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Analysis of the Determinants of Financial Inclusion in WAEMU Countries: An Approach Based on a Fixed Effects Model

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Abstract: This research aims to analyze the determinants of financial inclusion in the West African Economic and Monetary Union (WAEMU) over the period 2012–2022. Using a panel-data, fixed-effects econometric approach, it identifies the key factors that promote or hinder access to financial services in this region. The results show that the geographical accessibility of services and the adaptation of products to the needs of the population are essential drivers of financial inclusion. Furthermore, the high cost of credit limits access to financing for vulnerable populations. These observations call for an integrated policy that combines infrastructure deployment, the development of digital solutions, and regulations governing financial costs to promote sustainable and equitable financial inclusion within WAEMU.

Keywords: Financial inclusion; Panel data; Cost of credit; WAEMU

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1. Introduction

Between the 1970s and 1980s, the concept of financial inclusion gradually took shape and evolved, initially drawing on the development of modern microcredit, championed in particular by the economist Muhammad Yunus (Yunus, 1999). This innovation aimed to provide access to credit for populations excluded from the traditional banking system, thereby highlighting huge disparities in banking penetration in developing regions (34% compared with 69% in East Asia and 94% in-high-income economies)[1]. Subsequently, prudential regulation evolved to regulate microfinance institutions within more formal frameworks, notably through the creation of appropriate legal frameworks and the official recognition of decentralized financial institutions. At the same time, the sector has gradually seen the emergence of new forms of financial services, including crowd-funding, 'remote banking', mobile banking, and electronic payment methods, accompanied by specific legislation concerning electronic money and non-salaried payment agents (BCEAO, 2025).

Financial inclusion, generally defined as the provision of accessible, affordable, and suitable financial services for all individuals and businesses, is central to economic policies in West Africa, particularly within the West African Economic and Monetary Union (WAEMU). This entity comprises eight countries (Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, and Togo)[2] that share a common currency, the CFA franc, and coordinated monetary policies (BCEAO, 2025). In these countries, where a large portion of the population lives in poverty, equitable access to basic financial services is a fundamental challenge for reducing inequalities and promoting inclusive development.

At the regional level, several ambitious initiatives have been deployed. The BCEAO's 2021 annual report indicates that member states have implemented coordinated national financial inclusion strategies, accompanied by financial education programs and awareness campaigns to increase demand for and use of financial services. Furthermore, the digitalization of payments and support for financial innovation have been essential levers for reaching populations far removed from traditional banking networks. Consequently, the development of national funds dedicated to microfinance has strengthened the financing capacity of the poorest (BCEAO, 2025). These efforts have

[1] According to the Findex Global database report produced in 2015

[2] The WAEMU is a sub-regional institution which brings together eight coastal and Sahelian states (Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo).

contributed to a significant improvement in banking penetration indicators in the region, demonstrating positive momentum.

Since 2005, the issue of improving people's access to basic financial services has become increasingly significant globally, particularly in African countries. The promotion of an inclusive financial system thus led to the publication of a blue book entitled « Building Financial Sectors for All » by the United Nations (UN) in 2006. Within the WAEMU, financial inclusion has been made a priority with the adoption by the Council of Ministers of the Regional Strategy for Financial Inclusion in the Union (BCEAO, 2016). It is seen as a key instrument for promoting the integration of the most disadvantaged social groups into the economic and social fabric of the Union (BCEAO, 2018).

In analyzing this issue in the context of sub-Saharan Africa, Guérineau and Jacolin (2014) show that, from a supply-side perspective, the following factors contribute to the underdevelopment of the banking sector in particular: excessive bank concentration, the density of banking infrastructure, and the degree of information asymmetry between banks and their potential customers. On the demand side, the low level of GDP per capita in sub-Saharan Africa and in the countries of the Franc Zone, as well as lower levels of education (both financial and general), contribute to the low rate of banking penetration.

