Are there bubbles in the Housing Market of Namibia?: An Analysis of Historical Evidence

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Abstract

The dividend yield ratio in the stock markets is, to an extent, comparable to the rent price ratio in the housing market. Taking advantage of this definitional similarity, one can then use the traditional unit root test for log dividend yield in this case, the log rent-price ratio to test for the existence of real estate bubbles. Such unit root tests are conducted for the whole of Namibia. We develop a continuous and monthly rent price information-based method to track the periods when real estate prices diverge from their fundamental levels. The effect of those investigations would suggest the existence of pockets of bubbles in the real estate market. We finally get to distinguish of the pockets of bubbles observed, which are minor, intermediate and major bubbles.

Keywords: Unit Roots, Rational Bubble, Minor Bubble, Intermediate Bubble, Major Bubble.

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1 Introduction

Recently a number of reports have highlighted a concern over the rapid rise in house prices. These concerns have been observed on a global scale. The concern is justified as the behaviour of house prices influences the economy through various channels[1].Results show that booms that were followed by a large recession and in some cases financial instability are typically longer and give rise to significantly greater real monetary imbalances and in particular are characterized by a big boom and burst in real estate markets [1].

In particular Namibia's real estate prices have hiked so much that, it stands as one of the most expensive countries in real estate and housing market. This scenario brings about the need to ask the question; Is Namibia's real estate prices exhibiting a bubble and if so how are we going to identify that phenomenon? In attempting to identify bubbles in the real estate market, time series analysis is used to construct a rolling and frequently updating indicator of unit roots. The indication of unit roots would imply the existence of bubbles[3].

We begin by attempting to answer the question; how do we evaluate if there are signs of bubbles in

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the real estate and housing prices? This is as good as us asking ourselves the question; how does one identify that the prices are detached from their fundamentally justified level? One way to approach the fundamental value in real estate markets would be to examine the rent-price ratio in the markets. As known, the rent-price ratios can be seen to correspond to dividend yields in the stock markets as rents and dividends both represent the underlying capital component [1].

The fundamental value of a house is the present value of the future housing service flows that it provides to the marginal buyer. In a well-functioning market, the value of housing service flow should be by the rental value of the house. This means that the price of the house should be approximately the discounted future flow of rents that it would give if it would be rented. It is so evident from previous literature that the use of rent-price ratio makes it easier to define the bubble concept [1].
The dividend yield ratio in the stock markets is, to an extent, comparable to the rent-price ratio in the housing market. Taking advantage of this definitional similarity, one can then use the traditional unit root test for log dividend yield in this case, the log rent-price ratio to test for the existence of real estate bubbles [1].

2 Literature review

Ever since the occurrence of the House price bubble in the 1980's a lot of applied mathematicians and economist have shown interest in this problem. It has been observed that understanding this phenomenon would help prevent it from reaching unsustainable levels. Different approaches have been taken to investigate the existence of bubbles. We mention here some of the interesting work on the real estate house price bubble. The list is obviously non-exhaustive.

Katja Taipalus (2006), points out the definitional similarity, one can then use the traditional unit root test for log dividend yield in this case, the log rent-price ratio to test for the existence of real estate bubbles [1]. John Y. Campbell and Robert J. Schiller (1988), develop the implications that for the present-value model of stock prices and for recent results that long-horizon stock returns are highly forecastable and works on developing a log linear regression estimate model that overcomes non-linearity [7]. Zivot, Eric and Wang, Jiahui (2007), Highlight A common technique to assess the constancy of a models' parameters is to compute parameter estimates over a rolling window of a fixed size through the sample [4].

Seonghoon Cho and Antonio Moreno (2008) , Assumes the no-bubble condition to rule out non-fundamental bubble solutions [3]. Heng Jiang and Yu Song and Chunlu Li (2006). Investigation on the existence of house price bubbles in Australia's eight capital cities in recent years were made by using quantitative analysis including Johansen cointegration test, Granger causality test, impulse response and Chow forecast test.While interactions between house prices and market fundamentals are discussed in long-run and causal estimations, shocks from the market fundamentals to house prices are investigated in generalized impulse response analysis [6].

