Effects of Financial Inclusion on Tax Revenue Mobilization: Evidence from WAEMU Countries

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Abstract

Financial inclusion remains at the heart of government concerns. By creating favorable conditions for access to a diversified range of adapted financial products and services at affordable costs for the population, financial inclusion generates important opportunities that could lead to increased tax revenue mobilization. This paper analyzes the effects of financial inclusion on tax revenue mobilization, using panel data from West African Economic and Monetary Union (WAEMU) countries over the period 2006-2019. The findings suggest that financial inclusion positively and significantly influences the government's tax revenue. For example, an increase in one point of the financial inclusion index corresponds to an increase in total tax revenues by 0.63 points. Moreover, by looking at the effects of disaggregated financial inclusion dimensions (access, use, and affordability) on various components of tax revenue, we find that the estimated coefficients on the sub-components of financial inclusion are statistically significant. Results also indicate the magnitude of the effect of financial inclusion is higher on indirect taxes compared to direct tax revenues. This research recommends that policymakers should prioritize financial inclusion in their policies and development agenda through National Financial Inclusion Strategies (NFIS) because it can increase countries' resource mobilization and help them build fiscal resilience.

Keywords: Financial inclusion; Tax revenue; Panel data; WAEMU.

JEL Classification : C23 ; E62 ; G20 ; H20.

1. Introduction

Since the Maya Declaration in 2011, governments in developing and emerging countries have become more committed to promoting financial inclusion, which is considered a key factor for achieving the 2030 Sustainable Development Goals (SDGs) (Cull et al. 2021; Espinosa-Vega et al., 2020). In the West African Economic and Monetary Union (WAEMU) zone, financial inclusion has become a priority in countries' political agenda. WAEMU countries have developed a regional financial inclusion strategy to provide permanent access to financial services and effective use by the Union's populations of a diversified range of adapted and affordable financial products and services (BCEAO, 2021).

As part of the implementation and monitoring of this strategy, the Central Bank of West African States (BCEAO) is developing contextualized indicators[1] to provide an annual update on the state of financial inclusion in WAEMU member states. An analysis of the evolution of these indicators shows that countries are making significant progress in this area. For example, the average synthetic financial inclusion index (regional financial inclusion index) rose from 0.21 in 2006 to 0.52 in 2020 (BCEAO, 2021).

Theoretically, financial inclusion could draw on financial intermediation theory, known as the adjustment of financing needs and capacities through the intervention of a third party (Allen and Santomero, 1997). Poor disaggregation of the intermediation chain could lead to financial exclusion that can result in persistent inequality and poverty (Allen et al., 2016), hence diminishing the capacity of these people to contribute to taxes. Thus, financial inclusion is a source of economic development. It may reduce inequality and poverty by increasing educational and entrepreneurial opportunities among vulnerable populations (Cull et al. 2021) and consequently allow these populations to increase their tax contributions to the government (Maherali, 2017).

It is widely acknowledged that taxation provides a predictable and sustainable source of government revenue, in contrast with the volatility of other important sources of public revenues such as development aid and natural resources revenues (OECD/AUC/ATAF, 2020). According to UNECA (2010), the occurrence of the global financial crisis and economic crisis underscored the volatility and uncertainty revolving around external sources of development finance (Bayale et al., 2023). Under these conditions, tax revenue has become an increasingly

[1] - The BCEAO developed eight financial inclusion indicators. Seven of these indicators are grouped around three dimensions of financial inclusion, namely access, use and affordability while the eighth is a synthetic indicator of financial inclusion for the other seven.

vital source of income for governments to be able to pay for essential public services (Bayale et al., 2022; Bayale, 2020). Taxes also have a vital role to play in making growth sustainable and equitable, particularly in the context of the Covid-19 crisis. As a result, the identification of influential drivers of tax revenue has become an important issue in economic policy formulation and is vital for policymakers in designing more effective economic policies.

According to Government Finance Statistics (GFS, 2022) of the International Monetary Fund (IMF), the total tax-to-GDP ratio for WAEMU countries has been increasing although the Union's average still lags behind the African average. Indeed, the total tax-to-GDP ratio for WAEMU countries increased from 11.4% in 2010 to 13.2% in 2019, while Africa's average rose from 14.8% to 16.6% over the same period. WAEMU has set a goal for member countries to achieve a tax-to-GDP ratio of at least 20% (GFS, 2022). Indeed, WAEMU member countries have the potential to achieve and surpass this target. Based on the previous empirical studies financial inclusion could potentially be a source of mobilizing more taxes in WAEMU that will in turn be used by governments to address development challenges in their countries including the adverse economic consequences of the Covid-19 pandemic.

Empirically, several studies highlight the importance of financial inclusion for socio-economic development. For instance, access to financial services promotes economic growth (Kim, 2016) and improves household living conditions (Coulibaly and Yogo, 2020; Ibrahim and Aliero, 2020). In addition, it enhances financial stability (Ahamed and Mallick, 2019), increases willingness to engage in entrepreneurial activity (Koloma, 2021), and contributes to women's empowerment and decision-making (Ndoya and Tsala, 2021; Mndolwa and Alhassan, 2020; Ogunleye, 2017). These studies show the importance of government initiatives and efforts to improve financial inclusion and present empirical evidence of the beneficial effect of financial inclusion on economic growth, financial stability, and inequality and poverty reduction respectively. However, little attention has been paid to the question of the effects of financial inclusion on tax revenue mobilization. On this emerging issue, literature indicates a positive and significant relationship between financial inclusion and tax revenue (Al-Own and Bani-Khalid, 2021; Oz-Yalaman, 2019; Maherali, 2017).

