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LONG-RUN RELATIONSHIP BETWEEN INFLATION RATE AND REAL ESTATE INVESTMENT IN KENYA

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Abstract: *This paper has analyzed the inflation rate in form of consumer price index, comparing them with real estate investment from GDP contribution in the long-run. The long-run relationship between inflation and real estate investment is considered one of the primary financial concerns of long-term investors as well as prudent contribution to GDP in Kenya. Despite the fact that Kenyan government is pushing for affordable housing as one of her four main agenda, it is going through various transformations such as; Sustainable Development Goals for health, and enhancing manufacturing sector, at the same time thus raising a concern over how inflation relates with real estate investment. Gordon growth theory has been employed as an underlying theory while all variables are measured annually in a period of 34 years from 1985 to 2018 comprising of 34 observations. The study has employed time series data where real estate investment and inflation data have been obtained from KNBS. The quantitative analyses have been carried out, whereby, the stationarity test of the time series are investigated through unit root tests. Real estate investment and inflation rate stochastic processes have been found to be stationary at 5% level of significance with the aid of KPSS test. The causality tests of the time series have been performed using one lag SC selection criteria and finally the VAR system is estimated. It is found that, in the long-run, real estate's GDP contribution are associated with 2.177 increase in current inflation rate but associated with a 3.455 decrease in the subsequent year's inflation showing an inverse relationship making the researcher to conclude that real estate investment exhibited a hedging ability on inflation in the long-run which is consistent with. Based on conclusions, the study recommended that, in order to curb serious future inflation rates in Kenya, real estate investment should be given priority in terms of sectorial development both in the long-run since real estate investment responded well towards inflation rates in terms of shocks. Also, county governments should adopt the national's policy of affordable housing to improve their GDP.*

Keywords: *Real Estate Investment, Inflation rates, Vector Autoregressive (VAR), Hedge, Schwarz information criterion (SC), Kwiatkowski, Phillips, Schmidt, & Shin (KPSS)*

Introduction

The relationship between inflation and the value of assets is considered one of the primary financial concerns of long-term investors. While actual and expected rates of inflation have slowed down considerably since 1980's, researchers and investors have a great concern over future increases. Zhou & Clements (2010) and Arnasson & Parsson (2012) found that real estate is not a perfect hedge against inflation rates in the long-run since property prices keep on increasing thus based their argument on the background of economic volatility and recession. The importance of long-run relationship between inflation and housing prices varies depending

on different factors (Hoesli *et al.,* 2008). Results may vary across time periods, market conditions, characteristics of the countries in question and components of returns.

Fluctuations in property prices have been experienced in many countries which have attributed them to financial instability resulting from house price boom and bust. According to Kenya National Bureau of Statistic, in Kenya the real estate sector has been a driver of growth since 2010. Inflation has pushed up the cost of doing business, contributing to the cutting down of the number of properties. Investors in real estate who are looking for safe haven for their money in turbulent times in the equity markets have underestimated the and risk property price fluctuations that have been witnessed in many countries over the past decades which have been associated with financial instability. The resent financial crisis led to the accelerated housing defaults in the U.S and other countries (Burnside *et al.,* 2011).

It is projected that Kenya will have a population of over 60 million people by the year 2030 and more than 50% of them will be living in urban areas, creating a huge demand for new housing units. There is therefore an urgent need to increase the supply of new and affordable housing units (Mwathi, 2013). In 2018, Kenya's National Housing Corporation, NHC, established the Affordable Housing Initiative as one of its Big Four Pillars to promote long-term economic development. The initiative is focused on delivering 500,000 housing units for the lower and middle income population to reduce the existing house deficit. Despite the Kenyan government pushing for the affordable housing as one of her four main agenda, it is going through various transformations at the same time. Such transformations like technological changes led to change in prices of various goods and services. Peyton (2011b) asserted that fiscal policy in the form of excessive deficit spending as well as combined fiscal and monetary stimuli can boost demand beyond an economy's capacity thereby igniting inflation.

Since the relationship between inflation and the value assets is considered one of the primary financial concerns of long-term investors such as pension funds and life insurance companies, it has not been clearly defined whether investing in real estate will hedge against inflation or high inflation will lead to high asset returns. Most of the empirical researches confirm that asset returns act as the best hedging characteristics against high and low period inflation but not specific whether it is in long-run or short-run.