3 Methodology

Having established that the dividend yield ratio in the stock markets is, to an extent, comparable to the rent price ratio in the housing market. We begin by introducing how the net simple return is derived. Total return of a stock is intuitively got by getting appreciation in price or amount and its sum with dividends and then dividing it by the initial price this is known as the holding period return [10].

$$R_{t+1} = \frac{P_{t+1} - P_t + D_{t+1}}{P_t} \tag{1}$$

working it out for P_t

$$P_t = \frac{P_{t+1} + D_{t+1}}{R_{t+1} + 1} \tag{2}$$

where R_{t+1} denotes the return on the asset held from time t to $t+1$, P_t and D_t denote the stock price and the dividends payable at the end of period t respectively. The dividends in this scenario imply rent in the housing markets. The return is not known until period *t+1*. Further manipulating the expression (1), the mathematical expectation is taken and extending the expression obtained for k periods, yields:

$$P_t = E_t \left[\sum_{i=1}^{k} (1 + R_{t+i})^{-i} D_{t+i} \right] + E_t \left[(1 + R_{t+k})^{-k} P_{t+k} \right]$$

As the horizon lengthens, the last term is assumed to converge to zero [4]. The time-varying expected stock return component in equation above renders the equation into a nonlinear form [11]. To overcome the problems due to nonlinearity, a log-linear approximation is employed [5]. As shown below:

$$\tilde{r}_{t+1} \equiv \alpha + \lambda \tilde{P}_{t+1} + (1 - \lambda) \tilde{D}_{t+1} - \tilde{P}_t$$

here,

$$\alpha \equiv -\log(\lambda) - (1 - \lambda) \log \left(\frac{1}{1 - \lambda} \right)$$

$$\lambda \equiv \frac{1}{[1 + \exp(d - p)]}$$

where $0 < \lambda < 1$ [7] and α are parameters. The log linear approximation equation holds exactly when the log rent-price ratio is constant as then d_{t+1} and P_{t+1} move together one-to-one.

In a quest to obtain the forward solution, the forward method is applied. With this method a key property known as the no-bubble condition is embedded as a solution refinement process. The forward solution is the only fundamental solution satisfying the no-bubble condition and that it is hard to justify economically fundamental solutions violating this condition [4].

Solving forward and imposing the no rational bubble terminal condition [4], and finally, taking the mathematical expectation based on the information available at time t and rearranging in terms of the log dividend price ratio yields we have :

$$\tilde{d}_t - \tilde{P}_t = -\frac{\alpha}{1 - \lambda} + E_t \left[\sum_{j=0}^{\infty} \lambda^j \left[-\Delta \tilde{d}_{t+1+j} + \tilde{r}_{t+1+j} \right] \right]$$

If Δd_t and r_t are stationary stochastic processes, then the log rent-price ratio, $\tilde{d}_t - \tilde{P}_t$, is a stationary stochastic process under the no-rational-bubble restriction. Therefore, if we can find a unit root in the log rent-price ratio, this is consistent with the existence of rational bubbles in asset prices in the case when Δ_t and r_t are stationary and stochastic processes.

In order to test for the existence of unit-roots in the log rent-price ratio series generated, we use the Augmented Dickey-Fuller (ADF) test. This test is carried out using the Eviews package;we first choose the appropriate lag-structure for the Augmented Dickey-Fuller test. Merits of the ADF test is that, we are able to control for higher order correlation. After diagnostic analysis the Augmented Dickey-Fuller test is carried out to identify non-stationarity or explosive attributes. Explosive attributes or unit roots of the log rent-price ratio series would indicate periods where dividend flows do not match the asset price level (in our case rent flows not matching the housing price level). In other words, such values would indicate the presence of bubbles in asset prices.

