Available online at
http://myjms.moe.gov.my/index.php/JEEIR

e-ISSN: 2289-2559

Journal of Emerging Economies & Islamic Research 8(2) 2020, 88 – 99.

Journal of Emerging Economies and Islamic Research

Financial Inclusion and Monetary Policy in West Africa

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ARTICLE INFO

Article history:
Received 29 February 2020
Accepted 18 May 2020
Published 31 May 2020

Keywords:
Financial inclusion
Monetary policy
Inflation
Informal sector

ABSTRACT

The study investigated the impact of financial inclusion on the effectiveness of monetary policy in West Africa for the period 2005 to 2018. The study employed Granger panel non-causality test developed by Dumitrescu and Hurlin to determine the direction of causality between inflation (a proxy for monetary policy) and indicators of financial inclusion. The system GMM was also employed to investigate the impact of each indicator of financial inclusion on monetary policy. The results show that financial inclusion is a significant determinant of monetary policy. The study concludes that financial inclusion should be broadened to include a large number of economic agents in the rural areas and informal sector because a large volume of financial transactions takes place within this sector.

1. Introduction

Monetary policy is one of the critical macroeconomic policies often used by the monetary authorities to regulate the amount of money in circulation to achieve internal and external balances. It involves the use of money and monetary tools to achieve the objectives of price and foreign exchange stability, external balances, economic growth and development (Layi, 1998). Monetary policy has become a vital policy approach of policy authorities due to its timeliness and potency in fine-tuning the economy towards the long-run equilibrium path (Dornbusch, Fisher and Startz, 2011). The ability of this policy to achieve the macroeconomic objectives depends on many factors such as integrity and quality of the central bank, the analytical capability of the monetary authority as well as the level of development of a nation's financial system. The main challenge often faced by most monetary authorities, especially in developing countries, is how to conduct monetary policy to achieve the country's macroeconomic objective of price stability.

In recent years, a quiet number of central banks have taken inflation targeting (IT) as a policy to achieve not only price stability but also financial stability. The efforts of most central banks in the West Africa

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region towards achieving price stability have not yielded desired results because inflation in most of these countries is above the targets (Okwori and Abu, 2017). However, financial inclusion has been recognised across the globe as an essential factor for monetary policy to be more productive. Financial inclusion is a policy action that came forth when economists all over the world began to realise the economic benefits inherent in ensuring access to financial services for the most significant number of people at the least possible cost, irrespective of their income, geographical location or economic activities (Ouma, Odongo and Were 2017). In line with the Maya Declaration of 2011 by many West African countries, some of these countries have introduced financial inclusion strategy in one form or the other. For example, Nigeria introduced the Financial Inclusion Strategy in 2012; Cote d'Ivoire introduced the National Financial Inclusion Strategy Action Plan in 2013, and the Digital Financial Service Guideline was introduced in Ghana by 2015.

However, monetary policy effectiveness requires the involvement of a large number of economic agents in which the informal sector play an important role. Monetary policy is more effective when the informal sector is financially inclusive. The informal sector is vital in monetary policy implementation and its effectiveness because a large volume of financial transactions take place within this sector. Khan (2011) opined that the effect of monetary policy on the economy reckons on the extent of the involvement of the large informal sector of such an economy. Even though the universal recognition of the importance of financial inclusion ineffectiveness of monetary policy, limited access to the formal financial services has continued to be a significant challenge especially in developing countries (Demirguc-Kunt, Klapper, Dorothe and Oudheusden, 2014). Even account ownership among adult people in most developing countries is lower when compared to ownership in advanced economies (CGAP, 2014). Therefore, this study investigates the effect of financial inclusion on monetary policy effectiveness in West Africa. The remaining part of this paper is grouped into four sections. Section 2 reviewed literature that is relevant to this study; section 3 presents the methodology and estimation techniques; section 4 presents data analysis and discussion of results, and section 5 is the conclusion and recommendation.

