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Testing for bubbles in the commercial real estate rental market in Nairobi, Kenya.

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Testing for Bubbles in the Commercial Real Estate Rental Market in Nairobi, Kenya

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a master's degree by this or any other University. To the best of my knowledge and belief, the dissertation contains no material previously published or written by another person except where due reference is made in the dissertation.

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ABSTRACT

This study tests for a bubble in the commercial rental market in Nairobi by examining the movements of commercial rental prices within Nairobi between Q1 2010 and Q2 2020 and whether they are driven by economic fundamentals. The study sought to construct a commercial rental price index using index numbers with a base period of Q1 2010. This index was used to test the relationship between the movements in price and the selected macroeconomic variables through the use of correlation and regression analysis. The study found strong positive correlation between the commercial rental price index and GDP as well as building cost index while weak negative correlation with lending rates, inflation rates and the Nairobi stock exchange index. The study proceeded to drop lending rate and inflation rate from the model as they were seen to have no linear relationship with the commercial rental price index. The study adopted the Johansen cointegration test as a bubble detection method to test for the existence of a long run relationship between the commercial rental price index and the remaining variables, this was found to be present with GDP and the Nairobi stock exchange index seen as having a negative impact on the commercial rental price index while the building cost index having a positive impact. The existence of a long run relationship between the variables was seen as a rejection of the existence of a bubble within the rental price market. Granger causality test was also used to detect for the existence of a bubble and the results were that two, unidirectional causality existed between the commercial rental price index and GDP as well as with the Nairobi stock exchange index while no causality relationship existed with the building cost index; this was seen as affirmation that a bubble exists. Accordingly, the remaining macroeconomic variables were seen not to precede the commercial rental price index and couldn't therefore be used to predict it. Despite the mixed findings as regards the cointegration and Granger, the study concluded that the movements in the commercial rental price was part of the cyclic behavior of the market and not evidence of the existence of a bubble. The study suggested use of longer study period and development of a more robust index to further test for a bubble.

Key words: commercial rental price index, macroeconomic variables, bubble, Nairobi

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Interpretation of meaning:

“And We had certainly given Luqman wisdom (and said), ‘Be grateful to Allah.’ And whoever is grateful is grateful for (the benefit of) himself. And whoever denies (His favor) – then indeed, Allah is Free of need and Praiseworthy.” (Luqman 31:12)

All Praise is due to Allah taala, Who has blessed me with the opportunity to present this work through the guidance and encouragement from my beloved family, my supervisor, the university through my program coordinators, colleagues, friends, and through the wealth of knowledge accessible online and in books.

CHAPTER ONE

1.1. Introduction

This chapter presented the background of the study as well as the problem statement which the study sought to investigate through the study objectives and questions. Also discussed under this chapter is the scope of the study and its significance to the various players within the market as well as to theory building and academia.

1.2. Background to the Study

Property and real estate are synonymous and according to Hoesli and MacGregor (2000) it comprises of both residential and commercial investment. Commercial real estate can represent offices, retail or industrial property. Investment in commercial real estate is undertaken for the purpose of generating income through leasing or selling of the space to tenants or would be owners.

According to Leszczyński and Olszewski (2015) the price of the property is the discounted rent value which depends on the unique attributes of the property as a commercial property and is strongly differentiated in terms of type, quality and location. This rental value is seen as a key parameter for measuring real property performance as it is a major cost for tenants and an important source of income for the owner. Thus understanding the nature and basic features of rental movements provides a better comprehension of the dynamics of the commercial property market (Boon & Higgins, 2007)

Baum (2011) defined property cycles as the tendency for property demand, supply, prices and returns to fluctuate around their long term trends or averages. Property cycles are often characterized by a surge in prices followed by a fall or crash. The real estate market is said to experience either a boom, steady state or bust regime within the cycle and a bubble is said to occur when these regimes aren't supported by fundamentals (Stiglitz & Stiglitz, 1990).

The price of an asset is said to be driven by the growth in the economy and an oversupply or shortage of office stock creates fluctuations in the rental values in the short term due to the disequilibrium within the market, but when investors want to

pay more than the assets' fundamental value in the future i.e. the fundamental part of the asset price is the present value of future revenue; a bubble is said to exist. As such, Kubicová and Komárek (2011), proceed to define a bubble as an explosive and asymmetric deviation of the market price of an asset from its fundamental value with the possibility of a sudden and significant reverse correction. Understanding that the existence of a bubble can affect the real economy of a country is important to policy makers as bubbles are seen to last longer on average i.e. 4 years than in the case of stock market bubbles which is said to last around 1.5 years.

The real estate sector in Kenya is seen as one of the major four contributors to the economic growth of the country and has over the years been a center of interest for investors with much focus on the capital city of Nairobi for both local and foreign investors. As regards commercial development, Nairobi is said to account for over 60% of the total number of new private non-residential buildings completed in Kenya between 2010 and 2019 as per figures drawn from the Kenya National Bureau of Statistics (KNBS) this compared to the combined number from all other major counties including Mombasa, Kisumu, Nakuru, Eldoret etc.

This development in the commercial real estate sector is reaffirmed by Cytonn Investments in their Nairobi metropolitan area commercial office report 2019, which reported a growth of office space supply between the years 2012 to 2018 at a rate of 23.6% compound annual growth ratio (CAGR) attributing this growth of office space in the capital as being due to its attractiveness of the city as a regional hub with major multinational agencies having their headquarters within it as well as growth of the small and medium sized enterprises.

Considering that supply lags demand due to the length of time it takes for delivery of new office stock and the issue of uptake or acquiring full occupancy within existing buildings, an oversupply of approximately 5.2 Million square feet as at 2019 was reported by Cytonn Investment. This oversupply was further confirmed by Knight Frank Kenya, in their Kenya market update report 2019 noting a slow down within the sector notably from the decline of the overall value of building plans approved as well as cement production and consumption. This slow uptake in office space was

attributed to the decreased demand or low transactions owing to the economic slowdown, decreased credit as well as the interest rate cap which resulting in reduced lending to the sector and downsizing of multinational organizations within Nairobi.

From the reports of the oversupply of office space in Nairobi, it is rational to conclude that prices are expected to have dropped between the years 2012 to 2018 as office rental values in the short run exhibit similar results when there is imbalance in the office market (Chin, 2003). However, according to the reports by Knight Frank Kenya and Cytonn Investments, the market didn't experience any rapid drops in rental values and has basically stagnated/flattened over the past couple of years with projected signs of growth due to perceived market corrections; basically the property cycle steady state regime. The question thus arises, does the current market situation simply imply the general cyclic behavior as price increase and decrease is merited in the short run only or could it imply the creation of a bubble?

1.3. Problem Definition

Given that calculating the fundamental value of a given asset or range of assets has proven difficult as evidenced in the study of the residential bubble by Kibunyi et al., (2017) , office rental values can thus be modeled by using the theoretical demand and supply framework by using a wide range of proxy demand and supply influences and that detection of a bubble can be implied through the relationship between price (with the price index as its normal proxy) and exogenous macroeconomic variables.

According to Mahalik and Mallick, (2011), a variety of demand and supply factors determine real estate prices including population, economic growth, government policy intervention and monetary policy among others. Boon and Higgins, (2007) in their study of the Singapore office market cited studies in European and Pacific Rim regions had strong preference to utilize economic growth, employment rate, unemployment rate as the demand side proxy while available office stock/inventory as the key supply side proxy. Due to the immense number of factors, it is said to be difficult to capture all these in the macro modeling of the real estate prices, hence tendency for research to choose amongst them. As can be noted by the use of GDP, Mortgage rate, Non-food bank credit, exchange rate and the stock price in the study by Mahalik and Mallick, (2011); Zawir et al., (2015) utilized the economic growth,

interest rate, inflation rate, exchange rate, employment; Boon and Higgins, (2007) in their study applied the economic growth, employment and unemployment rate, interest rate as demand side proxy while the floor stock, vacancy rate and construction cost as supply side proxy.

While locally, the relationship between GDP, Diaspora remittances, interest rates, loans to real estate, cost of construction, exchange rates and inflation rate and residential real estate prices have been tested through studies (see e.g. Ouma (2015), Nzalu (2013), Nduti & Wambugu,(2017), Kibunyi et al., (2017) albeit for residential property.

Following on from utilizing the indirect method of evidence of bubbles, studies such as Arshanapalli and Nelson, (2008), Saarinen, (2014), Kibunyi et al., (2017), LUO et al., (2011) , Mahalik and Mallick, (2011) and Berk et al., (2017) all based their research on the unit root test and the cointegration test as these tests were seen to be the most popular tests used in identifying bubbles in the real estate market.

Worth noting is a lack of local studies focusing on the office market as local research mainly focus on the residential market (see e.g. Ouma (2015), Nzalu (2013), Nduti & Wambugu, (2017), Kibunyi et al., (2017), Ungayi, (2019) etc) , preference being noted as due to it being a political matter in any country and that housing problems can easily lead to social conflict especially with the housing deficit reported and the governments initiatives under the Agenda 4 to meet these shortfalls.

In addition to a lack of office centered studies, there exists no index for the commercial rental market neither a body dedicated to the collection of rental data in Kenya. The only existing indices are by Kenya Bankers Association and Hass Consult who publish residential price indices.

This study therefore seeks to analyze the relationship between the commercial rental price and macroeconomic variables so as to establish whether these movements are indicative of a bubble. The study identified GDP and inflation rate as the demand influences while lending rate, cost of construction and the stock price index as the supply influences.

The study further seeks to construct a commercial rental price index for the purpose of monitoring the rental price movements to enable analysis of the market performance.

