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Macroeconomic Dynamics and Property Investment Returns: Evidence from Time Series Econometrics

Nwosu A.E. & *Ige V.O.
Department of Estate Management, Federal University of Technology Akure, Nigeria
*Corresponding author**:** voige@futa.edu.ng

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The paper examines macroeconomic variables influencing returns on investment in hostel property in Akure and its policy implications at both a local and a national level. The study drew on rental and capital values of off-campus hostels in Akure from 2003 to 2023, with macroeconomic data sourced from the Central Bank of Nigeria and the National Bureau of Statistics. The Augmented Dickey-Fuller test determined stationarity, Granger causality established directional relationships between variables, and the Fully Modified Least Squares methodology assessed the impact of macroeconomic variables on hostel property returns. Results show that macroeconomic factors have a causal relationship with hostel property returns, accounting for 65.5 percent of the variation. The Granger causality test confirmed that macroeconomic variables drive hostel property returns, but not the reverse. The Engle-Granger co-integration test established a long-run convergence between variables. Future predictions of dependent variables were reasonable when exogenous variables were applied. The study recommends that macroeconomic variables be treated as significant tools in predicting the direction and fluctuation of hostel property investment returns.
Keywords: Econometric modelling, Real estate, Hostel Return, Macroeconomic determinants, Investment decisions

Introduction

The rapid expansion of tertiary education globally, including in Nigeria, has generated substantial student enrolment, and the shortfall of on-campus accommodation at the Federal University of Technology, Akure has necessitated off-campus hostel provision. An off-campus hostel is a housing unit specifically constructed for students at tertiary higher institutions who live outside the school campuses (Norwich City Council, 2017). The government's inability to satisfy on-campus hostel demand has created a significant opportunity for private real estate investors. Investors generally seek to minimise risk while maximising returns (Odu, 2011; Uwubanmwen & Eghosa, 2015). Off-campus hostel property is of considerable interest to investors worldwide, as returns are perceived to remain positive even in adverse economic conditions. Nevertheless, macroeconomic variables are involved in a complex interplay that can significantly influence investment profitability and the broader dynamics of the housing market (Xulu-Gama, 2019).

Macroeconomic variables are exogenous factors that drive the changes in general business cycles (Renigier-Bilozor & Wisniewski, 2013). It also determines performance, structure, behaviour and decision-making in all investment sectors, such as the real property investment sector at large (Kitati *et al*., 2014). Laichena and Obwogi (2015) revealed a substantive relationship among macroeconomic variables and real returns. Nevertheless, the study by Ilahi, Ali, and Jamil (2015) disclosed a low correlation between the returns of the real estate and macroeconomic variables. The studies by Apergis (2011) and Ge (2009) have proved that the supply and demand of the rented space in real property investment market is determined by the macroeconomic variables.

Adams and Fuss (2010) found GDP growth positively affects the property market, while Cerutti, Dagher and Dellariccia (2015) noted GDP's contribution is limited to approximately 10 percent relative to property price. Kimani and Mutuku (2013) found inflation rate effects on property investment to be unpredictable, and Otama (2012) reported positive correlations between exchange and interest rate volatility and property investment returns. However, Mukira (2020) found negative correlations with interest rate. These contradictions are more prevalent in emerging economies with frequent monetary policy changes. In Nigeria, where policy instability and currency depreciation are recurring phenomena, establishing how macroeconomic factors affect real estate investment performance is critical for guiding investors. The dearth of empirical investigation on macroeconomic dynamics and off-campus hostel investment in Nigerian universities constitutes a significant research gap. This paper examines the impact of macroeconomic variables on hostel property investment returns in Akure, Nigeria, and tests whether changes in hostel property returns are driven by macroeconomic factors.

Literature Review

Real estate is a critical sector significant to national growth and economic stability, and numerous studies have examined the effects of macroeconomic factors on real estate using varied methods. Sivitanides (2015)

used regression and time series analysis to demonstrate that GDP significantly influences property prices in Cyprus. Bojan and Darja (2015), using regression analysis across five European countries, found statistically significant relationships between macroeconomic variables and property prices, with unemployment rate exerting the greatest explanatory power, though findings were period-specific and limited in generalisability. Udoekanem *et al*. (2015), using Granger causality on Abuja office rent data (2001–2012), found vacancy rate, inflation and GDP had strong causal effects on office rent, while interest rates, employment rates, monetary policy rates and exchange rates had insignificant causal relationships. Shen *et al*. (2018) applied a VAR model in China and used Granger causality to assess the impact of short-term interest rates and money supply on the housing market, finding that monetary policy reduced housing price growth in China. Jiwen and Weiyu (2018), using VAR on Chinese quarterly data (2006 Q1–2017 Q4), established that aggregate economic changes drove real estate investment returns. Jaya (2019) employed correlation and multiple regression analysis on Indian data (2010 Q1–2017 Q4) and found a strong positive relationship between the House Price Index and GDP, exchange rates, housing credit and inflation, with interest rates showing a weak negative relationship.

