

Real Estate Market Performance in Nigeria: Longitudinal Evidence from Residential and Commercial Property Sectors in Port Harcourt



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ABSTRACT: The low transparency characterization of the real estate market in Africa presents an antithesis to the promising potentials of the market to global real estate investors and mutual funds. In spite of this, there appears an asymmetric synchronicity between increasing global attention towards investment potentials of the Sub-Saharan African real estate industry and an almost 50% market opacity. In addressing this anomaly, the study examines residential and commercial real estate returns from a Nigeria, using Port Harcourt city as test market. It has objectives of determining the rental value trend of residential and commercial properties in Port Harcourt, Nigeria, and the longitudinal rental growth rate of residential and commercial properties in the study area. The study employed qualitative technique to collect, peruse and analyze data from valuation reports obtained from Estate Surveying and Valuation firms in the study area. The resulting data were subjected to content analysis, Analysis of Variance and Correlation. The population of the study was all residential and commercial properties which have been subjected to rental valuation by designated professionals over the periodic scope of the study. Therefore, the unit of analysis was all rental valuation reports on residential and commercial properties in the study area. Given the infinite nature of the population, Godden (2004) formula was used for sample size determination of 384. It was found that rents from residential and commercial property investments in Port Harcourt, Nigeria recorded a steady increase within 2009 to 2018, with mean rental growth rates of 10.8% and 17.8% for residential and commercial properties respectively. It was concluded that the real estate market in Port Harcourt is a high performing market, with the commercial sector offering high return on investment potentials for investors.

KEYWORDS: Performance appraisal, Property market returns, Real estate market transparency, Rental growth trend.

I. INTRODUCTION

The relative opacity of the real estate market in Sub-Saharan Africa has continued to muddle the outlook of global investors and fund managers. Perusal of the "Global Real Estate Transparency Index 2020 Rankings" (Jones Lang LaSalle, 2020) provides an empirical foundation for the assertion while offering a grim reading for industry stakeholders. In perspective, South Africa (24th in the ranking) was deemed the only transparent real estate market in the region. Fifteen Sub-Saharan African (SSA) countries populate the index which ranks countries in accordance with highly transparent, transparent, semi-transparent, low transparency and opaque levels, and Table 1 elucidates the low market transparency characterizations of their real estate markets:

Table 1: Market Transparency Levels of the Real Estate Industry in Sub-Saharan Africa

Ranking	Countries	Frequency	Percentage
Highly Transparent	N.A.	0	0%
Transparent	South Africa	1	6.6%
Semi-transparent	Mauritius, Kenya, Botswana	3	20%
Low Transparency	Zambia, Nigeria, Rwanda, Ghana	4	26.7%
Opaque	Angola, Mozambique, Uganda, Ivory Coast, Senegal, Tanzania, Ethiopia	7	46.7%
Total		15	100%

Source: JLL, LaSalle (2020).

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A juxtaposition of this low market transparency with the paucity of extant empirical data on the subject relegates any strategic approach to exploiting the enormous potentials of the region's property market to conjectural levels, at best. It then becomes necessary to go beyond speculation and establish empirical evidence on real estate market performance in the region through a cornucopia of micro investigations into the returns profile of the market. In view of suggestions that the potentials of the Nigerian property market have not been matched with corresponding internationalized property investment (Babawale, 2008; Obi-Aso et al., 2019; Odenigbo & Ewurum, 2018), the study anchors its investigation on the residential and commercial property markets in Port Harcourt, Rivers State, South-South, Nigeria.

Generic applications of real estate market performance appraisals highlight adoptions of weighted appraisal models, random forest approach, hedonic models, genetic algorithm models, artificial intelligence and multicriteria analysis (Abidoye & Chan, 2017; Braun et al., 2020; Hong et al., 2020; Morano et al., 2018; Tajani et al., 2017; Tajani et al., 2020). In light of the scope of the study which focused on the residential and commercial real estate market in Port Harcourt, Nigeria, a benchmarking of these performance appraisal frameworks may not be apposite in view of the data constructions deficit encumbering the market. Therefore, we resort to an extension of appraisal parameters employed by indexed real estate performance calculators as Jones Lang LaSalle (JLL) and Morgan Stanley Capital International (MSCI) in a determination of residential and commercial market returns in Port Harcourt, using a longitudinal rental value construction as proxy.

The Problem

Decision models of global mutual fund and real estate investors have to a significant extent been informed by appraisal reports on rental values and rental growth rate of investment properties. Correspondingly, these have fulcrumed performance appraisal approaches of indexed real estate investment appraisers. However, there appears an asymmetric synchronicity between increasing global attention towards investment potentials of the Sub-Saharan African real estate industry and an almost 50% market opacity. In what might be deemed a response, the study presents empirical information on the Nigerian real estate industry, using Port Harcourt residential and commercial real estate sectors as test markets, as a means of enhancing international investor insight into its returns profile.

Objectives of the Study

1. To establish the rental value trend of residential and commercial properties in Port Harcourt, Nigeria.
2. To determine the longitudinal rental growth rate of residential and commercial properties in the study area.

Scope of the Study

The scope of the study was on a performance appraisal of residential and commercial property returns in Port Harcourt, Rivers State, Nigeria. Returns were proxied with rental values and rental growth rate of the properties under study. The study is longitudinal, and therefore covers a 10 year-period that spans 2009 to 2018.

II. EMPIRICAL REVIEW

Determination of Rental Value Trend

Iroha et al. (2014) conducted a study on the trends in rental values of residential and commercial properties in Akure, Ondo, Nigeria. The study was cross-sectional, and employed Survey method through the use of questionnaire as the primary source of data. The population of the study was 22 Estate Surveying Firms, representing all of such firms in the study area. Descriptive and inferential statistics were employed, with specific adherence to Simple Linear Regression, Analysis of Variance (ANOVA) and Turkey post-hoc test. The study found that purpose-built office spaces generated the highest returns as obtained from trend in rental values over time. The study recommended that purpose-built offices hold the highest potential for quick recoup of investment capital.

