

INBOUND AND OUTBOUND REMITTANCES IN WAEMU COUNTRIES: EXPLORING THE DYNAMICS AND THE MAIN DRIVERS

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Abstract

This paper examines recent trends in migrant remittances in West African Economic and Monetary Union (WAEMU) and explores the main underlying factors, with a particular focus on digitization of financial services and financial sector development. A gravity model is estimated based on corridor data (8 WAEMU countries and 25 other countries) for the period from 2000 to 2021. The paper showed that remittances (inbound and outbound) are influenced by the sharing of a common border and official language, the stock of migrants in host and origin countries, and the GDP growth rate. Low GDP growth in WAEMU countries attracts inward remittances but reduces outward remittances. The adoption of digitalization with the use of mobile phones and the deepening of the financial sector both accelerate the entry of remittances into WAEMU countries. The marginal effect of adopting digital financial services on inward remittances is positively linked to financial development. Countries with more developed financial systems benefit from greater leverage of digitalization on migrant remittances. These results suggest some policy recommendations aimed at enhancing inbound remittance flows in WAEMU countries.

Keywords: *Bilateral remittances; WAEMU; Gravity model.*

JEL Classification codes: *F24; J61.*

¹ The ideas developed in this research do not necessarily represent the views of the Central Bank of West African States (BCEAO) or the institutions to which the author is affiliated. They engage the exclusive responsibility of the author.

1. Introduction

Recent decades of globalization and increasingly interconnected economies have seen an increase in the international migration of people in search of better living and working conditions. This dynamic has been accompanied by an unprecedented increase in the flow of remittances to migrants' countries of origin. Migrant remittances are private transfers of goods or financial assets made by workers considered resident in their host country to recipients in their country of origin. For many developing economies, remittances are more stable than other sources of external financing, such as official development assistance, external debt, and foreign direct investment flows. This financial resource provides an additional source of financing for growth, while alleviating liquidity constraints in developing countries.

Notwithstanding the potential drawbacks cited in the literature, such as the appreciation of the real exchange rate ("*Dutch disease*") and the possibility of reducing the labor supply of recipient households, remittances offer definite advantages for developing countries. On the one hand, they are mainly used to finance household consumption expenditure, education, and healthcare (Lucas and Stark, 1985, Yang and Choi, 2007). They also reduce income volatility and inflationary pressure in recipient countries, thereby helping to combat poverty (Ebeke and Drabo, 2010). Remittances also have a counter-cyclical effect, playing a stabilizing role in the face of shocks affecting recipient countries (Kpodar et al., 2022). They help to support the liquidity of commercial banks in the receiving country, which in turn helps to sustain the supply of credit to the economy (Gupta et al, 2007). Moreover, for many countries, migrant remittances are essential for mitigating the current account deficit in the balance of payments. In the presence of insufficient savings to finance investments, these funds constitute foreign currency inflows which help to mitigate the current account deficit with the outside world and contribute to the consolidation of foreign exchange reserves.

In the West African Economic and Monetary Union (WAEMU)², migrants use several formal channels (money transfer companies, postal networks, commercial banks, exchange offices, etc.) to send remittances. While remittance receipts are generally free of charge for the receiver, the costs inherent in sending remittances vary according to the destination country. They are generally lower when the recipient is a WAEMU member country, and relatively high when it is a non-member country. Transaction costs also depend on the amount sent and the exchange rate. Depending on the migrant's situation and the desire to benefit from competitive costs, informal channels are used³. In addition,

² The WAEMU includes Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, and Togo. These countries share the African Financial Community Franc (CFA Franc) managed by the Central Bank of West African States (BCEAO).

³ A survey conducted by the BCEAO in 2013 reveals that 17.3% of migrant remittances in the WAEMU pass through informal channels.

WAEMU monetary authorities have implemented several measures to facilitate migrant remittances by allowing financial institutions to subcontract this service to sub-agents and microfinance institutions, thereby expanding the distribution network across the territory.

In September 2025, the Central Bank of West African States (BCEAO) launched an interoperable platform for WAEMU instant payment system. This platform enables instant, low-cost digital payments within WAEMU countries, between customers of different players (banks, microfinance institutions, fintechs, and mobile money providers). This project is expected to improve financial inclusion and increase the efficiency of cross-border payments in the region. This project comes at a time when digital finance is gradually evolving alongside the deepening of the WAEMU financial sector, which is characterized by growth in the number of active banks and the emergence and rapid development of fintech companies that provide certain financial services to the population (deposits and withdrawals, domestic and cross-border payments, and transfers).

The literature on migrant remittances emphasizes that they are influenced by several microeconomic and macroeconomic factors (Amuedo-Dorantes, 2014; Yang, 2011). Following the altruistic motive, migrants send remittances to their families back home to support their consumption, education, and health needs (Rapoport and Docquier, 2006). Remittances also act as a safety net or insurance against income shocks in migrants' countries of origin. In this context, the literature has shown that they increase when the country of origin goes through a period of economic crisis, drought, and natural disasters (Agarwal and Horowitz, 2002; Chami et al., 2008). During the Covid-19 pandemic, migrant remittances acted as a shock absorber in developing countries (Kpodar et al., 2022; Dinarte et al., 2021; Shimizutani and Yamada, 2021). More recently, Imam et al. (2024) and Gnanon (2024) have highlighted the safety net role of remittances in times of high uncertainty in developing countries. Motivated by self-interest, remittances are sent by migrants to repay debts, set up businesses or make other forms of investment (Kpodar et al., 2022; Combes and Ebeke, 2011).

While the literature on migrant remittances is extensive, studies focusing on WAEMU countries are scarce due to a lack of data, particularly corridor data. Furthermore, the persistent use of informal channels by migrants suggests the existence of constraints that need to be identified and addressed. To help reduce the constraints that limit remittances and amplify their positive impact on WAEMU economies, this paper aims to analyze recent trends in remittances and identify the main factors behind their levels, focusing on factors overlooked in the literature, such as financial development and the adoption of digital technologies. The study relies on monthly and corridor or bilateral inbound and

outbound remittances data (8 WAEMU countries and 25 non-WAEMU countries) over the period 2000M1 to 2022M6 and mobilizes a gravity model.

The paper makes three contributions to the literature on migrant remittances in WAEMU countries. First, the paper showed that remittances (sent and received by migrants) are influenced by the sharing of a common border and official language, the stock of migrants in host and origin countries, and the GDP growth rate. Low GDP growth in WAEMU countries attracts inward remittances but reduces outward remittances. Second, the adoption of digitalization with the use of mobile phones and the deepening of the financial sector both accelerate the entry of remittances into the WAEMU countries. Third, the marginal effect of adopting digital financial services on inward remittances is positively linked to financial development. Countries with more developed financial systems benefit from greater leverage of digitalization on migrant remittances. These results suggest some policy recommendations aimed at enhancing remittance flows in WAEMU countries.

