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Digital financial inclusion in WAEMU countries: does the development of digital financial services stimulate economic growth?

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***Abstract*---**This study analyzes the effect of digital financial inclusion on economic growth in WAEMU countries. Using data from BCEAO (2024) and the World Bank (2024) for the period 2011-2022, we employ the two-stage system generalized method of moments (System GMM). This approach allows us to take into account the endogeneity of lagged variables and to correct for biases linked to the omission of unobservable but time-constant variables. The results show that digital financial inclusion stimulates economic growth through several mechanisms. It encourages the mobilization of domestic savings and directs resources toward productive investment, thus contributing to capital accumulation and job creation. It also enables households to invest in health and education, boosting human capital and long-term productivity. Furthermore, the development of digital finance improves economic governance by facilitating the traceability of financial flows, tax collection and the targeted distribution of public aid, strengthening the State's ability to support inclusive growth. Sustainable growth requires a multidimensional approach. It is essential to extend the infrastructure of digital financial services, particularly in rural and peri-urban areas, to reduce inequalities in access. Moreover, the development of digital technologies and platforms must be encouraged while guaranteeing the security of transactions, the protection of personal data and the interoperability of systems. Finally, strengthening financial and digital education remains crucial to transforming access to technologies into effective financial inclusion.

***Keywords*---**Digital financial services, Financial inclusion, Economic growth, Two-step system GMM, WAEMU.
JEL Classification: C36, G20, O30, O55.

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1. Introduction

Digital financial inclusion broadly refers to the access to and use of formal financial services via digital channels by traditionally excluded or underserved populations (CGAP, 2015). These digital financial services are based on three key elements: a digital transactional platform, retail agents and the use by customers and agents of a device, most often a cell phone, to carry out transactions via the platform. The rise of digital financial services can be analyzed in light of theories of financial innovation and banking regulation (Frame & White, 2009; Moufakkir & Qmichchou, 2020; Silber, 1975), which highlight the structuring role of technological advances in transforming the financial landscape. These innovations have enabled the emergence of low-cost, dematerialized financial services accessible via digital channels, contributing to an unprecedented democratization of access to financial services, particularly in developing economies. Several studies have established a positive relationship between financial inclusion and economic growth. Greater access to and greater use of financial services help mobilize savings, strengthen investment capacity, and facilitate access to credit, particularly for poor populations and SMEs (Dianda et al., 2025; Houngbonon et al., 2017; Ndione et al., 2024; Ongo Nkoa & Song, 2022). Furthermore, digital financial services, by facilitating access to basic social services such as health and education, improve worker productivity (Karabou & Adeve, 2018). Mo et al. (2025) revealed that digital financial inclusion supports both traditional economic growth and green growth. Peng and Zeng (2025), studying 270 Chinese cities from 2011-2021, reported that inclusive digital finance stimulates regional inclusive green growth, mainly by promoting green technological innovation, entrepreneurship and industrial upgrading. Banna and Alam (2021) suggest that digital financial inclusion enhances banking stability and that an integrated digital financial system for banks in emerging Asia is essential for inclusive and sustainable economic development, contributing to the achievement of the SDGs by 2030.

However, some studies have reported contrasting results. Shamwil et al. (2023), investigating the impact of broadband penetration and financial inclusion on the Nigerian economy (2004--2021), reported that fixed broadband subscriptions, cell phone subscribers, bank accounts and a composite broadband index have a negative impact on economic growth. Ahmad et al. (Ahmad et al., 2020) highlighted, in particular, the money laundering and terrorist financing risks associated with the use of digital financial services, particularly cryptocurrencies. In Kenya, Gitonga & Wambua (2024) highlighted numerous tragedies linked to large-scale fraud involving mobile money. Fraud cases are reported daily, exposing victims to financial hardship, social isolation and emotional distress that can persist for years after the scam. In Ghana, Odai (2025) argues that mobile money platforms, by making certain data easily accessible during transactions, unwittingly widen the attack surface for fraudsters. On a more global scale, Forghani Bajestani et al. (2024), using panel data covering seventy-two (72) countries over the period of 2012--2020, show that digital tools can also facilitate corrupt practices, particularly in countries where the rule of law is weak.

