Identifying a housing bubble in South Africa

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Abstract

Emerging market economies are high sources of potential growth but unfortunately fall victim to financial bubbles. The Global Financial Crisis of 2008 led to an increase in studies conducted on emerging markets and even more on the behaviour of house prices. This study makes use of South African house price data to determine whether a bubble was present between the period 2000 and 2016, making use of small, medium and large house prices. The fundamental house price is determined using the Consumer Price Index as a deflator. Next, a flexible moving average sample test is run using a test technique that recursively executes an ADF-type regression. The results indicate that that there were two bubbles in the South African housing market between January 2000 and November 2016, the longest of which coincided with the increasing house prices in the United States.

Keywords: GSADF House Price

JEL classification L250, L100

1. Introduction

The recent financial crisis and its detrimental global economic effects have highlighted the devastating real economic consequences of an asset bubble collapse in key asset markets. The presence of asset bubbles in global markets seem to contradict the notion that asset prices are always consistent with their fundamentals. Asset bubbles that have occurred periodically in local and global real estate markets and are regard as a fundamental cause of financial crises. The occurrence of asset bubbles in the property raises concerns for not only the economy as a whole but for individual consumers whose portfolios consist of property market assets. Asset bubbles can be particularly

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damaging for emerging market economies that have undeveloped asset markets that experience high levels of volatility, episodes of bubble-like dynamics have consistently ended with the collapse of the sector. The detrimental impact of collapsing Property market asset bubbles on not only the economy but on households has resulted in the emergence of a vast body of literature that focus on developing methods that would be able to detect asset price bubbles.

The aim of this is to detect periods of bubble like behaviour in the South African housing market from January 2000 to November 2016. Thus the fundamental question is how to define and identify asset bubbles in the data. An asset bubble is defined as a significant price deviation away from their underlying fundamentals. But a key challenge will be attempting to define a fundamental asset price, no conclusive method or procedure has been adopted throughout the literature. Determining the fundamental asset price can be particularly difficult in emerging markets where many companies and assets have no dividends or fundamental value.

Numerous methods that have been put forth include determining the fundamental price level based on the asset prices long run trend (Goodhart and Hofmann 2008 Bordo and Jeanne (2002); Jorda, Schularick, and Taylor 2015) or estimating the fundamental price based on the return to holding the asset by defining a price-earnings ratio (Lammerding et al. 2013; Gilbert 2010; Gomez-Gonzalez et al. 2013; Oliveira 2014). But given the volatility in the South African asset markets and its vulnerability to foreign exogenous shocks and the lack of data for rental prices in South Africa, the housing price index is deflated by CPI to provide a more accurate index for houses in South Africa.

To date-stamp the periods of explosivity, the Generalised sup Augmented Dickey-Fuller (GSADF) test procedure is employed, which is a recursive right-tailed unit root test technique that allows for the detection of multiple periods of price explosivity, which was first put forth by Phillips, Shi and Yu (2013). The rest of the paper will proceed as follows: Section 2 discusses all the relevant literature pertaining to the asset price bubbles and the South African property market. Section 3 presents the data that will be used in this analysis. Section 4 will outline the methodology being employed in this study. Section 5 will examine the empirical results and lastly section 6 will contain concluding remarks.

2. Literature Review

2.1. Methodology Review

Asset Prices are assumed to contain all relevant information and adjust instantaneously when new information becomes available. Thus, market prices are assumed to always be consistent with their fundamentals. Yet historical events such as the Dutch Tulip mania, which was an era in the Dutch Golden Age during which the contract prices for bulbs of the tulip abruptly collapsed after reaching historic highs, the 1929 stock market crash in the United States and the most recent subprime crisis in 2008 have proven that abrupt and significant price changes that result in a divergence from the fundamental price level in a relatively short period of time can have significant effects on the economy (Oliveira 2014). Asset Bubbles are therefore usually defined as a deviation of the asset price from its fundamental level, but defining the fundamental price can be difficult. These asset bubbles have a number of common features. Firstly, the bubble is proceeded by substantial credit expansion and a continuous increase in the asset price and secondly, when the bubble bursts, the collapse of asset prices may lead to the default of a number of consumers who are unable to repay their accumulated credit (Gomez-Gonzalez et al. 2013).