It is therefore, important to establish on the long-run causal relationship between inflation rates and real estate investment.

Materials and Methods

Area of Study

This study has been based on Kenya's experience whereby Kenya's inflation rate and real estate returns are used as underlying variables. The real estate sector has been one of the major sectors towards GDP contribution in Kenya but also is one of the sectors which is closely related with changes in inflation and therefore, important variables to study.

Research Design

This study has used theoretical and empirical approaches based on the study of long-run relationship between inflation rates and real estate investment. The study has employed Gordon growth theory as the underlying theory in determining the relationship between the variables.

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Data sources and collection

Secondary time series data is employed in the study whereby it has been collected from Kenya National Bureau of Statistics spanning from 1985 to 2018. This study has taken Roache and Atties' 2009 model of using actual inflation rates with the aid of CPI year-on-year (the annualized percentage in a general price index, usually the consumer price index over time) at 2009 constant prices. Real estate investment is measured as percentage real estate contribution to GDP (real estate growth rate) which has been measured in year-year under 2009 constant prices.

Methods of Data Analysis

Theoretical Framework

Gordon Growth Theory

The study has replicated Gordon's theory whereby, the model, has illustrated that real estate asset prices are given by the net present value (NPV) of the future rent cash-flow stream, which is treated to grow indefinitely at a constant rate **g** and is discounted by the appropriate nominal rate **r.**

Real Estate Price = NPV (Future Rent Income) = Next Period Rent/(r – g)

REIT Equity Price = NPV (Future Dividends) = Next Period Dividend/(r – g)

On the one side, real estate investment is a function of inflation rate, while on the other side, inflation rate is a function of real estate investment. This is expressed as:

$$RER_t = f\,(Infl_t) \qquad (1)$$

$$Infl_t = g\,(RER_t) \qquad (2)$$

Where; RER_t is real estate investment in period t, $Inflt$ is actual inflation rate in period t, g and f represent the function

The Empirical Model Estimation

The following equation shows that inflation rate granger causes investment in real estate,

$$RER_t = \beta_0 + \sum_{i=1}^{p} \beta_i RER_{t-i} + \sum_{i=0}^{p} \alpha_i Infl_{t-i} + \mu_{1t} \qquad (3)$$

Again, investment in real estate granger causes inflation rates thus expressed as follows;

$$Infl_t = \Upsilon_0 + \sum_{i=1}^{q} \Upsilon_i Infl_{t-i} + \sum_{i=0}^{q} \Phi \mathrm{i} RER_{t-i} + \mu_{2t} \qquad (4)$$

In analyzing data, the study has employed KPSS test which helps the researcher to identify whether to go with stationary process or non-stationary process. The quantitative analyses therefore, carried out in three different phases. First, the stationarity of the time series were investigated through unit root tests in order to determine whether the time series are stationary or non-stationary. The results obtained from these tests enabled the second phase, i.e. the causality tests. Lastly, the estimation of variables is done with the aid of VAR system.

Diagnostic Tests

Since the model has turned out to be linear, it is then taken to be normally distributed with a mean of zero at all values of RER and a constant variance hence termed as stationary.

Stationarity tests

Stationary time series is one whose statistical properties such as mean, variance, autocorrelation, among others are all constant over time. Trend stationarity will be established since it helps in the choice of the model to be used and therefore, will enable the researcher to detect the existence or non-existence of unit roots.

Testing of the Hypotheses

Regression coefficients were determined by use of t-test statistics and the significance tests carried at 95% confidence level at 5% level of significance.

The statements for hypotheses are:

H_o: $\beta_1=\beta_2=\beta_3=\ldots\beta_k=0$

$H_o=\beta_j=0$ for at least one j.

Specification and Measurement of Variables

Inflation rate

Inflation is defined as a sustained increase in the general level of prices of goods and services in an economy over a given period. When the general price level rises, each unit of currency buys fewer goods and services; consequently, inflation reflects a reduction in purchasing power per unit of money. While other studies estimate inflation rates in terms of expected inflation, this study employs Roache and Atties' 2009 model of using actual inflation rates based on CPI year-on-year (the annualized percentage in a general price index, usually the consumer price index over time) at 2009 constant prices.

