The impact of monetary policy on private capital formation in Nigeria: Autoregressive Distributed Lag Approach

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Abstract

The study examines the impact of monetary policy on private capital formation in Nigeria from 1980 to 2020. The study adopts Keynes's theory of capital formation as its theoretical framework. The stationarity tests show a mixed level of stationarity among the variables. Consequently, the study employs ARDL as its estimation technique. The study reveals that Monetary Policy has a positive impact on Private Capital Formation in Nigeria. Based on the findings, the study recommends that the government should maintain the current Monetary Policy Rate (MPR) to continue impacting Private Capital Formation positively. Secondly, the government should formulates appropriate policies that will ensure that the Exchange Rate (EXCHR) is stable so that it can improve the level of Private Capital Formation in Nigeria. Lastly, the government should embark on policies that will curb inflation or help reduce the rate of inflation to increase the level of Private Capital Formation.

Keywords: *ARDL, Monetary policy, Private capital formation*

JEL Classification: C23, D24, E52

INTRODUCTION

One of the major objectives of macroeconomics is maintaining sustainable economic growth, and the role of Private Capital Formation in achieving this objective is of great importance (Robert, 2014). For a country to achieve impactful Private Capital Formation, the role of government policy and its impact cannot be over-emphasized. Capital formation, which is an increase in or expansion of real capital stock such as machines, tools, factories, and transport equipment in a country, is usually geared towards future good production (Suman, 2018). Savings and investment are indispensable in the addition of capital stock, and the monetary policy can mainly stimulate this.

Due to the claim that monetary policy as one of the government policies determines the rate of accumulation of physical capital (otherwise called capital formation) through its mechanism, it, therefore, becomes an important factor in the increase of productive activities of the country and contributes to growth generally. Monetary policy, which is a deliberate action imposed by the government through the Central Bank in order to maintain domestic prices and exchange rate stability, the balance of payment equilibrium, among others, has been identified as a vital instrument that enhances private capital formation by affecting the level of the money supply

through either the expansionary or contractionary measures. It also influences the level and structure of interest rates and, thus, the cost of funds in the market depending on the prevailing economic conditions (Nzotta, 2014). Capital formation is therefore said to be a prerequisite to an increase in the physical capital stock with investment in social and economic infrastructures (Atuma et al. 2017).

Over the years, the Nigerian government has adopted various monetary policies through the Central Bank in order to attain stabilization in economic growth, which is one of the objectives of Monetary Policy. To achieve this, the Central Bank relies on Monetary Policy tools as its major barometer for adjusting economic activities designed by the monetary measures to be either expansionary or contractionary (Nwoko et al., 2016). These policies seek to impact directly or indirectly on the supply of money, supply of credit to the economy, the structure of interest rate to achieve price stabilization, the balance of trade equilibrium, and sustainable rate of growth (Uwazie & Aina, 2015), which will result to either an increase or decrease in the capital formation of the country which tends to boost the private sector or the public sector through increased economic activities.

Unfortunately, these policies are yet to drive the country's capital formation to its desired point, as revealed in Table 1. The table shows that despite the reducting in MPR from 14 points in 2018 to 13.5 points in 2019, the increase in Capital Formation does not commensurate with the reduction of MPR. The table further shows that the reduction of MPR by one point from 12.5 in 2020 to 11.5 in 2021 had no positive impact on capital formation rather, it reduced its value. Hence, the authority has moved further to introduce privatization and commercialization to encourage private and public investment due to the country's low productivity, which, when encouraged, will increase the country's Gross Domestic Product (GDP) and, ultimately, the total capital formation. Private Capital Formation has the tendency to increase the level of investment and capital stock in the country which will also give rise to a stable Economic Growth (Osundina & Osundina, 2014). Despite the increase in the Monetary Policy regulations by the monetary authorities in Nigeria, the problems of shortage of private capital formation persist. This study will investigate the impact of monetary policy on private capital formation in Nigeria.