Elile *et al*. (2019) used OLS to assess macroeconomic performance indicators in Nigerian real estate and found high positive impacts of inflation and GDP, while exchange rate had a significant negative effect. Habinshuti and Philippe (2019), using a VAR model on Kigali City data (2008–2017), found real estate prices most affected by interest rates and GDP. Oladeji *et al*. (2020) applied correlation and logistic regression to listed property in South Africa and Nigeria and found that exchange rates positively influenced JSE-listed real estate, while the interest rate by the bank, rate of inflation, and Treasury bill rate (TBR) are significant indicators in the Nigerian market. Feng *et al*. (2020) used VAR analysis across Beijing, Shanghai, Guangzhou and Chongqing and revealed a stable long-run relationship between macroeconomic conditions and housing prices, with Beijing and Shanghai showing greater price sensitivity.

Ahmed (2020), using VAR in Saudi Arabia, found housing prices negatively correlated with Consumer Price Index and unemployment rate and not significantly correlated with GDP per capita. Li (2020) found in China (2010–2018) that CPI (inflation) was the most significant driver of housing price increases, followed by GDP index and fixed asset investment. Wahab et al (2021) applied ADF and co-integration to real estate dynamics in Abuja during the COVID-19 pandemic and found strong effects of GDP, exchange rate, inflation and interest rates on property returns. Ifebi *et al*. (2021) used OLS on Nigerian data (1981–2017) and confirmed long-run relationships among the macroeconomic variables.

Zulkifli *et al*. (2022), using quarterly Malaysian data (2000–2019), found GDP and money supply had significant positive long-run impacts on house prices, while inflation was negatively related. Okolo and Oladejo (2022) applied OLS to commercial property in Onitsha (2011–2020) and found exchange rate, interest rate and inflation accounted for 83.5% of variance in real estate returns. Saliu and Akode (2022) used Westerlund Error Correction Panel Cointegration across twelve African countries (2000–2020) and found positive long-run relationships between macroeconomic fundamentals and real estate. Soon *et al*. (2023) used Johansen cointegration and Error Correction Model on Malaysian data and confirmed a maintained positive long-run relationship between macroeconomic factors and real estate returns. Jibrin *et al*. (2024) found that exchange rate and inflation accounted for 73.3% of commercial rental return variation in Abuja (2010–2022). Pesa *et al*. (2024) applied model averaging to Spain and Croatia (2013–2022) and found unemployment negatively influenced real estate price movement in both markets.

The foregoing empirical evidence demonstrated that macroeconomic variables influence real estate investments differently depending on economic structure, market information sufficiency and property market maturity. In Nigeria, a mono-product economy characterised by frequent policy shifts and economic instability, continuous investigation of macroeconomic effects on real estate remains necessary. Research on student hostel property investment is particularly limited in developing economies, despite its growing prominence in Nigerian institutions of higher learning, thus making this study both timely and relevant.

Research Methodology

The study population comprised the registered Practising Estate Surveyors and Valuers in Akure (27 firms) who provided rental and capital values of off-campus hostels from 2003 to 2023. Estate Surveyors and Valuers were selected as they are certified professionals regulated by ESVARBON, with expertise in property valuation. Macroeconomic data (2003–2023) were retrieved from the Central Bank of Nigeria and the National Bureau of Statistics. The time-series data were analysed using the Vector Autoregressive (VAR) model, incorporating stationarity testing, lag order selection, the Engle-Granger co-integration test, the Granger causality/Block exogeneity test, and co-integrating regression. The Augmented Dickey-Fuller (ADF) test was employed to determine unit roots, represented as follows: follows:

$$\Delta X_t = \beta_0 + \beta_1 X_{t-1} + \sum_{i=1}^{k} \pi_i \Delta X_{t-1} + U_t \quad eq.1$$