Research by Chukwu et al. (2016) adopted Survey method in a comparative determination of the "trends in rental values of residential properties in the Achara Layout and New Haven" neighbourhoods of Enugu State, Nigeria. The longitudinal study employed a "sample of 50 properties and 455 respondents" which were accessed using Stratified Random Sampling Technique. Data were analyzed using ANOVA, and findings revealed a "steady increase in rental value of residential properties in Enugu over a 10-year period. In comparative terms, the study found that the rental growth rate of residential properties was higher in New Haven than in Achara Layout. The study concluded that the neighbourhoods hold a potential of steady increase in rental growth rate, and therefore recommended that new layouts be opened to further expand increased private sector participation in the market.

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Dabara & Oyewole (2015) examined the trend in rental and capital values of commercial properties in Ibadan, Oyo State, Nigeria. The survey employed structured questionnaire in primary data collection from a sample of 56 Estate Surveying and Valuation firms in the metropolis. Over 2,072 properties were examined by the study. Weighted means and growth rate determination formula were utilized in data analysis and findings showed continuous rise in both rental and capital values of the selected properties throughout the study period. Rental growth rates averaged “8.35% and 8.1% for office and shop properties respectively.

Determination of Rental Growth Rate

Chiwuzie et al. (2019) evaluated the influence of Gross Domestic Product on rental growth rates of residential properties in Ede, Nigeria. The study collected primary and secondary data on rental values for the period 2002 to 2017 and analyzed them using ANOVA and Linear Regression. The results showed a mean annual rental growth rate of 18.26% for residential properties in the area.

From the empirical review, certain observations stand out. First, majority of the studies on determination of cross-sectional rental value trends and growth rate employ survey method, while analyzing data with ANOVA and Simple Linear Regression. Second, every one of the studies found a significant and continuous increase in rental values and growth rate over the years, usually over a decade. Several of the studies were scoped on residential and commercial properties in South West, Nigeria, with very few focusing on other geopolitical zones of the country. Therefore, our approach to the problem from the perspective of Port Harcourt in South-South, Nigeria presents a departure from the norm, and further provides potential for an expansion of investor insight into the dynamics of the phenomenon from a different clime.

Thus, the study set out to determine and establish the rental growth trend of residential and commercial properties, while also reporting the movements of rental values of same properties over the immediate decade prior to the Covid-19 pandemic. This would also establish a benchmark for future studies on a comparative analysis of pre and post pandemic real estate returns from the residential and commercial sectors of a developing country with low transparency property market.

III. METHODOLOGY

The research approach adopted for this work was the *Ex post facto*, which involved the collection, perusal and analysis of data from valuation reports, that were obtained from Estate Surveying and Valuation firms in the study area. The resulting data were subjected to content analysis, correlation and ANOVA. The population of the study was all residential and commercial properties which have been subjected to rental valuation by designated professionals over the periodic scope of the study. Therefore, the unit of analysis was all rental valuation reports on residential and commercial properties in the study area. Given the infinite nature of the population, Godden (2004) formula was used for sample size determination. The formula is given as:

$$n = \frac{Z^2 p(1-p)}{C^2}$$

Where:

- n = sample size
- p = population proportion
- C = margin of error
- Z = level of confidence

From the result of the pilot study, $p=0.5$ was generated, and at $\alpha=0.05$ (margin of error), $Z = 1.96$. Thus, we have:

$$n = \frac{(1.96)^2(0.5)(.5)}{(.05)^2} = \frac{3.8416(0.25)}{.0025} = \frac{.9604}{.0025}$$
$$= 384.16$$

Thus, the sample size of the study is 384, and this directed the dissemination of the study questionnaire to Estate Surveying and Valuation firms in the study area.

The sample frame of the study was principal partners and head of practice of all real estate firms in the study area. Data from the Nigerian Institution of Estate Surveyors and Valuers in Port Harcourt records a total of 99 Estate Surveyors and Valuers firms

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in the area. The justification for the sample frame lies on the fact that Estate Surveyors and Valuers are the only recognized value determining professionals in Nigeria in consistence with the Estate Surveyors and Valuers Registration Act No. 24 of 1975.

The average rental growth rate and coefficient of variation for residential property investments in Port Harcourt for the period 2009 – 2018 collected from Estate Surveying and valuation firms were calculated using geometric mean rental growth rate and is determined as follows: -

$$X = \sqrt[n]{X_1 \times X_2 \times X_3 \times \dots \times X_n}$$

Where X = geometric mean

X_1, X_2, \dots, X_n are rental growth rate for each year

n = total number of years within the period

The choice of geometric mean for the calculation of the average rental growth rates for the properties for the period 2009 – 2018 is based on the fact that each annual rental growth rate accumulated over each year, thereby creating a compounding process for the entire period. The geometric mean reasonably approximates the exponential characteristics of this compounding process (Hargitay and Yu, 2019). The standard deviation is given by: -

$$\text{Standard Deviation} = \sqrt{\sum \left(\frac{x - \bar{x}}{N-1} \right)^2}$$

Where x, \bar{x} and N are as defined earlier. The coefficient of variation is the ratio of standard deviation of rental growth rates to the average rental growth rate and is determined as follows: -

$$\text{Coefficient of variation} = \frac{\text{Standard Deviation of Rental Growth Rate}}{\text{Average Rental Growth Rate}}$$

In order to determine whether increase in rental values of residential properties in Port Harcourt was due to rise in inflation, correlation analysis was adopted. However, annual rental growth in the properties under study was carried out using the Pearson's Product Moment Correlation Model. The Pearson's Correlation Coefficient is denoted by r and is computed with the expression:

$$r = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{[N \sum X^2 - (\sum X)^2][N \sum Y^2 - (\sum Y)^2]}}$$

where X = Inflation Rate

Y = Annual Rental growth Rate

XY = Product of Inflation and Annual Rental Growth Rates

N = Number of pairs

r = Correlation Coefficient

IV. RESULTS AND DISCUSSION

In this section, an analysis of the distribution and collection of questionnaire distributed were presented in the following Tables:

Table 2: Collection of Valuation Report from Estate Surveyors and Valuers.