4 Results And Interpretations

4.1 Unit Root Test

Regarding the bubble-indications, it is important to notice that bubble-indications do not realize only when prices are rising at a higher pace than could be justified according to the rent flow (as was the case in positive rational bubbles), but also when prices are descending faster that could be justified according to the rent flow. This is due to the fact that the underlying model behind this theory is the present-value pricing formula, according to which the prices and dividends (here rents) should be co-integrated. In this case this indicator should be able to react to either large over-or undervaluation's in the market prices compared to their fundamentals [1].

The lag is chosen through Schwartz Information Criteria (SIC). It automatically chooses a maximum lag length of 11. We include constant and trend (C+T) to the tests, when carrying out the test. This is because constant and trend are significant.[1]

Test Statistic		
ADF Test Statistic	t-Statistic	Test CV
-3.87819	-4.058619	1%
-3.87819	-3.458326	5%
-3.87819	-3.155161	10%

We can infer from the table that absolute value of the ADF test-statistic value is less than its critical value at 1% .This implies that we accept our null hypothesis which says that there is a unit root at 1% critical value.We can also deduce that there is an existence of bubbles in the Nambian real estate market from the figure 1.

The figure 1 displays the log rent-price ratio series plotted over a period of 7 years. This graph basically gives a bird's eye-view of the attributes of our series as explosive or rather non-stationary and it

[1]We only include either the constant (C) or the Constant and Trend (C+T) if their P value is < 0.05 implying its significant otherwise its not significant thus do not include.

also shows an upward trend. In other words, the log rent-price ratio series has unit roots, in the context of our paper the series has bubbles. This in itself is not enough to make a clear distinction of where exactly the bubbles are exhibited and by what magnitude.

4.2 Localization of Bubbles

In an attempt to aid in the localization of the bubbles in the log rent-price ratio series, we superimpose the percentage price change series and the log rent-price ratio series.Stacking the two series on-to one graph will get to magnify the occurrences of the pockets of bubbles and hence be able to know where exactly within the 7 year period the rent flows are not matching the housing price level.

It can be observed from figure 2 that the points where the log rent-price ratio series displayed significant variations; the percentage price change series also corresponded with significant spikes [2]. Having localized the pockets of bubbles exhibited; the follow up question that arises is, by what magnitude are these bubbles significant?

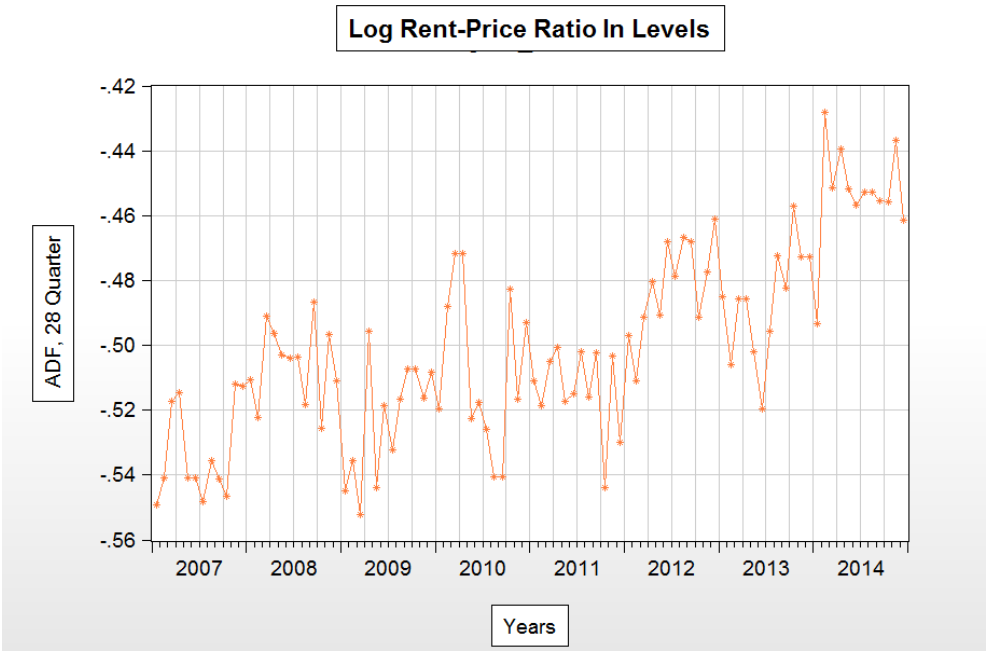

Figure 1: Real estate Bubble-Indications in Namibia (ADF, 28 Quarter)