X_t = a time series of vectors, t = time, U_t = error terms, 0 = the coefficient matrix of the variables, and 0 = differences between variables. The Engle-Granger co-integration test was also applied, as the variables were stationary in the same order and the study period does not exceed 25 years (Engle & Granger, 1987). A single-equation co-integrating regression was adopted, assuming one speed of adjustment to equilibrium:

$$X = y + \beta_1 GDP_{t-n} + \beta_2 INF_{t-n} + \beta_3 INT_{t-n} + \beta_4 EXCH_{t-n} + \beta_6 UNEMP_{t-n} + U_{t-n} \quad eq.2$$

X is the property returns, Y is a constant, β = the coefficient, GDP is gross domestic product, INF is the inflation rate, INT is the interest rate, EXCH is the exchange rate, UNEMP is the unemployment rate and t-n is the number of lags taken on the independent variables to indicate the lag in the reaction of property returns.

Results and Discussion

The trend in returns of hotel property investment in Akure is presented in Table 1. The return exhibited upward movement across the selected markets, and while SG and NG markets were found to be relatively stable in returns with no volatility, WG exhibited little volatility, which makes the market less attractive to the investor when compared to SG and NG.

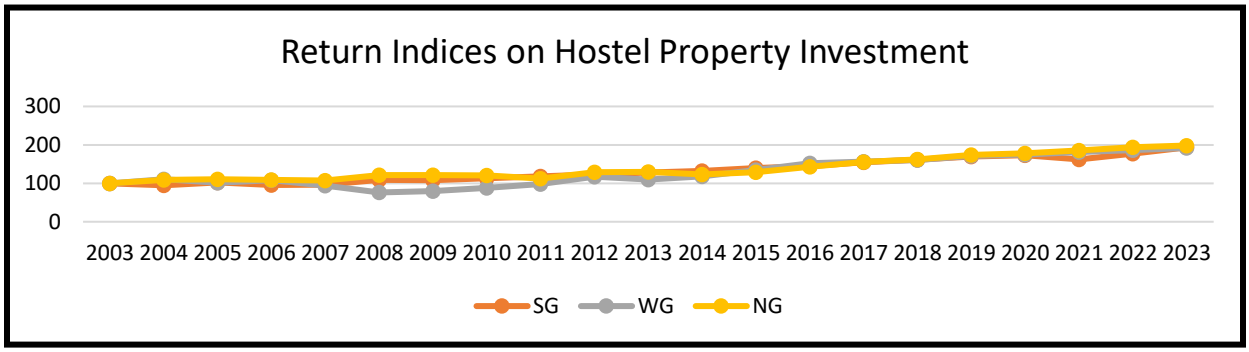

Figure 1: Trend in Hostel Property Return Indices in FUTA, Akure

The aggregated return index on hostel property return, representing the average market return indices across the study area, is presented in Figure 2 and provides a true reflection of the overall market trend.

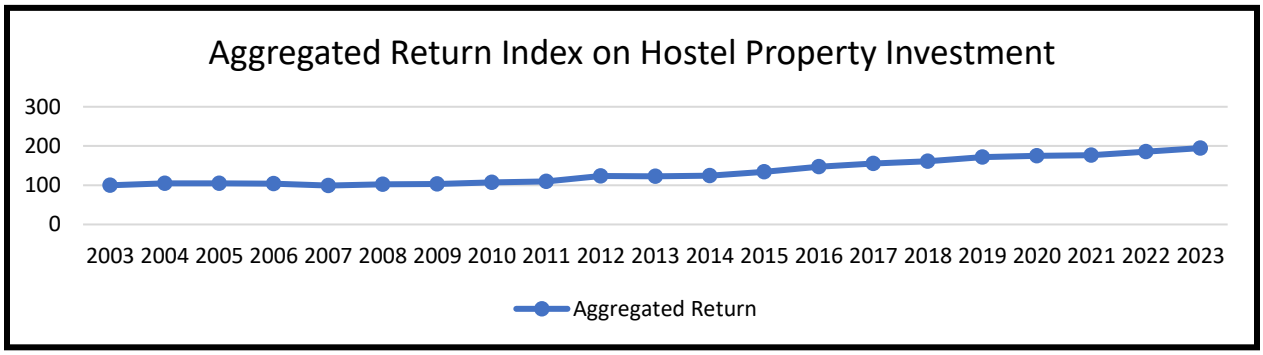

Figure 2: Aggregated Return Index on Hostel Property Investment

The result of descriptive statistics of macroeconomic variables used before transformation is presented in Table 1. The GDP is provided in billions at N1672.40b annually. The average inflation rate, which represents consumer price index (CPI), is given as 13.26. The Nigerian exchange rate against the Dollar is moving at an average of N435.92/1US Dollar over the years. While the unemployment rate is moving at an average of 7.517% and the average interest rate is at 11.049%.