Consequently, the BCEAO (Central Bank of West African States) has developed strategies and reforms to promote an inclusive financial system and address challenges in regulation, access to financial services, supervision, and financial stability (BCEAO, 2021). To this end, the central bank has decided to focus attention on:

- The ongoing adaptation of the regulatory framework to ensure secure transactions, consumer protection, effective financial risk management, and compliance with anti-money laundering rules (BCEAO, 2018; FATF, 2020);

- The restructuring and consolidation of the microfinance sector, notably through improved governance and professionalism within the sector (BCEAO, 2018);

- The expansion of the distribution and acceptance network, particularly via mobile telephony, which is expected to enhance access to and use of digital financial services (BCEAO, 2022);

- The involvement of the public sector in financial education for the population, a key to greater financial inclusion, and the adoption of measures aimed at the digitalization of public payments (BCEAO, 2021; AFI, 2021).

In this work, we will focus on the characteristics of the countries to analyze the level of access to financial services, using the determining factors identified by WAEMU. These include, on the one hand, macroeconomic, institutional, and technological factors, and on the other hand, socio-demographic factors. Although financial inclusion is regarded as a means of reducing poverty and stimulating economic development, understanding its determinants poses a major challenge in Africa compared to other countries, according to Zins and Weill (2016).

The international empirical literature highlights the vital importance of financial inclusion in combating poverty and vulnerability. Vivekanandan (2013), in a study on India, demonstrated that the financial marginalization of low-income groups is a major cause of persistent inequality and that limited access to basic financial services hinders social and economic advancement. For Odeleye and Olusoji (2016), this link between financial inclusion and the reduction of poverty and vulnerability, by promoting improved well-being and sustainable economic growth, is confirmed across various contexts, reinforcing the importance of a proactive financial inclusion policy.

To better monitor developments in financial inclusion and facilitate comparisons, it is essential to have an accurate measure of financial inclusion. This research, therefore, focuses on the following question: What are the determinants of financial inclusion in the WAEMU region?

To provide appropriate responses to this concern, our article analyzes the factors influencing financial inclusion in the WAEMU. Whilst the economic and financial literature has long examined the impact of various indicators on financial performance, a fresh analysis is now required to understand the specific effects of these indicators on financial inclusion within a specific regional context (Beck et al., 2007; Honohan, 2008).

The following hypotheses guide this work:

- H1: The overall demographic penetration rate and the geographical penetration rate of financial services have a positive impact on financial inclusion in the WAEMU;

- H2: The nominal interest rate on loans has a positive impact on financial inclusion in the WAEMU.

This article is divided into three sections. We will first present a review of the literature, then the methodological framework, and finally examine the analysis and discussion of the main findings, as well as the resulting economic policy proposals.

2. Literature Review

This section first presents the theoretical foundations of financial inclusion and then provides an overview of empirical research on persistent inequalities.

Financial inclusion is traditionally defined as the ability of all individuals to access and use a full range of appropriate financial services, including credit, insurance, and payment systems, on affordable and transparent terms (AFI, 2010). Although this definition is a key reference point, it is subject to numerous nuances and debates across disciplines and the objectives pursued by institutions. Some authors, such as Leyshon and Thrift (1995), emphasize that financial inclusion is a dynamic process. They view it as the gradual, continuous integration of individuals into the formal financial system, with the shift from exclusion to effective participation as paramount.

The understanding of financial exclusion has also evolved. Leyshon and Thrift (1995) define it not simply as the lack of a bank account, but as the result of institutional, social, and structural mechanisms that block access to the formal financial system. This exclusion disproportionately affects specific social groups, notably rural populations, women, young people, and the poorest sections of society. Gloukoviezoff (2004) and Servet (2006) expand on this analysis by emphasizing the qualitative dimension of exclusion. According to them, it also encompasses the inability to make adequate use of essential financial instruments, such as payment methods, credit, insurance, and the ability to transfer funds. In this respect, the quality of the services on offer, their relevance to users' actual needs, and proficiency in using the tools prove to be just as fundamental as mere physical access.