1.4. Research Objectives

1.4.1. Overall Objective

The overall objective is to establish whether a bubble exists in the commercial rental market in Nairobi.

1.4.2. Specific Objectives

a) To create a commercial rental price index for offices in Nairobi.
b) To determine whether the commercial rental prices are driven by the economic fundamentals.
c) To establish whether the movements in the commercial rental prices is indicative of a bubble.

1.5. Research Questions

a) How is a commercial rental price index created for offices in Nairobi?
b) How are the commercial rental prices driven by economic fundamentals?
c) How are the movements in the commercial rental prices and are they indicative of a bubble?

1.6. Scope of the Study

The study focused on the available quarterly data for a period of 10 years i.e. Q1 2010 to Q2 2020, totaling to 42 quarters for commercial rental prices and of selected macroeconomic variables. The study was limited to Nairobi County due its significance in regards to the commercial real estate market and the considerable number of commercial developments within it. Nairobi is also known for its attractiveness as a regional hub with several multinationals from diverse industries having its head offices located here.

1.7. Significance of the Study

1.7.1. For Policymakers

JLL's city momentum index 2019 of the most dynamic city in the world ranked Nairobi as number 6 up from number 10 in 2018 while EY attractiveness program

2018, recorded a 68% increase in inward investment projects within the country boosting the capitals appeal to both local and international firms and favored by property developers.

The real estate sector being a significant contributor to the economy posits that the sector is of high interest to the country's economy and as such the governments and its agents would benefit from understanding the movements of the commercial rental prices and its effects on the property cycle regimes especially if it is indicative of a bubble, presence of which would then require deflating otherwise the country would inevitably be faced with a similar crisis as that experienced in the United States and other countries.

1.7.2. For the Banking Industry

The fact that changes in asset prices can adversely affect the process of financial intermediation means that asset price fluctuations can have important implications for bank supervisors and for central banks in their role as custodian of the stability of the financial system (Kent & Lowe, 1998). When banks become more exposed due to the number of loans secured by property, this affects the banking sector and the financial markets as a whole.

1.7.3. For Investors/Agents

Commercial property is one of the many forms of investment vehicles that an investor or its agent/s selects for the purpose of income and profit generation. The key is in the identification and selection of commercial properties to achieve investment goals and as such understanding this market as well as its movement's aids in the capture of profit through timely decisions.

1.7.4. For Theory and Academia

As the study seeks to present an analysis of the commercial rental prices in Kenya through the creation of the commercial rental price index for offices in Nairobi and the testing for the existence of a bubble, it shall therefore add to literature.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presented a review and analysis of previous studies on real estate pricing. It commenced with the theories applied in the study of real estate pricing. Also discussed under literature review were the methods of constructing an index as well as methods of detecting a bubble in the property market. While the empirical review which followed discussed the variables that made up the conceptual framework of the study and how the variables were measured.

2.2 Theoretical Approaches

2.2.1 The Economic Theory of Demand and Supply

The concept of demand and supply dates back to the Middle Ages but it was not until the 17th and 18th century that the theory was further developed into a model by economists such as Adam Smith, David Ricardo among others.

In its simplest form, the supply and demand theory postulates that in a free market, the price of a commodity depends on the extent to which it is demanded by consumers and if at a given set of prices, the demand exceeds the available supply then price rises; this increase in price causes the demand to decrease; the inverse holds true. According to Gale (1955), the above prices will eventually regulate themselves to values at which supply and demand exactly balances or achieves equilibrium.

In line with the above, Wheaton (1999) posits that durable goods markets in general and real estate in particular are most often modeled within a stock flow framework, which assumes that the market clears in each period i.e. rents adjust until demand equals the current stock of space. In the long run, the stock adjusts gradually because of lags in delivery of new capital. Capital investment decisions are based on a forecast of asset prices at the time of new space deliveries; thus rent and prices react quickly to change while physical assets do not.

Mueller (2002) stated that many economists consider real estate cycles to be a mirror reflection of the economy. They consider real estate a cyclical industry because its

demand side is affected by economic cycles and supply historically lags demand i.e. too little space stock is available during the times of rapid growth and once development production has geared up, too much supply continues even after demand has slowed.

Charles Kindleberger (as cited in Kibunyi et al., (2017) defined a bubble in line with the demand and supply framework, where he states the occurrence of a bubble as a sharp rise in price of a range of assets in a continuous process with the initial rise generating expectations of further rises and attracting new buyers. This rise is usually followed by a reversal of expectations and a sharp decline in price often resulting in a financial crisis as the price increase or decrease is only merited in the short run. Thus the theoretical demand and supply framework can be used to model these prices as researchers have a preference towards it given the historically stable relationship between real rent levels and demand and supply side influences.

DiPasquale, Wheaton and Riddel (as cited in Mahalik & Mallick, (2011) defined the long run equilibrium stock to be a function of price and a vector of cost shifting variables such as construction cost, land cost and credit availability. While the equilibrium demand for the current stock as a function of price and a set of demand variables such as income, interest rate, population growth, wealth and overseas demand. Thus, the housing price model being referred to as an inverted demand equation can be represented as;

$P_t = f\ (X_{d,\,t},\ X_{s,\,t},\ Z_t)$;

Where $P_{t:}$ price model, $X_{d,t}$: the equilibrium supply, $X_{s,t}$: the equilibrium demand and Z_t : other qualitative variables influencing the property price. This equation is normally depicted in a single linear manner such as that by Chin, (2003), where the equation was used to determine the relationship between economic activity and office rental market using the demand and supply framework based on the interactions of demand and supply.

The interaction between the two opposing considerations is said to settle at an equilibrium price which is the price that marginal utility of the tenant matches that of the marginal cost of the landlord (Njiru, 2003).

Despite the widespread adoption of this theory, critics of the theory posit that due to the circular concept of the theory, one can't draw conclusions as to the underlying reason for the change in price. While others state that the theory fails to explain the prevalence of administered prices as set by the owners of the commodities/seller as opposed to the price set through market forces.

This research adopts this framework for its analysis.

2.2.2 The Efficient Market Theory/Hypothesis (EMH)

This hypothesis dates back to the 1900 and is credited to the pioneering work of Louis Bachelier. However, the theory only became popular between the 1950s and 1960s with notable empirical work from Eugene Fama in 1970.

The theory is concerned with whether prices at any point in time 'fully reflect' all available information at all times and thus an investor is said to immediately recognize if the price of an asset is too high (or too low) and thus responds by selling (or buying) the asset until the over (or under) pricing is eliminated; the theory thus denying possibility of the existence of a bubble. (Fama, (1970) ; Arshanapalli & Nelson, (2008). Market conditions that suffice for its efficiency include no transaction costs for trading, all information available to all at no costs and investors agree on the implications of this information on the market. However as Fama, (1970) states, they are not necessary, as in practice no market meets these conditions.

According to Arshanapalli & Nelson, (2008), the EMH assumes that investors can sell an asset short to eliminate overpricing but real estate is an illiquid asset notwithstanding the existence of the futures market/ real estate investment trusts (REITs); as these markets don't function well enough to fulfill the assumption of the EMH.

Criticism of the theory include behavioral economists who attribute market imperfections to a combination of cognitive biases and other human errs of reasoning and information processing (Shiller, 2002). The claim by proponents of the EMH that an actual investor will converge with an average investor given enough time, that no investor will beat the market average and that in the case of an investor

beating the said market they attributed it to luck, further draws criticism because in practice some firms have outperformed markets in the long run.

2.3 Empirical Review

2.3.1 Construction of a commercial rental price index

Academic research on price index construction can be traced back to half a century with work on commercial property index construction primarily confined to the United States due to its market maturity though other countries across the globe have also partaken into indices construction (An et al., 2016).

Types of index methodologies include the appraisal/valuation based method and the transaction based method (see e.g. Ahmad, Daud, & Esha, (2014), An et al., (2016) and Omikunle, (2011). The appraisal approach is common due to the nature of property and its infrequent sales. Although this approach tends to show less volatility to market shocks, it has a number of technical difficulties including appraisal smoothing and lagging i.e. its inability to depict real time true market volatility.

According to Ahmad, Daud and Esha (2014), the transaction approach is divided into the repeat sales approach, the hedonic pricing and the hybrid model approach; the latter being a combination of the two. The repeat sales approach is where transaction prices of the same property are observed from two periods with the assumption that the property quality remains constant irrespective of time. This approach is often applied to residential property as transactions are frequent and many.

The hedonic price approach has been developed for more than 70 years and uses the transaction price as a function of the characteristic/attribute of the property such as age, location, floor space, quality etc. It uses regression techniques to control for the compositional and quality change with its key advantage being that it provides direct estimates of pure price change. The drawback of the hedonic pricing model approach is that the use of regression techniques implies that the model is as good as the attributes used to derive them and this is as a result of the quality of data available for use (Ahmad et al., 2014).

Unlike selling price, rental data has the advantage of the availability of rent amounts in consecutive quarters for a large cross sectional sample of properties. Thus, unlike

the less frequently transacted residential and commercial property price data, to create an index doesn't require the repeat sales approach that most residential indices utilize and according to An et al., (2016), one would be avoiding the restrictive assumption this approach has.

An et al. (2016) in their research utilized rental data from the National Council of Real Estate Investment Fiduciaries (NCREIF) over the local rent information collected by brokers through survey, noting that the data was potentially more representative in terms of property coverage and more consistent in data reporting. Other researchers have borrowed rental data from sources such as the Reserve Bank of India, the Rating and Valuation Department of Hong Kong, the Korea Chamber of Commerce Industries and the National institute of Statistics of Portugal (see e.g. Mahalik & Mallick, (2011), Lan, (2019), Kim, (2011) and Meira & Costa,(2019). Also important to note is that, in addition to these sources some of these studies also utilized data from real estate companies.