This paradox raises a major question: to what extent does digital financial inclusion contribute to economic growth in WAEMU countries? The analysis

focuses on seven of the eight member countries of the Union, Guinea-Bissau, which were excluded because of the unavailability of relevant data (Appendix 1). The choice of this region is based on several empirical considerations. The countries of the West African Economic and Monetary Union (UEMOA) have seen a substantial rise in digital financial services over the past two decades. The value of mobile financial services rose from 7% of GDP in 2014 to 34% in 2018 (BCEAO, 2020). The number of service points and e-money accounts also exploded, reaching 819,610 and 76.96 million, respectively, in 2019. By 2022, e-money service points accounted for 98.8% of all financial service points in the region, compared with 22.0% for microfinance institutions and 21.0% for banks (BCEAO, 2023). Digital financial services are thus becoming the most widely used services in UEMOA, with a usage rate of 56.6%. Despite this dynamic, empirical studies exploring the effects of digital financial inclusion on economic growth in West Africa remain limited. This research aims to fill this gap by analyzing the impact of digital financial inclusion on economic growth in WAEMU countries. This is based on the hypothesis that an increase in digital financial services contributes positively to economic growth in a region.

This study aims to make a substantial contribution to the literature by mobilizing a variety of indicators of digital financial inclusion, including geographic and demographic penetration rates, as well as the rate of use of digital financial services. These indicators, which are widely used in the literature, provide a better understanding of the accessibility and intensity of use of these services by populations (Dianda et al., 2025; Dieme, 2020; Haoudi & Rabhi, 2018). Second, this study uses the two-stage system generalized method of moments (System GMM). This approach makes it possible to consider the endogeneity of lagged variables, to correct for biases linked to the omission of certain unobservable but time-constant variables, and to produce more reliable estimates than those obtained by conventional methods, such as ordinary least squares or fixed-effects models. Finally, the results show that digital financial inclusion stimulates economic growth through several mechanisms. It encourages the mobilization of domestic savings and directs resources toward productive investment, thus contributing to capital accumulation and job creation. It also enables households to invest in health and education, boosting human capital and long-term productivity. Furthermore, the development of digital finance improves economic governance by facilitating the traceability of financial flows, tax collection and the targeted distribution of public aid, strengthening the State's ability to support inclusive growth.

Although this research makes a significant contribution to understanding the relationship between digital financial inclusion and economic growth in WAEMU countries, it has two main limitations. On the one hand, it focuses on a relatively homogeneous region, where countries share the same currency (FCFA: Communauté Financière Africaine franc) and common policies on digital financial inclusion. This specificity may restrict the external scope of the results and limit their generalizability to other African or international contexts. On the other hand, the use of aggregate macroeconomic data, while suitable for global analyses, does not capture the geographical (urban versus rural) or social (gender, level of education, economic status) disparities that influence access to and use of digital financial services.

The remainder of this article is structured as follows: the second and third sections present the literature review and methodology, respectively. The fourth section discusses the main findings. Finally, the last section concludes and provides some policy implications.

2. Empirical review

The rise of digital financial services can be understood through theories of financial innovation and banking regulation (Frame & White, 2009; Moufakkir & Qmichchou, 2020; Silber, 1975), which highlight the structuring role of technological advances in transforming the financial landscape. These innovations have enabled the emergence of dematerialized, low-cost financial services accessible via digital channels, contributing to an unprecedented democratization of access to financial services, particularly in developing economies. Jameaba (2024) argues that the adoption of technologies such as API-based open banking, block chain technology (BCT) and the entrance of fintechs, Big Technology companies (Big Tech) and telecommunications has promoted financial inclusion while reducing transaction costs. Ononiwu et al. (2024) and Ozili (2023) argue that digital finance, which is expanding worldwide, is playing an increasing role in improving financial inclusion, the efficiency of financial services and the achievement of sustainable development goals. Finally, Saal et al. (2017) insist that digital financial services offer banks in emerging countries the opportunity to reach previously excluded populations, particularly in rural areas. Furthermore, by facilitating access to basic social services such as health and education, digital financial services improve worker productivity (Karabou & Adeve, 2018). Claessens et al. (2002) emphasize that telecommunications and internet infrastructures are essential for the development of e-finance, as they guarantee faster and more stable economic growth.