2. Literature review

Financial inclusion implies that all individuals, businesses and other economic agents have access to formal financial services at affordable cost and such services are provided to meet their needs (FII, 2017; CBN, 2012; World Bank, 2008). This definition shows that financial inclusion is more than having access to a transaction account, but also include the usage of a full spectrum of services like loans, payments, deposits, pension and insurance services. However, there are four principal dimensions of financial inclusion – access, usage, quality, and welfare.

Financial access is measured by account ownership, and it is considered as a first step towards broadening the financial inclusion because it serves as a window to other financial services. This is the main reason why universal financial access (UFA) 2020 initiative aims at ensuring that transaction accounts are accessible to people worldwide by the year 2020. The Financial Inclusion Insight (FII 2017) observed that account ownership varies across the globe with sub-Sahara countries ranked lowest. However, Demirguc-Kunt and Klapper (2012) opined that technology advancement and adoption of mobile money had increased number of account ownership in sub-Sahara Africa with more than 16% of an adult having a mobile money account. Financial usage concerns with the use of financial products and services by the customers of financial institutions. Financial usage is ensured when the more significant proportion of the population use the products and services offered by financial institutions. The banks must also offer services that are needed by consumers most appealingly and at least cost. Some of the services that fall under this dimension include loan and advances, savings, among others.

The third dimension is the quality of the services offered by financial institutions. Quality of a product or service matters a lot in ensuring continuous patronage by the customers as well as continuity of the financial service providers. Improvement in the quality of services rendered by the financial service providers ensures that the customers' needs are met accordingly. Thus, banks and financial service providers are expected to offer demand-based services required by financial service consumers. Welfare is the fourth dimension that concerns with how financial inclusion influences the decision of economic agents in terms of consumption, investment and savings. Financially included households have access to financial services which improve their consumption and businesses when compared to those financially excluded. Chakraverty and Pal (2010) observed that access to financial services could be regarded as an essential ingredient of human wellbeing. Thus, financial inclusion could improve the welfare of low-income earners and rural dwellers.

The theoretical literature on the relationship between financial inclusion and effectiveness of monetary policy is still in its early stage. However, a strand of thought in the literature has shown that greater financial inclusion could strengthen the effort of the central bank in maintaining price stability through interest rate, thereby making monetary policy effective. For example, Galí, Lopez-Salido and Valles (2004) argued that the existence of financially excluded individuals could influence the economy under different monetary policy rule. In a situation where policy rule responds to the current inflation and output values, there must be a more significant response to inflation if a unique equilibrium is to be achieved. In this case, the Taylor principle is strengthened, and monetary policy is useful, especially when the share of excluded customers is high.

On the other hand, in a situation where a policy rule is forward-looking, a large number of consumers that are financially excluded may not allow unique equilibrium. One of the significant reasons why policy rules may not be active in stabilising the economy with a decline in the level of financial inclusion is that interest rates do not affect the financially excluded directly thus, making monetary policy to be less effective (Mehrora and Yatman, 2014). Bibiie (2008) opined that as the number of non-asset (financially excluded household) holders decreases, the more effective is monetary policy because the link between aggregate demand and interest rates becomes stronger. Iyer (2017) also agreed that financial inclusion is an essential factor for monetary policy to be effective. He opined that financial inclusion makes inflation targeting an optimal monetary policy, especially where financial inclusion is high. He suggested that the monetary policy of the central bank should focus on reducing output volatility instead of inflation when financial inclusion is very marginal. This is the case in many developing countries.

Several empirical studies have investigated the postulated link between financial inclusion and monetary policy effectiveness. While some found adverse effects (Huong, 2018; Hung, 2016; Lenka & Bariwa, 2016; Mehrotra & Yetman, 2014; and Mbutor & Uba, 2013), others found no effects (Evans, 2016 and Lapukeni, 2015). While acknowledging the efforts of these researchers and the robust nature of their studies, there are lapses in the way they measured their variables. For instance, Lenka & Bariwa (2016) measured financial inclusion with an index constructed using principal component analysis (PCA). Also, Elsherif (2019) also used financial inclusion index in his empirical work for Egypt and found a significant impact of financial inclusion on monetary policy transmission. The index used by these authors did not give room for assessing the individual impact of each of financial inclusion indicators on the effectiveness of monetary policy which prevent the central bank from identifying the indicator that is doing well and the one that needs urgent review.