Class of Respondent	Number of valuation report collected	Number of valuation report considered	Number of valuation report not considered	Percentage of total number of report considered	Percentage of valuation report not considered	Total
Practicing Estate Surveyors and Valuers	384	288	96	75%	25%	100%
Total	384	288	96	75%	25%	100%

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As depicted from Table 2, 384 valuation reports were collected from Estate Surveying and Valuation firms, out of this number, 288 reports were considered relevant, representing 75% of the total reports collected while 96 reports representing 25% were not considered.

Table 3: Number of Commercial Properties in Property Portfolio

Description	Frequency	Percentage
Tenantable States	35	12.2
Block of Flats (2- & 3-Bedroom Flat)	95	33
Semi-detached houses	15	5.2
Duplex	28	9.7
Offices	44	15.2
Shops	71	24.7
Total	288	100

Table 3 showed that 60% residential properties and 40% commercial properties respectively were considered in the study area.

Table 4: Ranking lease structure often used for residential and commercial properties in the study area

Rank	Always	Sometimes	Seldom	Not Used	N	FX	\bar{x}	Ranking
	X	X	X	X				
Weekly	0	0	10	278	288	298	1.03	4
Monthly	156	132	0	0	288	1020	3.54	2
Biannual (Half yearly)	0	246	32	10	288	812	2.82	3
Annually (Yearly)	278	10	0	0	288	1142	3.97	1
Biennial (Every two years)	0	0	3	285	288	291	1.01	5
Total							2.47	

Table 4 showed the mean mark calculated from the response of the respondents on ranking lease structure often used for residential and commercial properties. Annually (yearly) was rated highest with a weighted mean score of 3.97 while Biennial (Every two years) on the other hand was the least rated from the valuation report used for the study having a weighted mean score of 1.01. This result confirms that annually (yearly) is the major lease structure used for residential and commercial properties in the study area.

Table 5: Quality of Construction for the Physical Characteristics of both Residential and Commercial Properties

Description	Very Good	Good	Fair	Poor	Very Poor	N	FX	\bar{x}	Decision
Tenantable States	0	97	153	38	0	288	923	3.20	Rejected
Block of Flats (2- & 3-Bedroom Flat)	0	139	104	42	3	288	955	3.32	Rejected
Semi-detached houses	17	139	132	0	0	288	1037	3.60	Accepted
Duplex	69	132	66	17	4	288	1109	3.85	Accepted
Offices	4	90	111	69	14	288	865	3.0	Rejected
Shops	4	94	97	90	3	288	870	3.02	Rejected
Total								3.33	

The finding in Table 5 showed the mean mark calculated from the response of the respondents on the decisions regarding the quality of construction for the physical characteristics of both residential and commercial properties. The table shows a lower

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weighted mean score of 3.0 as against the average weighted mean score of 3.33 and as such rejected proving that most residential and commercial properties in the study area are not in a tenenable state. The quality of construction for the physical characteristics for Block of flats (2- and 3-bedroom flat, offices and shops are very bad compared to duplex and semi-detached houses that are in good shape.

Table 6: Rent Review Intervals Observed in Residential and Commercial Properties in the Study Area

Description	Rent Review Intervals Observed and Frequency of Properties					
	2years	3years	4years	5years	6years	Total
Block of Flats (2- & 3-Bedroom Flat)	48	34	4	0	0	86
Semi-detached houses	28	14	0	0	0	42
Duplex	11	10	0	0	0	21
offices	42	28	3	0	0	73
shops	28	28	10	0	0	66
Total	157	114	17	0	0	288

Data collected on rent review frequency in residential and commercial properties in the study area as presented in Table 6 reveals that most rent review in residential and commercial properties in the city are between 2 and 3 years, representing about 93.99% of the intervals observed.

Table 7: Rent Review Pattern in Residential and Commercial Property Investments in the Study Area

S/N	Rent Review Pattern	Frequency	% Occurrence	Probability	Observed Rent Review Pattern
1	2 years	157	54.51	0.5451	1.0902
2	3 years	114	39.58	0.3958	1.1874
3	4 years	17	5.91	0.0591	0.2364
4	5 years	0	0	0	0
5	6 years	0	0	0	0
	Total	288	100	1.0000	2.5140

The analysis for the rent review pattern showed that the expected rent review pattern is 2.5140 representing approximately 3years.

Rental levels in the residential properties under study for the period, 2009–2018 were determined based on the annual average rental values of each type of property for each year. In calculating the average rental value for each year for each type of residential property under study, the weighted mean was used:

Table 8: Weighted Mean Rent for 2-bedroom flat in Study Area for 2009

Rent (N)	Frequency	Relative Frequency	Weighted Rent
₦800,000	14	0.05	₦ 40,000
₦ 900,000	14	0.05	₦ 45,000
₦ 1,000,000	69	0.24	₦ 240,000
₦ 1,200,000	42	0.13	₦ 156,000
₦ 1,300,000	14	0.05	₦ 65,000
₦ 1,400,000	45	0.16	₦ 224,000
₦ 1,500,000	45	0.16	₦ 240,000
₦ 1,700,000	45	0.16	₦ 272,000
∑	288	1.000	₦ 1,294,000

The same procedure was adopted for the calculation of weighted rents for each year for the other type of residential properties. These calculations are summarised in Tables 9.