Table 1. Monetary Policy Rate (MPR) and Gross Capital Formation (GCF) in Nigeria, 2016 - 2021

Year	MPR (%)	GCF (US $)
2016	14.0	62,181,498,801
2017	14.0	58,144,239,836
2018	14.0	78,698,428,099
2019	13.5	113,893,799,699
2020	12.5	127,089,444,456
2021	11.5	120,491,622,077

Sources: 1. MPR from Central Bank of Nigeria statistical bulletin.
2. GCF from World Bank indicator

This current research investigates how monetary policy instruments have contributed to Private Capital Formation in Nigeria. The study seeks to add to an existing body of knowledge. It will also greatly benefit the government and policymakers in terms of helping them understand the influence of monetary policies on private investment and building policies that will ensure increased and sustainable

private investment growth in Nigeria. This study will help policymakers, government, agents, and researchers in monetary policy and private capital formation.

Dang, et al. (2020) sheds new light on the relationship between monetary policy and private investment in Vietnam. They found that private investment is positively affected by monetary policies through broad money, domestic credit, and interest rate channels. There is no credible evidence yet regarding the effect on the exchange rate. Similarly, Okumoko & Akarara (2016) investigated the impact of the Monetary Policy rate on savings and investment in the Nigerian economy from 1960 to 2016. The study employed Vector Autoregressive (VAR) technique to estimate the data, and they found that shocks such as an increase in Monetary Policy Rate (MPR) increase both Savings Rate (SAVR) and Total Investment (INVR) in the short-run and the long-run.

Hassan (2015) explored the impact of Monetary Policy on Private Capital Formation in Nigeria. The study covered 1986 to 2013 and used the Ordinary Least Square Multiple regression techniques. The study showed that the GDP growth rate had not attracted significant private investment. In contrast, the money supply and the exchange rate have been relatively stable, encouraging an increase in private investment and promoting sustainable economic growth through private investment. Ayodeji & Oluwole (2016) investigated the impact of Monetary Policy on Economic Growth in Nigeria between 1981 and 2016 using the Johansen cointegration and vector error correction model. The findings revealed that money supply and exchange rate are positively related but have a fairly insignificant impact on Economic Growth. Also, interest rate and liquidity ratio are negatively related but have a highly significant impact on Economic Growth. The study advised that full autonomy should be in place for Central Banks of developing countries, and Government interference should be encouraged. Egbe et al. (2015) investigated the impact of Monetary Policy on corporate investment in Nigeria. The study revealed no significant relationship between the volume of investment and interest rate, and there is a weak relationship between the cost of capital and interest rate. Shuaib & Ndidi (2015) examined the Private Capital Formation impact on Nigerian economic growth between 1980 and 2013. From the empirical findings, it was discovered that there is a significant relationship between capital formation and Economic Development in Nigeria. The study recommended that the government continue to encourage savings, create a conducive investment climate, and improve the infrastructural base of the economy to boost capital formation and promote sustainable growth. Anowor & Okorie (2013) reassessed the impact of Monetary Policy on Economic Growth in Nigeria between 1982 and 2013. They found that interest rate and Monetary Policy rate have a negative relationship with Economic Growth, and the cash reserve ratio has a positive relationship with Economic Growth.

This study, therefore, revealed that for Nigeria's economy to be put along the path of sustainable growth and development particularly through an increase in private investment, Monetary Policy that directs credit to the private sector is expected to be embarked upon to encourage private investment in Nigeria. Given the important role of Monetary Policy and Private Capital Formation in Nigeria, this study will contribute enormously to the planning and implementation of Monetary Policy to increase private investment in Nigeria.

METHODS

This study adopts Keynes's theory of capital formation as its theoretical framework. The theory emphasizes that given the marginal efficiency of capital, a fall in

the interest rate will increase the volume of investment (capital formation). Keynes believes that the economy is always at or near the natural level of real GDP. The main function of this approach is to act as a medium of exchange and determine the general price level of which goods and services are to be exchanged (Blinder, 1987). The quantity theory of money is usually discussed in Fisher's equation of exchange, where it was believed that there is full employment in the economy. Thus, the amount of investment taken depends on the expected returns and the cost of capital (interest rate). The investment will only be profitable when the marginal efficiency of capital is equal to the cost of capital. Assuming the price of capital goods changes over time, it becomes necessary to distinguish between the marginal efficiency of capital (MEC) and the marginal efficiency of investment (MEI).