Given the availability of the rent time series, Kim, (2011) constructed the Seoul rent index from the constant value of quarterly rents based on 100 in Q1 2010. An et al., (2016), stated that an easy to construct rental index is the cross sectional average but due to the issue of constant quality problem utilized the panel data methodology. In their journal article of 'How should commercial real estate be priced', Linneman and Rubenstein, (2008), stated that pricing of real estate is based on the presence of market alternatives, property and tenant profiles, liquidity and cash flow growth expectations and thus can be inferred that the asking rental price is an aggregate of all the above.

Locally though, it is important to note that Kenya Bankers Association and Hass Consult publish residential price indices with the former using the hedonic approach and the latter using the mix adjusted averaging approach. As can be noted, there exists no index for the commercial rental market neither a body dedicated to the collection of rental data outside these two.

2.3.2 The interaction between the real estate price index and economic fundamentals

According to Mahalik and Mallick, (2011), a variety of demand and supply factors determine real estate prices including population, economic growth, government policy intervention and monetary policy among others. Due to the immense number of factors, it is said to be difficult to capture all these in the macro modeling of the real estate prices, hence tendency for research to choose amongst them. In their research which was based on a study period between Q1 1996 to Q1 2007, the macro economic variables used were GDP, Mortgage rate, Non-food bank credit, exchange rate and the stock price. The study found that income positively influenced real estate prices while credit adversely affected it and that the shocks in the non food bank credit significantly affected the variability of price and thus should not be underestimated.

Zawir et al., (2015) in their study of the rental rates and selling prices of office space in Jakarta, attributed the demand factors to the macroeconomic variables which included GDP, interest rate, employment, unemployment, inflation rate, income, population, taxation while the supply factors were attributed to the microeconomic variables which included vacancy rates, office space/stock inventory, absorption rate, occupancy rate, cost of construction, physical characteristics among others. The study focused on the economic growth, interest rate, inflation rate, exchange rate, employment as determining factors affecting the rental rate. The study results showed that there was a long term relationship between the macroeconomic factors and the rental rates. While the study by Udoekanem et al. (2014) of the commercial property market in Minna, Nigeria, found that the economic growth and vacancy rate were the major determinants of rental growth. The study further used the rental index to establish the trend of rental rates and found out that there was a progressive upward movement in rental values within the study period of 2001 to 2012.

Boon and Higgins, (2007) in their study of the Singapore office market cited studies in European and Pacific Rim regions had strong preference to utilize economic growth, employment rate, unemployment rate as the demand side proxy while available office stock/inventory as the key supply side proxy. The study further cited that the United States preferred the use of the vacancy rate as the supply side proxy.

The study applied the economic growth, employment and unemployment rate, interest rate as demand side proxy while the floor stock, vacancy rate and construction cost as supply side proxy. The study identified the vacancy rate, employment, lending rate and construction cost as the key determinants in explaining the variation in office rents in the Central Region of Singapore.

The relationship between GDP, Diaspora remittances, interest rates, loans to real estate, cost of construction, exchange rates and inflation rate and residential real estate prices have been tested locally through studies (see e.g. Ouma (2015), Nzalu (2013), Nduti & Wambugu,(2017), Kibunyi et al., (2017). The results having similar findings in relation to GDP, Diaspora remittances, interest rates, loans to construction, cost of construction having strong positive relationships with residential real estate prices while the study by Kibunyi et al. (2017) showing a weak negative relationship of house prices and inflation rate which is contrary to several studies such as that of Debelle (as cited in Nzalu, 2013) where inflation is noted to account for more than half of the total variations in house prices with impact larger in the short run than in the long run. This result is similar to that of Bioreri (2015), whose findings show that inflation rate had a great positive relationship towards house prices.

It can therefore be deduced that a variety of demand and supply factors have shown an underlying relationship (positive and negative) with real estate prices with researchers opting for various mix of the variables in their studies with minor dissimilarities in a few of them, this owing to the difficulty in capturing the host of factors.

2.3.3 Methods of detecting a bubble

Stiglitz (1990) posit that if the reason that the price is high today is only because investors believe that the price will be high tomorrow when fundamental factors do not seem to justify such a price, then a bubble is said to exist. At least in the short run, the high price of the property is merited because it yields a return equal to that of an alternative asset.

Kubicová and Komárek (2011) assert that although the theoretical approach of asset price composition arising from fundamental factors and those components affected by non fundamental factors seem straightforward, empirical application is difficult as observing and measuring them is more complicated and requires estimation.

Berk, Biçen and Seyidova (2017) cited that some researchers advocate that bubbles can be identified in advance while others suggested that measures can be taken before they become more dangerous, however others altogether stated that bubbles cannot be detected and recommend that measures could be undertaken to reduce the effects once they explode.

According to Kubicová and Komárek (2011), the basic techniques for identifying bubbles from the field of indirect tests can be grouped into three. The first is that of trend curves, statistical filters and price ratios; which compares the time series trend with actual development to give an idea of the degree of misalignment and existence of asset price bubbles. The drawback of this approach is that it requires long historical time series which aren't always available. Examples of these tests include univariate filters like the Hodrick-Prescott (HP) filters and the Band-Pass (BP) filter that are used to calculate the trend. The study by Kurniawan (2017), utilized the HP filter in 5 major cities in Indonesia between 2006 and 2014, finding a bubble in every city lasting for 2 periods.

The second group is the empirical methods and models which includes the variance bound tests, stationarity and cointegration test and regime switching models (Vishwakarma & Paskelian, 2012). The variance bound tests find difficulty in identifying the appropriate fundamental while the stationarity and co-integration tests observe the order of integration of the time series and whether there is an explosive element in the asset price time series. If the growth rate of the price is not more explosive than the key fundamentals, a bubble isn't present. However, these tests tend to reject the presence of bubbles too often and are not sufficient to test for non linear behavior especially in the case of periodically collapsing bubbles. These tests are however the most popular tests used to identify bubbles in the real estate market (see e.g. Arshanapalli & Nelson, (2008), Saarinen, (2014), Kibunyi et al., (2017),

LUO et al., (2011) , Mahalik & Mallick, (2011) and Berk et al., (2017)) who all based their research on the unit root test and the cointegration test.

Berk et al., (2017) applied the Johansen co-integration test and thereafter the Granger causality test for analyzing the direction of causation between variables. The findings were that a real estate bubble existed where the asset price increases were not sustainable in some regions of Turkey with no likelihood of bursting despite the bubble existence. The coupling of cointegration tests and Granger causality can be seen in other similar studies such as LUO et al., (2011) where the study found a long run relationship between the house prices and the macroeconomic variables in all 3 observational periods but the results of the Granger causality were unstable. While the study by Kibunyi et al., (2017) found that the results of the cointegration tests were indifferent as regards the existence of a bubble while the Granger causality negated its existence.

It is important to note that Granger causality test measures precedence and information content and doesn't in itself indicate causality i.e. does the past values of one variable assist in predicting present values of another variable over and above the variable's past values alone. Therefore, one would expect that if the variables are cointegrated i.e. they have a long run relationship, it would imply casuality. Results from studies such as that of Kibunyi et al., (2017) cite that there existed a bidirectional causality between house prices and GDP, Building cost index and NSE index and no causality between house prices and Diaspora remittances. The study by LUO et al., (2011) however found that there was no causality between house prices and the 4 variables; mortgage rate, population, unemployment rate and weekly earnings, between September 1988 to December 1996 but the variables Granger caused house prices between March 1996 and June 2005. While the study by Ungayi, (2019) found no causal relationship between the variables; GDP, Lending rate, exchange rate, Diaspora remittances, cost of construction, real estate investment, and house prices.

The regime switching method on the other hand, tests for presence of bubbles with changes in regimes and analyze the price process properties in out-of-line bubble regimes (Vishwakarma & Paskelian, 2012);their paper found that using the conventional techniques provided no conclusive evidence of a bubble in the Indian real estate market while the regime switching method found conclusive evidence of presence of a bubble within their study period of 2007 and 2011.

Specification tests can also be used to test for a bubble, where the basic idea is that they compare estimates for discount factors that are taken from differently defined formulations of forward looking asset price models and subsequent performance of a specification test.

Worth noting is that Gurkayak (as cited by LUO et al., (2011), stated in the conclusion of his empirical study that for every test that finds a bubble, there is another that disputes it and points out the we are still unable to distinguish bubbles from time varying or regime switching fundamentals. One possible explanation of the heterogeneity of the results of empirical testing could be based on inadequately specified models or the tests limiting power. Another explanation is in line with the critics of the efficient market theory i.e. the behavioral finance proponents who put forth that evaluation of a bubble is through knowledge of price determinants and expert judgment (LUO et al., 2011).

2.4 Research Gap

Despite the immense amount of literature on the construction of commercial rental price indices (see e.g. Ahmad, Daud, & Esha, (2014), An et al., (2016) and Omikunle, (2011) and the various sources of commercial indices where researchers have borrowed rental data such as the National Council of Real Estate Investment Fiduciaries (NCREIF), the Reserve Bank of India, the Rating and Valuation Department of Hong Kong, the Korea Chamber of Commerce Industries and the National institute of Statistics of Portugal (see e.g. An et al. (2016) , Mahalik & Mallick, (2011), Lan, (2019), Kim, (2011) and Meira & Costa,(2019); locally only two known sources for price indices exist i.e. Kenya Bankers Association and Hass Consult who publish residential price indices and not commercial. As can be noted,

there exists no index for the commercial rental market neither a body dedicated to the collection of rental data outside these two in the country and as such this research seeks to fill in this gap by constructing a commercial rental price index for Nairobi which will be a first of its kind.