Real Estate Investment

Real estate is one of the leading sectors in contribution to GDP and therefore, one of the most preferred investment by investors. Unlike other studies which split real estate returns into commercial, residential and industrial departments, this study seeks to emphasize on percentage real estate contribution to GDP (real estate growth rate).

Table 1: Data sources (1985-2018)

Variable	Data sources
Real Estate Investment Growth Rate (contribution towards GDP)	Kenya National Bureau of Statistics Economic Survey (1985-2018)
Inflation Rate , CPI	Kenya National Bureau of Statistics Economic Survey (1985-2018)

Results and Discussions

Stationarity Tests

The study has employed Kwiatkowski – Phillips-Schmidt-Shin (KPSS) as a statistical package to examine stationarity tests by performing tests of the null hypotheses of variables against the alternative of a unit root.

Table 2: Stationarity Test for Inflation

Null Hypothesis: Infl is stationary

Exogenous: Constant

Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.233566
Asymptotic critical values*:	1% level	0.739000
	5% level	**0.463000**
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

From Table 2, the value of LM- statistic is given as 0.23 while asymptotic critical value at 1% level is 0.73. At 5% the level is 0.46 and at 10% it is 0.34. It is therefore, observed that LM statistic value (0.23) is less than the asymptotic critical value (0.46) at 95% level of confidence. The null hypothesis (**H_0**: Infl is stationary) cannot to be rejected. The alternative hypothesis (**H_1**: Infl is not stationary) is rejected, thus terming the variable as stationary.

Table 3: Stationarity Test for Real Estate

Null Hypothesis: RER is stationary

Exogenous: Constant

Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.312960
Asymptotic critical values*:	1% level	0.739000
	5% level	**0.463000**
	10% level	0.347000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

In examining the stationarity test in the real estate variable, it is observed that RER is stationary at 95% level of confidence. This means that the null hypothesis (**H_0**: RER is stationary) cannot be rejected while the alternative hypothesis is rejected (**H_1**: RER is not stationary).

The results have been supported by the fact that LM-Statistic (0.31) is less than the critical value (0.46) at the 5% level of significance. After establishing that the two variables are stationary at levels, performed Lag Selection Criteria are then performed to determine the number of lags to be included.

Lag Selection Criteria

Table 4: VAR Lag Order Selection Criteria

Endogenous variables: Infl RER

Exogenous variables: C

Sample: 1985 2018

Included observations: 24

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-125.8159	NA	144.8453	10.65132	10.74949	10.67737
1	-104.5069	37.29075*	34.32184*	9.208907	**9.503421***	9.287042*
2	-103.8898	0.977033	45.94495	9.490818	9.981673	9.621042
3	-98.36042	7.833305	41.36749	9.363368	10.05057	9.545682
4	-92.91200	6.810529	38.23789	9.242666	10.12621	9.477070

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

In lag selection, the study tested a number of lags in order to determine the most significant number of lags to be used in regression. It is found that, the lags indicated by an asterisk (*) were the ones which are used as the maximum lag length. The study has, therefore, employed **SC** in lag selection because of its capabilities of comparing the efficiencies of different models at predicting outcomes compared to other criteria.

Granger Causality

Table 5: Causality Test

Pairwise Granger Causality Tests

Sample: 1985 2018

Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
RER does not Granger Cause Infl	33	10.6887	0.0027
Infl does not Granger Cause RER		1.64047	0.2101

The probability level at which H_0 being rejected is 0.27% which is less than 5% thus suggesting that real estate investment Granger causes inflation rate.

The probability level at which H_0 being rejected is 21% which is greater than 5% thus suggesting insignificant that inflation rates does not Granger cause real estate investment.

Results obtained from Table 4 depict a unidirectional effect in the sense that investment in real estate granger causes inflation rates and therefore, inflation rates, as a variable, is taken as an exogenous variable while real estate investment taken as an endogenous variable. After establishing the direction, VAR estimates are then carried out and results are presented in Table 6 below.