4.3 Minor, Intermediate and Major Bubbles

The percentage price change series can be used to answer our question regarding the magnitude of the bubbles displayed.In order to arrive at our objective we start off by observing figure 3, it captures the histogram and a descriptive statistic chart of the series. We pay particular attention to the standard deviation of the series. In the context of our paper we view standard deviation as the expected deviation of the house prices from the mean house price. This implies that any house price variations that exceed the expected house price deviation would suggest bubbles (overheating in the housing prices). Hence, what remains is for us to verify whether the pockets of bubbles identified are minor, intermediate or

[2]The log rent-price ratio series and the percentage price series strongly correlate in attributes.

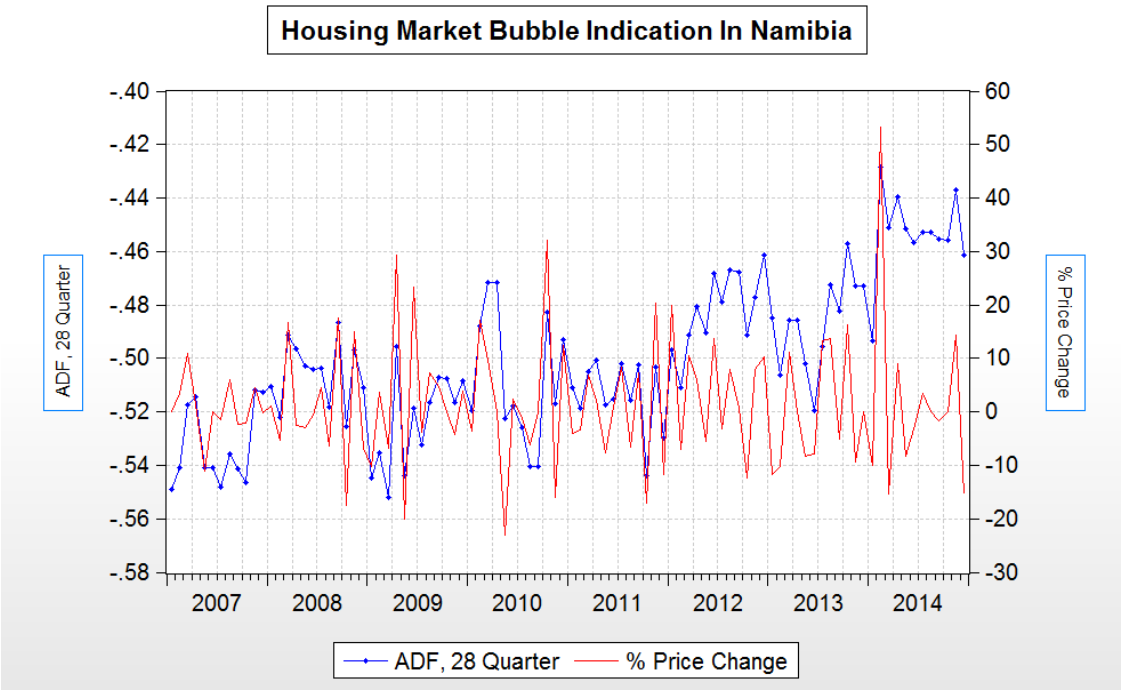

Figure 2: Bubble Localization

major bubbles. At this stage we are motivated to introduce a few definitions [12].

In the context of our paper we further qualify the definition of a bubble. A **Bubble** is a spike that exceeds plus or minus the standard deviation mark of 11.82236 (percentage price change). In other words, a bubble is an observation of percentage price change spikes, that exceed the range $\bar{X} \pm s$.