In the WAEMU zone, most studies have focused on the effect of financial inclusion on monetary aggregates (Diarra and Ali, 2020), economic growth (Gourène and Mendy, 2019), inequality reduction, and poverty (Senou, 2021). Yet, financial inclusion could be an important opportunity to mobilize more tax revenue, which is a predictable and sustainable source of government revenue

(Bayale, 2020). Therefore, this research paper aims to analyze the effects of financial inclusion on tax revenue mobilization in the WAEMU countries.

By applying an econometric approach to WAEMU countries and analyzing data spanning the period 2006-2019, we find that all dimensions of financial inclusion (access, use, and affordability) have a positive and significant effect on the total tax revenue and its different components. The remainder of the paper is organized as follows. Section 2 presents the literature review. In Section 3, we present the methodology and data. Results from our empirical analysis are presented in Section 4. Finally, Section 5 concludes and establishes economic policy implications.

2. Literature review

Most studies available in the literature have focused on the effects of financial development on tax revenue (Lompo, 2023; Gnangnon, 2022; Nnyanzi et al., 2018; Ebi, 2018; Bayar and Karamelikli, 2017; Akram, 2016). These studies used aggregate financial indices that include the depth of the banking system, access, and efficiency of financial institutions and financial markets (including credit to the private sector, number of bank branches, etc.).

Empirical research on the specific impact of financial inclusion on tax revenue mobilization is scarce. A pioneering study on this topic is Maherali's (2017) empirical analysis, which provides valuable insights into this relationship. The study examines financial inclusion, digital payments, and their impact on tax revenues and receipts around the world. Using a forecasting model to analyze 2014 World Bank Global Findex data, the results indicate a sharp increase in financial inclusion rates and digital payment rates reflecting the entry of hundreds of millions of people into the formal economy. The study points to the importance of mobile phone technology in enhancing the level of financial inclusion which may generate digital transactions that can be officially captured and taxed. Second, both financial inclusion and digital payments have a positive impact on tax revenues. In addition, the study finds that China and the United States are the major beneficiaries of this revenue gain due to the advanced level of financial inclusion in these countries.

Oz-Yalaman (2019) analyzes the effect of financial inclusion on tax revenue using data from 137 countries, over the period 2011-2017. The study uses two financial inclusion indicators from Global Findex: the percentages of people over 15 years of age proceeding with a bank account and a credit card, respectively. The results indicate that these indicators have a positive and significant effect on direct taxation and total tax revenue. These results suggest that the more financially included people are, the more their income should

increase, which would translate into an increase in their tax contribution to the government.

Examining the impact of financial inclusion on public finances in Argentina, Brazil, and Chile between 2002 and 2015, Mitchell and Scott (2019) show that financial inclusion contributes to better tax collection, including value-added tax (VAT) collection by encouraging more formal market transactions via the use of bank-provided credit and debit cards.

For his part, Compaoré (2020) studies the impact of financial inclusion on tax revenues in 63 developing countries over the period 2004-2017. Using the dynamic generalized method of moments (GMM), the study shows that improved access to financial services (measured by the number of ATMs per 100,000 adults) increases non-resource tax revenues in these countries. The study highlights that a well-developed financial sector coupled with greater access to credit allows individuals and corporations to finance profitable projects, consequently increasing tax contribution.

Al-Own and Bani-Khalid (2021) apply a panel data methodology on 28 European countries between 2011-2017, to analyze the relationship between financial inclusion and tax revenue using Global Findex measures including the percentage of people over 15 years of age proceeding with a bank account and a credit card. The results show a positive and significant impact of financial inclusion on tax revenues in these European countries.

Using a wide dataset of 45 countries in Europe, the Middle East, and Africa from 2008 to 2019, Raouf (2022) employs a panel threshold regression model to analyze whether changes in the total tax-to-GDP ratio are linked to changes in financial inclusion. The results show a nonlinear relationship between financial inclusion and tax revenue, which indicates that, at low levels, financial inclusion has a negative impact on tax collection, whereas, at high levels, financial inclusion has a positive and significant impact on tax revenue.

Overall, empirical studies presented above suggest that greater financial inclusion is associated with increased tax revenue. However, no study has investigated the effects of financial inclusion on tax revenue mobilization in WAEMU. Besides, the studies presented in this section have used aggregate financial indices that include the depth of the banking system, access to and efficiency of the financial institutions, and financial markets (including credit to the private sector, number of bank branches, etc.). Our paper makes two important distinctions. First, financial inclusion is measured using eight contextualized indicators that are developed by the BCEAO. Second, unlike past studies that have been limited to a few disaggregations, this study analyzes

the effects of financial inclusion on total tax revenues as well as their sub-components.

3. Methodology and Data

Econometric model

For this analysis, a panel model studying the effect of financial inclusion on tax revenues is defined as follows:

$$TAXR_{it} = \alpha_0 + \beta_i FI_{it} + \delta_i Z_{it} + \lambda_i + \eta_i + \varepsilon_{it} \quad (1)$$

Where $TAXR_{it}$ is tax revenue. This is a composite variable that includes taxes on income, profits, and capital gains (tipcg), taxes on payroll and workforce (tpw), taxes on property (tpp), taxes on goods and services (tgs), and taxes on international trade and transactions (titt) as presented in Table 1. Analysis is also done on total tax revenues. Similarly, financial inclusion (FI_{it}) is measured by the eight indicators[2] developed by BCEAO. λ_i and η_i denote time-invariant factors at the country level and time-varying factors that could affect tax revenues, respectively. The last term ε_{it} represents the error and α_0 is the constant of the model. Z_{it} is a vector of variables that determines the level of tax revenue, the choice of which is based on the available literature on the determinants (economic and institutional) of tax revenue mobilization. The determinants considered include GDP per capita, trade openness, natural resources' rents, education, agricultural and industrial value-added, and control of corruption and political stability indices.