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Table 9: Weighted Mean Rents for 3 Bedroom Flat, Duplex and Semi-Detached Houses in the Study Area, 2009 – 2018

Year	3 Bedroom Flat	Duplex	Semi-Detached Houses
2009	₦ 805,000	₦ 1,010,000	₦ 980,000
2010	₦ 975,000	₦ 1,120,000	₦ 1,000,000
2011	₦ 1,112,000	₦ 1,270,000	₦ 1,243,000
2012	₦ 1,227,500	₦ 1,480,000	₦ 1,495,000
2013	₦ 1,412,500	₦ 1,760,000	₦ 1,679,000
2014	₦ 1,533,250	₦ 1,907,500	₦ 1,842,000
2015	₦ 1,651,250	₦ 2,205,000	₦ 2,070,000
2016	₦ 1,775,000	₦ 2,575,000	₦ 2,220,000
2017	₦ 1,845,000	₦ 2,770,000	₦ 2,450,000
2018	₦ 2,090,000	₦ 2,980,000	₦ 2,800,000

Rental Growth for 2 Bedroom Flat, Duplex and Semi-Detached Houses in the Study Area, 2009 – 2018

Annual rental growth rates were determined for the properties under study for the period, 2009 – 2018. The annual rental growth rates were determined based on weighted rents in each type of property for each year under study. The annual rental growth rates were calculated as percentage increase in rent for each of the years under study. For example, the annual rental growth rate in 2-bedroom flat for 2010 is 21.12%. This is calculated as follows:-

Rent for 2009	₦ 805,000
Rent for 2010	₦ 975,000
Rental Increase	₦ 170,000
Rental growth rate for 2009	$\frac{₦ 170,000}{₦ 805,000} \times 100$
	= 21.12%

The same procedure was adopted for the calculation of annual rental growth rates for each year for each type of property under study as summarised in Tables 10.

Table 10: Annual Rental Growth for 2 Bedroom Flat, 3 Bedroom Flat, Duplex and Semi-Detached Houses in the Study Area, 2009 – 2018.

YEAR	ANNUAL GROWTH RATE			
	2 Bedroom Flat (%)	3 Bedroom Flat (%)	Duplex (%)	Semi-Detached Houses (%)
2009	–	–	–	–
2010	21.12	10.89	2.04	15.47
2011	14.05	13.39	24.3	12.06
2012	10.39	16.54	20.27	17.01
2013	15.07	18.92	12.31	8.92
2014	8.55	8.38	9.71	17.38
2015	7.70	15.60	12.38	3.18
2016	7.49	16.78	7.25	5.99
2017	3.94	7.57	10.36	7.64
2018	13.28	7.58	14.29	8.02

Table 11: Average Rental Growth Rates for 3 – Bedroom Flat in the study Area

YEAR	X	(x - x̄)	(x - x̄) ²
2009	–	– 11.43	130.6449
2010	10.89	– 0.54	0.2916
2011	13.39	1.96	3.8416
2012	16.54	5.11	26.1121

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2013	18.92	7.49	56.1001
2014	8.38	- 3.05	9.3025
2015	15.60	4.17	17.3889
2016	16.78	5.35	28.6225
2017	7.57	- 3.86	14.8996
2018	7.58	- 3.85	14.8225

Average Growth Rate (X)

$$\begin{aligned}
 &= \sqrt[10]{(1.0)(1.1089)(1.1339)(1.1654)(1.1892)(1.0838)(1.1560)(1.1678)(1.0757)(1.0758)} - 1 \\
 &= \sqrt[10]{2.9505} - 1 \\
 &= 1.1143 - 1 \\
 &= 0.1143 \\
 &= 11.43\%
 \end{aligned}$$

$$\text{Standard Deviation} = \sqrt{\frac{302.0263}{9}}$$

$$\text{Standard Deviation} = \sqrt{33.5585} = 5.79\%$$

$$\text{Coefficient of variation} = \frac{5.79}{11.43} = 0.5066$$

The same procedure was adopted for the calculation of average rental growth rate, standard deviation and coefficient of variation for each type of property under study for the period 2009 – 2018. These are summarised in Table 12 as follows:-

Table 12: Average Rental Growth Rates, Standard Deviation and Coefficient of Variation for 2-Bedroom Flat, 3-Bedroom Flat, Duplex and Semi-Detached Houses in the study areas, 2009 – 2018.

Type of Residential Property	Rental Growth Rate, 2009 – 2018	Standard Deviation	Coefficient of Variation
2-Bedroom flat	10.01	6.03	0.6024
Duplex	11.43	5.79	0.5066
Semi-detached Houses	11.07	7.41	0.6694

Generally, the average rental growth rate are for residential properties in the study area for the period, 2009 – 2018 is phenomenal as summarised in Table 13. The table shows similar trend for all the residential properties in study. Though 3-Bedroom flat have the lowest rental growth rate followed by 2-Bedroom flat. The table shows that all the study residential properties have average rental growth rates and the implication of these is that, investors in residential property investments in the study areas are likely to get high returns if they invest in such properties.

Rental Index For 2-Bedroom Flat, 3-Bedroom Flat, Duplex and Semi-Detached Houses in the Study Areas, 2009 – 2018.

Using 2009 as the base year, rental index was constructed for the residential properties for the period 2009 – 2018, rental index was calculated as follows: -

where r = annual rental growth rate in the current year.

For example, the annual rental growth rate for 3-bedroom flat for 2010 is 10.89%. The rental index is calculated as follows:-

$$\begin{aligned}
 &= \left[\frac{1 + 10.89}{100} \right] \times 100 \text{ (Rental Index for the base year)} \\
 &= [1 + 0.1089] \times 100 \\
 &= [1.1089] \times 100 \\
 &= 110.89
 \end{aligned}$$

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Table 13: Rental Index for 2-Bedroom Flat, 3-Bedroom Flat, Duplex and Semi-Detached Houses in the study area, using 2009 as the base year.

