as illustrated in Figure 1. This large proportion of excluded people can be explained by the high proportion of poverty. In addition, the lack of documentation, particularly property titles are a major obstacle in the access of financial services for all individuals 'categories. The cost of accessing to financial services and the distance to a service point are also barriers of having a bank account. To a lesser extent, there are also religious reasons. Indeed, Islamic culture forbids holding an interest-bearing account or taking out an interest-bearing loan, which automatically excludes some Muslims from conventional finance. However, Only Niger recorded a large share (20.1%) and to a lesser extent Senegal and Mali, which both have rates above the global average of 7% in 2017. This religious effect is still restricted in WAEMU. (Demirgüç-Kunt et al., 2018).

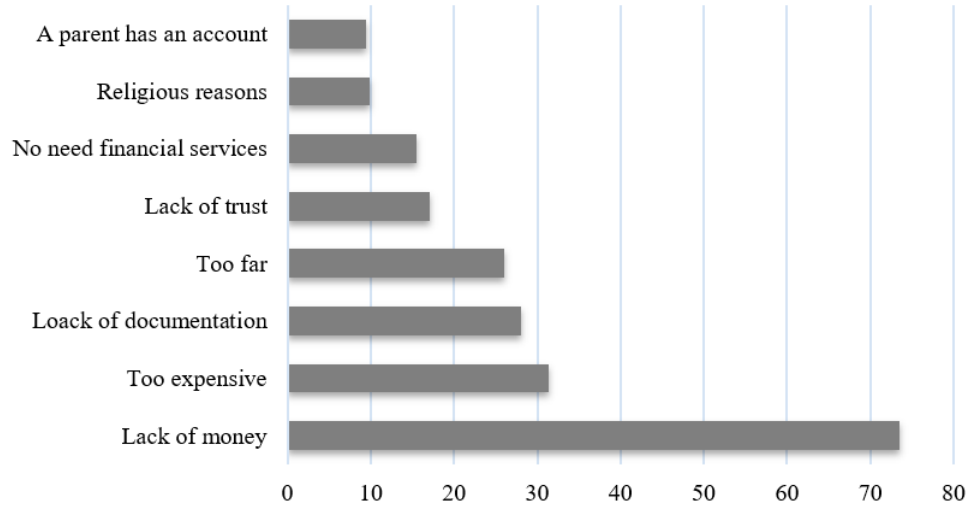

Figure 1. Barriers to financial inclusion in WAEMU (% of respondents).

4.2. Against Barriers, for Financial Inclusion Accelerating: The Potential of Fintech

Given the constraints on financial development presented above, we wanted to know whether the use of Fintech could improve access, use and even the quality of financial services offered in WAEMU.

Results from the logit model estimations are reported in Table 4, specifically the marginal effects. Many of results are consistent with previous studies (Kass-Hanna et al., 2022; Loaba, 2022; Zins & Weill, 2016): being female, young people, having a low level of education or belonging to the 20% poorest are barriers to access and use of financial services. These obstacles to financial inclusion all seem to make having a bank account with a financial institution more difficult. This is an expected result since respondents reported these as their main barriers in accessing bank accounts and other financial institutions.

However, the impacts of these different barriers differ from one another. For example, the lack of money reduces the likelihood of having an account at these institutions by 37.5%. This is a major economic barrier. The absence of a requirement for financial services results in a decrease of 7.5% in the likelihood of possessing an account. This in turn constitutes financial self-exclusion. The religious reasons arise around 2.8%. These perceived disincentives to holding a bank account have varied and contrasting impacts when it comes to Fintech adoption. For instance, the proximity to a financial services centre is not as significant of an obstacle for maintaining a mobile account. This can be linked to cheaper telephone network infrastructures that are installed across countries, making geographic penetration easier. However, the weakness or even non-existence of telephone networks, especially in certain isolated areas continues to limit access to mobile accounts. The probability of accessing mobile accounts decreases by 3.5% concerning distance from a point of service. This result is almost identical to that for lack of documentation (-3,7%). Only the religious reason seems to aggravate the situation with an estimated probability of exclusion of 7.6%.

The employment of Fintech appears to be diminishing a majority of these hindrances. Undoubtedly, the sole impediment that persists for digital payments is the absence of funds. The lack of trust is no longer a barrier to mobile account, simply because users have found that it works well and with greater transparency (Jünger & Mietzner, 2020; Senyo & Osabutey, 2020). Other more, it provides more incentives to account holders. Indeed, cell phone companies are deploying appropriate incentive structures to attract more customers. The same results are found that are varying in degrees for other digital services (transfers issued and received). The persistence

of religious beliefs acts as a hindrance in achieving financial inclusion in the context of digital transfers, both for senders and receivers, which presents a challenging outcome that requires careful interpretation.

Table 4. Determinants of financial inclusion and Fintech adoption (Marginal effects).