The data used in this study were sourced from the Central Bank of Nigeria statistical bulletin and World Bank indicator. This study employs the model of Hassan (2015) with modifications.

$$\text{GFCF} = F(\text{MPR}, INF, RGDP, \text{EXCHR}, \text{PUBEXP}) \quad \text{(1)}$$

The econometric form of the model above is stated as:

$$GFCF_t = \beta_0 + \beta_1 MPR_t + \beta_2 INF_t + \beta_3 RGDP_t + \beta_4 EXCHR_t + \beta_5 PUBEXP + \mu_t \quad \text{(2)}$$

where

GFCF = Gross Fixed Capital Formation
MPR = Monetary Policy rate
INF = Inflation rate
RGDP = Real Gross Domestic Product
EXCHR = Exchange rate
PUBEXP = Public expenditure
μ_t = stochastic error term
β_0 = constant intercept
$\beta_1 - \beta_5$ = coefficient of the associated variables

However, the dependent variable and one of the independent variables were not in the same unit. Hence, they were logged to bring the data to the same level. Thus, the above equation (2) can be re-specified as;

$$LOG(GFCF)_t = \beta_0 + \beta_1 MPR_t + \beta_2 INF_t + \beta_3 RGDP_t + \beta_4 EXCHR_t + \beta_5 LOG(PUBEXP)_t + \varepsilon_t \quad \text{(3)}$$

RESULTS AND DISCUSSION

Descriptive statistics

Table 2 indicates that from 1980 to 2020, all of the variables under consideration show an averaged positive mean value with 40 observations. The standard deviation showed that the GFCF records the highest standard deviation (869090.4) while MPR records the least. The skewness statistics from the table revealed that five of the variables are positively skewed, while one variable is skewed negatively. The kurtosis coefficients show that two of the variables are leptokurtic, suggesting that the distributions are high relative to a normal distribution. Three variables are mesokurtic, indicating not too flat-topped, while one other variable is platikurtic, suggesting that the distributions are flat-topped.

Table 2. The descriptive statistics

	GFCF	MPR	INF	RGDP	EXCHR	PUBEXP
Mean	630714.4	6.209944	18.89225	4.893821	97.62067	3869836.
Median	154362.5	6.709583	12.15500	5.260085	97.40000	1211066.
Maximum	2442704.	11.06417	72.84000	14.60438	365.9000	12700000
Minimum	10597.00	0.316667	5.380000	-1.583065	0.550000	14697.41
Std. Dev.	869090.4	3.056790	16.91599	3.669652	106.1097	4422113.
Skewness	1.196938	-0.234382	1.823960	0.409243	1.187449	0.601925
Kurtosis	2.728945	2.069166	5.151077	2.695332	3.795190	1.668728
Jarque-Bera	9.673521	1.810319	29.89076	1.271236	10.45412	5.369234
Probability	0.007933	0.404477	0.000000	0.529608	0.005369	0.068247
Sum	2522858	248.3977	755.6900	195.7529	3904.827	1.55E+08
Sum Sq. Dev.	2.95E+13	364.4147	11159.88	525.1876	439111.5	7.63E+14
Observations	40	40	40	40	40	40

The Jarque-Bera (JB) test statistic was used to determine whether the variables (control variables) follow the normal probability distribution. The JB test of normality is a large-sample or asymptotic test that computes kurtosis and the skewness measures. Therefore, we examine the Sample mean, standard deviation, skewness and kurtosis, and the Jacque-Bera statistics and p-values. The probabilities of the Jarque-Bera test of normality for the variables indicate that four of the variables have values greater than the 5% significance level, thus indicating that the variables are normally distributed.

Correlation

Under the correlation test, we conduct the test to ascertain the degree of relationship that exists between the dependent variable and the independent variables. It is done using the correlation matrix. In the correlation test, we test the variables to ascertain the degree of relationship between the independent and dependent variables. The relationships among the studied variables depicted in the model were tested using a correlation matrix, and the result is presented in Table 3.