YEAR	RENTAL INDEX			
	2 Bedroom flat	3 Bedroom flat	Duplex	Semi-Detached Houses
2009	100	100	100	100
2010	121.12	110.89	102.04	115.47
2011	135.17	124.28	126.34	127.53
2012	145.56	140.82	146.61	144.54
2013	160.63	159.74	158.92	153.46
2014	169.18	168.12	168.63	170.84
2015	176.88	183.72	181.01	174.02
2016	184.37	200.5	188.26	180.01
2017	188.31	208.07	198.62	187.65
2018	201.59	215.65	212.91	195.67

Table 13 shows rental index for study residential properties in the study area for a period of ten years. Results of the rental index analysis in the study area maintained higher upward trends in rental values. These upward trends are due to annual growth in inflation, among other factors.

Analysis of Variance of Annual Rental Growth Rates for Residential Property Investments in the Study Area, 2009 – 2018.

Table 14: ANOVA

Year	Annual Rental Growth Rates for 2-Bedroom Flat, 3-Bedroom Flat, Duplex and Semi-Detached Houses			
	X ₁	X ₂	X ₃	X ₄
2009	–	–	–	–
2010	21.12	10.89	2.04	15.47
2011	14.05	13.39	24.3	12.06
2012	10.39	16.54	20.27	17.01
2013	15.07	18.92	12.31	8.92
2014	8.55	8.38	9.71	17.38
2015	7.70	15.60	12.38	3.18
2016	7.49	16.78	7.25	5.99
2017	3.94	7.57	10.36	7.64
2018	13.28	7.58	14.29	8.02
∑	101.59	115.65	314.87	95.67

From Table 14

X₁ = Annual Rental Growth Rates for 2 – bedroom flat

X₂ = Annual Rental Growth Rates for 3 – bedroom flat

X₃ = Annual Rental Growth Rates for duplex

X₄ = Annual Rental Growth Rates for Semi-detached Houses

Table 15: ANOVA

Year	Square Of Annual Rental Growth Rates for 2-Bedroom Flat, 3-Bedroom Flat, Duplex and Semi-Detached Houses								
	X ₁	X ₁ ²	X ₂	X ₂ ²	X ₃	X ₃ ²	X ₄	X ₄ ²	∑X
2009	–	–	–	–	–	–	–	–	–
2010	21.12	446.0544	10.89	118.5921	2.04	4.1616	15.47	239.3209	49.53
2011	14.05	197.4025	13.39	179.2921	24.3	590.49	12.06	145.4436	63.8

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2012	10.39	107.9521	16.54	273.5716	20.27	410.8729	17.01	289.3401	64.21
2013	15.07	227.1049	18.92	357.9664	12.31	151.5361	8.92	79.5664	55.22
2014	8.55	73.1025	8.38	70.2244	9.71	94.2841	17.38	302.0644	44.02
2015	7.70	59.29	15.60	243.36	12.38	153.2644	3.18	10.1124	38.86
2016	7.49	56.1001	16.78	281.5684	7.25	52.5625	5.99	35.8801	37.51
2017	3.94	15.5236	7.57	57.3049	10.36	107.3296	7.64	58.3696	29.51
2018	13.28	176.3584	7.58	57.4564	14.29	204.2041	8.02	64.3204	43.17
Σ	101.59	1358.8885	115.65	1639.3363	112.91	1768.7053	95.67	1224.4179	425.83

The Analysis of Variance calculation is summarised in Table 16 as follows:-

Table 16: Analysis of Variance of rental value used for residential properties

Source of variance	Sum of squares	Degree of freedom	Mean square	F – ratio
Within groups	284.068	8	35.51	1.3300
Between groups	29.59	3	9.86	0.3493
Error (residual)	640.71	24	26.70	
Total	954.368	35	27.27	

The critical (table) value of F at degree of freedom of 3 and 24 at 0.05 level of significance is 1.33. This is greater than the calculated F ratio. Since the calculated F – ratio of 0.3493 is less than the critical F – value of 1.33, showing that the annual rental growth rates for residential property investments in the study area do not differ significantly. It also implies that although rental values of residential properties in the study area, comprising 2-bedroom flat, 3-bedroom flat, duplex and semi-detached houses respectively increased at a phenomenal rate within the period, 2009 – 2018, differences in the rates of such increases within and between the various types of residential properties in the property market are not statistically significant and hence, rental growth in residential properties in the study area follows a similar trend and pattern.

Table 17: Correlation between Inflation and Rental Growth in 2–bedroom flat

Year	Inflation (X)	Rental Growth (Y)	X ²	Y ²	XY
2009	11.54	0	133.17	0	0
2010	13.72	21.12	188.24	446.0544	289.77
2011	10.84	14.05	117.51	197.4025	152.30
2012	12.22	10.39	149.33	107.9521	126.97
2013	8.48	15.07	71.91	227.1049	127.79
2014	8.06	8.55	64.96	73.1025	68.91
2015	9.01	7.70	81.18	59.29	69.38
2016	15.68	7.49	245.86	56.1001	117.44
2017	16.52	3.94	272.91	15.5236	65.09
2018	12.09	13.28	146.17	176.3584	160.56
Σ	118.16	101.59	1471.24	1358.8885	1178.21

$$r = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{[N \sum X^2 - (\sum X)^2][N \sum Y^2 - (\sum Y)^2]}}$$

$$r = \frac{10(1178.21) - (118.16)(101.59)}{\sqrt{[10(1471.24) - (118.16)^2][10(1358.8885) - (101.59)^2]}}$$

$$r = \frac{11782.1 - 12003.87}{\sqrt{[14712.4 - 13961.79][13588.885 - 10320.5281]}}$$