Furthermore, the rise of financialization is profoundly transforming the conditions under which financial services are accessed and used. Servet (2006) and Gloukoviezoff (2013) describe financialization as the intensification of social relations mediated by financial products and mechanisms, affecting all aspects of daily life, including housing, health, agriculture, and employment. This development means that financial exclusion can no longer be separated from social exclusion in the broader sense; in other words, the inability to access or use these tools constitutes a new form of marginalization, thereby amplifying economic and social inequalities. This complexity is recognized and taken into account by the conceptual frameworks of major institutions such as the World Bank, which adopted a holistic approach in 2017.

Financialization influences not only demand but also the supply of financial services. Indeed, the emergence of digital technologies and, subsequently, fintech is fundamentally redefining how these services are accessed and used. Doligez (2017) and the BCEAO (2022) highlight that digitalization offers new opportunities, particularly for alleviating constraints linked to geographical distance or access costs, especially in underserved rural areas. However, this development also presents new challenges in terms of regulation, consumer protection, and financial education, to ensure that technological advances do not create new forms of exclusion.

In this debate, microfinance occupies a special place as a key theoretical and operational tool for promoting financial inclusion in resource-constrained countries. By offering tailored products such as microcredit, microinsurance, and flexible savings options, microfinance institutions (MFIs) seek to address the shortcomings of traditional banks (Morduch, 1999). This sector is the subject of debate, particularly regarding the tension between social inclusion and financial viability. Guéri et al. (2009) and Morduch (1999) warn that the economic profitability of microfinance institutions may be incompatible with maximum inclusivity, with some MFIs refocusing on more creditworthy urban populations at the expense of the poorest.

Empirical research on financial inclusion emphasizes the macroeconomic environment's role in determining people's ability to access and use financial services. Allen et al. (2016) demonstrated, using a panel of developing countries, that growth in per capita national income stimulates not only the demand for financial services but also households' actual ability to access them. This idea, consistent with classical analyses of economic capital, is taken up in several subsequent studies that discuss the knock-on effects of growth on financial inclusion (Beck et al., 2007; Demirguc-Kunt and Klapper, 2012). Honohan (2004) provides essential institutional insight by emphasizing that the creation of a stable environment is a prerequisite for effective use of microfinance institutions.

Furthermore, the role of technology, particularly mobile telecommunications, is unanimously recognized in the empirical literature as a catalyst for financial inclusion, especially in countries

with poor physical infrastructure. Zins and Weill (2016) provided robust empirical evidence showing that the spread of mobile telephony is positively correlated with increased access to financial services in sub-Saharan African countries. Empirical studies also show that socio-demographic factors are key determinants in explaining persistent inequalities in financial inclusion. The link between educational attainment and financial inclusion was highlighted in early quantitative research (Chikalipah, 2016), demonstrating that greater human capital improves financial risk management and facilitates active, diversified use of financial products.

About gender disparities, the work of Zins et al. (2016) shows that, despite the growth of digital services, socio-cultural and institutional barriers limit women's access to a significantly lower extent than that of men; this is supported by the longitudinal analyses of Bruhn and Love (2014) on the impact of policies promoting women's inclusion. This issue remains pronounced in rural areas, where social norms still largely restrict women's economic autonomy (Kabeer, 2015)

The geographical divide between urban and rural areas is also well documented. For example, Suri and Jack (2016) show that urban areas account for the majority of formal financial infrastructure, reinforcing the spatial advantage, whilst rural areas suffer from a persistent deficit despite the growing use of mobile finance. Finally, numerous multidimensional studies have examined the barriers to financial inclusion. Beck (2016), as well as Chamberlain and Walker (2005), emphasize that these barriers are not limited to economic and physical aspects, but also include informational, cultural, and psychological constraints, particularly those linked to self-exclusion, a phenomenon whereby certain individuals voluntarily choose not to use formal financial services due to mistrust or a lack of confidence.