Several empirical studies have examined the impact of financial inclusion on economic growth. Saienko et al. (2025), using a qualitative approach, demonstrated that universal access to financial services helps reduce poverty and inequality, stimulate entrepreneurship and investment, strengthen financial stability and promote economic growth. Amaliah et al. (2024), using the generalized method of moments (GMM) on Indonesian data from 2011-2020, confirmed that digital financial inclusion promotes sustainable economic growth. Kouandou and Laajimi (2025), analyzing Ivorian data (EHCVM 2018--2019), reported that owning a mobile bank account increases the probability of investing in modern agricultural inputs by 14%. Dahiya et al. (2024) noted that digital currency facilitates international trade, benefiting SMEs and reducing foreign exchange risk.

Other studies have specifically explored the link between digital financial inclusion and growth. Banna (2020) reported that digital financial inclusion stimulates economic growth and that its integration by banks is crucial not only for achieving the Sustainable Development Goals (SDGs) but also for ensuring the economic stability of financial institutions. Employing a two-way fixed effects model, Mo et al. (2025) revealed that digital financial inclusion supports both traditional economic growth and green growth. Peng and Zeng (2025), studying 270 Chinese cities from 2011-2021, reported that inclusive digital finance

stimulates regional inclusive green growth, mainly by promoting green technological innovation, entrepreneurship and industrial upgrading. Banna and Alam (2021) suggest that digital financial inclusion enhances banking stability and that an integrated digital financial system for banks in emerging Asia is essential for inclusive and sustainable economic development, contributing to the achievement of the SDGs by 2030.

However, some studies have reported contrasting results. Shamwil et al. (2023), investigating the impact of broadband penetration and financial inclusion on the Nigerian economy (2004--2021), reported that fixed broadband subscriptions, mobile subscribers, bank accounts and a composite broadband index have a negative effect on economic growth. In particular, Ahmad et al. (2020) highlight the money laundering and terrorist financing risks associated with the use of digital financial services, particularly cryptocurrencies. In Kenya, Gitonga & Wambua (2024) highlighted numerous tragedies linked to large-scale fraud involving mobile money. Fraud cases are reported daily, exposing victims to financial hardship, social isolation and emotional distress that can persist for years after the scam. In Ghana, Odai (2025) argues that mobile money platforms, by making certain data easily accessible during transactions, unwittingly widen the attack surface for fraudsters. On a more global scale, Forghani Bajestani et al. (2024), using panel data covering seventy-two (72) countries over the period of 2012--2020, show that digital tools can also facilitate corrupt practices, particularly in countries where the rule of law is weak.

In summary, the literature emphasizes that digital financial inclusion is an important lever for economic growth, facilitating access to financial services, saving mobilization, investment and entrepreneurship, while contributing to the achievement of sustainable development goals. However, research also reveals contrasting effects and associated risks, particularly in terms of fraud, money laundering, terrorist financing and corrupt practices. These findings highlight the need to consider local institutional and regulatory contexts, as well as geographical and social disparities, to assess the impact of digital financial inclusion fully. In this context, this empirical study aims to fill the gaps identified by specifically analyzing the effect of digital financial inclusion on economic growth in WAEMU countries.

3. Empirical Analysis Methodology

This section presents the various econometric models used, the data sources and descriptive statistics, and the estimation procedure.

3.1. Econometric model specification

The second model, inspired by Waverman et al. (2005) and Barro (1991), incorporates the financial inclusion variable to analyze its impact on economic growth.