Data sources and descriptive statistics

This study covers the 8 WAEMU member countries over the period 2006-2019, based on the availability of granular data on tax revenues and financial inclusion indices. Data on financial inclusion indicators was sourced from BCEAO. Data on tax revenue components is taken from the Government Finance Statistics (GFS) database developed by the International Monetary Fund (IMF). Economic and institutional variables in the model (GDP per capita, trade openness, natural resource rents, education, and agricultural and industrial value added) were taken from the World Development Indicators (WDI). Data on the informal sector is from Ordonez (2014) and Medina and Schneider (2018), while data on the control of corruption and political stability was obtained from the International Country Risk Guide (ICRG).

[2] - These indicators include synthetic financial inclusion index (sfii), overall demographic financial services penetration rate (odfsp), overall geographic financial services penetration rate (ogfsp), strict banking rate (sbr), expanded banking rate (ebr), overall financial services utilization rate (ofsur), nominal interest rate on deposit (ndir), nominal interest rate on loans or credit (cnir).

Table 1 below provides some descriptive statistics for these variables. It appears that financial inclusion is in full swing in WAEMU countries. Indeed, the average demographic and geographical penetration rates of financial services are 19.6% and 77.7% respectively, reflecting the proximity of financial services to the population, particularly due to the increase in the number of distribution points for financial services via mobile telephony. The average rate of use of financial services is 33.2%, due to the significant contribution of financial services via mobile telephony. Concerning the "*affordability price*" dimension, it can be observed that the average nominal interest rate of deposits is 5.03% while the average nominal interest rate of loans is 8.87%.

The results also indicate that throughout the study, countries mobilized tax revenues at a rate of 12.55% of GDP. Analysis of the components of these tax revenues indicates that their composition is dominated by taxes on goods and services (5.35% of GDP), taxes on income, profits, and capital gains (3.81% of GDP), and the tax on international trade (2.82% of GDP). The weight of the other tax revenue components (taxes on wages and labor and taxes on wealth or property) is marginal. Descriptive statistics on control variables are provided in Table 1.

Table 1: Descriptive statistics and data sources

Code	Variables	Obs.	Mean	SD	Min	Max	Sources
-	***Financial inclusion indicators***	-	-	-	-	-	-
sfii	synthetic financial inclusion index	112	0.26	0.12	0.08	0.611	BCEAO
odfsp	overall demographic penetration rate of financial services	112	19.62	31.37	0.00	166.00	BCEAO
ogfsp	overall geographic penetration rate of financial services	112	77.67	153.21	0.00	990.00	BCEAO
sbr	strict banking rate	112	13.20	7.11	0.86	26.70	BCEAO
ebr	expanded banking rate	112	29.98	19.28	0.86	73.30	BCEAO
ofsur	overall financial services utilization rate	112	33.18	22.15	0.77	79.00	BCEAO
ndir	nominal interest rate on deposits	112	5.03	0.62	2.40	6.17	BCEAO
ncir	nominal interest rate on loans or credits	112	8.71	1.62	5.67	12.44	BCEAO
-	***Tax revenue and its components***	-	-	-	-	-	-
ttr	total tax revenues	112	12.55	2.76	5.91	16.95	GFS/FMI

tipcg	taxes on income, profits and capital gains	112	3.80	1.65	1.50	11.92	GFS/FMI
tpw	taxes on payroll and workforce	112	0.30	0.16	0.00	1.83	GFS/FMI
tpp	tax on property	112	0.12	0.13	0.00	0.56	GFS/FMI
tgs	tax on goods and services	112	5.38	2.93	0.34	9.46	GFS/FMI
titt	tax on international trade and transactions	112	2.82	1.58	0.08	6.32	GFS/FMI
-	***Economic variables***	**-**	**-**	**-**	**-**	**-**	**-**
gdpc	GDP per capita	112	838.82	255.41	437.12	1705.9	WDI
open	trade openness	112	74.31	24.87	33.77	144.66	WDI
infor	share of the informal sector in the economy	112	42.86	6.21	31.45	59.63	WDI
nress	natural resource revenues	112	9.39	5.87	1.91	31.15	WDI
educ	human capital index (secondary school enrollment)	112	31.92	12.85	8.35	72.52	WDI
indva	industrial value added	112	29.88	10.97	0.89	42.52	WDI
agrva	agricultural value added	112	28.06	16.74	14.65	84.34	WDI
-	***Institutional variables***	**-**	**-**	**-**	**-**	**-**	**-**
corr	corruption index	112	1.99	0.44	1.00	3.00	ICRG
govst	government stability index	112	7.41	1.37	4.91	11.00	ICRG

Note: *Obs. = observations; SD=Standard deviation; Min=Minimum; Max=Maximum.*

Source: Authors' construction

The correlation matrix indicates that all dimensions of financial inclusion appear to contribute to improved tax revenue collection (see Table 2). This positive correlation between financial inclusion indicators and tax revenue is confirmed in the figure 1. However, Table 2 indicates a strong correlation between various indicators of financial inclusion. Nearly 90% of the correlation coefficients are greater than 0.5. Hence, all these indicators cannot be introduced simultaneously into the same estimating equation without risk of bias (Bayale and Kouassi, 2022). Therefore, separate regressions should be done for each equation including only one financial inclusion indicator.