Variables	Having an account in financial institution	Having a mobile account	Digital payment	Digital transfer issued	Digital transfer received
Barriers of financial inclusion					
Too far away	-0.054***	-0.035**	-0.009	-0.007	-0.055***
	(0.010)	(0.016)	(0.009)	(0.015)	(0.014)
Too expensive	-0.064***	0.025	-0.002	-0.012	0.002
	(0.001)	(0.016)	(0.007)	(0.014)	(0.014)
Lack of documentation	-0.069***	-0.037**	-0.002	0.003	-0.012
	(0.010)	(0.015)	(0.009)	(0.014)	(0.014)
Lack of trust	-0.059***	0.052***	0.024**	0.002	0.012
	(0.010)	(0.019)	(0.010)	(0.016)	(0.017)
Religious reasons	-0.028**	-0.076***	0.014	-0.068***	-0.050**
	(0.140	(0.019)	(0.014)	(0.016)	(0.019)
Lack of money	-0.357***	-0.022*	-0.053***	-0.107***	-0.013
	(0.013)	(0.011)	(0.007)	(0.010)	(0.011)
No need of financial services	-0.075***	0.029	0.004	0.024	0.037**
	(0.001)	(0.018)	(0.01)	(0.016)	(0.017)
Gender					
Female	-0.027***	-0.052***	-0.022***	-0.036***	-0.002
	(0.010)	(0.011)	(0.006)	(0.006)	(0.011)
Education level					
Primary or less	-0.077***	-0.151***	-0.064***	-0.104***	-0.125***
	(0.010)	(0.012)	(0.008)	(0.110)	(0.012)
Tertiary	0.172***	0.022	0.025	0.060**	0.018
	(0.050	(0.032)	(0.016)	(0.029)	(0.028)
Age groups					
15-25	-0.042***	0.054***	0.032***	0.007	0.045***
	(0.001)	(0.017)	(0.010)	(0.014)	(0.016)
26-35	-0.012	0.076***	0.018*	0.057***	0.037**
	(0.010)	(0.021)	(0.010)	(0.016)	(0.017)
36-45	0.000	0.086***	0.032**	0.082***	0.061***
	(0.010)	(0.018)	(0.014)	(0.019)	(0.020)
Quintiles of income					
The poorest 20%	-0.026***	-0.053***	-0.014	-0.042***	-0.046***
	(0.010)	(0.016)	(0.009)	(0.014)	(0.015)
Middle class – 50%	-0.012	-0.005	-0.016*	-0.003	-0.000
	(0.010	(0.015)	(0.008)	(0.013)	(0.014)
The richest 20%	0.024***	0.037***	0.013*	0.071***	0.036***
	(0.010)	(0.014)	(0.008)	(0.012)	(0.013)
Having an identity card	0.046***	0.168***	0.051***	0.126***	0.118***
	(0.007)	(0.011)	(0.007)	(0.010)	(0.011)
Person has an employment	0.057***	0.106***	0.041***	0.087***	0.038***
	(0.006)	(0.011)	(0.006)	(0.009)	(0.011)
Log likelihood	-2159.84	-3729.32	-2163.73	-3196.26	3639.72
Wald Chi2	3650.22	929.87	469.16	1044.47	506.38
Significance	0.000	0.000	0.000	0.000	0.000
Pseudo R^2	0.458	0.111	0.098	0.140	0.065
Observations	7000	7000	7000	7000	7000

Note: *; **; ***: significance at 10%; 5%; 1%. In parentheses robust standard errors.

In terms of the microeconomic characteristics of respondents, results indicate that being a woman remains a penalty to financial inclusion, regardless of the type of financial service. This variable decreases the likelihood of possessing a financial institution account by 2.7%. This is very close to the result found by Zins and Weill (2016) for all Africa, which is 3%. The findings indicate that individuals who belong to the lower income bracket in the West African Economic and Monetary Union (WAEMU) encounter greater challenges in accessing banking services and mobile banking, despite the perception that the former group is more affected by financial constraints. Specifically, the study highlights that the bottom quintile experiences a significant disadvantage in

terms of both types of financial services. The likelihood decreases around5% for mobile banking, while it represents only 2.6% for accounts in a financial institution.

Having a primary level or less in education also reduces the chance of having a bank account by 7.7% and by 15.1% for the mobile account. This result is consistent with Zins and Weill (2016), but with less severity. On the other hand, people with a high level of education or wealthy register a better financial inclusion. Additionally, having an account raises your likelihood by 2.4% if you are among the richest 20% of people. The situation is even better when the individual has a valid identity document, as this probability rises to 17%. The findings pertaining to age indicate that individuals who belong to the youngest age bracket (15-25) experience the highest degree of restriction with regards to their ability to access and utilise financial services. The 26- 35 and 36-45 age groups have virtually no difficulty accessing and using these services. The potential impact of Fintech use is also very favourable for them. The probabilities increase substantially at all levels. These results are certainly related to the active status of the respondents who are mostly in these age groups.

The adoption of Fintech is positively associated with certain demographic and socioeconomic factors, including being a young male between the ages of 15 and 35, possessing a tertiary education, belonging to the top 20% of income earners, and being employed. Conversely, factors such as religious beliefs, low levels of education, and poverty exhibit a negative correlation with Fintech adoption.