Table 3. The correlation matrix

	GFCF	MPR	INF	RGDP	EXCHR	PUBEXP
GFCF	1.000000	0.603761	-0.300488	-0.173753	0.872786	0.846234
MPR	0.603761	1.000000	-0.190167	-0.092143	0.615049	0.547866
INF	-0.300488	-0.190167	1.000000	-0.208966	-0.308031	-0.362926
RGDP	-0.173753	-0.092143	-0.208966	1.000000	-0.090602	0.050619
EXCHR	0.872786	0.615049	-0.308031	-0.090602	1.000000	0.815902
PUBEXP	0.846234	0.547866	-0.362926	0.050619	0.815902	1.000000

The correlation result shows that three variables have positive relationships with private investment. The relationships are at 60%, 87%, and 84%, respectively, while two variables, INF and RGDP, indicate negative signs ranging from -30% and -17%, respectively. Hence, we conclude no multicollinearity among the variables under consideration.

Unit root test

Economic variables are generally non-stationary, and they are a random process. Linear combination of non-stationary series, in general, is a non-stationary series and closely associated with economic theory. Because economic theory guarantees stagnation of a combination of economic variables, Dickey Fuller's generalized test for investigating stationary variables are used in this study. In order to assess the time-series properties of the data, a unit root test was conducted. As Engle & Granger (1987) argued, if individual time series data are non-stationary, their linear combinations could be stationary if the variables were integrated of the same order. The assumption is stated

as follows: If the absolute value of the Augmented Dickey-Fuller (ADF) test is greater than the critical value either at 1%, 5%, or 10% level of significance at order zero, one, or two, it shows that the variable under consideration is stationary otherwise it is not. The results of the Augmented Dickey-Fuller (ADF) test obtained are as follow:

Table 4. The unit root test

Variable	Level difference	Probability	Order of integration	First difference	Probability	Order of integration
GFCF	4.713284	1.0000		-4.470275	0.0010	I(1)
MPR	-2.007436	0.2826		-12.68686	0.0000	I(1)
INF	-3.001260	0.0435	I(0)			
RGDP	-3.412167	0.0165	I(0)			
EXCHR	0.314309	0.9761		-3.863114	0.0052	I(1)
PUBEXP	-0.505734	0.8786		-10.80370	0.0000	I(1)

The stationarity test result indicates that three of the variables under consideration are stationary at the level difference. In contrast, order one integrates four other variables at a 5% significance level. A bound cointegration test is conducted since there is a mixed order of cointegration.

Bound Auto-Regressive Distributed Lag (ARDL) testing approach

Conducting the ARDL bounds test procedure, it is expected that the variables are I(0) or I(1). Otherwise, the variable may be considered spurious. In the conduct of the ARDL test, we adopt the Augmented Dicky Fuller (ADF) test to determine the different levels of the variables. We, therefore, compute an F-statistics test procedure to test the long-run relationship in which the maximum lag length p is 2 in the ECM. The results for the bounds F-test is presented in Table 5.

Table 5. The ARDL Bound test results

Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	K
F-statistic	4.327165	5
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

The Bound test result from the table above indicates that the underlining ARDL model can be established to determine the long-run slope-estimated coefficients and the short-run dynamic-estimated coefficients for the private investment in Nigeria. The ARDL (1, 4) is selected based on the Akaike information criterion (AIC).

The short-run error correction coefficients

There is a long-run equilibrium relationship among the variables in the regression model; however, the short-run transmits to the long-run. Thus, the Error Correction Mechanism (ECM) is used to correct or eliminate the discrepancy that occurs in the short run. The assumption of the ECM states that if two variables are cointegrated, then there is an error correction mechanism to revise instability in the short term (Engle and Granger, 1987). ECM is used to see the speed of adjustments of the variables to deviations from their common stochastic trend. ECM corrects the deviations from the long-run equilibrium by short-run adjustments. It shows us that changes in independent

variables are a function of changes in explanatory variables and the lagged error term in cointegrated regression. The ECM result is presented in Table 6.