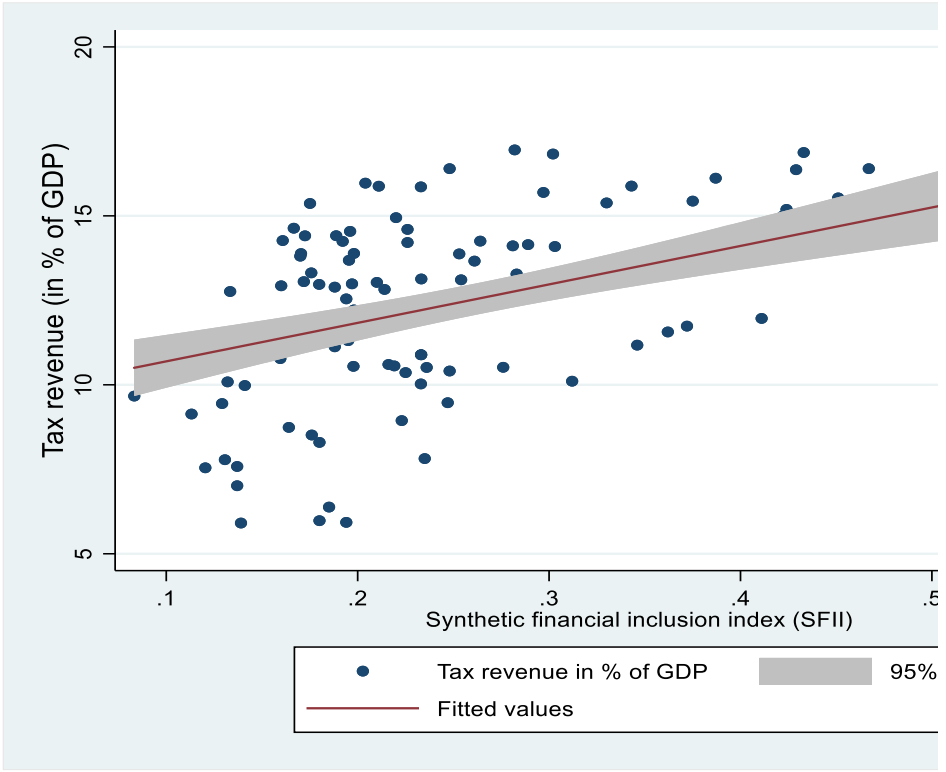
Table 2: Correlation matrix: financial inclusion indicators and total tax revenue

	ttr	sfii	odfsp	ogfsp	sbr	ebr	ofsur	ndir	ncir
ttr	1.000								
sfii	0.217**	1.000							
odfsp	0.370**	0.869*	1.000						
ogfsp	0.393**	0.735**	0.838	1.000					
sbr	0.258**	0.669***	0.422**	0.579*	1.000				
ebr	0.195***	0.621	0.685	0.566	0.903**	1.000			
ofsur	0.296***	0.862**	0.632***	0.767**	0.894	0.879	1.000		
ndir	0.478**	0.519*	0.761	0.483*	0.583	0.547****	0.513	1.000	
ncir	-0.312***	-0.741	0.476**	-0.496	-0.512**	-0.608*	-0.636**	-0.507*	1.000

***Note**: *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. Furthermore, **ttr**=total tax revenues, **sfii**=synthetic financial inclusion index, **odfsp**=overall demographic penetration rate of financial services, **ogfsp**=overall geographic penetration rate of financial services, **sbr**=strict banking rate, **ebr**=expanded banking rate, **ofsur**=overall financial services utilization rate, **ndir**=nominal interest rate on deposits and **ncir**=nominal interest rate on credits or loans.*

Source: Authors' construction

Figure 1: Correlation between financial inclusion index and tax-to-GDP



Source: Authors' construction, based BCEAO and GFS/IMF data

Estimation strategy

To determine the appropriate estimation technique, spatial dependence and unit root tests are necessary. The cross-sectional dependence test, which informs the choice of stationarity test, is a crucial step. In this study, we use the cross-sectional dependence test developed by Pesaran (2004), given the panel data's limited time dimension. The result of the CD-test of Pesaran (2004) shows that there is no cross-sectional dependence between countries (Table A.1 in the Appendix). The first-generation unit root tests are therefore appropriate compared to the second-generation unit root test under study.

The first-generation stationarity tests include those of Levin, Lin, and Chu (2002) and Maddala and Wu (1999) and the second-generation tests include those of Pesaran (2003), and Moon and Perron (2004). The first-generation stationarity tests assume of independence between the individuals in the panel, whereas the second-generation tests assume the existence of dependence between the individuals in the panel. We then performed Levin,

Lin, and Chu (2002) test and the results are reported in Table A.3 of the Appendix. Findings indicate that all the variables under study are stationary in level.

Among the pre-estimate tests performed in this study included multi-collinearity and Hausman's (1978) specification tests to determine the appropriate estimator. We constructed the correlation matrix to assess the values and signs of the coefficients (Table A.2 in the Appendix). The results indicate that they have, overall, low values. Then, we constructed the Variance Inflation Factors (VIF) statistic to test the multi-collinearity. Its value is on average 2.12, less than 5. Since the VIF statistics associated with each variable do not exceed 5 (individual VIFs), it can be concluded that there is no multi-collinearity between tax revenue and explanatory variables (*macroeconomic and institutional variables*) of the model. These variables can therefore be maintained in the same empirical model without the risk of creating a bias in the econometric results (Table A.4 in the Appendix). As for the results of the Hausman test (1978), they led us to the specification of a fixed-effects model where the specific effect is assumed to be fixed over time (p-value equal to 0.000) (Table A.5 in the Appendix). We therefore selected the fixed effects estimator to make our estimates.