The equation is written as follows:

$$y_{i,t} - y_{i,t-1} = \rho y_{i,t-1} + \alpha_1 FI_{i,t} + \alpha_2 X_{i,t} + \xi_{i,t} \quad (3)$$

By positing $\rho = \alpha_0 - 1$, the equation becomes:

$$y_{i,t} = \alpha_0 y_{i,t-1} + \alpha_1 FI_{i,t} + \alpha_2 X_{i,t} + \xi_{i,t} \quad (4)$$

We therefore have a dynamic panel model with temporal and individual dimensions, where i indicates the country and $\xi_{i,t}$ is the error term.

y is the logarithm of real GDP per capita. This variable is used as an indicator for measuring economic growth, as in several empirical works (Kpodar et al., 2011; Traore and Ouedraogo, 2020).
$y_{i,t-1}$ is the logarithm of real GDP per capita lagged one period and is used to test conditional convergence (Barro, 1991).
FI measures the degree of digital financial inclusion via three main indicators: the geographical penetration rate, which is measured by the number of digital financial service points per 1,000 km²; the demographic penetration rate of e-money services, which is measured by the number of service points per 10,000 adults; and the digital financial services usage rate. These indicators, which are commonly used in the economic literature, reflect the level of access to and use of formal financial services (Cámara & Tuesta, 2014; Dianda et al., 2025; A. Traore & Diaw, 2020). Access to financial services is an important driver of economic growth (Bhattacharya & Wolde, 2010; Hariharan & Marktanner, 2012).
X is a vector of control variables. These are:

The gross primary school enrollment ratio is a key indicator of human capital. An increase in this rate translates into a higher level of education among the population, which favors the adoption of new technologies and improves productivity (Tarno, 2012). Access to electricity is also a key factor in growth. By improving household and business productivity, electrification helps stimulate economic activity (Bernard and Torero, 2011; Chaurey et al., 2004).
tax revenues as a percentage of GDP (Tax): these resources represent a means of financing for developing countries in the face of dwindling official development assistance (Houngbonon et al., 2017; Niang, 2020).
inward foreign direct investment (FDI) as a percentage of GDP: The inflow of foreign private capital in the form of foreign direct investment is sustainable and has relatively greater spillover effects on growth than other types of financing (BCEAO, 2013).

The nominal interest rate on loans: this provides information on the costs incurred by customers in accessing loans granted by financial institutions. Avom and Bobbo (2018) and Rabhi and Haoudi (2020) have indicated that a rise in the cost of credit discourages a large part of the population from applying for bank financing. This leads to a drop in investment and therefore production. The inflation rate, which measures macroeconomic instability. Low, stable inflation increases economic growth (Ghosh and Phillips, 1998; Mubarik, 2005). On the other hand, Hakik (2021) also shows that high inflation reduces money holdings and thus increases costs, with a negative impact on investment and economic growth.

The trade openness rate, which is measured by the sum of exports and imports as a percentage of GDP. Grossman and Helpman (1991) show that trade openness facilitates imports of goods and services that incorporate new technologies, leading to higher productivity. Young (1991), on the other hand, finds that trade openness for developing countries appears to be more disadvantageous than beneficial for economic growth.

3.2. Data sources and descriptive statistics

3.2.1. Data sources

This study is based on annual panel data covering the period 2011-2022, mainly from the World Bank (WDI, 2024). Only the variables geographic penetration rate, demographic penetration rate and digital financial services usage rate are taken from BCEAO (2024). The analysis covers seven of the eight UEMOA member countries, Guinea-Bissau, which were excluded because of the unavailability of relevant data. The countries included are Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal and Togo.

3.2.2 Descriptive statistics

Descriptive statistics provide an overview of economic indicators in the WAEMU. Table 1 presents those for the period 2011-2022. On average, the geographical penetration rate of digital financial services is 180.77 service points per 1,000 km², the demographic penetration rate is 45.58 service points per 10,000 adults, and the usage rate is 62.25%. The average GDP per capita is $2,533.40, with values ranging from $1,142.52 to $5,443.23 over the period studied.