Table 6. The short-run error correction coefficients results

ARDL Cointegrating And Long Run Form					
Dependent Variable: LOG(GFCF)					
Variable		Coefficient	Std. Error	t-Statistic	Prob
DLOG(GFCF(-1))		0.246864	0.167130	1.477076	0.1545
D(MPR)		0.037702	0.021846	1.725788	0.0991
D(MPR(-1))		-0.036036	0.021048	-1.712079	0.1016
D(INF)		-0.000966	0.002467	-0.391460	0.6994
D(RGDP)		-0.003000	0.011148	-0.269118	0.7905
D(EXCHR)		0.000441	0.000850	0.518653	0.6094
DLOG(PUBEXP)		-0.047848	0.065888	-0.726204	0.4757
DLOG(PUBEXP(-1))		0.070593	0.071935	0.981340	0.3376
DLOG(PUBEXP(-2))		-0.009619	0.070308	-0.136806	0.8925
DLOG(PUBEXP(-3))		-0.268678	0.069576	-3.861621	0.0009
ECM(-1)		-0.374290	0.094476	-3.961763	0.0007
R-squared	0.641354	Mean dependent var		0.132075	
Adjusted R^2	0.402256	S.D. dependent var		0.238203	
SE of regression	0.184164	Akaike info criterion		-0.251645	
Sum squared resid	0.712243	Schwarz criterion		0.408155	
Log-likelihood	19.52961	Hannan-Quinn criteria.		-0.021357	
F-statistic	2.682396	Durbin-Watson stat		2.453156	
Prob(F-statistic)	0.020083				

The equilibrium error-correction coefficient ECM (-1) is -0.374290. The coefficients have the expected negative sign and are statistically significant at 5% significant levels. It implies that there is a long-run impact running from independent variables to a dependent variable. It also confirms that all the variables are cointegrated or have a long-run relationship. Therefore, we can state that 37 percent gaps between long-run equilibrium values and the actual values of the dependent variable have been corrected. It can also be said that the speed of adjustment towards long-run equilibrium is 37 % annually. Its t-ratio is -3.961763, and the probability of the null hypothesis being true for zero is [0.0007], which is significant even when $\alpha = 0.05$. Thus, it can also be concluded that the adjustments are quite meaningful in the short-run ARDL relationship.

Statistically, the coefficient of determination R-squared is 0.641354. This implies that the independent variables explain the dependent variable to the tune of 64%. The F-statistic shows that the overall estimate of the regression has a good fit and is statistically significant. Also, the Durbin Watson (DW) statistics DW = 2.453156 greater than the R2 show that the overall regression is statistically significant. Thus, the result indicates no serial autocorrelation among the variables under consideration.

The long-run relationship between the monetary policy rate and private investment

Table 7 shows that MPR has a positive and significant impact on private investment in Nigeria at a 10% significant level in the long run. A 1% change in MPR will lead to a 0.112365% increase in private investment in Nigeria. The result is in line with the findings of Auer, 2014 and Dang et al. 2020. It also conforms with the apriori expectation. It implies that the monetary authority is formulating appropriate policy that stimulates the expansion of real capital stock such as machines, tools, factories, and

transport equipment in a country are usually geared towards future production of a good in Nigeria.

Table 7. Long run coefficients results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MPR	0.112365	0.061282	1.833583	0.0809
INF	-0.002580	0.006556	-0.393471	0.6979
RGDP	0.029949	0.037186	0.805393	0.4296
EXCHR	0.001178	0.002087	0.564343	0.5785
LOG(PUBEXP)	0.604552	0.096080	6.292199	0.0000
C	3.478699	0.944730	3.682215	0.0014

The result further shows that the inflation rate, real gross domestic product, and exchange rate have no significant impact on private investment in Nigeria. It implies the variables are irrelevant and of no value in enhancing private investment in the country.

Lastly, the result reveals that exchange rate public expenditure has a positive and significant impact on private investment at a 1% significant level. A 1% change in public expenditure will lead to a 0.604552% increase in private investment. The result is in line with the study of Hassan (2015), Adegboyo, and Olaniyan (2021), and it conforms to the apriori expectation. It implies that the government is judiciously expending the available resources, stimulating private investment in Nigeria.

Diagnostic test

Diagnostic tests examine the model for serial correlation, functional form, non-normality and heteroscedasticity.