Studies like that of Mahalik and Mallick, (2011) utilized variables such as GDP, Mortgage rate, Non-food bank credit, exchange rate and the stock price; Zawir et al., (2015) utilizing the economic growth, interest rate, inflation rate, exchange rate, employment and Boon and Higgins, (2007) utilizing the economic growth, employment and unemployment rate, interest rate as demand side proxy while the floor stock, vacancy rate and construction cost as supply side proxy. Locally, the relationship between GDP, Diaspora remittances, interest rates, loans to real estate, cost of construction, exchange rates and inflation rate and residential real estate prices have been tested through studies (see e.g. Ouma (2015), Nzalu (2013), Nduti & Wambugu,(2017), Kibunyi et al., (2017) albeit for residential property. The lack of studies focusing on the office market within the country and specifically Nairobi is the focus of this study which has indentified GDP and inflation rate as the demand influences while lending rate, cost of construction and the stock price index as the supply influences.

As stated earlier in regards to the difficulty in obtaining the fundamental value of assets and as such evidence of a bubble, researchers have opted for the indirect methods of evidence of bubbles including studies such as Arshanapalli and Nelson, (2008), Saarinen, (2014), Kibunyi et al., (2017), LUO et al., (2011) , Mahalik and Mallick, (2011) and Berk et al., (2017) who all based their research on the unit root test and the cointegration test. Some studies adopted the Granger causality test as a subsequent test to the indirect tests such as cointegration (see e.g. Kibunyi et al., (2017), LUO et al., (2011) and Ungayi, (2019) while few studies such Kurniawan (2017) utilized the HP filter test and Vishwakarma and Paskelian, (2012) utilized the regime switching method. Due to the lack of bubble detection studies on the commercial rental price market locally, the study identified the unit root test, the cointegration test and the granger causality test as its detection strategy.

2.5 Conceptual Framework

The figure below represented the framework for this research.

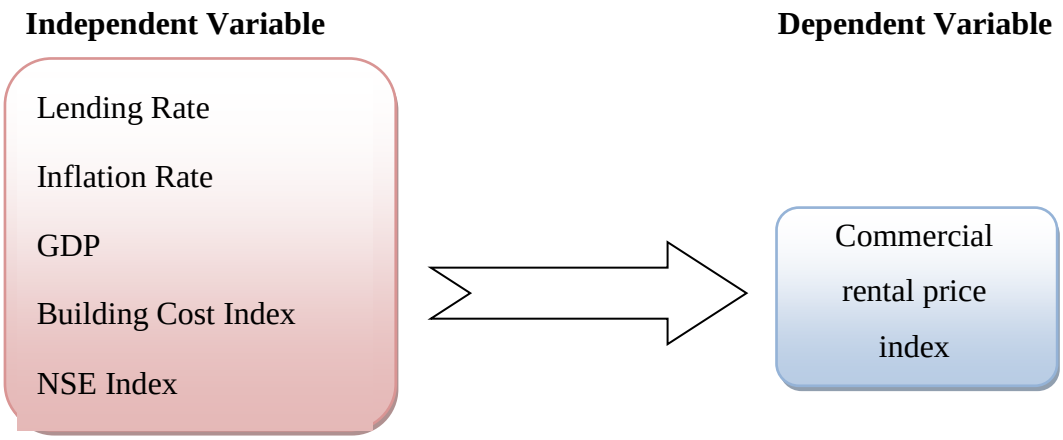

Figure 1: Conceptual Framework

Source: Author (2021)

2.6 Operationalization of variables

Variable	Name	Description	Indicator	Impact on Price
Dependent	CPINDEX	Commercial rental price index for all office buildings within Nairobi County.	Quarterly asking rental prices collected by author. Index numbers approach to construction of index with Q1 2010 = 100	
Independent				
Demand Factors	INFRATE	Inflation rate; level of increase in prices of goods and services over time.	Quarterly data sourced from the Kenya National Bureau of Statistics (KNBS) Measured in percentages (Feb 2009 = 100)	Negative
	GDP	Gross Domestic Product; measure of the economic health of a	Quarterly data sourced from the Kenya National Bureau of	Positive

		country.	Statistics (KNBS) Measured in Millions of Kshs. (Q1 2014 = 100 ; rebasing)	
Supply Factors	LENDRATES	Interest rates; cost of borrowed funds.	Monthly commercial banks weighted average interest rates sourced from Central Bank of Kenya (CBK) and converted to Quarterly data. Measured in percentages	Positive
	BCINDEX	Non residential Building cost index; represents the cost of materials and labour. Proxy for the cost of construction	Quarterly data sourced from the Kenya National Bureau of Statistics (KNBS) Measured in Kshs./square meter (1972 = 100)	Positive
	NSEINDEX	Nairobi stock exchange 20 share index; performance of the stock exchange as a substitute to real estate investment.	Quarterly data sourced from the Kenya National Bureau of Statistics (KNBS) With a base year 1966 = 100	Positive

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research philosophy that was adopted in carrying out this study, as well as the overall research design. It summarizes the description of the various data collection procedures adopted and the data analysis approach used. The research quality aspects and ethical considerations are also highlighted.

3.2 Research Philosophy

Research philosophy refers to a system of beliefs and assumptions about the development of knowledge which help underpin the researchers' methodological choice, research strategy, data collection techniques and the analysis procedures to be used (Saunders et al., 2015). As such the research philosophy adopted for the research was that of positivism where use of existing theory was adopted to develop the study hypotheses which would confirm, in part or whole, or refutes it. The term positivist, according to Saunders et al.,(2015), refers to the importance of what is posited or given from the strictly scientific empiricist method adopted to yielding facts.

3.3 Research Design

Research design is the general plan of how one shall go about answering the research questions(Saunders et al., 2015). The research design adopted for this study was the quantitative research design as the study examined the relationship between the commercial rental price index and the macroeconomic variables; the variables being numerical in nature.

The nature of the research is explanatory (Saunders et al., 2015), as the essence here was to determine the relationship between the dependent variable and independent variables and to further establish a causal relationship between them within the 42 observational periods of the study i.e. between Q1 2010 to Q2 2020 within Nairobi. The study was thus longitudinal in nature as it utilized 42 quarterly observations of the various time series data for the variables.

The study adopted the archival and documentary research strategy in obtaining the various data sets that were subjected to econometric analysis, the findings of which are discussed in subsequent chapters.

3.4 Population and Sampling

As regards the first objective on the construction of a commercial rental price index, the study utilized a total sample size of 151 commercial properties/office buildings across Nairobi County for which the author could adequately assess time series data for 42 quarters for the study period of Q1 2010 to Q2 2020. This was based on the difficulty in acquiring historical rental data, which from the research literature was attributed to the maturity of the real estate industry and lack of institutions either public or private that dedicate in the collection of commercial rental data that are more representative in terms of property coverage and more consistent in data reporting standards (An et al., 2016). Time series data was gathered for the macroeconomic variables for a total of 42 quarters i.e. between Q12010 to Q22020. This data was utilized in testing for the interaction between them and the commercial rental price index.

3.5 Data Collection Methods

Secondary data for the construction of the commercial rental price index was collected from developer/owners published offerings, fact sheets from property agents, print and electronic advertisements, developer/owner and agent websites as well as other property listings platforms. While secondary data for the macroeconomic variables i.e. the lending rates, inflation rates, GDP, Building cost index and NSE index were collected from published databases by the Central Bank of Kenya (CBK) and the Kenya National Bureau of Statistics (KNBS) for the 10 year study period.

3.6 Data Analysis

Secondary data for the construction of the commercial rental index was triangulated i.e. the author used various sources of individual historical rental data where possible to ensure quality. The quarterly asking rental data for each property was collected and the index was thereafter constructing using the index numbers formula with a

base year of Q1 2010 = 100 using Excel. The second and third objective of the study was evaluated using Eviews 12 software.

The single equation model for the analysis of the commercial rental market based on the demand and supply framework was adopted and can be represented in a linear equation form as represented below;

CPINDEX =

$ß_0+ß_1$LENDRATES$+ß_2$INFRATE$+ß_3$GDP$+ß_4$BCINDEX$+ß_5$NSEINDEX **(1)**

Where:

CPINDEX = Commercial rental price index

LENDRATES = Lending rates

INFRATE = Inflation rate

GDP = Gross Domestic Product

BCINDEX = Building cost index

NSEINDEX = Nairobi Stock Exchange Index

$ß_0$ = Constant Term

$ß_{1-5}$ = Beta Coefficients

The following table summarizes the statistical tests that the time series data sets were subjected to;

3.6.2 Data Analysis Techniques

Test	Purpose	Decision Criterion/Hypothesis
Pearsons' Correlation	Assess strength of the relationship between the CPINDEX and macroeconomic variables.	If coefficient = 0 then the variables are perfectly independent. Positive values indicate positive correlation with stronger association to figures towards 1 and vice versa.
Regression	Establish linear relationship between variables. See equation	Reject the null hypothesis that there is no linear relationship when p-value returned is less than the 10% and 5% significance

	(1)	levels. The least model criterion returned advised the model specification for the unit root testing. If the Durbin Watson statistic is greater than 2, a serial correlation exists. This was important in unit root testing.
Unit Root (Stationarity)	Tests whether a time series variable is non stationary and possesses a unit root. This test was a prerequisite for testing for cointegration.	Use of the Phillips Perron unit root test was adopted as it took care of the serial correlation issue detected in the regression analysis. The Augmented Dickey Fuller test was used for comparison. Depending on the nature of the time series, one would select between no constant and trend, constant only and constant and trend options. This can be observed from the individual scatter plots and previous research. No lag selection is necessary H_0 = There is unit root (series is non stationary) H_1 = There is no unit root. If the test statistic is greater than critical value and significance returned is less than 5% reject the null hypothesis.
Johansen Cointegration	Tests for more than one cointegrating equation.	H_0 – there is no co-integrating equation among variables.