Some of the existing studies (like Mbutor & Uba, 2013; Lapukeni, 2015; and Evans, 2016) also predict direct impact of financial inclusion on monetary policy by specifying inflation rate as a function of both control and financial inclusion variables. Whereas, financial inclusion may not have a direct impact on monetary policy instead of indirect impact through the operating target variables of monetary policy.

Thus, there is a need to interact with the financial inclusion variables with the control variable to capture the indirect effects of the financial inclusion variables on monetary policy.

3. Methodology

3.1 Model specification

From the reviewed literature and the empirical studies of Evan (2016) and Hung (2016), interest rate, nominal exchange rate depreciation and growth rate of money supply are essential factors in determining the success and active conduct of monetary policy (Maumela, Nicholas & Odhiambo, 2011). In this study, inflation was used to proxy monetary policy effectiveness because it is the ultimate target of monetary policy. Expressing inflation as a function of the control variables mentioned above and financial inclusion gives:

$$inf = f(intr, excdep, grms, fincl) \tag{1}$$

Where *inf* is inflation, *intr* is the interest rate, *excdep* is nominal exchange rate depreciation, *grms* is the growth rate of money supply, and *fincl* is the vector of financial inclusion indicators (financial accessibility, financial availability and financial usage). Specifying equation 1 in econometric form and substituting financial inclusion indicators in the form of interacting variables with the operating variables of monetary policy yields:

$$\begin{aligned} inf_{it} = \psi_o + \psi_1 intr_{it} + \psi_2 excdep_{it} + \psi_3 grms_{it} + \psi_4 intr * nbdep_{it} \\ + \psi_5 excdep * nbdep_{it} + \psi_6 grms * nbdep_{it} + \omega_{it} \end{aligned} \tag{2}$$

$$\begin{aligned} inf_{it} = \beta_o + \beta_1 intr_{it} + \beta_2 excdep_{it} + \beta_3 grms_{it} + \beta_4 intr * atm_{it} \\ + \beta_5 excdep * atm_{it} + \beta_6 grms * atm_{it} + \mu_{it} \end{aligned} \tag{3}$$

$$\begin{aligned} inf_{it} = \alpha_o + \alpha_1 intr_{it} + \alpha_2 excdep_{it} + \alpha_3 grms_{it} + \alpha_4 intr * cbcred_{it} \\ + \alpha_5 excdep * cbcred_{it} + \alpha_6 grms * cbcred_{it} + \pi_{it} \end{aligned} \tag{4}$$

Where *nbdep* is the number of bank depositor per 100,000 adults to proxy financial accessibility, *atm* is automated teller machine per 1000^2 km to proxy financial availability, and *cbcred* is commercial banks' credit as a percentage of GDP to proxy financial usage. Other variables were as earlier defined.

3.2 *Estimation techniques*

This study employed both descriptive and inferential methods of analysis to achieve the objective of the study. The descriptive approach entails the pairwise correlation matrix while the inferential analysis entails statistical tool of regression, particularly, the dynamic two-step system Generalised Method of Moment (GMM). While the pairwise correlation matrix was employed to determine the level of relationships that exist among the variables, the system GMM was employed to determine the impacts of the independent variables on the dependent variable because it is efficient in taking care of endogeneity problems. The study also used Dumitrescu-Hurlin (D-H) panel Granger non-causality test to investigate the direction of causality between inflation rate and other financial inclusion indicators used in the study. The following equations were specified to test the direction of causality between the indicators of financial inclusion and interest rate in West Africa.