Based on these results, we should have applied a fixed-effects estimator. However, this approach does not address the problems of autocorrelation, cross-sectional correlation, and heteroscedasticity. For this reason, the study used the robust standard errors proposed by Driscoll and Kraay (1998). These standard errors are computed by taking cross-section averages of products of the regressors and residuals and then computing a heteroskedasticity autocorrelation estimator with these cross-section averages. Driscoll and Kraay (1998) establish consistency of these standard errors as the cross-section and time dimension sample sizes increase under mixing conditions that limit the dependence on the data both in the time and cross-section dimensions. Driscoll and Kraay's (1998) approach deliver robustness to spatial correlation and serial correlation in the panel as well as the heteroscedasticity issue (Vogelsang, 2012). Moreover, we implement the two-stage least squares (2SLS) estimator to deal with potential endogeneity issues.

4. Econometric results and discussions

Baseline results

Tables 3 and 4 present the results of the study. Table 3 presents the results of estimates of the effects of financial inclusion on tax revenue mobilization in

WAEMU countries. Several measures (access, use, and affordability dimensions) of financial inclusion were considered in the model. Two indicators measure the "*access*" dimension of financial inclusion. The first is the overall demographic penetration rate of financial services and the second is the overall geographic penetration rate of financial services (see columns 2 and 3). Three other indicators measure the "*use*" dimension of financial inclusion. They are strict bancarisation rate, expanded bancarisation rate, and overall rate of use of financial services which combines the expanded bancarisation rate and the percentage of the adult population holding an e-money account with e-money issuing institutions (see Columns 4, 5, and 6). Finally, we used nominal interest rates on deposits and nominal interest rates on loans to consider the "affordability" dimension of financial inclusion (see Columns 7 and 8). To analyze the effect of the overall level of financial inclusion on tax revenue, we used the synthetic index, calculated by considering all seven previous indicators listed (see columns 1).

It can be observed that each indicator of financial inclusion has a positive and significant effect on tax revenue. The sign of the coefficient associated to the nominal credit interest rate is negative because, with a decrease in the nominal interest rate on loans, SMEs and households may get more access to credits to engage and develop income-generating activities. Overall, financial inclusion enhances tax revenue mobilization in WAEMU countries. These results corroborate the findings of Maherali (2017), Oz-Yalaman (2019), Compaoré (2020), Al-Own and Bani-Khalid (2021), and Raouf (2022) who examine the beneficial effect of financial inclusion in enhancing tax revenue mobilization in different contexts. For instance, Al-Own and Bani-Khalid (2021) analyzed the relationship between financial inclusion and tax revenue in 28 European countries between 2011 and 2017, using Global Findex measures. Their findings indicated a positive and significant impact of financial inclusion on tax revenues.

In the case of WAEMU countries, there are several potential channels through which financial inclusion may enhance tax revenue. The first channel is the development of income-generating activities. As people become more financially included and their income grows over time, this may in turn increase their tax contributions to the government (Oz-Yalaman, 2019). According to Maherali (2017), an increase in tax revenue collected could emanate from two points: (i) an increased number of people paying taxes and their levels of income, both of which are affected by financial inclusion, (ii) financially included firms and household can finance credit investments and increase consumption, which in turn generate both, income and consumption taxes for public sector.

The second channel concerns the development of digital technology. People who are financially included may generate digital transactions that can be officially captured and taxed (Maherali, 2017). Finally, financial inclusion may increase tax revenue through formal sector development. Financial inclusion encourages the formalization of informal businesses for them to benefit from the advantages of financial inclusion such as lower cost of credit. In the formalization process, these businesses would be required to disclose information about their income and assets to financial intermediaries and tax authorities.

Several other control variables have a significant effect on tax revenue. For example, GDP per capita is added as a proxy for a country's development level and has a positive and significant effect on the total tax revenue. The increase in a country's development level increases the share of the formal economy (Gupta, 2007; Oz-Yalaman, 2019; Al-Own and Bani-Khalid, 2021). Hence, informality places large constraints on domestic revenue mobilization (Ordonez, 2014; Mawejje and Munyambonera, 2016). Openness, which measures trade volume, has a positive and significant effect. This is because an increase in trade volume increases economic growth and therefore increases tax revenue. Trade openness may contribute to broadening the base in terms of taxes on international trade (Oz-Yalaman, 2019; Compaoré, 2020; Al-Own and Bani-Khalid, 2021; and Raouf, 2022). The informal sector has a negative and significant effect on tax revenue. This is because the informal sector makes it more difficult to identify taxpayers.

Moreover, the industrial sector has a positive and significant effect on tax revenue. Indeed, industry is one of the sectors of the economy where transactions take place in a relatively more formal environment. As a result, the taxation of activities in the industrial sector should seem easier. By analyzing the determinants of tax revenue mobilization in West Africa, the World Bank (2019) highlighted the positive effect of the industry sector on tax revenue.

Concerning education (human capital index), this is essential for tax revenue collection. Education contributes to tax revenue mobilization by strengthening tax administration skills (Bayale et al. 2022). Furthermore, institutional factors such as control of corruption and government stability have positive and significant effects on tax revenue. Thus, by achieving a higher level of political stability and a lower level of corruption, the government can generate more tax revenue (World Bank, 2019). In the study by Gupta (2007), political stability and control of corruption are noted to be effective factors in tax revenue. Hence, political stability and corruption are variables included in governance indicators leading to efficient tax administration that consequently increases the amount of the tax revenues mobilized.

Other control variables such as natural resource revenues and agricultural sector are included in the model. However, these variables do not have statistically significant coefficients. The interpretation of the signs and values of their coefficients are not of major interest.