	Presence of cointegrating equation confirms a long run relationship between the variables and rejects existence of a bubble. Presence of cointegration between the time series data sets implies presence of Granger causality at least unidirectional. The possible number of cointegrating equations is equivalent to the number of variables being tested less 1.	H_{n-1}– there is at least 1,2,3 …n co-integrating equations among the n-1 number of variables Reject if trace statistic and the max-eigen value is greater than the critical value (c.v) The signs of coefficients of the normalized cointegrating equation are to be reversed when writing out the linear equation.
Granger Causality	Measures precedence not causality since the test is used to inform whether the past values of one variable can be used in the prediction of another over and above its own past values.	Null x ⟶ y represented x doesn't granger cause y. Reject if p-value is not greater than 5%

3.7 Research Quality

3.7.1 Reliability

According to Saunders et al., (2015), reliability refers to replication and consistency i.e. if another researcher uses the same methods would the results produced be consistent? This was achieved through the transparent manner in which the research was conducted; from the point of data collection (see appendices) to the various test specifications applied in the study, would allow other researches to judge and replicate this research. This was also achieved through use of published national data for the macroeconomic variables, the use of triangulation in assessing the historical rental data for the index creation and use of the time reversal test for the index adequacy.

3.7.2 Validity

Validity refers to the appropriateness of the measures used, accuracy of the analysis of the results and the generalisability of the findings (Saunders et al., 2015). This was achieved through ensuring that the operationalization of the variables was informed through the review of the literature and was grounded on the theory of demand and supply. The spectrum of statistical tests adopted allowed for result confirmation such as carrying out two tests for the unit root and proceeding to test for a bubble using the Johansen cointegration and the Granger causality tests.

3.8 Ethical Considerations

Secondary data collected for the time series data sets were obtained from publicly available information such as the websites and publications of Kenya National Bureau of Statistics and Central Bank of Kenya among others, these sources were cited where necessary in the research.

Ethical clearance for the research was obtained from Strathmore University ethics board and a study permit from the National Commission for Science, Technology and Innovation (NACOSTI); both included in the appendices section.

CHAPTER FOUR

PRESENTATION OF RESEARCH FINDINGS

4.1 Introduction

This chapter presents the findings of the study in accordance to the data analysis techniques. The chapter presents the formulation of the commercial property price index. The chapter also presents the Pearson correlation tests, Phillip Perron (PP) unit root tests, the Johansen cointegration test and finally the Granger causality test. The interpretation of the various findings is also presented.

4.2 The Data

4.2.1 Commercial Rental Price Index (CPINDEX) Creation

Data for the index was collected on a quarterly basis for the period between Q1 2010 to Q2 2020 for a total of 151 commercial properties from across Nairobi County. The nature of the data collected was that of asking rents as advertised by developers and/or its agents. This data was collected through fact sheets of agents, both print and electronic advertisement, developers and agents websites among other.

A total of 42 observations across the 151 properties were converted to index numbers using a base period of Q12010 to create the price index where;

$$\text{Index number at time t} = \left[\frac{\text{Time series value at time t}}{\text{Time series value at base period}} \right] 100$$

Shown below was a representation of a sample index formulation calculation;

$$\text{Price Index at Q4 2011} = \frac{83.29}{86.07} \times 100 = 96.77$$

The time reversal test was employed to test for the soundness of the index, the formula used was $P_{01} \times P_{10} = 1$. Where P_{01} represented the index number for period 1 and base period of 0 while P_{10} represented the index number for period 0 and base period of 1.

The index for commercial property price was found to satisfy the above test.

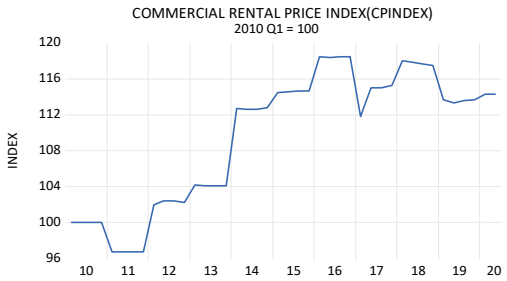

Figure 2: Rental Index

Source: Author (2021)

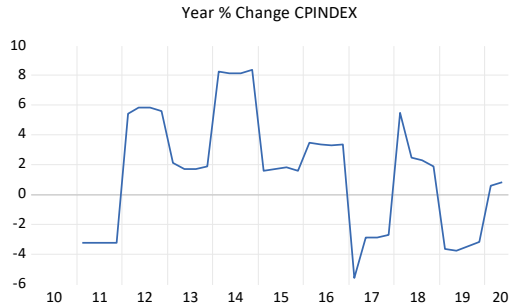

Figure 3: Annual % Change

Source: Author (2021)

According to the figures represented above, 2014 recorded the highest positive annual rental change of 8.3% while 2017 recorded the highest negative annual rental change of 5.6%. This was found to be in line with the commercial office reports from institutions such as real estate agents and project managements firms that attributed this rise to the increase in economic growth as well as growth in various sectors including banking and insurance while the decline was seen as attributable to the uncertainties of the general election as well as the evident oversupply of office space in the market and the downsizing of multinational corporations in the regional hub.

4.2.2 Macroeconomic variables

Data for lending rates was collected monthly and converted to quarterly data while those for GDP, inflation rate, building cost index and nse index was collected on a quarterly basis.

4.3 Interactions between Commercial Rental Price Index and Macroeconomic Variables.

The interactions between commercial property price and market fundamentals were examined through Pearson's correlation test and regression analysis. The results for the Pearson's correlation test were as reported in the table below.

Table 4.3.1 Correlations: CPINDEX, LENDRATES, INFRATE, GDP, BCINDEX, NSE INDEX

	CPINDEX	LENDRATES	INFRATE	GDP	BCINDEX	NSEINDEX
CPINDEX	1.000					
LENDRATES	-0.312	1.000				
	0.044					
INFRATE	-0.392	0.306	1.000			
	0.010	0.049				
GDP	0.753	-0.609	-0.182	1.000		
	0.000	0.000	0.250			
BCINDEX	0.893	-0.521	-0.302	0.943	1.000	
	0.000	0.000	0.052	0.000		
NSE INDEX	-0.253	0.517	-0.113	-0.674	-0.556	1.000
	0.106	0.000	0.475	0.000	0.000	

Cell contents: Pearson's Correlation
P-value

The study found there was a strong positive relationship between commercial rental price index and GDP as well as Building cost index which returned a correlation coefficient of 0.753 and 0.893 respectively. The study found there was a weak negative relationship between commercial rental price index and lending rates, inflation rates and nse index which returned a correlation coefficient of -0.312, -0.392 and - 0.253 respectively. The p-values returned for GDP, building cost index and lending rates indicates significance at the 5% level. While the p-value returned for inflation rate indicated significance at the 1% level. The p-value returned for the NSE index indicated no significance at the 10%, 5% or 1% levels.

The values returned was not seen to indicate presence of real estate bubble as GDP, BCINDEX and INFRATE were seen to follow the expected general trend i.e. positive relationship between price and GDP/BCINDEX while negative relationship between price and INFRATE. One anomaly was LENDRATES which was expected

to have a positive relationship but returned a weak negative which was significant, while NSEINDEX which was expected to return a positive but returned a weak negative but was not significant.

The study further utilized regression analysis to further test the relationship between commercial price index and the macroeconomic variables. The results are as reported in the table below.

Table 4.3.2 Regression Analysis: CPINDEX VERSES LENDRATES, INFRATE, GDP, BCINDEX and NSE INDEX

PREDICTOR	COEF.	STD. ERROR	T. STAT.	PROB.
CONSTANT	47.81496	7.039	6.79	0.000
LENDRATES	0.27015	0.2329	1.16	0.254
INFRATE	-0.07203	0.1327	-0.54	0.591
GDP	-0.0000178	0.00000963	-1.85	0.073
BCINDEX	0.008599	0.001106	7.77	0.000
NSE INDEX	0.0019333	0.000653	2.96	0.005

R-Sq = 90.44% R-Sq (adj) = 89.11% F- Statistic = 68.12451
Prob. (F- Statistic) = 0.0000

Akaike Info Criterion (AIC) = 4.768084 Schwarz Criterion (SIC) = 5.016323

Hannan-Quinn Criterion (HQC) = 4.859073 Durbin – Watson Statistic = 0.887972

From the results of the regression analysis reported above, it was noted that Inflation rates and GDP seem to negatively affect commercial rental price index. However, the coefficient returned for GDP of -0.0000178 is very low thus giving an indication that the magnitude is also low. The returned p-value of 0.073 indicates significance at the 10% level. On the other hand, inflation rates returned a coefficient of -0.07203 but it returned a p-value of 0.591 indicating no significance at either the 5% or 10% level and hence dropped.

Lending rates returned a positive coefficient of 0.27015 but its p-value returned of 0.254 was found not significant at the 5% or 10% level and also dropped.

Building cost index and NSE index both also returned a positive coefficient of 0.008598 and 0.001933 respectively with p-values returned of 0.000 and 0.005 respectively indicating significance at the 5% level for both variables.