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$$r = \frac{-221.77}{\sqrt{[750.61][3268.3569]}}$$

$$r = \frac{-221.77}{\sqrt{2453261.373}}$$

$$r = \frac{-221.77}{1566.29}$$

Table 18: Correlation between Inflation and Rental Growth in 3-bedroom flat

Year	Inflation (X)	Rental Growth (Y)	X ²	Y ²	XY
2009	11.54	0	133.17	0	0
2010	13.72	10.89	188.24	118.5921	149.41
2011	10.84	13.39	117.51	179.2921	145.15
2012	12.22	16.54	149.33	273.5716	202.12
2013	8.48	18.92	71.91	357.9664	160.44
2014	8.06	8.38	64.96	70.2244	67.54
2015	9.01	15.60	81.18	243.36	140.56
2016	15.68	16.78	245.86	281.5684	263.11
2017	16.52	7.57	272.91	57.3049	125.06
2016	12.09	7.58	146.17	57.4564	91.64
Σ	118.16	115.65	1471.24	1639.3363	1345.03

$$r = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{[N \sum X^2 - (\sum X)^2][N \sum Y^2 - (\sum Y)^2]}}$$

$$r = \frac{10(1345.03) - (118.16)(115.65)}{\sqrt{[10(1471.24) - (118.16)^2][10(1639.3363) - (115.65)^2]}}$$

$$r = \frac{13450.3 - 13665.204}{\sqrt{[14712.4 - 13961.79][16393.363 - 13374.9225]}}$$

$$r = \frac{-214.9}{\sqrt{[750.61][3018.4405]}}$$

$$r = \frac{-214.9}{\sqrt{2265671.624}}$$

$$r = \frac{-214.9}{1505.21}$$

$$r = -0.14$$

Table 19: Correlation between Inflation and Rental Growth in Duplex

Year	Inflation (X)	Rental Growth (Y)	X ²	Y ²	XY
2009	11.54	0	133.17	0	0
2010	13.72	2.04	188.24	4.1616	27.99

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2011	10.84	24.3	117.51	590.49	263.41
2012	12.22	20.27	149.33	410.8729	247.70
2013	8.48	12.31	71.91	151.5361	104.39
2014	8.06	9.71	64.96	94.2841	78.26
2015	9.01	12.38	81.18	153.2644	111.54
2016	15.68	7.25	245.86	52.5625	113.68
2017	16.52	10.36	272.91	107.3296	171.15
2018	12.09	14.29	146.17	204.2041	172.77
Σ	118.16	112.91	1471.24	1768.7053	1290.89

$$r = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{[N \sum X^2 - (\sum X)^2][N \sum Y^2 - (\sum Y)^2]}}$$

$$r = \frac{10(1290.89) - (118.16)(112.91)}{\sqrt{[10(1471.24) - (118.16)^2][10(1768.7053) - (112.91)^2]}}$$

$$r = \frac{12908.9 - 13341.4456}{\sqrt{[14712.4 - 13961.79][17687.053 - 12748.6681]}}$$

$$r = \frac{-432.55}{\sqrt{[750.61][4938.3849]}}$$

$$r = \frac{-432.55}{\sqrt{3706801.09}}$$

$$r = \frac{-432.55}{1925.31}$$

$$r = -0.22$$

Table 20: Correlation between Inflation and Rental Growth in Semi-detached Houses

Year	Inflation (X)	Rental Growth (Y)	X ²	Y ²	XY
2009	11.54	0	133.17	0	0
2010	13.72	15.47	188.24	239.3209	212.25
2011	10.84	12.06	117.51	145.4436	130.73
2012	12.22	17.01	149.33	289.3401	207.86
2013	8.48	8.92	71.91	79.5664	75.64
2014	8.06	17.38	64.96	302.0644	140.08
2015	9.01	3.18	81.18	10.1124	28.65
2016	15.68	5.99	245.86	35.8801	93.92
2017	16.52	7.64	272.91	58.3696	126.21
2018	12.09	8.02	146.17	64.3204	96.96
Σ	118.16	95.67	1471.24	1224.4179	1112.3

$$r = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{[N \sum X^2 - (\sum X)^2][N \sum Y^2 - (\sum Y)^2]}}$$

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$$r = \frac{10(1112.3) - (118.16)(95.67)}{\sqrt{[10(1471.24) - (118.16)^2][10(1224.4179) - (95.67)^2]}}$$

$$r = \frac{11123 - 11304.3672}{\sqrt{[14712.4 - 13961.79][12244.1795 - 9152.7489]}}$$

$$r = \frac{-181.37}{\sqrt{[750.61][3091.4306]}}$$

$$r = \frac{-181.37}{\sqrt{2320458.723}}$$

$$r = \frac{-181.37}{1523.31}$$

$$r = -0.12$$

The analysis carried out from the Tables shows there is a negative correlation between inflation and annual rental growth. Hence phenomenal increase in rental values of all the study properties which may be due to other factors, other than inflation.

Table 21: Weighted Rents for Offices and shops in the Study Area, 2009 – 2018

Year	Offices	Shops
2010	₦ 600,000	₦ 450,000
2011	₦ 680,000	₦ 500,000
2012	₦ 740,000	₦ 660,000
2013	₦ 780,500	₦ 720,000
2014	₦ 820,000	₦ 800,000
2015	₦ 990,000	₦ 870,000
2016	₦ 1,300,000	₦ 930,000
2017	₦ 1,700,000	₦ 1,000,000
2018	₦ 2,100,000	₦ 1,500,000
2019	₦ 2,500,000	₦ 2,000,000

Rental Growth for Office and Shop in the Study Area, 2009 – 2010

Annual rental growth rates were determined for the properties under study for the period, 2009 – 2018. The annual rental growth rates were determined based on weighted rents in each type of property for each year under study. The annual rental growth rates were calculated as percentage increase in rent for each of the years under study. For example, the annual rental growth rate in office for 2010 is 13.33%. This is calculated as follows:

Rent for 2009	₦ 600,000	
Rent for 2010	₦ 680,000	
Rental Increase	₦ 80,000	
Rental growth rate for 2009		$\frac{₦ 80,000 \times 100}{₦ 600,000} = 13.33\%$

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The same procedure was adopted for the calculation of annual rental growth rates for each year for each type of property under study as summarised in Tables 22.