$$inf_{it} = \sum_{i=1}^{k} \propto_i inf_{t-1} + \sum_{j-1}^{k} \beta_j \, nbdep_{it-1} + U_{it} \quad (5)$$

$$nbdep_{it} = \sum_{i=1}^{k} \propto_i nbdep_{t-1} + \sum_{j-1}^{k} \beta_j \, inf_{it-1} + U_{it} \quad (6)$$

$$inf_{it} = \sum_{i=1}^{k} \propto_i inf_{t-1} + \sum_{j-1}^{k} \beta_j \, atm_{it-1} + U_{it} \quad (7)$$

$$atm_{it} = \sum_{i=1}^{k} \propto_i atm_{t-1} + \sum_{j-1}^{k} \beta_j \, inf_{it-1} + U_{it} \quad (8)$$

$$inf_{it} = \sum_{i=1}^{k} \propto_i inf_{t-1} + \sum_{j-1}^{k} \beta_j \, cbcred_{it-1} + U_{it} \quad (8)$$

$$cbcred_{it} = \sum_{i=1}^{k} \propto_i cbcred_{t-1} + \sum_{j-1}^{k} \beta_j \, inf_{it-1} + U_{it} \quad (10)$$

Equations 5 to 10 are the Granger causality models used to establish the direction of causality between financial inclusion indicators (accessibility, availability and usage) and monetary policy target (inflation rate) in West Africa.

If β_j in equations 5, 7, and 9 are significant, then financial inclusion granger-cause monetary policy target proxied by inflation. If β_j in equations 6, 8, and 10 are significant, then the causality runs from monetary policy target to financial inclusion.

3.2 Diagnostic Tests

The study conducted post-estimation tests in other to validate the results of the estimated models. Breusch Pagan-Godfrey (BPG) approach was used to test for heteroscedasticity. BPG test asymptotically follows the chi-square distribution with one df. The test is conducted using the probability value to decide on whether to reject or accept the null hypothesis. If the probability value is less than a 5% significance level, the null hypothesis will be rejected and if otherwise, the null hypothesis will be accepted and conclude that there is no heteroscedasticity. Arellano and Bond (1991) autocorrelation approach for panel model was used to test if the successive error terms in the series are correlated with one another. Arellano and Bond autocorrelation approach has the advantage of detecting AR (1) and AR (2) form. It also remains valid in the presence of lagged endogenous variables among the regressors

Normality test was also conducted using Jarque–Bera test approach to confirm if the residuals from the regression estimate usually are distributed. If the error terms are not normally distributed, any inference made may be incorrect and may also violate the Central Limit Theorem. The assumption is that the error term is normally distributed and there will be no skewness or kurtosis in the distribution. If normality is correct, then there will be no skewness or kurtosis in the distribution. If the distribution has a probability value that exceeds 0.05, it implies that the error terms from the regression model are normally distributed.

3.4 S*ources of data and measurement*

The data used in this study were sourced from the World Bank database (World Development Indicator) for the period 2005 – 2018. Table 1 presents the details on the definition and measurement of the variables.

Table 1. Definition and measurement of the variable.

Variable Abbreviaton	Variable Name	Measurement
inf	Inflationrate	Measured as an annual percentage of change in consumer price index.
intr	Interest rate	Measured as the commercial banks' maximum lending rate.
excdep	Nominal exchange	Measured as an annual average rate depreciation based on monthly figures and was defined as per unit of dollar so that its upward movement signifies depreciation of the domestic currency against the dollar.
grms	Growth rate of money supply	Measured as the percentage change in broad money supply.
nbdep	Number of bank depositors	Measured as the total of commercial bank account holders per 10,000 adults (proxy to financial access) .
atm	Automated teller machine	Number of automated teller machine per 1000 kilometre square (proxy to financial service availability).
cbcred	Commercial banks' credit	Measured as the total private credit of commercial banks as percentage of GDP (proxy to financial usage).