In terms of other variables, trade openness, measured by the sum of imports and exports as a percentage of GDP, averages 45.83%, ranging from 26.52% to 84.15%. Inward foreign direct investment remains low, averaging 0.97% of GDP. The gross enrollment ratio averages 97.34%, fluctuating between 66.41% and 132.47%. The inflation is moderate, averaging 0.39%, ranging from -3.23% to 2.96%. Tax revenues represent an average of 14.10% of GDP. On average, 41.11% of the population has access to electricity. Finally, the nominal interest rate on loans is 5.23% over the 2011-2022 period.

Table 1: Descriptive statistics for variables

Variables	Mean	Std. Dev.	Min	Max
Demographic penetration of digital financial services	45.5858	37.7225	4.1790	166.1200
Geographic penetration rate of digital financial services	180.7703	206.5821	15.8320	990.0700
Usage rate of digital financial services	62.2509	20.7474	17.0210	84.0800
GDP per capita	2533.399	1165.4590	1142.5180	5443.2250
Trade openness rate	45.8318	11.5390	26.5282	84.1532
Foreign direct investment	0.9683	1.4616	-2.5445	6.1676
Gross primary school enrollment	97.3383	21.3256	66.4154	132.4668
Nominal interest rate on loans	5.2319	0.0718	5.1400	5.3383
Inflation rate	0.3936	1.3644	-3.2334	2.9676
Tax revenues as a percentage of GDP	14.1038	2.0193	11.1758	18.9543
Access to electricity	41.1155	18.7485	14.4000	70.4000

Source: Authors, based on data from BCEAO (2024) and the World Bank (WDI, 2024)

3.3 Estimation Strategy

3.3.1 Correlation matrix

Table 2 presents the Pearson correlation coefficients between the model variables. This reveals a positive and significant correlation between the indicators of digital financial inclusion (geographic and demographic penetration rates and the rate of use of e-money services) and real GDP per capita. Further analysis will be carried out to examine the nature of these relationships in more detail. In addition, strong correlations are observed between certain explanatory variables. In view of these strong correlations, a multicollinearity test was carried out. The results of this test, presented in Table 3, indicate an average variance inflation factor (VIF) of less than 5, individual VIFs of less than 5, and tolerance values all greater than 0.1. These results indicate the absence of multicollinearity problems in our models (Miles, 2014; Senaviratna & Cooray, 2019).

Table 2: Correlation analysis of variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Demographic penetration of digital financial services (1)	1.0000										
Geographic penetration of digital financial services (2)	0.827*	1.000									
Digital financial services usage rate (3)	0.46*	0.564*	1.00								
Gross domestic product per capita (4)	0.379*	0.456*	0.563*	1.000							
Trade openness rate (5)	-0.007	0.072	0.419*	0.019	1.00						
Foreign direct investment (6)	-0.017	-0.166	0.076	-0.001	0.347*	1.000					
Primary school enrollment (7)	0.0948	0.38*	0.593*	0.161	0.419*	-0.003	1.00				
Nominal interest rate on loans (8)	-0.186	-0.153	-0.156	-0.084	0.135	-0.181	-0.036	1.00			
Inflation rate (9)	-0.293*	-0.170	-0.072	-0.073	0.091	0.090	0.012	-0.260*	1.00		
Tax revenues (10)	-0.090	-0.160	-0.058	-0.41*	0.641*	0.215	-0.024	-0.013	0.207	1.000	
Access to electricity (11)	0.169	0.269*	0.591*	0.704*	0.341*	0.193	0.244	0.005	0.012	-0.060	1.00

Source: Authors, based on BCEAO data (2024) and the World Bank (WDI, 2024)
NB: * indicates significance at the 10% level.