The paper performed additional regression by considering (i) taxes on income, profits, and capital gains, (ii) taxes on payroll and workforce, (iii) taxes on property, (iv) taxes on goods and services, and (v) taxes on international trade and transactions, respectively as dependent variables. Table 4 compares the magnitude of the effect of financial inclusion indicators on disaggregated tax revenues, based on the standardized coefficients from regression results. It can be observed that the magnitude of effect seems to be generally high on indirect taxes as compared to direct taxes. This implies that financial inclusion generates more tax revenue through indirect taxes (tax on goods and services and tax on international trade and transactions for example) than direct taxes (taxes on income, profits, and capital gains, taxes on payroll and workforce, and tax on property, etc.).

Table 3: Regression results [Dependent variable: total tax revenue (% of GDP)]

Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Constant	0.913	0.923	0.851	0.839	0.828	0.727	0.849	0.861
	(1.981)	(1.820)	(1.612)	(1.937)	(1.874)	(1.151)	(1.782)	(1.278)
sfii	0.063***	-	-	-	-	-	-	-
	(0.005)	-	-	-	-	-	-	-
odfsp	-	0.009**	-	-	-	-	-	-
	-	(0.003)	-	-	-	-	-	-
ogfsp	-	-	0.014**	-	-	-	-	-
	-	-	(0.007)	-	-	-	-	-
sbr	-	-	-	0.014**	-	-	-	-
	-	-	-	(0.008)	-	-	-	-
ebr	-	-	-	-	0.018**	-	-	-
	-	-	-	-	(0.008)	-	-	-
ofsur	-	-	-	-	-	0.015**	-	-
	-	-	-	-	-	(0.007)	-	-
ndir	-	-	-	-	-	-	0.014**	-
	-	-	-	-	-	-	(0.006)	-

ncir	-	-	-	-	-	-	-	-0.017***
	-	-	-	-	-	-	-	(0.006)
lgdpc	0.146***	0.145***	0.146***	0.146***	0.155***	0.155***	0.146***	0.146***
	(0.032)	(0.031)	(0.032)	(0.031)	(0.038)	(0.035)	(0.032)	(0.035)
Open	0.018**	0.017**	0.017**	0.018**	0.015**	0.018**	0.018**	0.017***
	(0.008)	(0.005)	(0.006)	(0.009)	(0.006)	(0.005)	(0.008)	(0.000)
info	-0.154**	-0.147**	-0.173**	-0.178**	-0.171**	-0.153**	-0.185***	-0.167**
	(0.075)	(0.072)	(0.082)	(0.079)	(0.086)	(0.072)	(0.066)	(0.081)
nress	-0.008	-0.008	-0.007	-0.004	-0.007	-0.007	-0.008	-0.007
	(0.052)	(0.009)	(0.051)	(0.050)	(0.052)	(0.051)	(0.050)	(0.051)
agrva	-0.127	-0.132	-0.123	-0.131	-0.114	-0.117	-0.137	-0.129
	(0.154)	(0.156)	(0.158)	(0.156)	(0.161)	(0.158)	(0.156)	(0.158)
indva	0.088***	0.089**	0.092**	0.094**	0.075***	0.086**	0.099**	0.087**
	(0.025)	(0.045)	(0.049)	(0.055)	(0.019)	(0.042)	(0.055)	(0.039)
educ	0.023**	0.024**	0.021**	0.022**	0.021**	0.021**	0.023**	0.021**
	(0.010)	(0.011)	(0.011)	(0.011)	(0.009)	(0.009)	(0.010)	(0.010)
corr	0.179**	0.192***	0.148**	0.106***	0.102**	0.161**	0.141**	0.132**
	(0.068)	(0.057)	(0.079)	(0.001)	(0.049)	(0.054)	(0.051)	(0.047)
govst	0.161**	0.167**	0.191**	0.172**	0.155**	0.142**	0.193**	0.187***
	(0.067)	(0.081)	(0.092)	(0.089)	(0.072)	(0.050)	(0.009)	(0.005)
R-squared	0.786	0.785	0.788	0.789	0.787	0.791	0.792	0.793
Number of countries	8	8	8	8	8	8	8	8

Obs.	112.00	112.00	112.00	112.00	112.00	112.00	112.00	112.00

***Note**: *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.*

Source: Authors' construction

Table 4: Comparison of the magnitude of effect of the FI indicators on disaggregated tax revenues using standardized coefficients

Variables of interest	Total tax revenues	Taxes on income, profits and capital gains *(direct tax)*	Taxes on payroll and workforce *(direct tax)*	Tax on property *(direct tax)*	Tax on goods and services *(indirect tax)*	Tax on international trade and transactions *(indirect tax)*
Synthetic financial inclusion index	0.061	0.045	0.042	0.040	0.054	0.053
Overall demographic penetration rate of financial services	0.014	0.011	0.012	0.018	0.025	0.027
Overall geographic penetration rate of financial services	0.012	0.014	0.012	0.010	0.034	0.029
Strict banking rate	0.013	0.011	0.010	0.01	0.056	0.053
Expanded banking rate	0.011	0.010	0.011	0.010	0.022	0.028
Overall financial services utilization rate	0.014	0.012	0.014	0.013	0.041	0.045
Nominal interest rate on deposits	0.011	0.010	0.002	0.016	0.022	0.034
Nominal interest rate on loans (credits)	-0.018	-0.021	-0.012	-0.014	-0.031	-0.037

Source: Authors' construction

Robustness checks

To test the robustness of our baseline results presented in this subsection, we perform sensitivity analysis. Thus, we perform the two-stage least squares (2SLS) approach to account for the potential endogeneity issue. Indeed, Graham (2013) and Shapiro et al. (2013) argued that empirical studies on tax issues should address the endogeneity problem as tax rates are usually endogenous. Results exhibited in Table 5 indicate that coefficients do not indicate a drastic change compared to the previous ones (Table 3). Overall, financial inclusion enhances tax revenue mobilization in WAEMU countries. An increase in one point of the financial inclusion index corresponds to an increase in total tax revenues of 0.62 points, against 0.63 in baseline results. Moreover, each financial inclusion measure also contributes positively and significantly to tax revenue mobilization. Hence, these results support the main findings. Our empirical results are robust.