Despite the wealth of empirical research on financial inclusion, several divergent or contradictory findings have sparked significant debates in the academic and institutional literature. These controversies concern both the impact of certain factors and the actual effectiveness of inclusion tools.

A key debate concerns the effect of economic growth on financial inclusion. Whilst authors such as Allen et al. (2016) and Dermirguc-Kunt and Klapper (2012) observe a positive correlation between growth in per capita income and access to financial services, other research suggests that this relationship is far from linear or sufficient. Beck and De la Torre (2007) thus suggest that strong economic growth can coexist with limited financial inclusion, due in particular to internal disparities and institutional inequalities, or to vertical growth that concentrates the benefits within restricted segments of the population. This ambivalence indicates that growth does not automatically guarantee the democratization of financial services and highlights the importance of institutional and social conditions (Honohan, 2008).

Another point of contention concerns the impact of technology, particularly mobile finance and fintech. Whilst the majority of recent research (Zins and Weill, 2016; GSMA, 2023) tends to demonstrate a positive effect of digitalization, certain authors and other reports, such as those by Amer et al. (2016) and Owino et al. (2025), warn of the risk of exacerbating digital inequalities. Unequal access to digital infrastructure, difficulties with digital literacy, and challenges relating to the protection of personal data can indeed generate new forms of exclusion, sometimes referred to as « digital divides » (Donner, 2015). Thus, digitalization does not resolve all obstacles and requires vigilant, inclusive public policy.

The issue of socio-demographic disparities, particularly those related to gender, is also the subject of debate. Whilst Zins et al. (2016) report a persistent gap in women's access, analyses highlight contexts where this gap narrows significantly or disappears, notably in certain urban areas or through targeted interventions (Dupas et al., 2018). This variation across geographical, cultural, and political contexts fuels discussions on the reproducibility of empirical findings and the need to adapt policies to local specificities (Kabeer, 2015).

Finally, microfinance serves as a good illustration of the complexity of the debates surrounding the actual impact of inclusion schemes. Morduch (1999) and Guérin et al. (2009) highlight the recurring tension between social inclusion and financial viability, noting that most microfinance institutions struggle to reconcile profitability with the maximum extension of services to the poorest populations, which undermines long-term effectiveness. Nevertheless, other research, such as that by Banerjee and Duflo (2011) or Karlan and Zinman (2011) within the framework of Randomized Control Trials (RCTs), shows that certain microfinance programs significantly improve economic well-being and financial inclusion, even if these effects may vary depending on the nature and quality of the intervention. These contradictions highlight the importance of a nuanced, context-specific approach and the need to combine microfinance, digitalization, and financial education to maximize benefits.

In summary, these debates highlight the complexity of financial inclusion and the difficulty of drawing general conclusions from research that is sometimes contextually limited or methodologically distinct. The literature therefore calls for an integrative approach that takes into account

the interactions among economic, institutional, technological, and socio-cultural factors, as well as greater methodological rigor in the interpretation of results.

3. Methodology

Before proceeding with the regression tests and discussing the results, it is first necessary to outline the methodological framework by specifying the model and providing an overall analysis of the data used.

We adopt a hypothetical-deductive approach based on quantitative panel data. The analysis focuses on the determinants of financial inclusion in the WAEMU for the period 2012 to 2022. The data sources are drawn from the BCEAO database. In accordance with current standards and procedures, microfinance institutions must regularly report their financial information to the Central Bank of West African States (BCEAO) and to the Ministries of Economy and Finance.

3.1. Model Specification

The factors that can influence financial inclusion have, of course, evolved significantly and attracted the attention of financial authorities over time, particularly since the onset of the 2008 financial crisis. Consequently, the ordinary least squares method has been the most commonly used estimation technique for both time-series and panel-data analysis. However, this technique has several limitations, some stemming from the data structure, so it does not always yield the best results. For a given panel model, information is available in the individual (N) and time (T) dimensions.