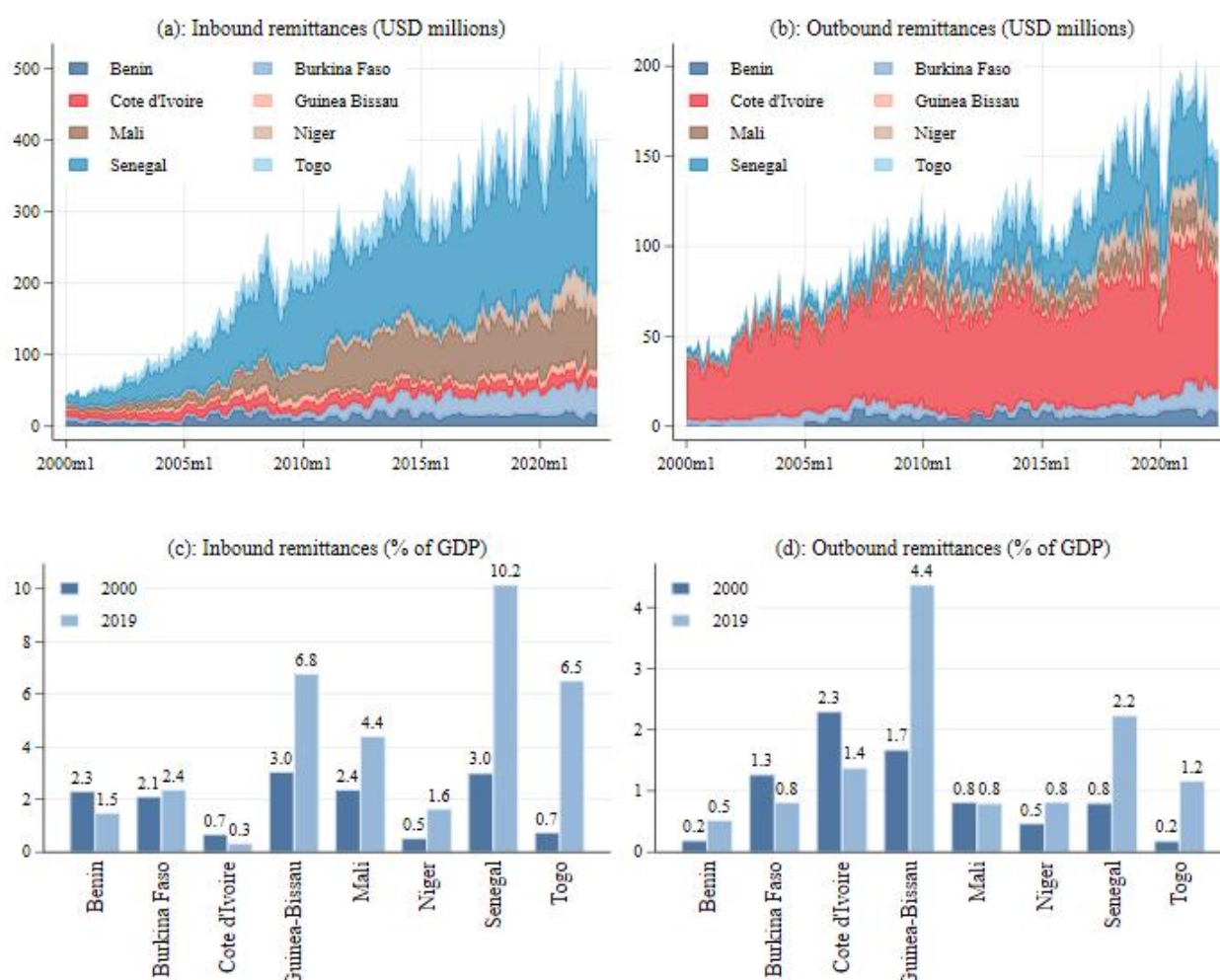
The rest of the paper is structured as follows. Section 2 presents some stylized facts concerning outgoing and incoming migrant remittances in the WAEMU region. The empirical strategy of the paper is presented in Section 3. Section 4 reports the main results and their implications. The last section concludes.

2. Recent trends in remittances in WAEMU countries

In the literature, migrant remittances refer to cross-border transfers of funds from an individual working in a foreign country to another person living in the country of origin. The amounts sent represent a fraction of the migrant's income from work, sent mainly to family members or close relatives. According to the 6th edition of the International Monetary Fund's guidelines for the compilation of the balance of payments, they include goods and financial assets. They also cover personal remittances and transfers to non-profit organizations providing services to households. Remittances generally involve small amounts sent frequently between relatively wealthy countries and relatively poor households or individuals in the receiving country. Large amounts are usually sent during religious celebrations and cultural events, or when shocks such as droughts, floods, and conflicts occur in the countries of origin. According to the results of a survey conducted by the Central Bank of West African States (BCEAO, 2013) in WAEMU countries, the funds received are mainly used for household consumption (54.6%), investment in real estate (15.8%), education and health expenses (6.4% and 3.4% respectively), and other investments (5.5%). Family and religious events account for 8.7% of migrant remittances. On the other hand, outbound remittances are used for current consumption expenditure (40.4%), education (22.3%), and real estate investment (16.5%).

Figure 1 below shows several stylized facts about remittances in WAEMU countries. First, countries in the region receive more remittances than they send, constituting a net inflow of financial resources and foreign currency (Figures 1a and 1b). In 2020, outbound remittances amounted to approximately 200 million USD, compared to a total of 500 million USD in inbound remittances. Second, the trend in remittances (received and sent) shows a significant increase over the period 2000M1 and 2022M6. To illustrate, inbound remittances received were multiplied by 10 between 2000 and 2020, before declining slightly during the covid-19 pandemic (Figure 1a). Focusing on individual countries, it emerges that Senegal and Mali are the two biggest recipients of migrant remittances, ahead of Côte d'Ivoire, the largest economy in the region in terms of GDP. On the other hand, Cote d'Ivoire and Senegal are the main remittance-sending countries.

Figure 1: Trends in remittances (received and sent) in WAEMU countries from 2000M1 to 2022M6

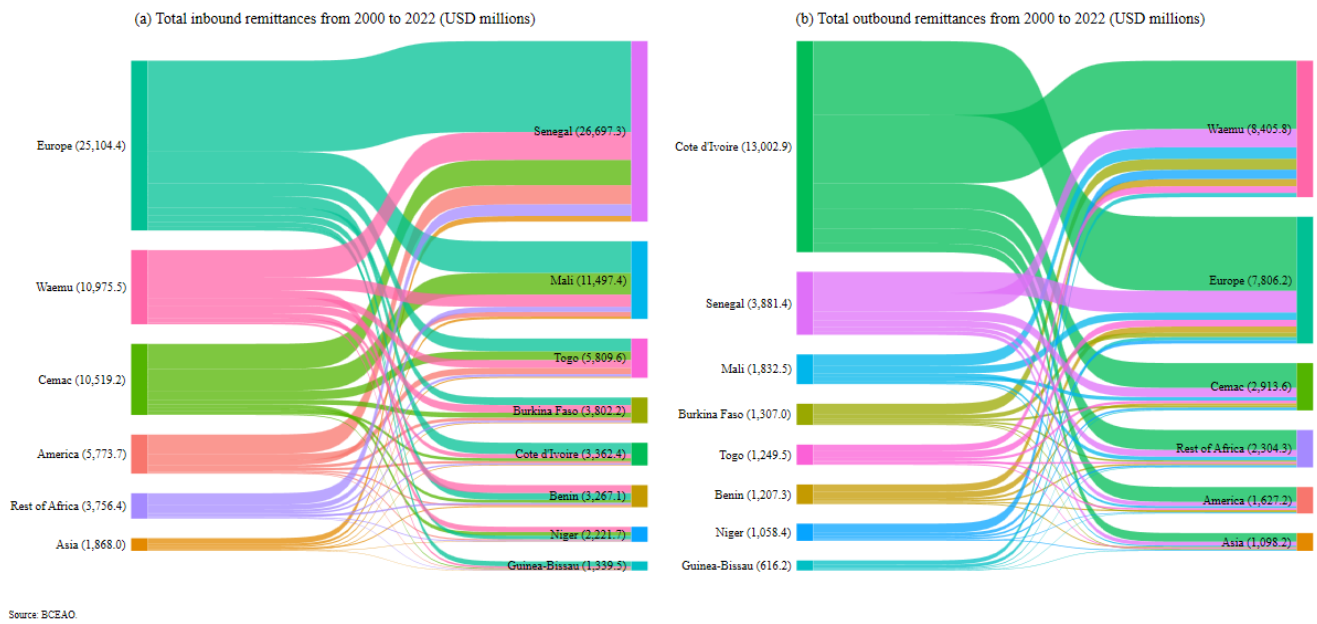


Source: Author based on BCEAO data

When comparing remittance as a percentage of annual GDP, a positive trend can be observed in most countries, particularly for inflows. Between 2000 and 2019, Senegal, Togo, and Guinea-Bissau were the