VAR Estimates

Sample (adjusted): 1986 2018
Included observations: 33 after adjustments
Table 6: VAR Estimates

	Infl	p-values
Infl(-1)	0.417083*	
	(0.12595)	
	[3.31141]	0.0025
C	12.63930	
	(2.99182)	
	[4.22462]	0.0002
RER	2.177438*	
	(0.78013)	
	[2.79111]	0.0092
RER(-1)	-3.455276*	
	(0.77900)	
	[-4.43555]	0.0001
R-squared	0.573133	
Adj. R-squared	0.528974	
Schwarz SC	6.817081	

Key

Standard errors **( )**

t-statistics **[ ]**

Significance at 5% *****

The results from the Table 6 are discussed as follows:

Infl on RER& RER$_{-1}$

The probability level at which null hypothesis is being rejected is 0.0092, which is smaller than the critical value of 0.05 at 5% level of significance hence making it an important determinant (0.0092<0.05). The first realization of real estate's GDP contribution is associated with 2.177 increase in current inflation rate, showing an instant impact and a direct relationship on average ceteris paribus, however, it is associated with a 3.455 decrease in the subsequent year's inflation showing an inverse relationship. Equation (5) is also important because it shows that, when RER of this year increases by a unit, inflation rate exhibits instantaneous increases by 2.177, however, when the current RER increases by a unit, inflation rate of the subsequent year decreases by 3.455 units. These results therefore, suggest that real estate investment has hedging characteristics towards inflation rates and therefore, consistent with Adriang, etl (2004), Arnasson & Parsson (2012), Roula (2011).

The results obtained are also consistent with the underlying theory of Gordon growth model in the sense that, real estate can be considered a perfect hedge against inflation, under the strong assumption that future rent growth and discount rates move in line with expected and actual inflation rates.

It is also found that, in terms of coefficient of determination, the adjusted R squared (0.529), which compares the explanatory power of regression models that contain different number of predictors, indicated that 52.9% of the variation in real estate investment is explained by an inflation rates which is relatively an average prediction.

The following is a statistical model drawn from Table 6.

$$Infl_t = \gamma_0 + \sum_{i=1}^{q} \gamma_i Infl_{t-i} + \sum_{i=0}^{q} \Phi i RER_{t-i} + \mu_t \quad \text{..... (5)}$$

$$\text{Infl} = 12.639 + 0.417\ \text{Infl}_{-1} + 2.177\ \text{RER} - 3.455\ \text{RER}_{-1} \quad \text{..... (6)}$$

[**4.2**] [**3.3**] [**2.7**] [**-4.4**]

Where,

Infl is inflation rates,

RER represents current real estate investment

RER $_{-1}$ represents previous real estate investment

Equation 5 shows the long-run relationship between real estate and inflation rates and therefore, answering the first objective of comparing long-run impact of inflation on real estate investment. There is a direct relationship between variables thus exhibiting a positive relation.

Summary and conclusions

The results of stationarity tests shows that both inflation rate and real estate investment are stationary at 5% significance level hence showing that the variables are important determinants in the long-run.

From causality tests, it is observed that inflation rates as a variable is influenced by RER, meaning, changes in RER affected inflation rates. The researcher has performed VAR system and found that in the long-run, the current inflation rate exhibits a direct relationship with future inflations rates, meaning, the consistent increase of prices in the current year leads to increased prices in the subsequent years hence instantaneous impact.

The study also finds that, the real estate's GDP contribution has a direct relationship with the current inflation showing an instantaneous impact between the variables. The study concludes that, real estate investment is one of the factors which influences inflation rate in Kenya. The study further concludes that real estate's contribution on GDP has a direct relationship on current inflation rates. This means that, when more houses are built, there is increased construction with increased purchase of raw materials such as cement, ballast, sand among others. As the costs of raw materials go high, they lead to instantaneous cost-push inflation and therefore, increase in inflation rates due to excess pressure from resource utilization. However, the future inflation suggests an inverse relationship meaning, the current real estate investment are unable to predict future inflation rates. Economically, this is true because, investors already invested in RER and therefore, no more purchase of raw materials, rather returns. This will automatically lead to fall in inflation in the long-run thus exhibiting hedging characteristics.

Recommendations

Based on conclusions, the study has recommended that, in order to curb serious future inflation rate in Kenya, real estate investment should be given priority in terms of sectorial development in long-run since RER responded well towards inflation rates in terms of shocks. This is because, as time goes by, real estate's contribution towards GDP will be of paramount importance in economic growth. The paper also recommends that, county governments should adopt the national policy of affordable housing to improve their GDP since, in the long-run.

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