Source: World Development Indicator (WDI) (2018)

4. Data analysis and discussion of results

The results of the pairwise correlation analysis are presented in table 2. The results show that the inflation rate has a positive relationship with an interest rate, exchange rate depreciation and money supply growth rate. This implies that countries with higher inflation rate also have a high-interest rate, exchange rate depreciation and money supply growth rate. The inflation rate has a negative relationship with commercial bank credit to the private sector, number of ATMs and number of depositors. The coefficients of the variables are low, which indicate a weak relationship. The results also revealed that interest rate is positively related to exchange rate depreciation, money supply growth rate, number of depositors and ATMs, but negatively related to commercial bank credit. Exchange rate depreciation is negatively related to all other variables except the money supply growth rate and inflation rate. The coefficients of these relationships show that exchange rate depreciation is weakly related to all the variables. Growth of money supply has a negative and weak relationship with the commercial bank loan, number of ATMs and number of depositors and has a positive but weak relationship with the inflation rate, exchange rate and interest rate. Number of ATMs has a positive relationship with the interest rate, commercial bank credit and number of depositors. Relationship between ATMs and inflation rate, growth of money supply and exchange rate depreciation is negative and weak. The coefficients show that ATM has a strong relationship with the growth of money supply, commercial bank loan and number of bank depositors.

Table 2: Pairwise Correlation Matrix

Variable	*inf*	*intr*	*excdep*	*grms*	*cbcred*	*atm*	*nbdep*
inf	1						
intr	0.3615	1					
	(0.000)						
excdep	0.3107	0.3703	1				
	(0.000)	(0.000)					
grms	0.579	0.205	0.2877	1			
	(0.000)	(0.012)	(0.000)				
cbcred	-0.2679	-0.3493	-0.2386	-0.1634	1		
	(0.001)	(0.000)	(0.003)	(0.047)			
atm	-0.1547	0.0647	-0.0457	-0.251	0.6416	1	
	(0.060)	(0.434)	(0.581)	(0.002)	(0.000)		
nbdep	-0.1075	0.1721	-0.0036	-0.1987	0.6773	0.7523	1
	(0.193)	(0.036)	(0.965)	(0.015)	(0.000)	(0.000)	

Commercial bank credit has a positive and robust relationship with several depositors and ATMs. The number of depositors has a positive relationship with the number of ATMs and commercial bank credit and a negative but weak relationship with an interest rate, exchange rate depreciation, and growth of money supply. It can be observed from the results that none of the values of the correlation coefficient was close to 1; the highest coefficient was 0.75. Therefore, regression analysis could be conducted with the variables without a multicollinearity problem.

Table 3. Granger non-causality test results

Null Hypothesis	p-value	Remark
Inflation rate does not Granger-cause commercial bank loan	0.0000	Bi-direction
Commercial bank credit does not Granger-cause inflation rate	0.0005	
Inflation rate does not Granger-cause the number of ATMs	0.0000	Bi-direction
Number of ATMs does not Granger-cause inflation rate	0.0117	
Inflation rate does not Granger-cause the number of depositors	0.7285	Uni-direction
Number of depositors does not Granger-cause inflation rate	0.0000	

The result of Dumitrescu-Hurlin (D-H) panel Granger non-causality test was presented in table 3. The results show the direction of causality between inflation rate and other financial inclusion indicators in West African countries. The results show that the inflation rate has a bi-directional causality with commercial bank credit and number of ATMs. This is shown by each of the D-H p-values being statistically significant, which indicate rejection of the null hypothesis of no Granger causality. This implies that cause and effect are not only from the inflation rate; it is also from commercial banks' credit and number of ATMs. On the other hand, the Inflation rate has uni-directional causality with several depositors as the inflation rate does not Granger-cause the number of depositors while several depositors do Granger-cause inflation rate.

The regression results of the dynamic system GMM were presented in table 4. The results were presented in four columns. The first column (Model 1) presents the results for the control variables, including the first period lag of inflation to control for the dynamic nature of the relationships that might influence the result. The first period lag of inflation is statistically significant with a positive sign, which indicates that the past level of inflation influences current inflation. Out of the three control variables in model 1, only growth of the money supply was statistically significant. Interest rate and exchange rate depreciation were not significant.