Table 1: Descriptive Analysis of Macroeconomic Variables

Descriptive	*GDP*	*INF*	*EXCH*	*UNEP*	*INT*
Mean	1672.402	13.25774	435.92	7.517224	11.04917
Standard Error	189.2813	0.977277	33.04769	1.955963	0.739791
Median	1226.16	12.475	154.875	0.06	12
Standard Deviation	867.3959	4.478447	151.4436	8.963351	3.390146
Sample Variance	752375.6	20.05649	22935.15	80.34166	11.49309
Kurtosis	0.312203	1.127321	4.291892	-1.21589	1.429574
Skewness	1.26507	0.706857	1.888456	0.647914	-0.4531
Range	2736.443	19.5425	630.9283	23.883	16
Minimum	990.8975	5.575	93.2925	0.037	2.5
Maximum	3727.34	25.1175	724.2208	23.92	18.5

Figure 3 shows the outcome of the trend of the macroeconomic indices of Nigeria. Macroeconomic indices observed a high degree of volatility with respect to the trend over the years. Among the macroeconomic variables that was looked into in this study, interest rate and the rate of unemployment were largely fluctuating. There was less volatility in GDP, interest rate and inflation rates between the year 2005 and 2010.

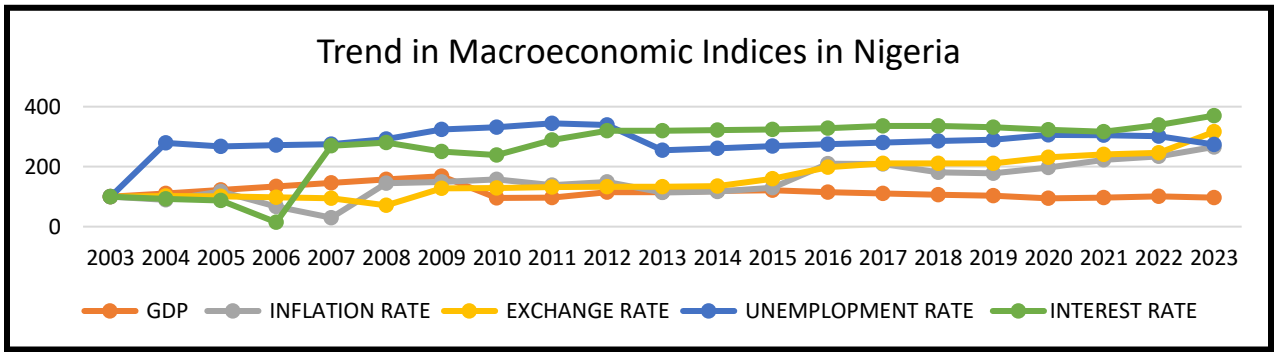

Figure 3: Trend in Macroeconomic Indices in Nigeria

The techniques used to establish suitable lag length in this study were information criteria techniques developed by Lutkepohl (1991). The information criteria values are built in 0,1,2,… k lags as shown in Table 2. As Lutkepohl (1991) argued, the right lag length is the one that will bring a minimum of the five information criteria on Table 2 to zero.

Table 2: VAR Lag Order Selection Criteria

Lag	Log L	LR	FPE	AIC	HQIC	SC
0	.875611		.059421	.014634	.019506	.063647
1	19.0275	36.304*	0.110*	.007907*	-2.00324*	-1.9935*
2	19.0275	.85672	0.355	.008479	-1.93599	-1.92137
3	19.7765	.64115	0.423	.009233	-1.85606	-1.83657
4	20.0473	.54158	0.462	.01015	-1.77027	-1.74591

Table 3. The result showed that not all the variables were stationary at the level, with a first differencing order though, the variables were all found to be stationary.