countries that experienced significant growth in remittance inflows as percentage of GDP. In Senegal, the ratio reached double digits, rising from 3% in 2000 to 10.2% in 2019 (Figure 1c). In these three countries, the dynamics of outflows also increased over the same period. In WAEMU, outbound remittances grew most significantly in Guinea-Bissau, reaching 4.4% of GDP in 2019, compared to 1.7% in 2000 (Figure 1d). These disparities in the size of remittances observed in WAEMU countries may be linked to differences in economic, cultural, migratory, regulatory factors, and the adoption of digital technologies.

Figure 2: Sources and destinations of remittances (received and sent) of WAEMU



Source: Author based on BCEAO data

The panel (a) in Figure 2 illustrates the main sources of inbound remittances received by WAEMU countries. It shows that over the entire analysis period, WAEMU countries receive more remittances from migrants in Europe (25,104.4 million USD) and the CEMAC zone (10,519.2 million USD). Inbound remittances within WAEMU countries amounted to 10.975.5 million USD, ranking second behind Europe. During the study period, Senegal, Mali, and Togo were the primary beneficiaries of these resources. Panel (b) of Figure 2 shows the main destinations of remittances sent from WAEMU countries. It shows that WAEMU region (USD 8,405.8 million) and Europe (USD 7,806.2 million) are the main destinations. The economic size of Cote d'Ivoire and Senegal explains why they are the top two sending countries of remittances from the WAEMU region. The relatively large size of Europe as a source and destination of remittances may be linked to linguistic and geographical proximity, as well as colonial ties between European countries and those of the WAEMU, which make this region a preferred destination for their migrants. In addition, the CFA franc, the currency of the WAEMU countries, is

pegged to the euro at a fixed exchange rate, which eliminates exchange rate volatility and facilitates remittances by migrants. The importance of intra-WAEMU remittances may be linked to the existence of a common regulatory framework and the use of a single currency. These factors eliminate exchange rate volatility risks and reduce the cost of intra-WAEMU remittances.

Figures 3a and 3b provide a more detailed geographical breakdown, highlighting the top 5 sources and destinations of remittances received and sent from WAEMU countries. Figure 3a shows that France, United States, Italy, Spain, and Cameroon are the top five countries sending remittances to WAEMU countries. Similarly, WAEMU countries send remittances mainly to Germany, France, United States, Cameroon, and Morocco (Figure 3b). Both inflows and outflows of remittances show an upward trend over the entire period from 2000 to 2021. Figures 3a and 3b show that the Covid-19 period was marked by an increase in remittances, followed by a slight decline over the period from 2020 to 2021. This dynamic reflects the role of remittances as a safety net in times of major shock.

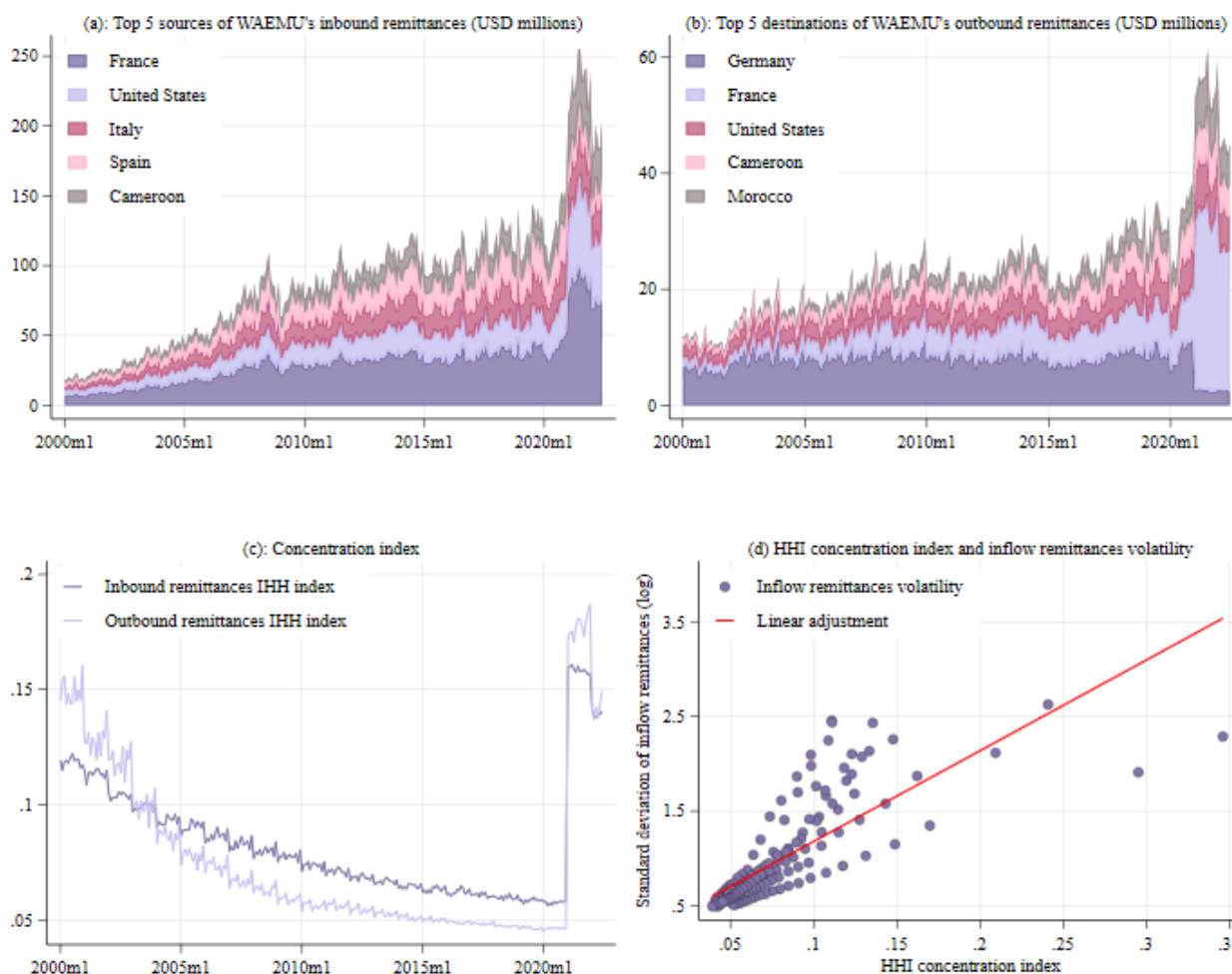
The analysis of stylized facts is supplemented by exploring the concentration of migrant remittances (received and sent) in terms of sending and receiving countries excluding WAEMU countries. A concentration index based on Herfindahl-Hirschman (HHI) was calculated as follows:

$$HHI_k = \sum_{i=1}^N \left(\frac{Rem_{ki}}{\sum Rem_{ki}} \right)^2 \quad (1)$$

Where k is either outbound or inbound remittances and Rem_{ki} represents the total remittances from (or to) country i . The total number N of non WAEMU countries is 25. The index is defined to range between $1/N$ and 1. The higher it is, the more remittances from (or to) WAEMU countries are concentrated among a small number of countries.