Given the devastating impact of historical asset bubbles that have collapsed such as the 1929 stock market bubble and the 2008 housing market bubble, numerous studies have been dedicated to the detection of asset bubbles. The most commonly used method for detecting an asset bubble, introduced by Campbell and Shiller (1987) and Diba and Grossman (1988), in the literature is the right tailed unit root and cointegration test. But, these methods fail to detect explosive bubbles when the sample data contains bubbles that are frequently collapsing. A limitation that was first noted by Evans (1991). To overcome these limitations, Phillips and Yu (2011) recently introduced the supremum Dicker-Fuller test (SDF) which significantly improves the power of the right-tailed unit root and cointegration test. It also provides the advantage of identifying the initial start date and final date of an asset bubble. While Phillips and Yu (2011) positively improved upon the original unit root and cointegration test, it still presented a significant limitation; the method was constructed to analyse a solitary bubble and failed to correctly estimate the duration of an asset bubble in a data set if the duration of a second bubble in the data set was shorter than the first asset bubble. Phillips, Shi and Yu (2013) thereafter proposed the generalized sup augmented Dickey-Fuller test (GSADF) which is able to detect numerous and continuously collapsing asset bubbles, the main difference between these two tests is that the start and end points are allowed to change and the starting point is not kept fixed, several different forward expanding sequences are used instead ("Testing for Bubbles in Eu and Us Property Markets" 2015). Earlier methods for bubble detection put forth consist of West's two step test (West, 1987) and the variance bound test (Shiller 1980). Studies conducted by Lammerding et al (2013) and Al-Anaswah and Wilfling (2011) employ the Markov-switching models to distinguish between periods of price stability and upward price volatility.

The literature does not identify a single common or conventional method for determining the fundamental price of an asset. Numerous methods that have been put forth include determining the fundamental price level based on the asset prices long run trend (Goodhart and Hofmann 2008; Bordo and Jeanne 2002; Jorda, Schularick, and Taylor 2015). Goodhart and Hofmann (2008) defines periods of house price explosivity where the real price exceeds some level relative to a Hodrick-Prescott (HP) filtered trend. On the other hand, Bordo and Jeanne (2002), tries to calculate a long-run fair value by measuring price deviations of the 3-year moving average. Other studies have attempted to estimate the fundamental price based on the return to holding the asset by defining a price-rent (PR) ratio (Lammerding et al. 2013; Gilbert 2010; Gomez-Gonzalez et al. 2013; Oliveira 2014). The PR ratio follows the theory of the price-earnings ratio (PER). The PER ratio contains information about whether a stock is under- or over- priced. Similarly, a rapid increase in the housing market while increases in the renting market remains flat or slow may be an indication that a bubble is forming. Thus, if the house price-to-rent ratio is not stationary, a bubbly may exist (Oliveira (2014)).

2.2. South African Property Market

Emerging market economies (EME's) are characterised by high levels of volatility but provide high returns due to their potential growth. The possibility of growth attracts both domestic and foreign investors to store their earnings in these countries. However, EME's have unfortunately been cursed with episodes of bubble-like dynamics and consistently end with the collapse of the sector, including credit, investments, asset prices etc. (Caballero (2006)).

There have been many EME's who have suffered housing price bubbles. Barth, Lea and Li (2012) studied the house prices in different regions of China by identifying the relationship between house prices and rental prices, disposable income as well as home mortgage interest rates. Not only were these variables significant in increasing the house prices, but local governments policies played a role in creating different housing stocks and market structures. Another study conducted by de Oliveira and Almeida (2014) on Brazilian data indicated that house prices soared after the Global Financial Crisis of 2008. While some economists argued that this large increase in house prices was a signal of a bubble appearing, others stated that the Brazilian economy was reaching its full potential and was experiencing high levels of growth in their average annual GDP.

The South African housing market has not been researched as thoroughly as other EME's. Before the Global Financial Crisis of 2008 the real estate market was researched less so than other assets such as bonds and shares. The crisis however stimulated interest in the housing market with most attention given to the small, medium and large households. Das, Gupta & Kanda (2011) determined that the growth of housing prices has had a generally negative trend between 2003 and 2009. This, however, may represent the economy recovering from a bubble or just a slowdown in the market due to the recession. Their exploration into the South African housing market showed that there was evidence of bubbles in small, medium and large segments throughout their sample of 1969 to 2009.