4.3. Robustness Check and Limits of the Study

A good logit model should have low values for error rate and false positive rate; high values of sensitivity, precision and specificity. The error rate is a symmetrical indicator, it gives the same importance to false positives and false negatives. Sensitivity and precision are asymmetrical, they give a particular role to the positives.

In terms of the robustness of econometric adjustments presented above, all these results Table 5 are acceptable. The Wald Chi-square test is significant at 1% in all estimations. Furthermore, the correctly classified cases exceed 70% for each of the estimates (except for the digital transfers received, which is 67.83%). Furthermore, the areas under the ROC curve Figure 2 show that all the estimates are of high quality (They are robust, acceptable and interpretable). Within the realm of literature, a model is commonly deemed satisfactory if its Area Under Curve (AUC) metric surpasses the threshold of 0.7. A well discriminating model must have an AUC between 0.87 and 0.9. When an AUC is higher than 0.9, we consider that the model is excellent (Hanley & McNeil, 1982).

Table 5. Quality of adjustment.

Criteria of quality	Having an account in financial institution	Having a mobile account	Digital payment	Digital transfer issued	Digital transfer received
Predicted probability	0.094	0.255	0.083	0.181	0.225
Correctly classified cases (%)	88.56	73.26	89.19	79.31	75.53
Area under ROC curve	0.917	0.726	0.805	0.754	0.678

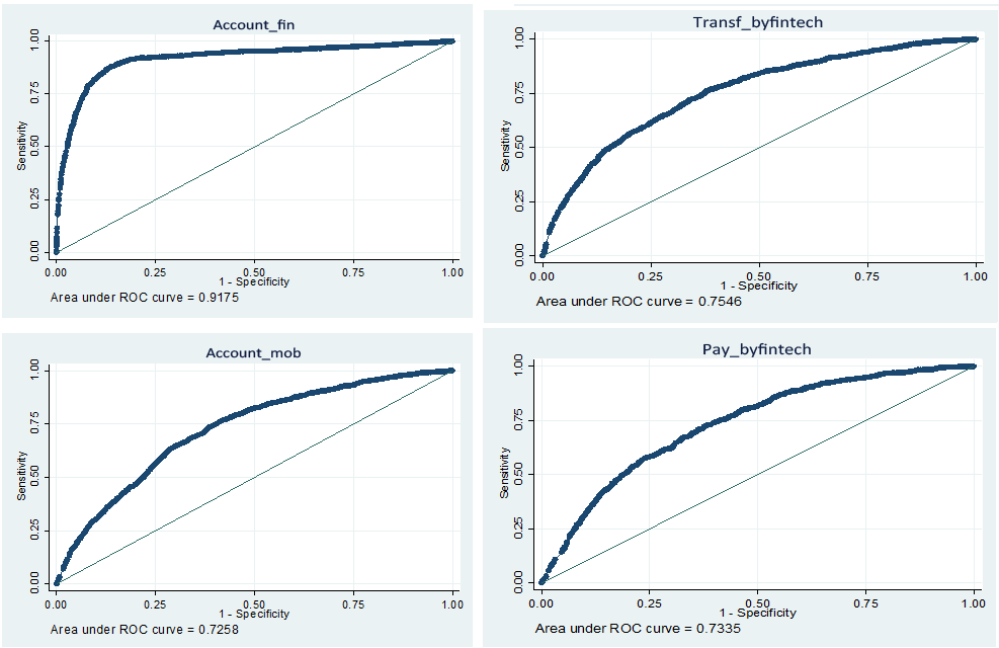

Figure 2. ROC curves of dependent variables.

The primary limitations of this study include the lack of certain variables, such as the respondents' place of residence (whether rural or urban) or marital status, which could potentially improve the fit of the models. Those variables could help us to know about the geographical aspect of financial inclusion while it is said that rural area is less served by financial services. Furthermore, variables related to Fintech's risk perception could give more information about decision making.

5. Conclusion

In conclusion, noteworthy findings were emphasised in this paper. First, the study reveals and corroborates factors that are conducive to financial inclusion in the WAEMU, including high education, income level, and possession of a national identity document. In contrast, the likelihood of being financially integrated is decreased by being a woman, having a low level of education, and being in the bottom 20% of income. These results are consistent with those found in previous studies of Sub-Saharan Africa. Second, the main barriers common to all WAEMU countries remain low geographical penetration (too far from service points), lack of documentation to serve as collateral, and insufficient financial resources to access financial services. Third, the comparative analysis of the determinants of financial inclusion between bank accounts and mobile accounts shows that flexibility and trust are more in favor of mobile banking than traditional banking system. Thus, results reveal that mobile banking reduces distance and requires fewer financial resources. These results also show that Fintech removes many of these barriers, allowing easier access to financial services and tailored to users' needs.

In general, it becomes relevant to note that Fintech can be an opportunity in many respects to remove or mitigate several barriers to financial inclusion, including issues of cost, geographic distance, trust in financial institutions. Stating differently, Fintech has advantages on at least three dimensions of financial inclusion: access, use and quality. In terms of economic policy implications, the main barriers to financial inclusion need to be addressed, including poverty, lack of transparency of conventional financial institutions on their products in order to gain trust. The development of Islamic financial products and the routine issuance of civil status certificates are required.

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