Figure 3c reveals that the amounts of remittances (received and sent) are relatively diversified among the 25 partner countries. The concentration levels of the HHI indices for both inflow and outflow of remittance declined significantly over the period from 2000 to 2020. This diversification of sources of migrant remittances ensures relative stability in the resources entering WAEMU countries in the event of economic shocks in the sending countries. Figure 3c also illustrates the effects of the Covid-19 crisis, which led to a sharp rise in concentration indices during 2020 with the implementation of lockdown measures in several countries. Figure 3d shows the correlation between the HHI concentration index and volatility (standard deviation of the log of remittances) over one year of total migrant remittance inflows. A positive correlation appears in Figure 3d. It shows that the more remittances come from a small number of countries, the more volatile the total migrant remittances of a country are.

Figure 3: Top sending and receiving countries of WAEMU's inbound and outbound remittances



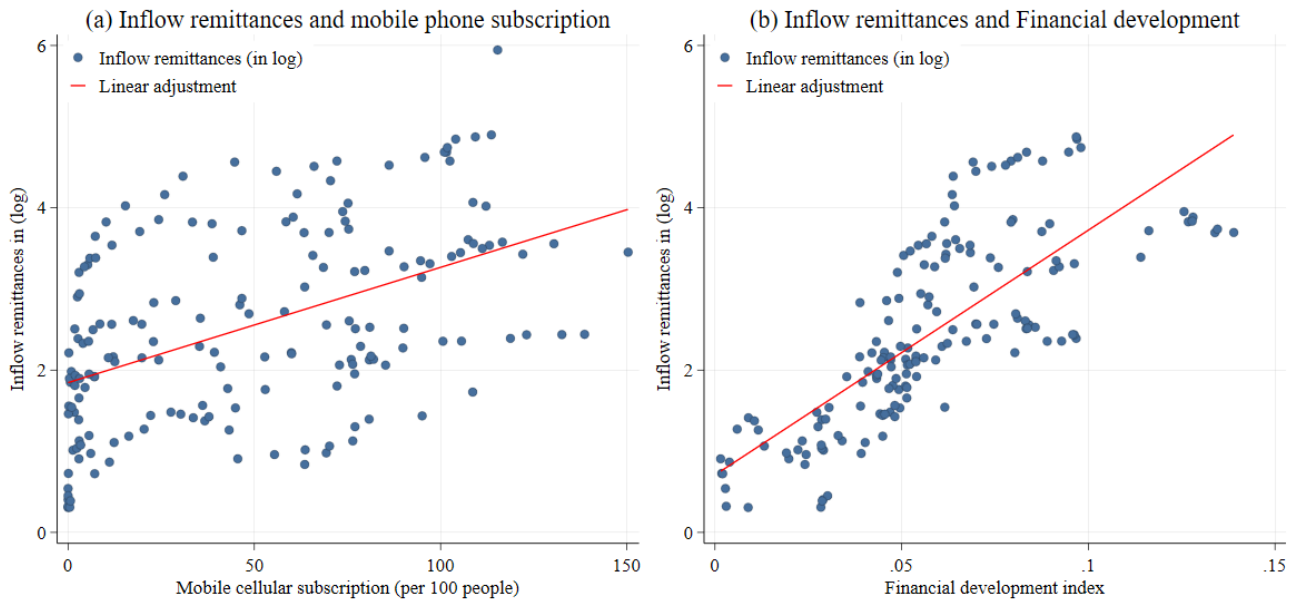
Source: Author based on BCEAO data

The trends in remittances described above have occurred in a unique context in which both the demand for and supply of financial services have changed significantly. On the demand side, there has been rapid growth in the adoption of digital financial services by the population, particularly services for deposits, withdrawals, payments, and domestic and cross-border transfers. Volumetric indicators for electronic money issuers in the WAEMU show that the number and value of transactions carried out between 2016 and 2022 have grown exponentially, increasing sixfold and sevenfold respectively (2016 and 2022 reports from the WAEMU Banking Commission). Regarding supply factors, it should be noted that, in addition to fintechs, there has been steady growth in the number of banks operating in the region over the last few decades. With a total of 66 banks and financial institutions in 2003, the WAEMU banking sector had 155 entities in operation in 2022, representing an increase of 135% in twenty (20) years.

Figure 4 illustrates the potential effects of these two major changes (digitalization and financial deepening) on remittances entering WAEMU countries. Digitalization was proxied over the study period

by the number of mobile phones per 100 inhabitants, while financial deepening was measured by the Financial Institutions Development Index proposed by the International Monetary Fund (IMF). There is a positive correlation between the adoption of digital financial services and inbound remittances in WAEMU countries (Figure 4a). Similarly, WAEMU countries with relatively more developed financial systems tend to receive more remittances from migrants. These correlations could also suggest that migrants tend to use digital tools offered by various stakeholders in the financial system to transfer money to their families.

Figure 4: Mobile cellular subscription, financial development, and inbound remittances in WAEMU



Source: Author based on WDI and IMF data

Overall, stylized facts showed that both inbound and outbound remittances experienced favorable developments in WAEMU countries. Factors underlying these trends are explored in the next section with more sophisticated methods.

3. Empirical strategy

Our empirical analysis of the drivers of migrant remittances is based on a gravity model. Derived from Newton's law of gravity, the gravity model has been widely used in the literature on international trade and in exploring the effects of trade agreements (Anderson, 1979; Bergstrand, 1985; Anderson and Wincoop, 2001). The main idea behind the model is that the intensity of exchanges or interactions between two economic entities is proportional to their size and inversely proportional to the distance between them. In the case of migrant remittances, the simplest expression of the model, for any pair of countries (i, j) , is as follows:

$$REM_{ij}^k = A \frac{(MIGRANT_{ij} \times MIGRANT_{ji})^\beta}{(DIST_{ij})^\alpha} \quad (2)$$

Where $k = \{Inflow, Outflow\}$, REM_{ij}^k represents the value of bilateral migrant remittances (inflow or outflow) between country i and country j , $MIGRANT_{ij}$ is the size of the stock of migrants from country i in country j , $MIGRANT_{ji}$ is the size of the stock of migrants from country j in country i , $DIST_{ij}$ is the distance between the two partner countries. A , α , and β are parameters. To address the research questions of this paper, we adopt a specification close to those of Lueth and Ruiz-Arranz (2008) and Fagiolo and Rughi (2023). We introduce additional control variables. We start with an augmented gravity model specified as follows:

$$\begin{aligned} \text{Log}(REM_{ijt}^k) = & \alpha_1 GDPG_{it} + \alpha_2 GDPG_{jt} + \alpha_3 LDIST_{ij} + \alpha_4 LANG_{ij} + \alpha_5 BORDER_{ij} \\ & + \alpha_6 LMIGRANT_{ijt} + \alpha_7 LMIGRANT_{jit} + \alpha_8 VOL_{ijt} \\ & + \gamma_i + \lambda_j + \vartheta_t + \varepsilon_{ijt} \end{aligned} \quad (3)$$