The adjusted R squared returned of 89.11% implies that the model explains 89.11% of the total sample variations in commercial property prices.

The F- Statistic result shows that all the independent variables were significant at the 5% level of significance, therefore implying that the overall model was significant and that the mean scores of variables differed.

The AIC, SIC and HQC returned results that saw the AIC as the lowest criterion and the best model for the analysis. While the DW statistic returned values less that 2 thus giving evidence that a positive serial correlation exists.

A point to note on the results of regression and correlation coefficients is that variables such as GDP, lending rates and NSE index returned contrasting signs. For GDP both coefficients were seen to be significant but the impact of the regression was too small i.e. near zero, to really bring a distinction while those for lending rates and NSE index could be as a result of suppression from the other predictor variables.

4.4 Testing for a bubble

4.4.1 Testing for Cointegration.

Based on the correlation analysis results presented above, there seemed to be no evidence that the relationship between commercial property prices and the macroeconomic variables were altered during the period of price increases. To further understand the relationship, it was necessary to examine the stability of this underlying relationship by checking for cointegration. A pretesting for unit root was the first step in the cointegration modeling i.e. in order to test for cointegration in commercial price equations, the variables had to be integrated of the same order. In interpreting the results, a bubble is said to exist when either; price/dependent variable at level is non stationary while the factors/independent variables at level are stationary or when the series of the dependent variable and independent variables are

of first order of integration but they are not cointegrated i.e. accept the none hypothesized number of cointegration equations.

The results for the Phillips Perron (PP) unit root test were as tabled below. The Augmented Dickey Fuller (ADF) test results were also examined for comparison. The time series data for each variable was used in log form so as to stabilize the variance by removing the unequal variances.

Table 4.4.1 Results of Unit Root Test

VARIABLES	**LEVELS**				**1ST DIFFERENCES**			
	PP		**ADF**		**PP**		**ADF**	
	Test stat (5% c.v.)	**Prob.**	**Test stat (5% c.v.)**	**Prob.**	**Test stat (5% c.v.)**	**Prob.**	**Test stat (5% c.v.)**	**Prob.**
LnCPINDEX	1.31^{C}	0.62	1.31^{C}	0.62	6.82^{N}	0.00	6.82^{N}	0.00
	(2.94)		(2.94)		(1.95)		(1.95)	
LnGDP	1.13^{C}	0.69	0.45^{C}	0.89	6.43^{N}	0.00	2.63^{N}	0.00
	(2.94)		(2.94)		(1.94)		(1.95)	
LnBCINDEX	1.83^{T}	0.67	1.82^{T}	0.67	7.54^{C}	0.00	6.24^{C}	0.00
	(3.52)		(3.52)		(2.94)		(2.94)	
LnNSEINDEX	0.58^{C}	0.86	0.24^{C}	0.92	5.54^{N}	0.00	5.48^{N}	0.00
	(2.94)		(2.94)		(1.95)		(1.95)	

Note: Model Specification: C represented Constant, N represented None i.e. no constant or trend and T represented Constant and Trend. The ADF test utilized the SIC criterion with a max lag of 9 while PP test didn't require lag selection.

H_0 = There is unit root (series is non stationary)

H_1 = There is no unit root.

Decision: Where the test statistic is greater than critical value and significance returned is less than 5% reject H_0.

As per the results returned above, all variables were found to be non stationary at level and stationary after the first difference.

Since the variables were integrated of order one i.e. I (1), the study proceeded with testing for cointegration using the Johansen cointegration test. The variables used for this test were non stationary i.e. I (0) because non stationary variables have a tendency to revert to a constant mean and it exhibits no trend. Thus only variables that are non stationary may be cointegrated. The results of the cointegration test are presented in the table below.

Table 4.4.2 Results of Cointegration Test

HYPOTHESIZED NO. OF COINTEGRATING EQUATIONS	**TRACE STATISTIC**	**5% CRITICAL VALUE**	**PROBABILITY**
None	50.04864	47.85613	0.0307
At most 1	14.41335	29.79707	0.8166
At most 2	3.780001	15.49471	0.9205
At most 3	0.482203	3.841465	0.4874
HYPOTHESIZED NO. OF COINTEGRATING EQUATIONS (CEs)	**MAX-EIGEN STATISTIC**	**5% CRITICAL VALUE**	**PROBABILITY**
None	35.63529	27.58434	0.0037
At most 1	10.63335	21.13162	0.6837
At most 2	3.297798	14.26460	0.9250
At most 3	0.482203	3.841465	0.4874

The results considered the possibility of having at most 3 cointegrating equations as the number of variables used were 4.

Here the hypothesized number of CEs is rejected i.e. Reject $\mathbf{H_0}$; if the test statistic is greater than the 5% critical value and the significance is less than 5% in addition to

where the max-eigen statistic is greater than the 5% critical value and the significance is less than 5%.

As per the results presented in the table above, it was found that there existed 1 cointegrating equation of the variables i.e. reject $\mathbf{H_0}$ of None. Since the results found that the variables were cointegrated it therefore implied that the variables were related and could be combined in a linear fashion. The results also indicated that even if shocks were experienced in the short run, which may have affected the movements of individual series, they would converge with time i.e. in the long run. The following table represented the normalized cointegrating coefficients for the cointegrating equation.

Table 4.4.3 The normalized cointegrating coefficients

CPINDEX	GDP	BCINDEX	NSEINDEX
1.0000	0.000129	-0.019471	0.002641
	(1.5E-05)	(0.00156)	(0.00094)

Note: the results in parentheses represent the standard error. All the coefficients were found to be significant at the 1% level i.e. the t-statistic derived from dividing the coefficients and the corresponding standard error were found to be greater than 2.

From the results above, the resultant long run relationship could be written in the following form;

CPINDEX = 0.019471BCINDEX-0.000129GDP-0.002641NSEINDEX

The interpretation was that, in the long run both the GDP and NSEINDEX had a negative impact on the CPINDEX while the BCINDEX had a positive impact.

4.4.2 Granger Causality Test.

The Granger causality approach sought to examine the causal relationship between the variables. The results of the test were as presented in the table below where 1 lag was selected for the test.

Table 4.4.4 Granger Causality Test

NULL HYPOTHESIS	F-STATISTIC	PROBABILITY	DECISION
GDP ⟶ CPINDEX	0.21148	0.6482	Accept
CPINDEX ⟶ GDP	2.89479	0.0970	Reject (@10%)
BCINDEX ⟶ CPINDEX	1.48817	0.2300	Accept
CPINDEX ⟶ BCINDEX	0.18393	0.6704	Accept
NSEINDEX ⟶ CPINDEX	0.54542	0.4647	Accept
CPINDEX ⟶ NSEINDEX	3.15079	0.0839	Reject (@10%)

Note: in the Null x⟶ y represented x doesn't granger cause y.

The results presented above indicated that no variable had a two way causal relationship with commercial rental price index and that the only causal relationship was found between commercial rental price index and GDP as well NSEINDEX i.e. CPINDEX granger caused GDP and NSEINDEX respectively.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter discusses the findings of the research in relation to the research objectives. The chapter further draws conclusions and recommendations from the discussions.

5.2 Discussion

The study's main objective was to establish whether a bubble exists in the commercial rental market in Nairobi. This was made possible through establishing a commercial rental price index that was used to test for the interactions between it and the macroeconomic variables used in the study.

5.2.1 The Commercial Rental Price Index

The study utilized asking rental data collected between the Q1 2010 and Q2 2020 for a total of 42 quarters and a total of 151 commercial properties in Nairobi. The rental index was created using the index numbers methods with Q1 index2010 = 100. The use of asking rental data for the index creation was in line with studies such as Kim, (2011) and An et al., (2016) with the latter opting to use data from the National Council of Real Estate Investment Fiduciaries (NCREIF) while the former utilizing data from a data collection site and from a previous study. It is important to note that the study by An et al., (2016), which proceeded to state that whilst the use of simple average method can be used to construct the index, they stated that constant quality issues might arise i.e. buildings change over time. It is however important to note that pricing of real estate is based on presence of market alternatives, property and tenant profiles, liquidity as well as cash flow growth expectations as stated in the study by Linneman and Rubenstein,(2008). Thus in the absence of such detailed historical data on properties, the asking rental price obtained should be reflective of the above pricing approach.

The number of properties utilized in the index creation was based on all the properties that the author could adequately assess 42 quarters worth of data, this was in line with studies such as that of Kim, (2011); An et al., (2016) ; Fuerst et al.,

(2015) and Deschermeier et al., (2015) that utilized all the available data especially considering the development of the real estate market in the cities which their researches were based i.e. Seoul, 5 major states in USA, Beijing and Berlin.

5.2.2 The interactions between commercial rental price index and macroeconomic variables

The research sought to evaluate the relationship between the CPIndex and macroeconomic variables on two fronts i.e. are the independent and dependent variables correlated and whether their relationship is linear.

5.2.2.1 The interactions between commercial rental price index and lending rates

A weak negative correlation coefficient was found to be significant. Considering that interest rate has more of a supply side force i.e. developers who seek debt financing for their activities pass the cost of financing to their tenants through consideration of the space (see e.g.(Ouma, 2015b) and Kibunyi et al., (2017), the results thus deviated and suggested the existence of a bubble. A different explanation to the negative result could be due to the fact that there is increased default by developers (investment in property being seen by banks as high return low risk market) due to the oversupply of office space in the market which in order to meet the financing repayments result in lower prices to attract tenants and avoid penalties, see the study by (Arshanapalli & Nelson, 2008), who found that interest rates and price index were negatively correlated. The results from the regression analysis returned a not significant positive coefficient and thus dropped from the model.