The panel model is written as : Yit=bXit+εit. The term (i) refers to the individual under consideration; in our case, this is the country; the term (t) refers to the point in time at which the, and E (εit) = 0. There are several patterns of parameter variation depending on whether a fixed-effects model or a random-effects model is used. The fixed-effects model in this specific case assumes that the coefficients are uniform across countries, except r the constant term Yit=αi+bXit+εit. In our analysis, the term αi is the individual effect that is constant over time but specific to each country ; it is called the « country specific effect » and captures individual heterogeneity.

The estimator for this fixed-effects model is called the Within estimator. However, as we are working with panel data and fixed effects, it is preferable to use an estimation technique that accounts for the presence of fixed effects across individuals.

A fixed effects panel model using the « Within » estimator. Thus, this method allows us to consistently analyze the determinants of financial inclusion.

We draw on the findings of the aforementioned research literature on the determinants of financial inclusion, as summarised in the empirical review, to guide our analysis of these determinants in the WAEMU.

Based on the above, the model is presented as follow :

$$\boldsymbol{y_{it}} = \boldsymbol{c} + \boldsymbol{\alpha Internal_{it}} + \boldsymbol{\beta Macro_{it}} + \boldsymbol{\delta Industry_{it}} + \boldsymbol{\varepsilon_{it}} \quad (1)$$

Where i denotes the country and t indicates the time period.

The dependent variable, y_it represents the financial inclusion index.

The independent variables are divided into three groups: internal, macroeconomic, and industry specific; c is the constant, and ε_it represents the error term. Since we have included a range of variables in each group, the terms α, β, and δ in equation (1) represent parameter vectors rather than individual parameters.

In this study, we use panel data. Our financial data is aggregated by country and is sourced from the BCEAO database, which provides annual financial information on banks (BCEAO, 2022).

They cover the 154 active credit institutions operating in the eight countries of the WAEMU zone. All financial statement data are annual and denominated in CFA francs. The period covered by the aggregated financial data by country is from 2012 to 2022. We will therefore need to introduce variables that can represent this inclusion. We have drawn on the literature on the determinants of financial inclusion to guide this work.

All variables are taken from the « 2018 Report on the State of Financial Inclusion in the WAEMU » published by the Central Bank of West African States (BCEAO). The definitions are given below :

- **Overall demographic penetration rate for financial services (ODPR)**: this measures the number of service outlets available per 10,000 adults:

- **Overall geographical penetration rate for financial services (OGPR)**: this assesses the degree of accessibility, i.e., the number of service outlets available within an area of 1,000 km²;

- **Strict banking penetration rate (SBPR)**: this measures the percentage of the adult population holding an account with banks, postal services, national savings banks, and the Treasury;

- **Broad banking penetration rate (BBPR)**: this measures the percentage of the adult population holding accounts with banks, postal services, national savings banks, and the Treasury, plus the percentage of account holders with microfinance institutions;

- **Overall Financial Services Usage Rate (OFSUR)** or financial inclusion rate: this estimates the percentage of the adult population holding an account with banks, postal services, national savings banks, the Treasury, and microfinance institutions, plus the percentage of e-money account holders ;

- **Nominal interest rate on deposits (NIRd)**: this measures the return on savers' deposits at banks and the decentralized financial system (DFS);

- **Nominal interest rate on loans (NIRL)**: this provides information on the costs borne by customers to access loans granted by banks and DFS;

- **Financial Inclusion Index (FII)**: financial inclusion is assessed, in all its dimensions, within the WAEMU, using a composite index calculated by taking into account all seven indicators combined. This is a single value, ranging from 0 to 1, representing total exclusion and full financial inclusion, respectively. It is derived from a weighted average of the various indicators analyzed above.

The main problem with panel data is intra-individual correlation, in which observations for the same unit over time are often correlated. This can lead to bias and inefficiencies in the estimates. To address this issue, fixed- or random-effects models are used, along with methods to correct for autocorrelation and heteroscedasticity.