Table 5: Robustness checks results (Dependent variable: total tax revenue (% of GDP))

Variables	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Constant	0.968	0.969	0.658	0.325	0.347	0.672	0.717	0.439
	(1.204)	(1.735)	(1.368)	(1.258)	(1.350)	(1.541)	(1.535)	(1.319)
sfii	0.062***	-	-	-	-	-	-	-
	(0.004)	-	-	-	-	-	-	-
odfsp	-	0.008**	-	-	-	-	-	-
	-	(0.004)	-	-	-	-	-	-
ogfsp	-	-	0.013**	-	-	-	-	-
	-	-	(0.006)	-	-	-	-	-
sbr	-	-	-	0.012**	-	-	-	-
	-	-	-	(0.005)	-	-	-	-
ebr	-	-	-	-	0.018**	-	-	-
	-	-	-	-	(0.008)	-	-	-
ofsur	-	-	-	-	-	0.014**	-	-
	-	-	-	-	-	(0.006)	-	-
ndir	-	-	-	-	-	-	0.013**	-
	-	-	-	-	-	-	(0.005)	-
ncir	-	-	-	-	-	-	-	-0.018***
	-	-	-	-	-	-	-	(0.005)
lgdpc	0.097**	0.096***	0.095**	0.093**	0.092**	0.092**	0.089**	0.075***
	(0.043)	(0.022)	(0.041)	(0.043)	(0.042)	(0.042)	(0.043)	(0.015)
Open	0.018**	0.017**	0.017**	0.018**	0.016**	0.018**	0.018**	0.017***
	(0.009)	(0.005)	(0.006)	(0.009)	(0.006)	(0.005)	(0.008)	(0.000)
infor	-0.154**	-0.147**	-0.173**	-0.178**	-0.171**	-0.153**	-0.185***	-0.167***
	(0.075)	(0.072)	(0.082)	(0.079)	(0.086)	(0.072)	(0.066)	(0.005)
nress	-0.008	-0.014	-0.007	-0.004	-0.007	-0.007	-0.008	-0.007
	(0.052)	(0.049)	(0.051)	(0.050)	(0.052)	(0.051)	(0.050)	(0.051)
agrva	-0.127	-0.132	-0.123	-0.131	-0.114	-0.117	-0.137	-0.123
	(0.154)	(0.156)	(0.158)	(0.156)	(0.161)	(0.158)	(0.156)	(0.158)
indva	0.089***	0.089**	0.092**	0.094**	0.075***	0.086**	0.099**	0.087**
	(0.025)	(0.045)	(0.049)	(0.055)	(0.019)	(0.042)	(0.055)	(0.039)
educ	0.024**	0.024**	0.021**	0.022**	0.021**	0.021**	0.024**	0.021**
	(0.011)	(0.011)	(0.011)	(0.011)	(0.009)	(0.010)	(0.010)	(0.010)

corr	0.058**	0.059**	0.049**	0.059**	0.055**	0.057***	0.058**	0.053***
	(0.025)	(0.022)	(0.021)	(0.021)	(0.021)	(0.015)	(0.023)	(0.015)
govst	0.152**	0.144**	0.202***	0.168**	0.175**	0.135**	0.219***	0.187**
	(0.071)	(0.069)	(0.073)	(0.087)	(0.082)	(0.067)	(0.077)	(0.095)
R-squared	0.786	0.785	0.788	0.789	0.787	0.791	0.792	0.793
Nb. Countries	8	8	8	8	8	8	8	8
Obs.	112.00	112.00	112.00	112.00	112.00	112.00	112.00	112.00

***Note**: *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.*

Source: Authors' construction

5. Conclusion and policy implications

The aim of this paper is to analyze the effects of financial inclusion on tax revenue mobilization in the WAEMU countries. Using panel data covering the period 2006-2019, fixed effects, and Driscoll and Kraay (1998) approach, the study provides empirical evidence that financial inclusion has a significant positive association with tax revenue collection in WAEMU countries. This positive impact is consistent when using different categories of tax revenues and different types of financial inclusion proxies. The results indicate that financial inclusion can be considered as a determinant of tax revenue, and therefore, regulators and policymakers can take advantage of the benefits of financial inclusion.

In terms of policy implications for WAEMU countries, this study calls for improved and greater access to financial services and financial inclusion of their citizens. Physical, economic, regulatory, and cultural factors contribute to a lack of access to financial services in most developing countries. Since the use of new technologies such as mobile money and innovative business models has exhibited a large potential and overcoming barriers to access, WAEMU governments have a crucial role to play in ensuring the continued set up of sound regulatory frameworks and setting conditions so that incentives can be provided to enable increased supply of financial services to the Union's population. Governments also have a role to continue investing in both the hard and soft infrastructure that will facilitate the increased financial inclusion efforts in the region. It is worth noting that the affordability of these essential infrastructural services such as the internet is essential in determining whether people will use the financial services.