The time dimension t has been added to this specification to obtain a panel data structure. Remittances (received or sent), migrant stock, and distance are taken as logarithms. While the literature focuses on remittances received by developing countries, our analysis also covers those sent from WAEMU countries. Real GDP growth rates ($GDPG_{i(j)t}$) of the country pair are added to the control variables. The role of remittances as a safety net suggests that migrants send more resources to their families when economic conditions deteriorate in their country of origin, particularly in the event of major shocks such as droughts, recessions, or disasters. Conversely, when the host country experiences a recession, such as during the 2008 financial crisis, the amounts sent by migrants decline (Freund and Spatafora, 2007; Abdih et al., 2012; Barajas et al., 2010). For instance, during the global financial crisis, when advanced economies suffered collapses in growth, remittance flows to low- and middle-income countries fell by 5 percent (Kpodar et al., 2022). Thus, a positive sign is expected for coefficient α_2 and a negative sign for parameter α_1 . On the other hand, coefficients α_6 and α_7 of the log of migrant stock ($LMIGRANT_{ijt}$ and $LMIGRANT_{jit}$) are assumed to be positive for both incoming and outgoing remittance equations, based on the idea that countries with larger numbers of migrants abroad generally receive more remittances. Similarly, a country i that hosts more nationals from a country j will tend to receive more remittances from that country. VOL_{ijt} captures the effect of bilateral nominal exchange rate volatility on migrant remittances. Volatility is measured by the standard deviation of the bilateral exchange rate obtained from monthly data. High bilateral exchange rate volatility can reduce remittances sent or received, as it may encourage migrants to defer transactions until they have a clearer idea of the amounts they will need to send to their families (Iman et al., 2024).

The logarithmic distance ($LDIST_{ij}$) can be used to approximate transaction costs. Distance is said to have a negative effect on migrant remittances because it generates transaction costs that are higher when the distance between two partners is greater (Lueth and Ruiz-Arranz, 2008). In the context of this paper, this variable could consider the fact that transaction costs are relatively lower when they involve WAEMU countries that are geographically close to each other compared to other countries in the sample. Sharing a common border influences migration flows, trade, and remittances through geographical, historical, and cultural proximity. This is captured by a dummy variable ($BORDER_{ij}$) which takes the value 1 if the two countries share a common border and 0 otherwise. In addition, sharing a common official language ($LANG_{ij}$) should have a positive effect on remittance flows. Sharing a common language is a factor that determines the choice of destination country and the economic and social integration of migrants. Positive signs are therefore expected for parameters α_3 , α_4 , and α_5 . The term ε_{ijt} captures the classic error, while γ_i and λ_j are country-specific effects. The ϑ_t term accounts for the temporal effects common to all country pairs.

Several estimation techniques are used in the literature to estimate a gravity model. However, best practices in the context of trade suggest using the Pseudo Poisson Maximum Likelihood (PPML) estimator. According to Santos and Tenreyro (2011) and Martinez-Zarzoso (2013), this method is robust to heteroscedasticity and is suitable when the proportion of zero trade is high. Yet, the issue of zero values is less of a concern in this study, as zero or non-existent remittances between country pairs represent 0.23% and 0.14% of total observations for inbound and outbound remittances, respectively. In line with the above, we estimate model (3) using the fixed effects panel estimator as the dependent and most of the independent variables in the study are stationary in level (Table A3 in Appendix). The introduction of time-invariant country fixed effects allows us to control for unobservable variables specific to each country.

The econometric analysis covers the period from 2000 to 2021 on an annual basis. A total of thirty-three (33) countries, including eight (8) from the WAEMU, are included in the sample. The data are structured to show, on the one hand, intra-WAEMU remittances, on the other hand, outbound and inbound remittances from twenty-five (25) non-WAEMU countries. The Table A2 in Appendix presents the countries in the sample. This panel structure provides a total of 5,632 ($8 \times 32 \times 22$) observations. They come from the BCEAO. The data on the bilateral migrant stock come from the World Bank. The growth rates, mobile cellular subscriptions, and financial sector rating are taken from the World Development Indicators (WDI) database. The nominal exchange rate data were extracted from International Financial Statistics (IFS). Financial Institutions Depth Index data is collected from the IMF database. Other data

relating to the gravity model come from the Center for Prospective Studies and International Information (CEPII). The data and descriptive statistics are presented in more detail in Table A1 and A4 in Appendix.

4. Results

This section presents the baseline results of the econometric analysis and the effects of digitalization and financial development on inward migrant remittances.

4.1. Baseline results

The results of the gravity model (3) estimates are presented in Tables 1 and 2, for inward and outward remittances, respectively. The variables are included progressively to assess their contributions to the overall significance of the models. Preferred specifications are reported in columns 4. The analysis of the results shows the significance of several variables with the expected signs in line with the existing literature. The gravity model proves to be effective in explaining bilateral flows of remittances (inward and outward) from migrants in the WAEMU region. The values of the R-squared statistics show that the model explains more than 82% of the variations in bilateral flows of inward and outward remittances.

Table 1 shows that remittances inflows into WAEMU countries are determined by both macroeconomic factors and variables related to geographical, linguistic, and cultural proximity. Regarding the classic variables of the gravity model, sharing a common official language significantly affects migrant remittance inflows. The coefficient for this variable is significant at 1% in all regressions. As most WAEMU countries are French-speaking, these results corroborate the stylized facts illustrated in Figures 2a and 3a, which revealed that most remittances received come from other WAEMU countries and Europe, with France as the main sending countries. Other gravity variables such as sharing a common border and distance are not significant in the specification in column 4. However, they are significant with the others, with the expected signs. Sharing a common border would encourage migrant remittances, while distance and transaction costs would discourage them.

These results can also be interpreted in relation to the migrant stocks of peer countries. Indeed, the parameters (α_6 and α_7) are significant at 1%, reflecting the positive effects of migration on remittances. Countries with a large stock of migrants abroad would therefore tend to attract more remittances (Kpodar et al., 2022; Imam et al., 2024). This result is also evident in countries that share a common border. Indeed, intraregional migration within the WAEMU is significant and can stimulate remittances. Although practiced by low-income individuals who cannot afford to migrate to developed countries outside the continent, these peoples, living in border countries, contribute to the economic life of their families in their home countries.

Table 1: Determinants of migrants' inbound remittances in WAEMU countries over 2000 to 2021 period

Variables	Inflow remittances in (log)			
	(1)	(2)	(3)	(4)
Common border	0.2209*** (0.026)	0.2209*** (0.026)	0.1260*** (0.027)	0.0376 (0.028)
Common official language	0.2603*** (0.031)	0.2603*** (0.031)	0.2028*** (0.030)	0.1598*** (0.031)
Distance (in log)	-0.0903*** (0.020)	-0.0903*** (0.020)	-0.0575*** (0.020)	-0.0289 (0.020)
Exchange rate volatility (sd)	0.0016 (0.002)	0.0015 (0.002)	0.0020 (0.002)	0.0018 (0.002)
GDP growth of the receiving country	-0.0329*** (0.003)	-0.0330*** (0.003)	-0.0342*** (0.003)	-0.0318*** (0.003)
GDP growth of the sending country		-0.0021 (0.002)	-0.0023 (0.002)	-0.0024 (0.002)
Migrant stock of the receiving country (in log)			0.0293*** (0.003)	0.0222*** (0.003)
Migrant stock of the sending country (in log)				0.0330*** (0.003)
Constant	2.3840*** (0.158)	2.3932*** (0.159)	2.0313*** (0.160)	1.7489*** (0.164)
Observations	5,376	5,376	5,376	5,376
R-squared	0.824	0.824	0.827	0.831
Receiving country fixed effects	Yes	Yes	Yes	Yes
Sending country fixed effects	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes

Source: Author's estimates. The model was estimated using the panel fixed effects method. Country fixed effects and time effects were included in the model. Robust standard deviations are shown in parentheses. (*), (**) and (***) respectively denote statistical significance at 10%, 5% and 1%.