Table 22: Annual Rental Growth for Office and Shop in the Study Area, 2009 – 2018.

YEAR	Annual Growth Rate	
	Office (%)	Shops (%)
2009	–	–
2010	13.33	11.11
2011	8.82	32
2012	5.47	9.09
2013	5.06	11.11
2014	20.73	8.75
2015	31.31	6.90
2016	30.77	7.53
2017	25.53	50
2018	19.05	33.33

Average Rental Growth and Coefficient of Variation for Commercial Property Investments in the Study Area, 2009 – 2018.

The average rental growth rate and coefficient of variation for commercial property investments in the study areas for the period, 2009 – 2018 were calculated from data in Tables 22. These are summarised in Table 23. The average rental growth rate for the period, 2009 – 2018 is the geometric mean rental growth rate and is determined as follows: -

$$X = \sqrt[n]{X_1 x X_2 x X_3 x \dots x X_n}$$

Where X = geometric mean

X₁, X₂,... X_n are rental growth rate for each year

n = total number of years within the period

The choice of geometric mean for the calculation of the average rental growth rates for the properties for the period, 2009 – 2018 is based on the fact that each annual rental growth rate accumulated over each year, thereby creating a compounding process for the entire period. The geometric mean reasonably approximates the exponential characteristics of this compounding process (Hargitay and Yu, 2019). The standard deviation is given by: -

$$\text{Standard Deviation} = \sqrt{\sum \left(\frac{x - \bar{x}}{N-1} \right)^2}$$

Where x, \bar{x} and N are as defined earlier. The coefficient of variation is the ratio of standard deviation of rental growth rates to the average rental growth rate and is determined as follows: -

$$\text{Coefficient of variation} = \frac{\text{Standard Deviation of Rental Growth Rate}}{\text{Average Rental Growth Rate}}$$

For example, the average rental growth rate, standard deviation and coefficient of variation for office in the study areas for the period, 2009 – 2018 is calculated as follows:

Table 23: Average Rental Growth Rates for Office in the study Area

YEAR	X	(x - \bar{x})	(x - \bar{x}) ²
2009	–	– 11.43	130.6449
2010	13.33	1.9	3.61
2011	8.82	– 2.61	6.8121
2012	5.47	– 5.96	35.5216
2013	5.06	– 6.37	40.5769
2014	20.73	9.3	86.49
2015	31.31	19.88	395.2144

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2016	30.77	19.34	374.0356
2017	25.53	14.1	198.81
2018	13.33	1.9	3.61

Table 24: Average Rental Growth Rates for Shop in the study Area

YEAR	X	(x - \bar{x})	(x - \bar{x}) ²
2009	-	- 11.43	130.6449
2010	11.11	- 0.32	0.1024
2011	32	20.57	423.1249
2012	9.09	- 2.34	5.4756
2013	11.11	- 0.32	0.1024
2014	8.75	- 2.68	7.1824
2015	6.90	- 4.53	20.5209
2016	7.53	- 3.9	15.21
2017	50	38.57	1487.6449
2018	33.33	21.9	479.61

The same procedure was adopted for the calculation of average rental growth rate, standard deviation and coefficient of variation for each type of property under study for the period, 2009 – 2018. These are summarised in Table 24 as follows:

Table 25: Average Rental Growth Rates, Standard Deviation and Coefficient of Variation for Office and Shop in the study areas, 2009 – 2018.

Type Of Residential Property	Rental Growth Rate, 2009 – 2018	Standard Deviation	Coefficient of Variation
Office	19.49	11.9039	1.0415
Shop	16.09	16.8971	1.4783

Generally, the average rental growth rate are for commercial properties in the study area for the period, 2009 – 2018 is phenomenal as summarised in Table 25. The table shows that all the study commercial properties have very high rental growth rates and the implication of these is that, investors in commercial property investments in the study areas will get high returns if they invest in such properties.

Rental Index for Office and Shop in the Study Areas, 2009 – 2018.

Using 2009 as the base year, rental index was constructed for the commercial properties for the period 2009 – 2018, rental index was calculated as follows: -

$$\left[\frac{1 + 13.33}{100} \right] \times 100 \text{ (rental index for the base year)}$$

$$= [1 + 0.1333] \times 100$$

$$= [1.1333] \times 100$$

$$= 113.33$$

The same procedure was adopted for the calculation of rental index for all the study commercial property in the study area using 2009 as the base year. These are summarised in Tables 26 as follows:

Table 26: Rental Index for Office and Shop in the study area, using 2009 as the base year.

Year	Rental Index	
	Office	Shop
2009	100	100

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2010	133.33	111.11
2011	132	132
2012	109.09	109.09
2013	111.11	111.11
2014	108.75	108.75
2015	106.9	106.9
2016	107.53	107.53
2017	150	150
2018	133.33	133.33

Table 26 show rental index for study commercial properties in the study area for a period of ten years. Results of the rental index analysis in the study area maintained higher upward trends in rental values. These upward trends are due to annual growth in inflation, among other factors.