3. Data

The data collected for this study includes house prices for small, medium and large housholds in South Africa for the period January 2000 to November 2016. This data is available through Bloomberg. To adjust the house prices and to determine their fundamental price, the Consumer Price Index (CPI) of South Africa was used. The CPI was collected for the same time period and was accessed through Statistics SA who provide monthly estimates. For the purpose of this study, the logged value of the deflated weighted average of the small, medium and large house price indices is used to calculate the GSADF sequence and critical values. This is represented in Figure 1 in the appendix.

Figure 2 shows the housing price index for small, medium and large households as blue, green and red lines respectively. What can clearly be seen is large increase in housing prices since 2000. Figure 3 shows the percentage change for small, medium and large households. This graph shows the large percentage differentials between 2008 and 2009 during the Global Financial Crisis.

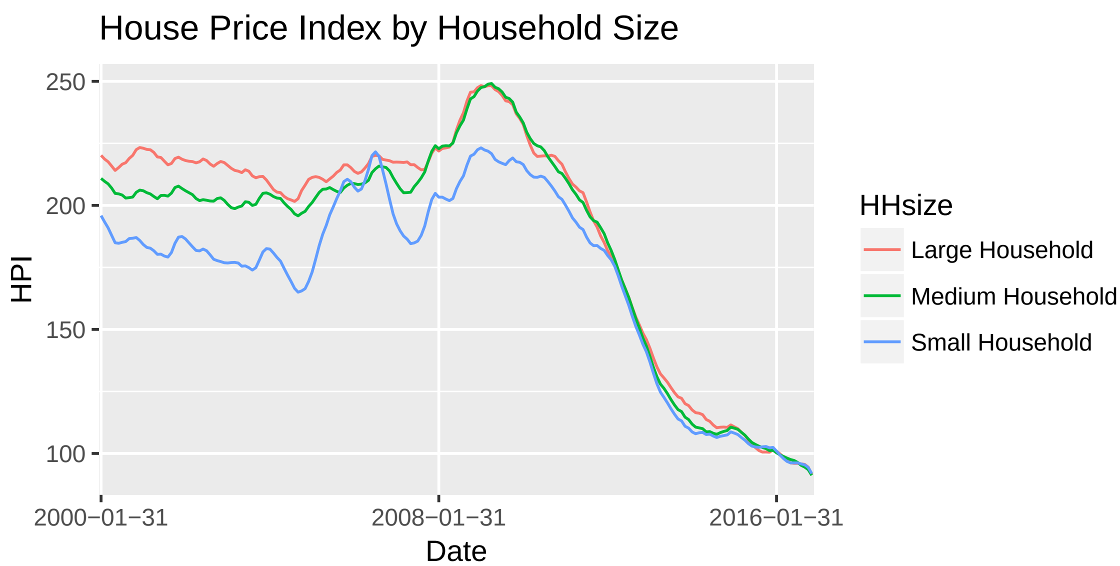


Figure 3.1: Backward SADF procedure

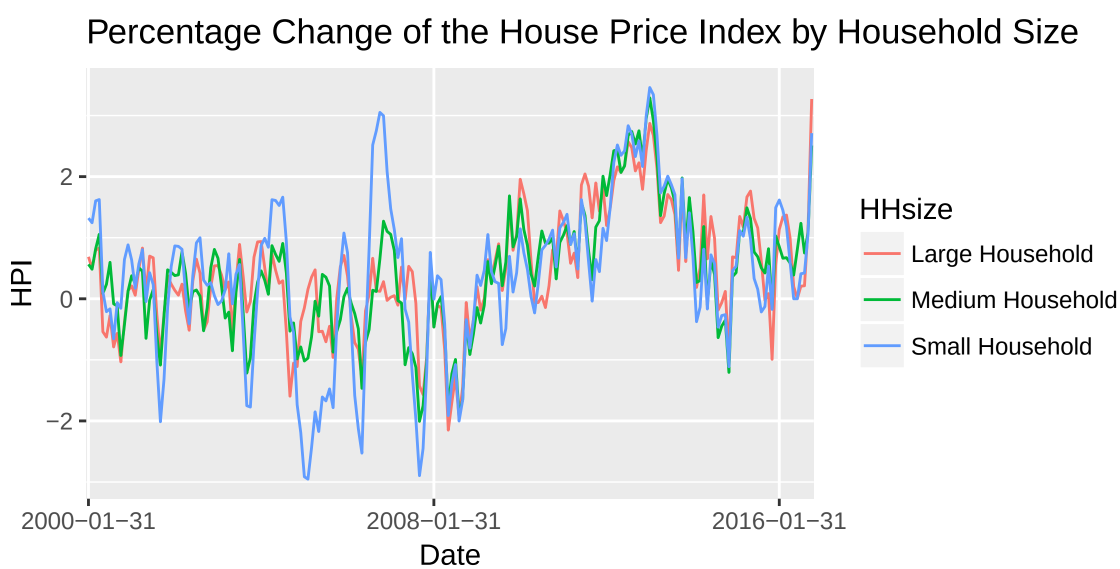


Figure 3.2: Backward SADF procedure

This result is in line with Das, Gupta & Kanda (2011) of negative growth during 2003 and 2009. Towards the end of the sample period the percentage change is not as large as the earlier years which slows low economic growth following the recession of 2008.The GSADF critical values were obtained from 1000 Monte Carlo simulations, the minimum size of the variable window width is set to 20.

4. Methodology

4.1. Fundameantal Price

While there have been many ways suggested of determining the fundamental house prices, for the purpose of this study the Consumer Price Index will be used to provide an estimate of the fundamental house price. This is due to a lack of data for rental prices in South Africa which can be disaggregated according to small, medium and large households. Another restriction on the data is a lack of monthly data for disposable income in South Africa which can be disaggregated according to the three household categories. Therefore, to estimate the fundamental house price, the housing price index is divided by CPI to adjust for inflation and to provide a more accurate index for houses in South Africa.