Nonetheless, the study calls for continued and increased action by the BCEAO to support member states in the implementation of projects to promote financial literacy. A regional financial literacy programme has been developed. However, more can be done to increase the level of financial literacy so that the Union's population is aware of the existence of financial products and can use them effectively hence increasing the level of tax revenue contribution in the region.

Given the pressing financing needs to finance structural investments for development, this study provides insights into WAEMU countries that are in the process of implementing financial inclusion policies through their National Financial Inclusion Strategies (NFIS). WAEMU governments have an ambitious target for member states to achieve a tax-to-GDP ratio of at least 20%. Thus, policymakers should prioritize financial inclusion in their policy design because it may increase countries' resource mobilization and provide an avenue to meet the tax-to-GDP ratio target of 20%, foster post-COVID-19 fiscal consolidation, and help countries build fiscal resilience to face external shocks.

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7. Appendices

Table A.1: Cross-sectional dependence test (CD-test)

Variables	Description	CD-test	p-value
sfii	Synthetic financial Inclusion Index	1.378	0.706
odfsp	Overall demographic penetration rate of financial services	1.681	0.524
ogfsp	Overall geographic penetration rate of financial services	1.689	0.499
sbr	Strict banking rate	2.004	0.163
ebr	Expanded banking rate	1.652	0.421
ofsur	Overall financial services utilization rate	1.487	0.704
ndir	Nominal interest rate on deposits	1.773	0.355
ncir	Nominal interest rate credits or loans	1.192	0.826
ttr	Total tax revenues	2.136	0.109
tipcg	Taxes on income, profits and capital gains	1.582	0.624
tpw	Taxes on payroll and workforce	1.458	0.724
tpp	Tax on property	1.389	0.701
tgs	Tax on goods and services	2.087	0.147
titt	Tax on international trade and transactions	1.254	0.814
lgdpc	GDP per capita	1.029	0.421
open	Trade openness	1.456	0.729
infor	Share of the informal sector in the economy	1.624	0.486
nress	Natural resource revenues	1.568	0.664
educ	Human capital index (secondary school enrollment)	2.451	0.099
indva	Industrial value added	1.589	0.403
agrva	Agricultural value added	2.984	0.074
corr	Corruption Index	0.169	0.866
govst	Government Stability Index	0.357	0.829

Source : Authors' construction

Table A.2: Correlation matrix

	ttr	sfii	gdpc	open	infor	nress	educ	indva	agrva	corr	govst
ttr	1.000										
sfii	0.218	1.000									
lgdpc	0.230	0.402	1.000								
open	0.187	0.158	0.407	1.000							
infor	-0.011	0.015	-0.049	0.104	1.000						

nress	-0.052	-0.081	0.347	0.376	0.348	1.000					
educ	0.163	0.253	0.109	0.239	0.137	0.455	1.000				
indva	0.389	0.239	0.428	0.251	0.042	0.158	0.009	1.000			
agrva	-0.251	0.415	0.365	0.248	0.099	0.369	0.296	0.344	1.0000		
corr	0.071	0.028	0.005	0.034	-0.256	0.008	0.347	0.272	0.066	1.000	
govst	0.194	0.483	0.204	0.322	-0.147	0.053	0.034	0.181	0.141	0.122	1.000

Source : Authors' construction

Table A.3: Unit root test

Variables	Description	Chi2	p-Value	Decision
sfii	Synthetic financial Inclusion Index	-4.397	0.003	I(0)
odfsp	Overall demographic penetration rate of financial services	-3.517	0.005	I(0)
ogfsp	Overall geographic penetration rate of financial services	-4.054	0.000	I(0)
sbr	Strict banking rate	-3.644	0.001	I(0)
ebr	Expanded banking rate	-3.852	0.001	I(0)
ofsur	Overall financial services utilization rate	-3.865	0.000	I(0)
ndir	Nominal interest rate on deposits	-5.855	0.000	I(0)
ncir	Nominal interest rate on credits or loans	-4.965	0.000	I(0)
ttr	Total tax revenues	-4.331	0.008	I(0)
tipcg	Taxes on income, profits and capital gains	-4.587	0.000	I(0)
tpw	Taxes on payroll and workforce	-2.034	0.010	I(0)
tpp	Tax on property	-3.845	0.000	I(0)
tgs	Tax on goods and services	-4.081	0.000	I(0)
titt	Tax on international trade and transactions	-4.687	0.000	I(0)
lgdpc	Log of GDP per capita	-4.038	0.000	I(0)
open	Trade openness	-4.164	0.000	I(0)
infor	Share of the informal sector in the economy	-4,467	0.003	I(0)
nress	Natural resource revenues	-3.998	0.000	I(0)
educ	Human capital index (secondary school enrollment)	-4.124	0.000	I(0)
indva	Industrial value added	-3.658	0.000	I(0)
agrva	Agricultural value added	-4.021	0.000	I(0)
corr	Corruption Index	-4.327	0.000	I(0)

govst	Government Stability Index	-3.856	0.000	I(0)

Source: Authors' construction

Table A.4: Multi-collinearity test results

Variables	**Variance Inflation Factors (VIF)**	**1/VIF**
sfii	1.85	0.541
lgdpc	2.29	0.417
open	2.57	0.389
infor	2.27	0.440
nress	2.26	0.442
educ	2.23	0.448
indva	2.12	0.471
agrva	1.99	0.502
corr	1.68	0.595
govst	1.64	0.609
Mean VIF	**2.12**	

Source: Authors' construction

Table A.5: Hausman test results

Test	Ho: difference in coefficients not systematic
$Chi^2(10)$ =	$(b-B)'\,[(V\_b-V\_B)^{\wedge}\,(b-B)]$
=	37.50
$Prob > Chi^2$ =	(0.000)

Source : Authors' construction

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