The results for the interaction of financial access (*nbdep*) with the control variables are presented in Model 2. The results revealed that interest rate exerts a negative and significant impact on inflation with a coefficient (-0.713) and p-value (0.016). This means that a percentage point increase in interest rate would bring about 0.713 percentage points reduction in the inflation rate. This result is consistent with the theory that an increase in interest rate will cause a reduction in inflation rate and vice versa. Exchange rate depreciation came out with an expected sign and statistically significant with coefficient value and p-value of (0.0162) and (0.04) respectively. This implies that a unit increase in exchange rate depreciation in West Africa would increase inflation by 0.0162 percentage points and vice versa. This result is also consistent with the theory. The results also revealed that the growth of money supply has a positive impact on inflation because the variable is statistically significant with coefficient value and p-value of (0.536) and (0.000) respectively. The interactions of the number of depositors with exchange rate depreciation (*excdep* cbdep*) and the growth of money supply (*grms*cbdep*) were negative and statistically significant. This implies that given a level of exchange rate depreciation, a unit increase in the number of depositors with the commercial bank will lead to 0.000022 per cent point reduction in the rate of inflation. Also, a unit increase in the number of commercial bank depositors, given a level of depreciation in the exchange rate, will lead to 0.00117 decreases in the inflation rate.

In column 3, the results of the three control variables revealed significant impacts on the inflation rate in West Africa. While the interest rate (*intr*) revealed a negative impact on inflation, exchange rate depreciation (*excdep*) and growth of money supply (*grms*) show positive impacts on inflation. The results of the interaction of financial availability (*atm*) with interest rate variable (*intr*atm*) revealed a positive impact on inflation which contradict the a-priority expectation. This could be ascribed to the overconcentration of the ATMs in the urban centres while few or none is available in the rural areas, which limit the effectiveness of the monetary policy. The results of the interaction of financial availability (*atm)* with exchange rate depreciation (*excdep*atm*) and growth of money supply (*grms*atm*) show negative impacts on inflation, which are consistent with the prior expectations. This implies that given a level of exchange rate depreciation, a unit increase in the number of Automated Teller Machine (ATM) will lead to a fall in inflation by 0.000515 per cent point. Also, given the level of growth of money supply, a unit increase in the number of ATM will lead to a fall in inflation by 0.0507 per cent point.

Table 4. System GMM estimation

Variable	Model 1	Model 2	Model 3	Model 4
L(inf_{it})	0.248***	0.472***	0.454***	0.364***
	(0.000)	(0.000)	(0.000)	(0.000)
$intr_{it}$	0.121	-0.713**	-0.636**	-299
	(0.742)	(0.016)	(0.012)	(0.703)
$excdep_{it}$	0.0014	0.0162***	0.0127***	-0.000705
	(0.742)	((0.04)	(0.003)	(0.363)
$grms_{it}$	0.529***	0.536***	0.532***	0.757***
1	(0.000)	(0.000)	(0.000)	(0.000)
*Intr*nbdep*$_{it}$		0.00124		
		(0.101)		
*excdep*nbdep*$_{it}$		-0.000022***		
		(0.004)		
*grms*nbdep*$_{it}$		-0.00117**		
		(0.023)		
*intr*atm*$_{it}$			0.0713***	
			(0.008)	
*excdep*atm*$_{it}$			-0.000515***	
			(0.005)	
grms*atm$_{it}$			-0.0507***	
			(0.003)	
*intr*cbcred*$_{it}$				0.0274
				(0.083)
*excdep*cbcred*$_{it}$				0.00113*
				(0.000)
*grms*cdcred*$_{it}$				-0.00229***
				(0.002)
Number of Observation	115	115	115	115
Number of Countries	15	15	15	15
Wald Chi-Square	100.06***	321.74***	201.05***	884.68***