Table 3: Multicollinearity test

Variable	VIF	Tolerance (1/VIF)
Commercial opening rate	3.32	0.300879
Tax revenues	2.71	0.368637
Gross domestic product per capita	2.62	0.382325
Access to electricity	2.24	0.447125
Demographic penetration of digital financial services	2.08	0.481319
Digital financial services usage rate	2.08	0.481319
Geographic penetration rate of digital financial services	1.93	0.518210
Nominal interest rate on loans	1.63	0.613030
Primary school enrollment rate	1.42	0.704290
Foreign direct investment	1.42	0.704735
Inflation rate	1.38	0.724744
Mean VIF	2.07	

Source: Authors, based on BCEAO data (2024) and the World Bank (WDI, 2024)

3.3.2. Choice of estimation method

The presence of lagged GDP per capita among the explanatory variables lends a dynamic structure to the panel model. In this context, conventional estimators such as ordinary least squares, Within, between or generalized OLS, are no longer convergent (Nickell, 1981; Roodman, 2009). To remedy this problem, we mobilize the generalized moment method (GMM) developed by Arellano and Bond (1991), which was enriched by Arellano and Bover (1995) and Blundell and Bond (1998). This approach is particularly suited to dynamic panels because of its ability to correct for biases linked to endogeneity, simultaneity and omitted variables (Kpodar, 2007) while internally generating the necessary instruments (Jude, 2012).

Two main variants exist: GMM in first difference (Arellano & Bond, 1991) and GMM in system (Blundell & Bond, 1998), the latter being an improvement over the former. First-difference GMM eliminates country-specific effects by differentiating the equation and uses level lagged values as instruments. However, this method can be biased when the instruments are small in finite samples. To remedy this, Blundell and Bond (1998) propose system GMM, which combines the difference and level equations instrumented by their differences, thus enhancing the precision and robustness of the estimates. In both cases, estimation can be performed in one or two stages. Two-stage estimation, which is based on a corrected error variance–covariance matrix (Windmeijer, 2005), is generally preferred because it provides more efficient estimators. The effectiveness of this method is assessed via two tests: the Sargan/Hansen overidentification test, which verifies the validity of the instruments, and the Arellano and Bond autocorrelation test, which must confirm the absence of second-order autocorrelation in the residuals. Finally, to guarantee the robustness of the estimates, it is recommended that the number of individuals be greater than the number of periods (Blundell & Bond, 1998; Roodman, 2009; Wooldridge, 2010). Our database includes seven UEMOA countries over twelve years (2011-2022). To meet this condition, we aggregate the data into biennial averages, following the approach of Kpodar and Andrianaivo (2011), which smooths out cyclical fluctuations and improves the relevance of the estimates.

4. Main Results and Discussion

The results of the two-stage GMM estimations are presented in Table 4. The probabilities associated with the second-order autocorrelation test in all three estimations are above the 10% significance level, which means that the null hypothesis of no second-order autocorrelation between the variables cannot be rejected. Additionally, the probabilities

associated with the Sargan test for all estimated equations are above the 10% significance level, confirming the validity of our instruments.