In a region-specific study, such as the WAEMU, panel data is among the most appropriate methods (Loya, 1999). Indeed, this technique not only captures the dynamic effects in economic agents' behavior but also facilitates control over individual and/or temporal heterogeneity.

The use of panel data provides greater variability and precision, and allows for the influence of unobservable characteristics to be taken into account. It also reduces the risk of multicollinearity among variables, offering greater degrees of freedom and improved performance. These features facilitate the study of change dynamics by enabling the capture of both short- and long-term effects.

Therefore, to address the question of the determinants of financial inclusion, this work draws on the model developed by Davis, Karim, and Noel in 2020. A country-level fixed effects panel model will be used to achieve our research objectives. Following the presentation of our variables and building on the baseline model, we explicitly specify the models to be estimated in this study so that the econometric estimates yield satisfactory results.

Equation (1) is the model to be estimated in this work. It includes all internal, macroeconomic, and industry-specific variables.

To clearly identify the factors most influencing financial inclusion, as measured by the FII, we break down the internal, macroeconomic, and industry-specific variables. The model specification, therefore, becomes:

$$\boldsymbol{Y}_{it} = \boldsymbol{\alpha}_{it} + \boldsymbol{\beta}_{it}\boldsymbol{lnodpr}_{it} + \boldsymbol{\beta}_{it}\boldsymbol{lnogpr}_{it} + \boldsymbol{\beta}_{it}\boldsymbol{lnsbr}_{it} + \boldsymbol{\beta}_{it}\boldsymbol{lnbbr}_{it} + \boldsymbol{\beta}_{it}\boldsymbol{lnofsur}_{it} + \boldsymbol{\beta}_{it}\boldsymbol{lnnird}_{it} + \boldsymbol{\beta}_{it}\boldsymbol{lnnirl}_{it} + \boldsymbol{\varepsilon}_{it} \quad (2)$$

The following table presents the descriptive statistics of the selected variables. The results obtained are summarized by mean, standard deviation, minimum, and maximum values for the country, based on the sample size.

Table 1. Descriptive Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
Fii	88	.3596023	0.1557216	.137	.667
Gdp	88	4.867254	2.695182	-5.370447	10.76021
Lnodpr	88	2.962637	1.576607	0	5.669881
Lnogpr	88	4.006966	1.889905	0	7.512618
Lnsbr	88	2.656944	0.5750648	0.7884574	3.54674
Lnbbr	88	3.399924	0.6760716	1.568616	4.433195
lnofsur	88	3.618946	0.7374239	1.410987	4.450853
Lnnird	88	1.642165	0.1134449	1.036737	1.819699
lnnirl	88	2.072012	0.1728657	1.667707	2.417698

*Source***:** Authors' calculations, data from BCEAO report, 2022

3.2. *Results and discussion*

This section first presents stationarity tests, then cointegration tests for the variables, and finally model estimation.

Table 2. Estimation of regression model variables

Variables	FII
Gdp	-0.005** (-2.57)
Lnodpr	-0.062 (-1.23)
Lnogpr	0.137** (2.63)
Lnsbr	-0.159 *** (-3.67)
Lnbbr	0.073 (0.266)
lnofsur	0.018 (0.48)
Lnnird	0.079 (1.29)
Lnnirl	-0.230 ** (-2.04)
Constant	0.475 (1.48)

Source: Authors' calculations, data from the BCEAO 2022 report.
(***), (**) and (*) denote the 1%, 5% and 10% thresholds respectively.

The fixed effects model yields a mean of 0.9005 ($R^2 = 0.9005$). Thus, 90.05% of the variation in the variables included in the analysis of financial inclusion intensity is explained by the model across all countries, accounting for the time dimension (Appendix 2).

The mixed-effects model shows a mean in the individual dimension ($R^2 = 0.8394$). This means that the model explains 83.94% of the variation in financial inclusion across countries. The model's goodness of fit, measured by the coefficient of determination (**Overall with an $R^2 = 0.8174$**), is fairly close to one.