Table 3: Stationary or Unit Root Test

Variables	Computed t-statistic	ADF Critical @0.05	Prob.*	Order of integration
Δ Real GPD	-1.443	-1.337	0.0025	I(1)
Δ Inflation Rate	-2.177	-1.746	0.0075	I(1)
Δ Interest Rate	-4.128	-3.600	0.0001	I(1)
Δ Unemployment Rate	-1.388	-3.337	0.0059	I(1)
Δ Exchange Rate	-2.183	-1.950	0.0255	I(1)
Δ Aggregated Return (Rt)	-4.578	-3.144	0.0048	I(1)

Critical ADF Statistic is significant at 0.05

Table 4 presents the Engle-Granger single-equation co-integration test, which examines whether the variables share a long-run relationship. At the 5% significance level, the tau-statistic and z-statistic reject the null hypothesis of no co-integration at 5%, confirming two co-integrating equations via tau-statistics (exchange rate and inflation) and three via z-statistics (return, GDP and interest rate). The AIC-selected lag length of 1 was then applied in the VAR Granger Causality test to determine causal relationships between macroeconomic variables and hostel property returns.

Table 4: Eagle Granger Co-integration Test

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
Return	-5.4377	0.0810	30.4855	0.0001
GDP	-4.9881	0.6333	-14.4478	0.0396
Interest rate	-4.6696	0.4449	30.33579	0.0001
Exchange rate	-6.2013	0.0184	-19.7269	1.0000
Inflation rate	-7.2529	0.0330	-21.0886	1.0000
Unemployment rate	-3.9023	0.6731	-14.8895	0.5266

Table 5 presents VAR Granger Causality/Block Exogeneity Wald Test results, with hostel property return (HPR) as the dependent variable and the natural logs of GDP, inflation rate, interest rate, unemployment rate and exchange rate as exogenous variables. The results confirm a significant overall relationship between HPR and the macroeconomic variables, with inflation rate, interest rate and unemployment rate showing individual significance. GDP and exchange rate did not individually show significant causal effects. These findings directed the analysis to co-integrating regression to quantify the impact of each macroeconomic factor on hostel property returns.

Table 5: VAR Granger Causality Results /Block Exogeneity Wald Test

Excluded	Chi. Sq	Df	Prob
GDP	5.73839	4	0.2196
Inflation rate	23.3088	4	0.0001
Interest rate	7.57782	4	0.0383
Unemployment rate	7.87027	4	0.0115
Exchange rate	6.32312	4	0.0964
All	40.434	16	0.0000

Dependent Variable: Hostel Property Return (HPR)

Table 6 presents the co-integrating regression results. The model explains 65.5% of the variation in hostel property returns. A one percent change in GDP leads to a 25.09 percent increase in returns; a one percent appreciation in exchange rate yields an 8.5 percent increase; a 1 percent change in interest rate increases returns by 46.09 percent; and a one percent rise in inflation rate increases returns by 14.25 percent, all other things being equal. Unemployment exerts a negative effect, with a 7.8 percent reduction in returns for each unit displacement of qualified labour. This is conformity with the findings of Pasa *et al*. (2024) that unemployment negatively influenced real estate price and contrary to Bojan and Darja (2015). The Durbin-Watson statistic of 2.02 exceeds the critical value (0.389) at the 0.05 level, confirming the absence of autocorrelation in the residuals.

Table 6: Results of Co-integrating Regression Analysis

HPR	Variables	Coefficients	Std. Error	t-statistic	Prob	R^2	DW
AKURE	REALGDP	0.2509	0.2597	0.9664	0.0082	0.655	2.02(0.389)
	EXCHRATE	0.0856	0.0228	3.7478	0.0433		
	INTERATE	0.4609	0.2279	2.0229	0.039		
	INFLATION	0.1425	0.0505	2.8218	0.037		
	UNEMPLRATE	-0.0781	0.0253	-3.0899	0.0572		
	Constant	19.728	9.0664	2.1759	0.0815		

Conclusion

The study established a meaningful causal relationship between macroeconomic variables and hostel property returns, with the Granger causality test confirming that macroeconomic variables drive returns but not the reverse. The Engle-Granger co-integration test confirmed a long-run convergence among the variables, and the exogenous variables demonstrated strong predictive power for future values of the dependent variable. The co-integrating regression confirmed that macroeconomic factors substantially explain fluctuations in hostel property returns. The empirical findings confirm that all five macroeconomic variables, GDP, exchange rate, interest rate, inflation rate and unemployment rate, significantly influence hostel property returns. The study therefore concludes that macroeconomic variables are essential predictors of the direction and fluctuation of hostel property investment returns. The study recommends that macroeconomic variables be treated as significant tools in predicting the direction and fluctuation of hostel property investment returns. However, due to the unemployment that exhibited a negative correlation the study also recommends that Government should create an enabling environment for businesses to strive.

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