5.2.2.2 The interactions between commercial rental price index and inflation rate

A weak negative correlation coefficient was found to be significant. Inflation affects the cost of doing business in any country, thus an increase in inflation creates an increase in the cost of doing business and therefore the demand for office space reduces which reduces the overall rental prices. This is however not in line with studies such as Kurniawan, (2017), Ouma, (2015) and Kibunyi et al., (2017), who found that inflation positively affected prices and that rising inflation was seen to raise the cost of acquiring capital which would deter real estate investment and thus decreases supply of office spaces which in turn raises prices. However, considering

that developers with debt were seen to benefit from the increase in inflation in terms of value repaid, it would suggest that overall rental prices would not increase. The results from the regression analysis returned a not significant negative coefficient and thus dropped from the model.

5.2.2.3 The interactions between commercial rental price index and GDP

A strong positive correlation coefficient was found to be significant. Thus an increase in GDP increases the demand for office space as companies expand and grow and that this increased demand results in an increase in rental prices as developers' expectations increases. This finding was found to be in line with studies such as that of Kurniawan, (2017) and Kibunyi et al., (2017); however, the study by Ouma, (2015) found that GDP negatively affected price and the argument posited was that GDP behaved as a supply factor and if it increases it would result in an increase in real estate investment which would thereafter decrease rental price, but remember that supply lags demand and that increased investment meant that the developer return expectations are high. The results from the regression analysis returned a significant negative coefficient, though seemingly presenting a negative relationship; the impact is seen to be very low.

5.2.2.4 The interactions between commercial rental price index and Building Cost Index (BCI)

A strong positive correlation coefficient was found to be significant. An increase in the building cost index which was used as a proxy for the non residential cost of construction and would result in an increase in rental prices as developers sought to recover this cost as they pass it to would be tenants. This is in line with findings from Kibunyi et al., (2017) who noted that cost of construction returned a positive relationship with prices in both correlation and regression noting this relationship as significant. Mahalik and Mallick, (2011) in their study of the Indian real estate market noted that studies from the US showed that cost of construction among other variables was significant in predicting prices and that the relationship was positive. The results from the regression analysis reaffirmed the positive relationship between BCI and rental prices and this relationship was also found to be significant.

5.2.2.5 The interactions between commercial rental price index and NSE Index

A weak negative correlation coefficient was found to not be significant. The regression analysis however returned a positive coefficient which was significant. This was in line with the study by Arshanapalli and Nelson, (2008) who found a strong positive correlation between the stock price index and the price index. However, the results were contrary to the findings of Kibunyi et al., (2017), who found that the stock price and the price index acted as substitutes and thus an inverse relationship was observed. Mahalik and Mallick, (2011) on the other hand, found that the stock price did not influence prices. It can be said that, yes the stock price and rental price can be seen as substitutes for investment but when the stock price performance increases, the investment into real estate would decrease and thus supply, however, prices would increase as demand would outstrip supply.

5.2.3 Testing for a bubble

The research adopted the cointegration test to establish whether there existed a long run relationship between the commercial rental price index and the remaining macroeconomic variables. The study further established the causal relationship between the variables.

5.2.3.1 Cointegration

The study adopted the Johansen cointegration test for long run relationship between the commercial rental price index and the remaining macroeconomic variables. The results for the unit root tests of the variables were found to be stationary at first difference/of order (1) which was a prerequisite for the cointegration test. Having confirmed that the variables weren't stationary at level but at first difference, the study proceeded in identifying the existence of one cointegrating equation. These results were in line with previous study findings such as Saarinen, (2014), Arshanapalli and Nelson, (2008), Mahalik and Mallick, (2011) and Kibunyi et al., (2017), who found that there existed a long run relationship between the price index and macroeconomic variables. The presence of a long run relationship is evidence of the absence of a bubble as variables were found to be able to be combined in a linear fashion.

The cointegrating coefficients for GDP and NSEINDEX were found to negatively impact the CPINDEX while BCINDEX was found to positively impact it. These results and that from the correlation and regression analysis had one similarity which was that of the BCINDEX which as a supply side factor was found to positively impact price while differences were noted with GDP and NSEINDEX. Since cointegration results are seen to be more suitable for the detection of shifts for the non stationary variables than correlation, then the arguments of Ouma, (2015) in regards to GDP having a negative impact on prices due to it being more of a supply side factor than that of demand holds true while the study of Kibunyi et al., (2017), who stated that the NSEINDEX acted as a demand side factor and that the stock price and price index were seen to behave as substitutes and that the impact would result in an inverse relationship also holds true in the long run.

The results from the Johansen cointegration tests didn't detect the presence of a real estate bubble in the commercial rental price market. The study further explored presence of a bubble using the Granger causality test.

5.2.3.2 Granger Causality

The results from the Granger Causality test presented unidirectional causality between CPINDEX and GDP as well as CPINDEX and NSEINDEX with no feedback i.e. GDP and NSEINDEX don't Granger cause CPINDEX. Thus, the past values of the commercial rental price index is seen to contain information that helps in predicting these variables above and beyond their individual past values, however this doesn't hold true for the predicting capabilities of past values of GDP/NSEINDEX on CPINDEX. This was contrary to the study by Kibunyi et al., (2017) who found a bidirectional causality between the price index and GDP/NSEINDEX.

The study also found that there was Granger non-causality between CPINDEX and BCINDEX and vice versa, meaning that past values of both variables were seen not to help either in predicting each other above and beyond individual past values. This was contrary to the results by Kibunyi et al., (2017) who found a bidirectional causality between the two.

Though the existence of cointegration between the variables implies the presence of Granger causality at least in one way i.e. at least one of the variables is seen to Granger cause the other. The study by LUO et al., (2011) found a similar result where there existed cointegration between variables in 3 observation periods between 1989 and 2005 but the results for Granger Causality returning unstable results i.e. unidirectional, bidirectional in some periods and Granger non-causality in others. While the study by Ungayi, (2019) found no causality between the house price and the macroeconomic variables tested.

Based on the results and the above studies, one can deduce the possibility of the existence of a bubble.

5.3 Conclusion

Based on the findings of the study, several conclusions were drawn.

First, the study sought to utilize rental price index as a proxy for the commercial rental prices in Nairobi. This was achieved through use of index numbers and the adequacy of the model checked prior to application. There has been no pre-existing index of this kind. The study attempted to make a contribution.

The study proceeded to test the relationship between the commercial rental price index and lending rates, inflation rates, GDP, building cost index and the NSE index. This was achieved through correlation analysis and regression. The study found that all relationships generally conformed to the research expectation based on previous literature except for lending rates. The regression analysis confirmed that their existed a linear relationship between the commercial rental price index and the variables excluding the lending rates and inflation rates which were dropped from the model.

To further test for the existence of a bubble, the study utilized the Johansen cointegration test after establishing that the time series were stationary after first difference. The results were that the variables were cointegrated with 1 cointegrating equation between them thus further negating the existence of a bubble. With GDP, building cost index and the NSE index being seen as influencing factors on commercial rental prices.

Finally, the study utilized the Granger causality test to test whether the past values of the commercial rental price index and that of the 3 macroeconomic variables could be used to predict the other. The results had no bidirectional causal relations and had one Granger non-causality result between commercial rental price index and that of the building cost index.

Considering the difference in results from the cointegration and Granger tests, one has to judge between the findings from the various tests utilized as well as the context in which the study was based i.e. does the commercial rental market simply imply the general cyclic behavior or could it imply the creation of a bubble. As per reports on rental values, the market didn't experience any rapid drops in rental values due to the oversupply of office space in Nairobi and had basically stagnated over the past couple of years with projected signs of growth due to perceived market corrections. Based on the above, the study thus negates the existence of a commercial rental market bubble in Nairobi and that the movements are a reflection of property cycles.

5.4 Recommendation

The importance of the commercial real estate market has been stressed throughout the research as can be seen by the impact of the GDP on the rental prices as well as the predicting impact of the commercial rental price index on GDP among other macroeconomic variables and as such data relating to the commercial real estate market is paramount in discerning the movements within the market and its effects. Like more mature real estate markets that have benefitted from this data and have constructed indices such as the NCREIF or National Chamber of Commerce among other institutions, Kenya as a regional hub would immensely benefit from it. As at the writing of this research, the Kenya National Bureau of Statistics (KNBS) had made an announcement that it had started a real estate survey to collect data for residential, commercial and land properties to enable creation of indices. Once published, these robust indices would benefit not only investors but also add to literature on this subject.

5.5 Suggestions for further research

The study suggests that further research be carried out on alternative index creation methods such as the hedonic price model. The study also suggests longer research periods so that periodically collapsing bubbles can be more easily identified. The study further suggests research with a different mix of macroeconomic variables that affect the commercial rental market such as employment and loans to real estate among others. A further study suggestion is undertaking a cross sectional/sub market approach to the analysis.

5.6 Limitations of the study

The study was limited to the availability of data i.e. data for GDP and BCINDEX was not available for Q3/4 2020. While data for rental data was limited to between 2010 and 2020 due to the fact that there existed no one reliable source that collates such data such as those in more mature markets. This limited the extent of the study period which if were longer would have enabled more conclusive results as most models were seen to work better with longer time series.

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APPENDICES

APPENDIX 1: ETHICAL REVIEW LETTER

Strathmore UNIVERSITY

18th June 2020

Ms Mohamed, Farhiya Ibrahim
mohamed.farhiya@strathmore.edu

Dear Ms Mohamed,

RE: What Do the Movements of Commercial Real Estate Prices Mean? Are They Reminiscent of a Bubble?