The negative and significant at 1% sign in all regressions of the GDP growth rate of the home country confirms the countercyclical role played by migrant remittances in WAEMU countries. According to the specification in column 4 of Table 1, all other things being equal, a 1 percentage point decline in the growth rate would lead to a 3.18% increase in inward migrant remittances in WAEMU countries. This result confirms the role of remittances as a safety net in the event of a major shock occurring in migrants' home countries (Lueth and Ruiz-Arranz, 2008).

Table 2 presents the results of the estimates of the determinants of outward remittances. They confirm the positive effects of the migrant stock, the sharing of an official language, and a common border, with statistical significance levels of 1% in all regressions. The effect of distance is significantly negative at 10% in only two specifications. However, unlike inward remittances, Table 2 shows that the stronger the economic growth in WAEMU countries, the more outward remittances increase. Indeed, migrants' ability to send money out of WAEMU countries improves as the GDP growth rate of the sending country accelerates. Similar results were highlighted by Iman et al. (2024) based on a sample of developing

countries. The authors showed that favorable economic prospects in host countries have a positive effect on migrants' remittances to their countries of origin. Specification 4 in Table 2 suggests that a 1% increase in the GDP growth rate of WAEMU countries leads to an average increase in outward remittances of 0.8%, with other determinants held constant.

Table 2: Determinants of migrants' outbound remittances in WAEMU countries over 2000 to 2021 period

Variables	Outflow remittances in (log)			
	(1)	(2)	(3)	(4)
Common border	0.3351*** (0.024)	0.3351*** (0.024)	0.2638*** (0.023)	0.2325*** (0.024)
Common official language	0.1283*** (0.020)	0.1283*** (0.020)	0.0851*** (0.020)	0.0698*** (0.020)
Distance (in log)	-0.0303* (0.016)	-0.0303* (0.016)	-0.0056 (0.016)	0.0045 (0.016)
Exchange rate volatility (sd)	0.0003 (0.001)	0.0003 (0.001)	0.0006 (0.001)	0.0006 (0.002)
GDP growth of the sending country	0.0084*** (0.002)	0.0083*** (0.002)	0.0074*** (0.002)	0.0083*** (0.002)
GDP growth of the receiving country		-0.0005 (0.001)	-0.0007 (0.001)	-0.0007 (0.001)
Migrant stock of the sending country (in log)			0.0220*** (0.002)	0.0195*** (0.002)
Migrant stock of the receiving country (in log)				0.0117*** (0.002)
Constant	1.2026*** (0.133)	1.2049*** (0.133)	0.9331*** (0.132)	0.8332*** (0.132)
Observations	5,376	5,376	5,376	5,376
R-squared	0.866	0.866	0.869	0.869
Receiving country fixed effects	Yes	Yes	Yes	Yes
Sending country fixed effects	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes

Source: Author's estimates. The model was estimated using the panel fixed effects method. Country fixed effects and time effects were included in the model. Robust standard deviations are shown in parentheses. (*), (**) and (***) respectively denote statistical significance at 10%, 5% and 1%.

4.2. Digitalization, financial development, and inbound remittances in WAEMU countries

This section expands on the previous empirical analysis by investigating the impact of changes observed in the WAEMU in terms of the adoption of digital financial services by the population and the development of the financial system on the dynamics of migrant remittances. Indeed, the digitization of financial services, which consists of integrating digital technologies into the process of providing financial services to make them more tailored to customer needs, could facilitate migrants' use of mobile phone-based digital payment systems to send money to their families. These new national and cross-border payment systems appear to be more secure than the informal channels previously used by

migrants and faster than traditional banking services such as bank transfers. To test this hypothesis, the paper extends the empirical model (3) by adding variables relating to digitalization in both the sending and receiving countries.

The adoption of financial services digitization was proxied by the number of mobile phones per capita over the study period. The rationale behind this choice is that most digital cross-border money transfer services in WAEMU countries are deployed on mobile phones. Furthermore, this choice is justified by the absence of uniform digital finance indicators across the study period and for all countries in the sample. However, it carries a risk of endogeneity in estimating the unbiased effect of digitization on migrant remittances. The probability of an inverse causality between remittances and mobile phone ownership is not zero. Remittances sent by migrants can be used to purchase various goods, including mobile phones. However, in the context of the WAEMU countries, this risk appears to be marginal because, on the one hand, the survey conducted by the BCEAO (2013) showed that 54.6% of remittances received are used for consumption and 15.8% for investment in real estate, and on the other hand, the purchase of mobile phones is not a regular household expense. We consider the proportion of remittances received that is used to purchase mobile phones in WAEMU countries to be very low. On this basis, the study assumes that it is mobile phone ownership, which facilitates access to digital services, that promotes the inflow of remittances from migrants.

Table 3 presents the results of the estimates using the fixed effects method. They show, on the one hand, that the inclusion of the new variables does not alter the previous results. On the other hand, they reveal that the adoption of mobile phones by WAEMU countries is a catalyst that facilitates the entry of migrant remittances. The coefficient for this variable (0.0057) is significant at 1%. This result suggests that the digitization of financial services would facilitate the inflow of migrant remittances. For migrants, digitization offers greater security for funds sent to family members compared to informal channels. It speeds up transactions, avoiding wasted time spent in banks and money transfer agencies to send money. Finally, digitization allows migrants to benefit from low transaction costs when sending funds. These costs tend to fall as the technology becomes more widespread in the financial sector and other players such as fintech companies offer similar services.

The effect of financial development on inbound migrant remittances is also explored. A relatively more developed financial system can offer new digital financial services tailored to the needs of migrants. On the one hand, the increase in the number of banks in WAEMU countries has been accompanied by an expansion of their networks of branches and outsourcing partners offering rapid transfer services. This development facilitates access to migrant remittance services. On the other hand, some fintech

companies, electronic money operators, and cross-border payment operators develop their services in partnership with WAEMU commercial banks to take advantage of their branch networks both nationally and across borders.

Table 3: Digital tools adoption effects on inbound remittances in WAEMU countries

Variables	Inflow remittances in (log)		
	(1)	(2)	(3)
Common border	0.0425 (0.027)	0.0370 (0.028)	0.0419 (0.027)
Common official language	0.1624*** (0.029)	0.1597*** (0.031)	0.1624*** (0.029)
Distance (in log)	-0.0314 (0.020)	-0.0288 (0.020)	-0.0314 (0.020)
Exchange rate volatility (sd)	0.0018 (0.002)	0.0017 (0.002)	0.0017 (0.002)
GDP growth of the receiving country	-0.0299*** (0.003)	-0.0317*** (0.003)	-0.0298*** (0.003)
GDP growth of the sending country	-0.0024 (0.002)	-0.0023 (0.002)	-0.0023 (0.002)
Migrant stock of the receiving country (in log)	0.0219*** (0.003)	0.0220*** (0.003)	0.0218*** (0.003)
Migrant stock of the sending country (in log)	0.0313*** (0.003)	0.0334*** (0.003)	0.0317*** (0.003)
Mobile cellular subscriptions in the receiving country	0.0057*** (0.001)		0.0057*** (0.001)
Mobile cellular subscriptions in the sending country		-0.0004 (0.000)	-0.0004 (0.000)
Constant	1.4991*** (0.162)	1.7797*** (0.167)	1.5263*** (0.165)
Observations	5,344	5,369	5,337
R-squared	0.836	0.831	0.835
Receiving country fixed effects	Yes	Yes	Yes
Sending country fixed effects	Yes	Yes	Yes
Year effects	Yes	Yes	Yes

Source: Author's estimates. The model was estimated using the panel fixed effects method. Country fixed effects and time effects were included in the model. Robust standard deviations are shown in parentheses. (*), (**) and (***) respectively denote statistical significance at 10%, 5% and 1%.