The results show that the geographical penetration rate of digital financial services, measured by the number of financial service outlets per 1,000 km² (column 2), the demographic penetration rate of e-money services, measured by the number of service outlets per 10,000 adults (column 1), and the usage rate of digital financial services (column 3) all exert a positive and statistically significant effect on economic growth, approximated by GDP per capita. This result can be explained by several economic mechanisms observed in WAEMU countries. Increased digital financial inclusion encourages the mobilization of domestic savings and directs resources toward productive investment, stimulating capital accumulation and job creation. It also enables households to invest in health and education, strengthening human capital and long-term productivity. Furthermore, the development of digital finance improves economic governance by facilitating the traceability of financial flows, tax collection and the targeted distribution of public aid, strengthening the State's ability to support inclusive growth. Digital financial inclusion extends the reach of services to previously underserved rural and peri-urban areas, reducing financial (transaction and travel costs) and physical (distance from branches) barriers. According to BCEAO (2023), e-money service points represented 98.8% of all financial service points in 2022, making it the most widely used service in the region, with a usage rate of 56.6%, ahead of microfinance services (22.0%) and traditional banking services (21.0%). Owing to these digital services, people in rural and peri-urban areas can access basic operations such as payments, money transfers and savings without having to travel long distances. These results are in line with the theoretical work of Schumpeter (1912) and the endogenous growth literature (Bencivenga & Smith, 1991; Berthélemy & Varoudakis, 1995; Levine, 1991), which argues that financial inclusion promotes innovation, optimizes resource allocation and stimulates long-term productive investment. Our results are also similar to those of several empirical studies. This is the case for Amaliah et al. (2024) and Peng & Zeng (2025), who have shown, in contexts as diverse as Indonesia and China, that digital financial inclusion contributes significantly to economic growth, including green growth, by enhancing investment, entrepreneurship and innovation. In addition, the findings of Kouandou & Laajimi (2025) highlight a concrete microeconomic mechanism: access to financial services, especially mobile services, stimulates productive household investment, particularly in agriculture. The results thus confirm our hypothesis that financial inclusion is an essential vector for inclusive and sustainable growth. However, it is important to note that this virtuous dynamic is not automatic. As Shamwil et al. (2023) have shown in the case of Nigeria, certain indicators of financial inclusion or ICT penetration can have ambiguous, even negative, effects on growth when they are not backed by an appropriate institutional and regulatory infrastructure.

Analysis of the control variables (columns 1, 2 and 3) reveals that lagged GDP per capita has a positive and significant effect on growth, contrary to our initial expectations. This result suggests the absence of convergence between WAEMU economies. This situation can be explained by the different impacts of exogenous shocks on these countries. Indeed, events such as political crises and terrorist attacks have severely penalized growth in countries such as Niger, Burkina Faso and Mali, accentuating income disparities within the region. In addition, the gross primary school enrollment rate, which measures human capital, is negatively associated with economic growth in the models estimated. Similar results have been reported by several authors (Koinda, 2019; Pritchett, 2001; Salouka et al., 2023). This counterintuitive relationship can be explained by several factors. First, as Pritchett (2001) noted, the quality of education can be inadequate in many developing countries, reducing the return on investment in human capital. Moreover, in developing countries, investing in education can be costly, especially when young graduates have difficulty finding skilled, well-paid jobs. Companies then often prefer to hire fewer qualified people, which slows economic growth.

Table 4: Two-Step System GMM Estimation of the Relationship between Digital Financial Inclusion and Economic Growth

	(1)	(2)	(3)
Variables	GDP per capita	GDP per capita	GDP per capita
GDP per capita (-1)	0.1027*** (0.0699)	0.1019*** (0.0680)	0.0998*** (0.0176)
Primary gross enrollment ratio	-0.0045* (0.0026)	-0.0058*** (0.0002)	-0.0004* (0.0003)
Inflation rate	-0.0050 (0.0045)	0.0047 (0.0016)	0.0004 (0.0027)
Nominal interest rate on loans	-0.0010 (0.0086)	0.0014 (0.0045)	0.0092 (0.0047)
Access to electricity	0.0019 (0.0037)	-0.0013 (0.0005)	0.0013 (0.0006)
Tax revenues as a percentage of GDP	-0.0083 (0.0037)	-0.0028 (0.0039)	-0.0052 (0.0044)
Foreign direct investment	-0.0031 (0.0032)	-0.0025 (0.0021)	0.0004 (0.0021)
Trade openness rate	0.0182 (0.0109)	0.0004 (0.0004)	0.0003 (0.0005)
Demographic penetration of digital financial services	0. 0604** (0.0153)		
Geographic penetration rate of digital financial services		0.0449*** (0.267)	
Usage rate of digital financial services			0.1273*** (0.4696)
Constant	0.6309 (0.4580)	0.102 (0.130)	0.0997 (0.138)
Observations	42	42	42
Arellano–Bond test for AR (1)	0.919	0.951	0.934
Arellano–Bond test for AR (2)	0.425	0.279	0.297
Sargan test of overid. restrictions:	0.244	0.421	0.547

Source: Authors, based on data from BCEAO (2024) and the World Bank (WDI, 2024).
Note: Values in parentheses represent standard errors, whereas ***, **, and * indicate the significance of coefficients at the 1%, 5%, and 10% levels, respectively.