As a result, the variables included in the model account for 81.74% of the observed variability in financial inclusion. Regarding the choice of model, the Hausman test indicates that the fixed effects model is best, as the p-value from the chi-squared test exceeds the threshold.

Table 2 above presents the robust estimates from a fixed-effects panel model. The dependent variable is financial inclusion. It is also noted that certain variables are significant at different significance levels (1%, 5%), notably :

- **Gross Domestic Product (GDP)**

The results show that gross domestic product has a significant negative effect on financial inclusion at the 5% significance level. This finding suggests that a 1% increase in GDP will lead to a 0.005% decrease in the financial inclusion index. It highlights that economic growth alone is not sufficient to improve financial inclusion. It is therefore necessary to accompany economic development with proactive, inclusive policies that broaden access to financial services, particularly for marginalized populations.

- **Overall geographical penetration rate of financial services (lngpr)**

The overall geographical penetration rate of financial services is positively associated with the financial inclusion index at a 5% significance level. A 1% increase in the overall geographical penetration rate of financial services (lngpr) is associated with a 0.137-point increase in the financial inclusion index, all else equal.

This result suggests that the physical accessibility of financial services plays a crucial role in improving financial inclusion. In other words, the more financial service outlets (bank branches, cash machines, microfinance institutions, etc.) there are across the territory, the easier it is for people to access services such as savings, credit, insurance, or payment methods.

The positive, significant effect of geographical penetration on financial inclusion underscores the importance of physical infrastructure in financial inclusion strategies. This implies that policymakers and financial institutions must continue to invest in the geographical coverage of financial services, particularly in remote or marginalized areas.

- **Strict banking penetration rate (lnsbpr)**

At the 1% significance level, the strict banking penetration rate is negatively associated with financial inclusion. A 1% increase in the strict banking penetration rate is associated with a 0.159% decrease in the financial inclusion index. This result highlights a significant limitation of the approach that relies solely on formal banking penetration as an indicator of financial inclusion. It suggests that simply having a bank account is not enough to guarantee effective inclusion. To improve financial inclusion, it is necessary not only to promote access but also to encourage the regular, useful, and appropriate use of financial services, taking into account the specific needs of excluded populations.

- **Nominal interest rate on loans (lnnirl)**

The nominal interest rate on loans has a significant negative effect on financial inclusion at the 5 per cent significance level; therefore, our hypothesis H2 is rejected. The results indicate that a 1 percentage point increase in the nominal interest rate on loans will lead to a 0.23 per cent decrease in the financial inclusion index. This finding suggests that the level of interest rates acts as a barrier to financial inclusion. Therefore, to promote better integration of the population into the financial system, it is crucial that monetary authorities and financial institutions ensure that interest rates remain sustainable, in particular by:

- Macroeconomic stability (reduction in inflation),
- Competition within the banking sector,
- And the development of financial products tailored to low-income groups.

5. Conclusions

The findings show that financial inclusion within the WAEMU region is shaped by a complex interplay of economic, institutional, technological, and social factors. The rigorous analysis covered the period 2012–2022. It used a panel econometric model, demonstrating that improvements in financial inclusion cannot rely solely on economic growth or the expansion of banking networks. It is above all the geographical expansion of service points, the rise of electronic money, the diversification of financial product offerings, and the development of the microfinance sector that prove decisive in including the most vulnerable populations and reducing disparities, particularly in rural areas.

Nevertheless, the persistence of challenges such as the high cost of accessing credit, the vulnerability of certain social groups within the financial system, and inequalities linked to education and

location shows that effective financial inclusion requires much more than simply increasing the number of accounts or boosting GDP. The quality of usage, the relevance of the solutions offered, and the expansion of financial education remain essential to transforming access into a genuine driver of improved living standards.

The findings of this research call on policymakers to prioritize an integrated strategy that combines infrastructure development, digitalization, appropriate regulation, and innovation to improve local access. The development of a healthy competitive environment, the promotion of microfinance, and targeted support for users also appear to be key drivers for more equitable inclusion.