Finally, WAEMU is characterized by the presence of several cross-border or pan-African banking groups that are setting up digital services to transfer money from one country to another. To assess the role of financial development in the recent dynamics of migrant remittances in WAEMU, the paper uses two indicators. The first indicator is the Country Policy and Institutional Assessment (CPIA) rating of the financial sector designed by the World Bank. This indicator, ranging from 1 (low) to 6 (high), measures the strength and effectiveness of a country's financial sector policies and institutions, with higher scores indicating better performance. The second indicator is a composite index from the IMF that measures

the development of financial institutions. The results of the estimates, with these variables incorporated into the gravity model (3), are presented in Table 4.

Table 4: Financial development, digital tools adoption and inbound remittances in WAEMU countries

Variables	Inflow remittances in (log)			
	(1)	(2)	(3)	(4)
Common border	0.0457 (0.028)	0.0386 (0.028)	0.0448 (0.028)	0.0390 (0.028)
Common official language	0.1675*** (0.029)	0.1631*** (0.028)	0.1674*** (0.027)	0.1634*** (0.028)
Distance (in log)	-0.0330* (0.020)	-0.0260 (0.019)	-0.0327* (0.020)	-0.0261 (0.019)
Exchange rate volatility (sd)	0.0019 (0.002)	0.0016 (0.002)	0.0019 (0.002)	0.0016 (0.002)
GDP growth of the receiving country	-0.0277*** (0.003)	-0.0285*** (0.003)	-0.0322*** (0.003)	-0.0286*** (0.003)
GDP growth of the sending country	-0.0025 (0.002)	-0.0024 (0.002)	-0.0025 (0.002)	-0.0024 (0.002)
Migrant stock of the receiving country (in log)	0.0223*** (0.003)	0.0213*** (0.003)	0.0209*** (0.003)	0.0210*** (0.003)
Migrant stock of the sending country (in log)	0.0309*** (0.003)	0.0264*** (0.003)	0.0326*** (0.003)	0.0265*** (0.003)
Financial Institutions Depth Index	4.4887*** (0.639)		-0.5116 (1.151)	
Mobile cellular subscriptions (MCS)	0.0067*** (0.001)	0.0022*** (0.001)	0.0020** (0.001)	-0.0019 (0.002)
Financial sector rating		0.4244*** (0.033)		0.3441*** (0.056)
MCS x Financial Institutions Depth Index			0.0539*** (0.009)	
MCS x Financial sector rating				0.0012* (0.001)
Constant	1.1784*** (0.168)	0.6256*** (0.176)	1.5294*** (0.177)	0.8827*** (0.219)
Observations	5,088	4,064	5,088	4,064
R-squared	0.833	0.864	0.834	0.865
Receiving country fixed effects	Yes	Yes	Yes	Yes
Sending country fixed effects	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes

Source: Author's estimates. The model was estimated using the panel fixed effects method. Country fixed effects and time effects were included in the model. Robust standard deviations are shown in parentheses. (*), (**) and (***) respectively denote statistical significance at 10%, 5% and 1%.

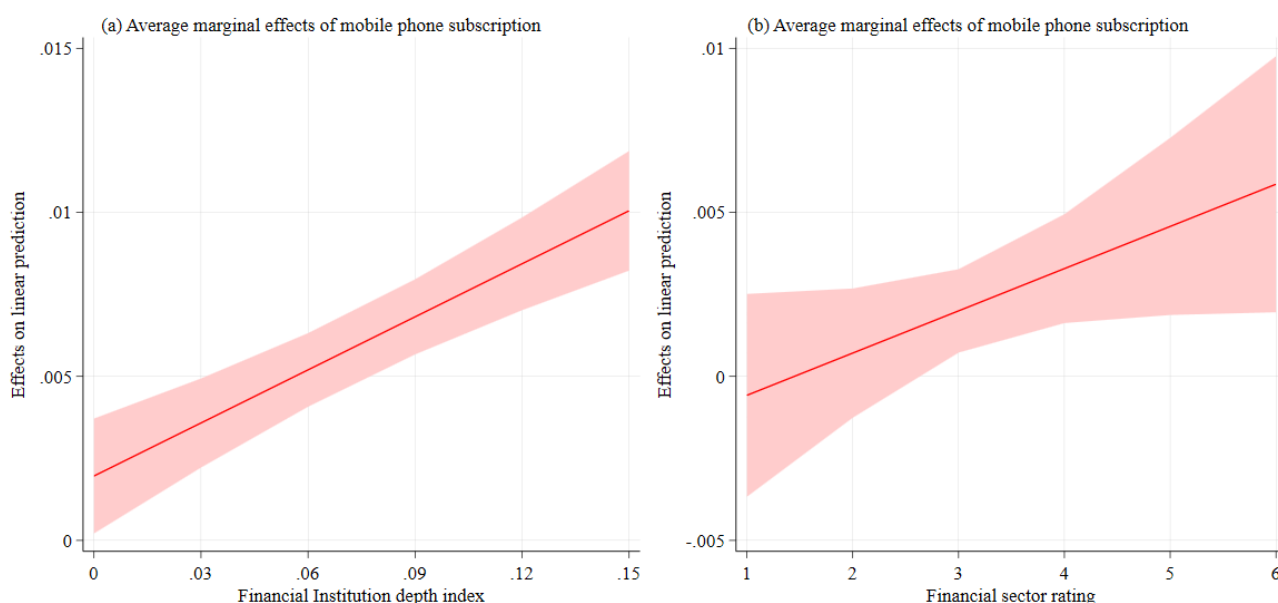
The results show, first, that the baseline results are robust to the inclusion of additional variables. Indeed, sharing a common official language, growth rate, migrant stocks, and the adoption of digital payments via mobile phones have preserved the signs of their coefficients and their statistical significance. Second, Table 4 shows that the overall significance of the baseline model improved with the inclusion of new

variables, as the R-squared value increased from 82% to 86%. Third, the signs of the coefficients of the variables capturing the effect of financial development are positive and significant at 1%. These results are in line with recent developments observed in the financial system of WAEMU countries. The hypothesis that the effect of digitization on remittances is conditional on the degree of financial development was tested by including an interaction variable between mobile phone subscriptions and financial development indicators. The results are shown in columns 3 and 4 of Table 4.

It appears that the coefficients of the interaction variables are all significant. This result shows that the effect of financial services digitization on migrant remittances depends on the level of financial development. The higher the level of financial development, the greater the effect. Countries with more efficient financial systems attract more remittances through the digitization of cross-border payment services. Indeed, the more efficient the financial system, the greater its capacity to amplify the momentum of financial service digitization. Despite the expected benefits, such as customer loyalty, improved quality of financial services, and reduced operating costs, the digitization of financial services requires significant human and financial resources that underperforming institutions do not necessarily have. In addition, it involves significant initial costs and raises a number of technical constraints relating to the existence of high-quality infrastructure (availability of a stable internet network, high-performance IT equipment, suitable software, interconnection of the institution's information systems with the mobile technologies used, and centralization of data) that only solid and developed financial institutions can support. Thus, the effect of digitization on migrant remittances goes hand in hand with financial development in WAEMU countries.