Table 27: ANOVA

Year	Annual Rental Growth Rates for Office and Shop	
	X ₁	X ₂
2009	–	–
2010	13.33	11.11
2011	8.82	32
2012	5.47	9.09
2013	5.06	11.11
2014	20.73	8.75
2015	31.31	6.90
2016	30.77	7.53
2017	25.53	50
2018	13.33	33.33
Σ	154.35	169.82

From Table 27

X₁ = Annual Rental Growth Rates for Office

X₂ = Annual Rental Growth Rates for Shop

Table 28: ANOVA

Year	Square of Annual Rental Growth Rates for Office and Shop				
	X ₁	X ₁ ²	X ₂	X ₂ ²	ΣX
2009	–	–	–	–	–
2010	13.33	177.69	11.11	123.43	24.44
2011	8.82	77.79	32	1024	40.82
2012	5.47	29.92	9.09	82.63	14.56
2013	5.06	25.60	11.11	123.43	16.17
2014	20.73	429.73	8.75	76.56	29.48
2015	31.31	980.32	6.90	47.61	38.21
2016	30.77	946.79	7.53	56.70	38.3
2017	25.53	651.78	50	2500	75.53
2018	13.33	177.69	33.33	1110.89	46.66
Σ	154.35	3497.31	169.82	5145.25	324.17

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The Analysis of Variance calculation is summarised in Table 29 as follows:

Table 29: Analysis of Variance of rent passing used for commercial properties

Source of variance	Sum of squares	Degree of freedom	Mean square	F – ratio
Within groups	1369.35	8	171.17	0.9631
Between groups	13.3	1	13.3	0.0748
Error (residual)	1421.79	8	177.72	
Total	2804.44	17	164.97	

The critical (table) value of F at degree of freedom of 1 and 8 at 0.05 level of significance is 0.9631. This is greater than the calculated F ratio. Since the calculated F – ratio of 0.0748 is less than the critical F – value of 0.9631, showing that the annual rental growth rates for commercial property investments in the study area do not differ significantly. It also implies that although rent passing of commercial properties in the study area, comprising office and shop respectively increased at a phenomenal rate within the period, 2009 – 2018, differences in the rates of such increases within and between the various types of commercial properties in the property market are not statistically significant and hence, rental growth in commercial properties in the study area follows a similar trend and pattern.

Rise in Inflation

The correlation analysis for Office and Shop are follows:

Table 30: Correlation between Inflation and Rental Growth in Office

Year	Inflation (X)	Rental Growth (Y)	X ²	Y ²	XY
2009	11.54	–	133.17	–	–
2010	13.72	13.33	188.24	177.69	182.89
2011	10.84	8.82	117.51	77.79	95.61
2012	12.22	5.47	149.33	29.92	66.84
2013	8.48	5.06	71.91	25.60	42.91
2014	8.06	20.73	64.96	429.73	167.08
2015	9.01	31.31	81.18	980.32	282.10
2016	15.68	30.77	245.86	946.79	482.47
2017	16.52	25.53	272.91	651.78	421.76
2018	12.09	13.33	146.17	177.69	161.16
Σ	118.16	154.35	1471.24	3497.31	1902.82

$$r = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{[N \sum X^2 - (\sum X)^2][N \sum Y^2 - (\sum Y)^2]}}$$

$$r = \frac{10(1902.82) - (118.16)(154.35)}{\sqrt{[10(1471.24) - (118.16)^2][10(3497.31) - (154.35)^2]}}$$

$$r = \frac{19028.2 - 18237.80}{\sqrt{[14712.4 - 13961.79][34973.1 - 23823.92]}}$$

$$r = \frac{790.4}{\sqrt{[750.61][11149.18]}}$$

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$$r = \frac{790.4}{\sqrt{8368686}}$$

$$r = \frac{790.4}{2892.87}$$

$$r = 0.2732$$

Table 31: Correlation between Inflation and Rental Growth in Shop

Year	Inflation (X)	Rental Growth (Y)	X ²	Y ²	XY
2009	11.54	–	133.17	–	–
2010	13.72	11.11	188.24	123.43	152.43
2011	10.84	32	117.51	1024	346.88
2012	12.22	9.09	149.33	82.63	111.08
2013	8.48	11.11	71.91	123.43	94.21
2014	8.06	8.75	64.96	76.56	70.53
2015	9.01	6.90	81.18	47.61	62.17
2016	15.68	7.53	245.86	56.70	118.07
2017	16.52	50	272.91	2500	826
2018	12.09	33.33	146.17	1110.89	402.96
Σ	118.16	169.82	1471.24	5145.25	2184.33

$$r = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{[N \sum X^2 - (\sum X)^2][N \sum Y^2 - (\sum Y)^2]}}$$

$$r = \frac{10(2184.33) - (118.16)(169.82)}{\sqrt{[10(1471.24) - (118.16)^2][10(5145.25) - (169.82)^2]}}$$

$$r = \frac{21843.3 - 20065.93}{\sqrt{[14712.4 - 13961.79][51452.5 - 28838.83]}}$$

$$r = \frac{1777.37}{\sqrt{[750.61][22613.67]}}$$

$$r = \frac{1777.37}{\sqrt{16974046.84}}$$

$$r = \frac{1777.37}{4119.96}$$

$$r = 0.4314$$

The analysis carried out from the Tables shows there is a positive correlation between inflation and annual rental growth. Hence phenomenal decrease in rent passing of all the study properties which is due to inflation

V. FINDINGS AND IMPLICATIONS

Rents from residential and commercial property investments in Port Harcourt, Nigeria recorded a steady increase within 2009 to 2018. The study shows a longitudinal increment in rental growth rates of residential properties with a mean rental growth rate 10.8%, while for commercial properties they were longitudinal increases which culminated in a mean rental growth rate 17.8%.

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Observations from the study shows that residential and commercial properties recorded steady growths in returns from a rent perspective, whereby commercial properties turned out the more lucrative of the two. The general implication is that real estate investors are poised for incremental returns from rents generated from residential and commercial properties in the study area, with commercial properties offering the higher prospects.

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