5. Conclusion

This paper analyzes the effect of digital financial inclusion on economic growth in WAEMU countries. Using data from BCEAO (2024) and the World Bank (2024) for the period 2011-2022, we employ the two-stage system generalized method of moments (System GMM). This approach allows us to consider the endogeneity of lagged variables, to correct for biases associated with the omission of unobservable but time-constant variables, and to produce more reliable estimates than those obtained by conventional methods such as ordinary least squares or fixed-effects models. The results reveal that digital financial inclusion promotes economic growth in UEMOA countries through several mechanisms. It increases the mobilization of domestic savings and directs resources toward productive investments, thus stimulating capital accumulation and job creation. It also enables households to invest in health and education, strengthening human capital and long-term productivity. Furthermore, the development of digital finance improves economic governance by facilitating the traceability of financial flows, tax collection and the targeted distribution of public aid, thus strengthening the State's ability to support inclusive growth. Digital financial inclusion extends the reach of services to previously underserved rural and peri-urban areas, reducing financial (transaction and travel costs) and physical (distance to branches) barriers. These findings are consistent with the theoretical underpinnings of endogenous growth (Bencivenga & Smith, 1991; Berthélemy & Varoudakis, 1995; Levine,

1991) and are consistent with recent literature on digital finance and inclusive development (Amaliah et al., 2024; Kouandou & Laajimi, 2025; Mo et al., 2025; Peng & Zeng, 2025).

To foster sustainable economic growth in UEMOA countries, a multidimensional approach is needed. It is essential to expand the digital financial services infrastructure by increasing the mesh of financial services and e-money outlets in rural and peri-urban areas to reduce inequalities in access. Moreover, the development of digital technologies and platforms must be supported. The aim is to promote accessible, secure and low-cost mobile solutions to facilitate day-to-day financial transactions. UEMOA states, in collaboration with BCEAO, should encourage the emergence of FinTech solutions and mobile financial services while guaranteeing transaction security, personal data protection and system interoperability. As an example, Senegal illustrates this orientation with the "SUNU NAFA" platform, a shared mobile banking project bringing together seven decentralized financial systems (SFDs) and aiming to strengthen access to digital financial services, particularly for rural and unbanked populations (Mansaly, 2024). Finally, it is crucial to strengthen financial and digital education to transform access to technology into true financial inclusion. Niger's experience is illustrative of the "Smart Villages for Rural Growth and Digital Inclusion" project, financed by the World Bank. This project mainly targets rural areas and vulnerable populations, particularly women and young people, to develop their digital and financial skills (Yahaya, 2023).

Although this research makes a significant contribution to understanding the relationship between digital financial inclusion and economic growth in UEMOA countries, it has two main limitations. On the one hand, it focuses on a relatively homogeneous region, where countries share the same currency (FCFA: Communauté Financière Africaine franc) and common policies on digital financial inclusion. This specificity may restrict the external scope of the results and limit their generalizability to other African or international contexts. On the other hand, the use of aggregate macroeconomic data, while suitable for global analyses, does not capture the geographical (urban versus rural) or social (gender, level of education, economic status) disparities that influence access to and use of digital financial services. Future research could enrich these findings by mobilizing more detailed data and qualitative methods to explore user perceptions and identify barriers to adoption. A comparative approach with other developing regions would also help to identify best practices and better understand the influence of local contexts on the adoption of digital financial services. Finally, the integration of qualitative approaches, which are based on interviews or field studies, would offer more nuanced insight into the dynamics at play and complement quantitative analyses.

Conflict of interest statement
The author presents no conflicts of interest.

Data availability
The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Appendix 1: List of countries in the sample

Numbers	Countries	Numbers	Countries
1	Benin	5	Niger
2	Burkina Faso	6	Senegal
3	Ivory Coast	7	Togo
4	Mali		

Source: Authors