Ultimately, addressing the challenge of financial inclusion within the WAEMU requires a multisectoral approach tailored to national contexts. Only by maintaining this momentum, combining local engagement, innovation, education, and effective regulation, will it be possible to ensure sustainable access to financial services and support economic and social transformation towards greater equity.

With a view to future research, it would be particularly relevant to conduct an in-depth analysis of the impact of financial inclusion on the reduction of multidimensional poverty and on the economic empowerment of women and young people within the WAEMU region.

Appendix

Table 1. Geographic Penetration Table

Country	Geographic Penetration (points / 1,000 km²)
Benin	1 831
Ivory Coast	856
Senegal	740
Togo	589
Burkina Faso	413
Mali	185
Guinea-Bissau	155
Niger	18

Source: BCEAO Report, 2023

Table 2. Fixed-effects model

Fixed-effects (within) regression — Number of obs = 88
Group variable: id — Number of groups = 8

R-sq:
within = 0.9005
between = 0.8394
overall = 0.8174

Obs per group:
min = 11
avg = 11.0
max = 11

F (8,72) = 81.42
corr(u_i, Xb) = -0.6487 — Prob > F = 0.0000

iif	Coef	Std. Err.	t	P > I t I	[95% Conf	Interval]
Gdp	-.0049526	.0019234	-2.57	0.012	-.0087868	-.0011184
Lnodpr	-.0615154	.0502091	-1.23	0.224	-.1616054	.0385746
Lnogpr	.137044	.0520456	2.63	0.010	.033293	.2407951
Lnsbr	-.1594822	.0434085	-3.67	0.000	-.2460155	-.0729489
Lnbbr	.0732321	.0653644	1.12	0.266	-.0570696	.2035337
lnofsur	.0176558	.0370976	0.48	0.636	-.0562969	.0916086
Lnnird	.0793047	.0616655	1.29	0.203	-.0436232	.2022326
Lnnirl	-.2303578	.1128495	-2.04	0.045	-.4553191	-.0053964
_cons	.4747537	.3203186	1.48	0.143	-.1637897	1.113297
sigma_u	.07351131					
sigma_e	.04474659					
rho	.72965014	(fraction of variance due to u_i)				

F test that all u_i = 0: F (7, 72) = 3.58

Source: Authors' calculations, data from BCEAO report, 2022

Table 3. Hausman fixed

hausman fixed

	— Coefficients — (b) Fixed	(B) .	(b—B) Difference	sqrt (diag(V_b-V_B) S.E.
Gdp	-.0049526	-.005287	.0003344	.
Lnodpr	-.0615154	-.0013289	-.0601865	.0489827
Lnogpr	.137044	.0822637	.0547804	.0505
Lnsbr	-.1594822	-.017607	-.1418752	.0335117
Lnbbr	.0732321	-.031822	.1050541	.0617612
lnofsur	.0176558	.0205708	-.0029149	.0250486
Lnnird	.0793047	-.0152049	.0945096	.0241103
Lnnirl	-.2303578	-.0483218	-.182036	.1032851

b= consistent under Ho and Ha; obtained from xtreg
B= inconsistent under H;a, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

Chi2 (B) = (b-B) ' [(V_b-V_B)^(-1)] (b-B)
= -13.00 chi2<0 ==> model fitted on these data fails to meet the asymptotic assumptions of the Hausman test; see suest for a generalized test

Source: Authors' calculations, data from BCEAO report, 2022

Table 4. Hausman fixed

```
================================================================================
*** Panel Data Breusch-Pagan Diagonal Covariance Matrix LM Test
================================================================================
    Ho: Run OLS Regression  -  Ha: Run Panel Regression

    Lagrange Multiplier Test  =  1.341e+04
    Degrees of Freedom        =       28.0
    P-Value > Chi2(28)        =    0.00000
================================================================================
```

Source: Authors' calculations, data from BCEAO report, 2022

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