A **Minor Bubble** is a spike that is in between the standard deviation mark of 11.82236 and 23.64472 (percentage price change) or is a spike that is in between the standard deviation mark of -11.82236 and -23.64472 (percentage price change). Generally minor bubbles are observations captured in between the ranges $\bar{X} \pm s$ and $\bar{X} \pm 2s$.

An **Intermediate Bubble** is a spike that is in between the standard deviation mark of 23.64472 and 35.46708 (percentage price change) or is a spike that is in between the standard deviation mark of -23.64472 and -35.46708 (percentage price change). Generally intermediate bubbles are observations captured in between the ranges $\bar{X} \pm 2s$ and $\bar{X} \pm 3s$.

A **Major Bubble** is a spike that at least exceeds plus or minus the standard deviation mark of 35.46708 (percentage price change). We can generally say a major bubble is an observation of percentage price change spikes that exceeds the range $\bar{X} \pm 3s$.

4.4 Bubble Magnitude Count

Having defined the different ranks of bubbles, our next step is to class each bubble exhibited respectively according to rank. It is clearly evident that figure 4 aids one in knowing where the bubbles occurred and by what magnitude. In the context of this paper, it is worth to note that, for each bubble rank defined they be a prescribed remedial measure if need be.

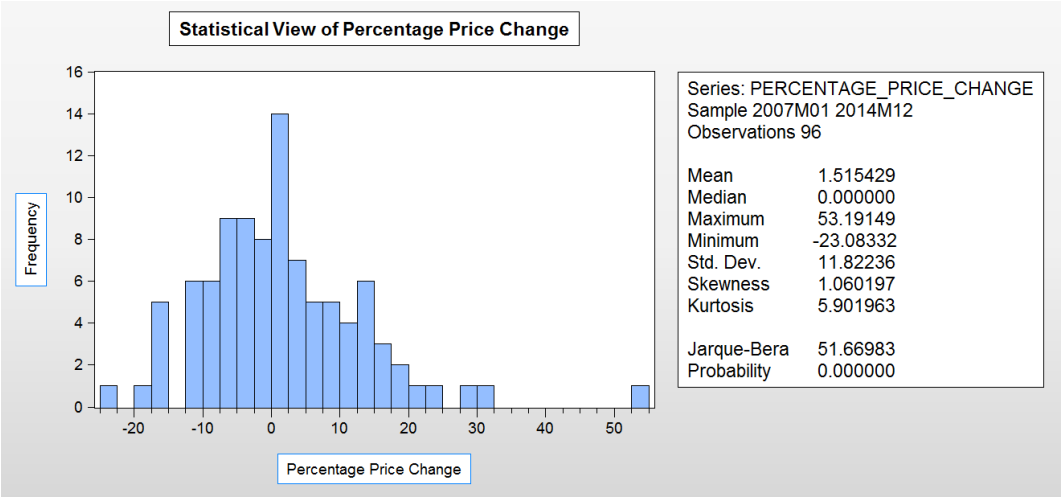

Figure 3: descriptive statistics chart of the percentage price change series

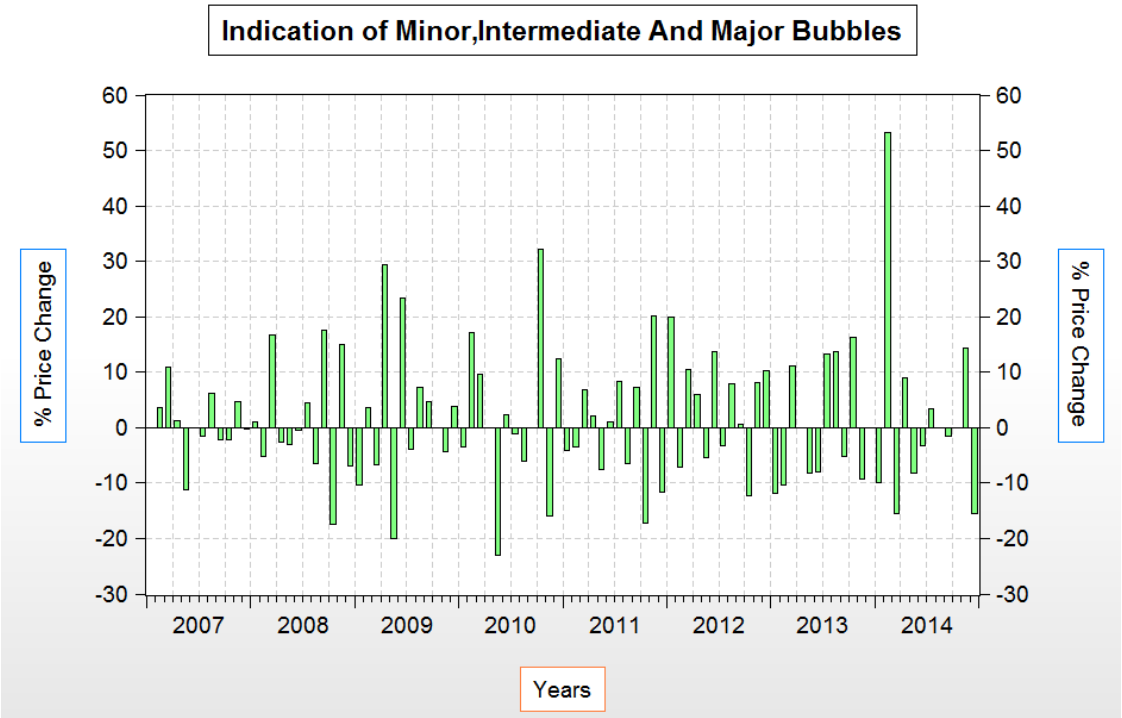

Figure 4: Bubble Count

For minor bubbles, they are viewed as non-threatening. At this stage no remedial action is required, so as to allow the dynamics at play to self-correct. As for intermediate bubbles they are viewed as potentially threatening and thus need for close monitoring is required to prevent exacerbation. Regarding major bubbles they are viewed as threatening and thus correctional measures should be employed at this stage, so as to restore normality.

Inference from **figure** 4:

- **Major Bubble:** We have observed that in the 1^{st} quarter of 2014 , a major bubble occurred.