Table 8. Serial correlation tests

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	5.070848	Prob. F(2,19)	0.0172
Obs*R-squared	12.52848	Prob. Chi-Square(2)	0.0019

The serial correlation test result shows that the null hypothesis of a serial correlation is rejected. The corresponding probability values of the F-statistics are statistically insignificant at a 5% level. Thus, we conclude no serial correlation among the variables under consideration.

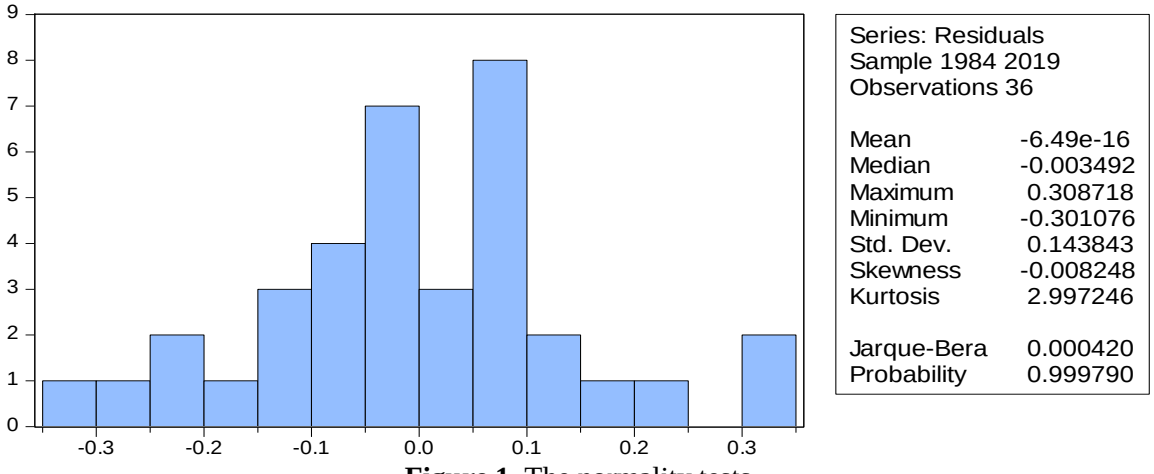

Figure 1. The normality tests

Ho: The sample data are not significantly different than a normal population
H1: The sample data are significantly different than a normal population.
Probabilities > 0.05 accept the null hypothesis
Probabilities < 0.05 reject the null hypothesis

The probability is 0.999790, greater than 0.05 at a 5% significant level; therefore, the null hypothesis is accepted. It implies that the residuals are normally distributed.

The heteroskedasticity test

Table 9 shows the probability of Chi-Square (14) is 0.2965, greater than 0.05 at a 5% significant level; therefore, the null hypothesis is accepted. It implies and therefore confirms the absence of heteroscedasticity in the model. That is, the error terms are homoscedastic, i.e., they have constant variance in repeated sampling

Table 9. Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.279684	Prob. F(14,21)	0.2965
Obs*R-squared	16.57333	Prob. Chi-Square(14)	0.2796
Scaled explained SS	5.631772	Prob. Chi-Square(14)	0.9749

Ho: homoscedasticity
H_1: heteroscedasticity
Probabilities > 0.05 accept the null hypothesis
Probabilities < 0.05 reject the null hypothesis

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The study examined the impact of Monetary Policy on Private Capital Formation in Nigeria from 1980 to 2020. This study adopts Keynes's theory of capital formation as its theoretical framework. The stationarity tests show that two of the variables under consideration are stationary at the level difference, while four other variables are integrated of order one at a 5% significance level. Based on the mixed result of the unit root test, the study employs ARDL as its estimation technique. The study concluded that monetary policy and public expenditure positively and significantly impact Nigeria's private capital formation based on the regression estimates. In contrast, the inflation rate, real gross domestic product, and the exchange rate had no significant impact on private investment in Nigeria.

Recommendations

From the findings discussed, the following recommendations were offered: first the government should maintain the current Monetary Policy Rate (MPR) to continue impacting Private Capital Formation positively. Secondly, the government should formulates appropriate policies that will ensure that the Exchange Rate (EXCHR) is stable so that it can improve the level of Private Capital Formation in Nigeria. Lastly, the government should embark on policies that will curb inflation or help reduce the rate of inflation to increase the level of Private Capital Formation.

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