This is to inform you that SU-IERC has reviewed and **approved** your above research proposal. Your application approval number is **SU-IERC0614/19.** The approval period is **18th June 2020 to 17th June 2021.**

This approval is subject to compliance with the following requirements:

i. Only approved documents including (informed consents, study instruments, MTA) will be used
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by SU-IERC.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to SU-IERC within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to SU-IERC within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to SU-IERC.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and also obtain other clearances needed.

Yours sincerely,

Dr Virginia Gichuru,
Secretary; SU-IERC

Cc: Prof Fred Were,
Chairperson; SU-IERC

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APPENDIX 2: NACOSTI PERMIT

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 375239

Date of Issue: 22/June/2020

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This is to Certify that Miss.. Farhiya Ibrahim of Strathmore University, has been licensed to conduct research in Nairobi on the topic: WHAT DO THE MOVEMENTS OF COMMERCIAL REAL ESTATE PRICES MEAN? ARE THEY REMINISCENT OF A BUBBLE? for the period ending : 22/June/2021.

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APPENDIX 3: DATA FOR THE COMMERCIAL RENTAL PRICE INDEX

QUARTER/YEAR	INDEX (2010=100)	QUARTER/YEAR	INDEX (2010=100)
Q1 2010	100.00	Q2 2015	114.53
Q2 2010	100.00	Q3 2015	114.65
Q3 2010	100.00	Q4 2015	114.62
Q4 2010	100.00	Q1 2016	118.49
Q1 2011	96.77	Q2 2016	118.36
Q2 2011	96.77	Q3 2016	118.41
Q3 2011	96.77	Q4 2016	118.46
Q4 2011	96.77	Q1 2017	111.82
Q1 2012	102.00	Q2 2017	114.96
Q2 2012	102.40	Q3 2017	115.00
Q3 2012	102.40	Q4 2017	115.25
Q4 2012	102.20	Q1 2018	117.97
Q1 2013	104.16	Q2 2018	117.80
Q2 2013	104.13	Q3 2018	117.64
Q3 2013	104.13	Q4 2018	117.44
Q4 2013	104.13	Q1 2019	113.62
Q1 2014	112.73	Q2 2019	113.35
Q2 2014	112.61	Q3 2019	113.55
Q3 2014	112.61	Q4 2019	113.66
Q4 2014	112.83	Q1 2020	114.27
Q1 2015	114.50	Q2 2020	114.27

Source: Author (2021)

APPENDIX 4: DATA FOR LENDING RATES

QUARTER/YEAR	INTEREST RATE %	QUARTER/YEAR	INTEREST RATE %
Q1 2010	14.92	Q2 2015	15.57
Q2 2010	14.48	Q3 2015	16.08
Q3 2010	14.15	Q4 2015	17.35
Q4 2010	13.89	Q1 2016	17.93
Q1 2011	13.96	Q2 2016	18.15
Q2 2011	13.90	Q3 2016	16.54
Q3 2011	14.42	Q4 2016	13.69
Q4 2011	17.92	Q1 2017	13.65
Q1 2012	20.05	Q2 2017	13.66
Q2 2012	20.21	Q3 2017	13.68
Q3 2012	20.00	Q4 2017	13.68
Q4 2012	18.32	Q1 2018	13.61
Q1 2013	17.90	Q2 2018	13.24
Q2 2013	17.43	Q3 2018	12.85
Q3 2013	16.95	Q4 2018	12.56
Q4 2013	16.96	Q1 2019	12.49
Q1 2014	17.00	Q2 2019	12.48
Q2 2014	16.68	Q3 2019	12.44
Q3 2014	16.40	Q4 2019	12.35
Q4 2014	15.98	Q1 2020	12.19
Q1 2015	15.62	Q2 2020	11.92

Source: Central Bank of Kenya

APPENDIX 5: DATA FOR INFLATION RATES

QUARTER/YEAR	INFLATION RATE %	QUARTER/YEAR	INFLATION RATE %
Q1 2010	5.54	Q2 2015	6.99
Q2 2010	3.67	Q3 2015	6.14
Q3 2010	3.33	Q4 2015	7.35
Q4 2010	3.84	Q1 2016	7.10
Q1 2011	7.05	Q2 2016	4.99
Q2 2011	13.16	Q3 2016	6.33
Q3 2011	16.51	Q4 2016	6.50
Q4 2011	19.19	Q1 2017	8.77
Q1 2012	16.86	Q2 2017	11.18
Q2 2012	11.77	Q3 2017	7.52
Q3 2012	6.37	Q4 2017	4.98
Q4 2012	3.53	Q1 2018	4.49
Q1 2013	4.08	Q2 2018	4.00
Q2 2013	4.37	Q3 2018	4.70
Q3 2013	7.00	Q4 2018	5.60
Q4 2013	7.42	Q1 2019	4.40
Q1 2014	6.80	Q2 2019	5.90
Q2 2014	7.00	Q3 2019	5.00
Q3 2014	7.50	Q4 2019	5.40
Q4 2014	6.20	Q1 2020	6.30
Q1 2015	5.82	Q2 2020	5.30

Source: Kenya National Bureau of Statistics (KNBS)

APPENDIX 6: DATA FOR GROSS DOMESTIC PRODUCT (GDP)

QUARTER/YEAR	GDP KSHS. MILLION	QUARTER/YEAR	GDP KSHS. MILLION
Q1 2010	785638.00	Q2 2015	1026833.00
Q2 2010	766209.00	Q3 2015	1001471.00
Q3 2010	760003.00	Q4 2015	994165.00
Q4 2010	792550.00	Q1 2016	1091750.00
Q1 2011	938501.00	Q2 2016	1089944.00
Q2 2011	920131.00	Q3 2016	1053216.00
Q3 2011	914518.00	Q4 2016	1065788.00
Q4 2011	952902.00	Q1 2017	1148933.00
Q1 2012	880802.00	Q2 2017	1138300.00
Q2 2012	853430.00	Q3 2017	1099807.00
Q3 2012	847709.00	Q4 2017	1120337.00
Q4 2012	862398.00	Q1 2018	1220345.00
Q1 2013	934348.00	Q2 2018	1206230.00
Q2 2013	917590.00	Q3 2018	1172184.00
Q3 2013	902361.00	Q4 2018	1193415.00
Q4 2013	892522.00	Q1 2019	1287443.00
Q1 2014	982917.00	Q2 2019	1270229.00
Q2 2014	972761.00	Q3 2019	1233529.00
Q3 2014	944087.00	Q4 2019	1258982.00
Q4 2014	942421.00	Q1 2020	1350941.00
Q1 2015	1039433.00	Q2 2020	1197679.00

Source: Kenya National Bureau of Statistics (KNBS)

APPENDIX 7: DATA FOR NONRESIDENTIAL BUILDING COST INDEX (BCI)

QUARTER/YEAR	BCI	QUARTER/YEAR	BCI
Q1 2010	6081.51	Q2 2015	8177.03
Q2 2010	6072.74	Q3 2015	8177.76
Q3 2010	6113.81	Q4 2015	8449.17
Q4 2010	6154.64	Q1 2016	8692.51
Q1 2011	6362.45	Q2 2016	8715.02
Q2 2011	6477.10	Q3 2016	8732.76
Q3 2011	6503.12	Q4 2016	8756.09
Q4 2011	6549.26	Q1 2017	8964.00
Q1 2012	6720.55	Q2 2017	8985.00
Q2 2012	6862.83	Q3 2017	8995.00
Q3 2012	6902.06	Q4 2017	9051.00
Q4 2012	6909.22	Q1 2018	9231.13
Q1 2013	7160.41	Q2 2018	9269.69
Q2 2013	7238.08	Q3 2018	9282.50
Q3 2013	7337.86	Q4 2018	9392.38
Q4 2013	7377.44	Q1 2019	9417.88
Q1 2014	7635.47	Q2 2019	9576.01
Q2 2014	7925.91	Q3 2019	9600.12
Q3 2014	8046.95	Q4 2019	9652.74
Q4 2014	8072.82	Q1 2020	9850.95
Q1 2015	8160.08	Q2 2020	9847.76

Source: Kenya National Bureau of Statistics (KNBS)

APPENDIX 8: DATA FOR NAIROBI STOCK EXCHANGE (NSE) 20 INDEX

QUARTER/YEAR	NSE 20	QUARTER/YEAR	NSE 20
Q1 2010	4073.00	Q2 2015	4906.00
Q2 2010	4339.00	Q3 2015	4173.00
Q3 2010	4630.00	Q4 2015	4040.00
Q4 2010	4433.00	Q1 2016	3982.00
Q1 2011	3887.00	Q2 2016	3641.00
Q2 2011	3968.00	Q3 2016	3243.00
Q3 2011	3284.00	Q4 2016	3186.00
Q4 2011	3205.00	Q1 2017	3112.00
Q1 2012	3367.00	Q2 2017	3607.00
Q2 2012	3704.00	Q3 2017	3751.00
Q3 2012	3972.00	Q4 2017	3712.00
Q4 2012	4133.00	Q1 2018	3854.00
Q1 2013	4861.00	Q2 2018	3286.00
Q2 2013	4598.00	Q3 2018	2876.00
Q3 2013	4760.00	Q4 2018	2801.00
Q4 2013	4927.00	Q1 2019	2846.00
Q1 2014	4946.00	Q2 2019	2633.00
Q2 2014	4885.00	Q3 2019	2432.00
Q3 2014	5256.00	Q4 2019	2654.00
Q4 2014	5113.00	Q1 2020	1966.00
Q1 2015	5346.00	Q2 2020	1942.00

Source: Kenya National Bureau of Statistics (KNBS)