Figure 5 illustrates this relationship. It shows the marginal effects of mobile phone adoption on migrant remittances depending on the level of financial development, surrounded by their 95% confidence intervals. These marginal effects are estimated based on the results reported in columns 3 and 4 of Table 4. They are increasing and significant for both indicators. To illustrate, a country whose financial system performance is rated at 3 benefits from a marginal effect of digitization of around 0.002, compared to 0.006 for a country with a score of 6 (Figure 5b). Similarly, when the financial institutions development index is 0.06, the marginal effect of digitization is estimated at 0.005, compared to 0.01 when the index reaches 0.15 (Figure 5a).

Figure 5: Conditional effects of digital tools adoption on inbound remittances in WAEMU countries



Source: Author's estimates.

5. Conclusion and policy implication

The objective of this paper was to analyze recent developments in migrant remittances in WAEMU countries and to explore the main underlying factors, with a particular focus on digitalization and financial sector development. The analysis was based on corridor data (8 WAEMU countries and 25 other countries) from 2000M1 to 2022M6. The stylized facts showed that WAEMU countries receive more remittances than they send. Inward and outward remittances increased significantly over the period under review, both in absolute terms and as percentage of GDP. Over the period under review, the WAEMU region witnessed a gradual decline in the concentration of remittances received from a small number of sending countries. Countries with more diversified sources tend to experience low volatility of inward remittances.

The econometric analysis of the determinants of inbound and outbound remittances was based on a gravity model estimated using the fixed effects panel method. The sharing of a common official language, GDP growth rate, the stock of migrants, the adoption of digital technologies, and financial development were the main factors explaining the dynamics of remittances in WAEMU countries with partner countries. The positive effect of migrant stocks on remittances suggests that as the population of WAEMU countries increases, it could be conjectured that there will be an increase in the number of migrants and also in inflows of remittances. However, a decline in the number of WAEMU nationals in developed countries due to anti-migration policies and deportations could result also in a drop in inward

remittances. The growth rate of WAEMU countries appears to have a positive impact on outward remittances, while it is negatively correlated with inward remittances. This latter relationship highlights the countercyclical or safety net role that inward remittances play for populations in WAEMU countries. Based on this important macroeconomic role, WAEMU countries could strengthen their policies and programs designed to reduce the constraints (costs and access to financial services) that limit the inflow of migrant remittances.

Focusing particularly on incoming remittances, the analysis showed that financial development and the digitization of financial services (proxied by the rate of mobile phone adoption) acted as catalysts for inward remittances in WAEMU during the study period. More importantly, the marginal effect of digitization appears to be positively linked to financial development. These results suggest that WAEMU countries could attract more migrant remittances when the benefits of digitization are fully exploited. Policies aimed at encouraging the development of cross-border payment and transfer methods could be strengthened by creating synergies between all players in the financial sector, including electronic money issuers, fintech companies, microfinance institutions, commercial banks, and the central bank. In this connection, the interoperability project launched in WAEMU countries in September 2025 has great potential to improve intra-WAEMU remittance and trade. The paper recommends further consideration of extending this initiative to other countries in the region and Africa in order to amplify its impact on migrant remittances.

The development of banks and the expansion of their branch networks in WAEMU countries could increase remittance inflows through formal channels. To reduce migrant remittances through informal channels, WAEMU countries should implement the measures set out in their financial inclusion, banking access, and digitalization policies, including financial education for the population and facilitating the use of digital tools with better internet access.

APPENDIX

Table A1: Variables definition and sources

Variable	Definition	Source
Inflow remittances	Total inward remittances in millions of US dollars	Central Bank of West African States (BCEAO)
Outflow remittances	Total outward remittances in millions of US dollars	
Exchange rate volatility	The standard deviation of the bilateral nominal exchange rate calculated from monthly data.	International Financial Statistics (IFS)
Migrant stock	Total migrant stock of the receiving country in millions (in log)	World Bank
Financial Institutions Depth Index	A component of the International Monetary Fund's Financial Development Index (FDI), which measures the depth and the scale of a country's banking system and other financial institutions.	International Monetary Fund (IMF)
Mobile cellular subscriptions	Mobile cellular subscriptions (per 100 people)	World Development Indicators (WDI)
GDP growth	Real Gross Domestic Product (GDP) growth rate	
CPIA Financial sector rating	World Bank Country Policy and Institutional Assessment (CPIA) rating of financial sector (1=low to 6=high)	
Common border	Dummy variable equal to 1 if the two countries of a pair share a common border and 0 otherwise.	Centre d'Etudes Prospectives et d'Information Internationales (CEPII).
Common language	Dummy variable equal to 1 if both countries share the same official language.	
Distance	Distance between the main urban areas (in terms of population) of the two countries of a pair. It is calculated based on latitude and longitude.	

Source: author

Table A2: List of countries in the sample

WAEMU Countries (8)	Non WAEMU Countries (25)		
Benin	Belgium	Algeria	Italy
Burkina Faso	Brazil	Spain	Luxembourg
Cote d'Ivoire	Central African Republic	France	Morocco
Guinea-Bissau	China	Gabon	Nigeria
Mali	Cameroon	United Kingdom	Portugal
Niger	Congo, Rep.	Equatorial Guinea	Chad
Senegal	Germany	Greece	Tunisia
Togo	Denmark	India	United States
			South Africa

Source: author

Table A3: Results of the unit root tests of Maddala and Wu (1999)

Variable	Level		First difference		Conclusion
	Stat.	Proba.	Stat.	Proba.	
Inflow remittances (log)	570.061	0.0383			I(0)
Outflow remittances (log)	693.039	0.0000			I(0)
Exchange rate volatility	1556.54	0.0000			I(0)
GDP growth of the sending country	1611.78	0.0000			I(0)
GDP growth of the receiving country	1308.26	0.0000			I(0)
Migrant stock of the sending country (log)	222.837	1.0000	1553.48	0.0000	I(1)
Migrant stock of the receiving country (log)	192.070	1.0000	1438.60	0.0000	I(1)
Mobile cellular subscriptions in the receiving country	116.143	1.0000	653.417	0.0000	I(1)
Mobile cellular subscriptions in the sending country	678.597	0.0000			I(0)
Financial Institutions Depth Index	147.868	1.0000	1253.67	0.0000	I(1)
CPIA Financial sector rating	49.1416	1.0000	1549.63	0.0000	I(1)

Source: author

Table A4: Descriptive statistics

Variable	Obs.	Mean	Std. dev	Min	Max
Inflow remittances	5632	9,958	22,79	0,000	380,77
Outflow remittances	5632	4,156	8,73	0,000	200,18
Common border	5632	0,105	0,307	0,000	1,00
Common language	5632	0,500	0,500	0,000	1,00
Distance	5632	3597,05	2475,93	105,1	12441,42
Exchange rate volatility	5632	2,151	6,198	0,000	58,95
GDP growth of the sending country	5376	4,480	2,449	0,061	15,37
GDP growth of the receiving country	5376	4,261	4,312	0,000	63,38
Migrant stock of the sending country	5376	16688,38	94608,78	0,000	1455427
Migrant stock of the receiving country	5376	13029,07	92939,49	0,000	1455427
Mobile cellular subscriptions in the receiving country	5600	49,055	40,4	0,000	150,34
Mobile cellular subscriptions in the sending country	5625	74,672	45,17	0,000	163,12
Financial Institutions Depth Index	5120	0,058	0,029	0,002	0,139
CPIA Financial sector rating	4352	2,915	0,377	2,000	3,5

Source: author

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