- **Intermediate Bubble:** We have observed that in the 2^{nd} quarter of 2009 and 4^{th} quarter of 2010,

an intermediate bubble occurred.

- **Minor bubble:** We have observed that approximately 18 minor bubbles occurred across the 7 year period.

5 Conclusion

The housing sector plays a pivotal role in Namibia's economic growth and the welfare of the Namibian's. This paper has investigated the existence of real estate bubbles and also if in existence, when the bubbles exactly took place and by what magnitude. We focused our investigations from the period of 2007 to 2014. We have found that the Namibian real estate market has pockets of bubbles prevailing across our data period.We observed that there was only one major bubble, two intermediate bubbles and eighteen minor bubbles. Reasons for the quick rise are several: partly this might be because of low interest rates, but mainly this came because of the scarcity of serviced land hence precipitating an artificial rise in house prices as the demand exceeded the supply.

The threat of being currently in danger of bubbling prices phase was backed by the ADF indicator test which was performed at country level . Regarding the data used to carry out our investigations and our data source. First National Bank Namibia (FNB) provided the median house prices, Bank of Namibia (BON) provided the mortgage rates and Namibia Statistic Agency (NSA) provided us with the rent index-proxy (Housing, Water, Electricity, Gas and Other Fuels) component from the Namibian Consumer Price Index (CPI) Basket. We used a rent index-proxy because rent prices are not yet regulated in Namibia. Much appreciation is rendered to each of the entities for the support given by providing the required data.

The purpose of this paper was to investigate the possible existence of bubbles in Namibia's housing market via the ADF test and by what magnitude, if in existence. Our objective was obtained and we can gladly conclude that this paper provides insightful knowledge on a subject that hardly has literature relative to the Namibian market and thus relevant to both the industry and academia.

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