***, ** indicate significance at 1% and 5% levels respectively

Column 4 (Model 4) presents the results of the interaction of commercial banks' credit (financial usage indicator) with the control variables. Out of the three control variables, the only money supply was significant in determining inflation in West Africa. Interest rate and exchange rate depreciation were not significant. Considering the interacted variables, the results for the interaction of interest rate with the commercial bank's credit (*intr*cbcred*) revealed a positive relationship but not significant at 5 per cent

level. Commercial bank credit, when interacted with exchange rate depreciation (*excdep*cdcred*), has a positive impact on inflation with coefficient value and p-value of 0.00113 and 0.000, respectively. This means that given a level of exchange rate depreciation, a unit increase in commercial bank credit will increase inflation by 0.00113 per cent, which contradicts the a-prior expectation. This could be attributed to the continuous fall in the currencies of most of the West African countries in terms of the dollar. The more the exchange rate depreciates, the higher the amount of credit needed to finance the import, thereby leading to more inflation in the domestic economy. The interaction of commercial bank credit with the growth of money supply (*grms*cbcred*) has a negative and significant impact on the inflation rate in West Africa. The results revealed that given a level of money supply growth rate, a unit increase in commercial bank credit would lead to 0.0229 per cent point decrease in inflation. This result contradicts the a-prior expectation of the study.

Table 5. Diagnostic test results

Wald χ^2								
Ho: Overall model not	χ^2		χ^2		χ^2		χ^2	
Statistically significant	value	p-val	value	p-val	value	p-val	value	p-val
	100.05	0.000	884.7	0.000	321.7	0.000	201.1	0.000
Arellano-Bound Test								
Ho: No autocorrelation	z-stat	p-val	z-stat	p-val	z-stat	p-val	z-stat	p-val
AR(1)	-1.419	0.1559	-2.185	0.029	-2.144	0.032	-2.259	0.024
AR(2)	1.0146	0.3103	-.1602	0.873	-0.492	0.623	0.679	0.496
Sargan Test								
Ho: Overidentifying	χ^2		χ^2		χ^2		χ^2	
Restrictions are valid	value	p-val	value	p-val	value	p-val	value	p-val
	9.760	0.993	4.749	1.000	2.036	1.000	4.203	1.000
Jargue Berra								
Ho: The residual is								
Normally distributed	J-B value		P-val					
	296.94		0.000					

The results of the diagnostic tests carried out to validate the findings are presented in table 5. The results show that the Wald Chi-squared values for the four models were statistically significant. The null hypothesis that the overall models are not significant is, therefore rejected, which implies that the models fit the data used in the study properly. The results also revealed that there is an absence of first-order and second-order serial correlation in the models. The null hypothesis of no autocorrelation is not rejected; this is evident from the p-values of the AR(2) test which are more significant than 0.1 significance level. This implies that there is no autocorrelation among the residuals of the models. This is in line with the outcome suggested by Arellano and Bond (1991) that model of such nature is free from the problem of serial correlation. The Sargan test results for the model over-identification also revealed that the null- hypothesis was not rejected. This implies that the restrictions on the instruments of the models in order not to be over-identified are valid. The jargue Bera test for residual normality for the models shows that the null hypothesis of normality of the residual term is accepted and the remaining term from the models are typically distributed. Therefore, the models are valid.

5. Conclusion and recommendation

This study examined the impact of financial inclusion on the effectiveness of monetary policy in West Africa. It is evident from the results of the study that financial inclusion plays a significant role in monetary policy effectiveness in West Africa because all the three indicators of financial inclusion have significant impacts on monetary policy target. It is, therefore, recommended that the West African countries should strengthen medium of monetary policy transmission through an efficient legal and regulatory framework that will facilitate voluntary financial inclusion by the excluded, low income and rural dwellers in their various countries. This could be achieved by broadening financial inclusion to rural areas and the informal sector to involve a large number of economic agents because a large volume of financial transactions takes place within this sector.

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