4.2. GSADF Test

The technique used to identify episodes of house price explosivity is based on the work initiated by Phillips, Shi, and Yu (2013). This method employs a flexible moving average sample test process to efficiently and accurately detect periods, from beginning to end, where the house price series contains a unit root that exceeds unity. The method proposed by Phillips, Shi and Yu (2013) is a test technique that recursively executes an ADF-type regression test using a rolling window process. Assuming the rolling interval starts with fraction r_1 and finishes with a fraction r_2, the size of the window is then given as

$$r_w = r_2 - r_1$$

Then:

$$y_t = \mu + \delta y_{t-1} + \sum_{i=1}^{p} \sigma_{r_w}^{i} \delta y_{t-i} + \epsilon_t \tag{4.1}$$

$$\tag{4.2}$$

where μ, δ and σ are parameters estimated using OLS. We then test null of $H_0 : \delta = 1$ against the right sided alternative $H_1 : \delta > 1$. The number of observations used in equation 1 is $T_w = [r_w T]$, where $[.]$ is the integer component. The ADF statistic corresponding to equation 1 is thus denoted by $ADF_{r_1}^{r2}$.

Phillips, Shi, and Yu (2013) then extended this approach by formulating a backward sup ADF test where the starting point of the window size expands from an initial fraction &r_{0}$ to r_2, the end point of the subsample remains fixed at a fraction r_2 for the entire sample. The backward sup ADF process can be defined as:

$$SADF_{r2}(r_0) = sup_{r_1} \in [0, r_1 - r_0] ADF_{r_1}^{r2} \tag{4.3}$$

$$\tag{4.4}$$

The Sup ADF procedure in equation 2 is then repeatedly implemented for each $r_2 \in [r_0, 1]$, leading to a generalized sup ADF form (GSADF), the motivation behind the recursively estimated GSADF test is grounded on the periodically collapsing nature of asset price bubbles throughout a single sample. The GSADF test is represented as follows:

$$GSADF(r_0) = sup_{r_2} \in [r_0, 1] SADF_{r_2}(r_0) \tag{4.5}$$

$$\tag{4.6}$$

The sup ADF test presents proficient bubble detection abilities in a sample where more than one bubble is present. Thus, the GSADF test performs well even with the occurrence of multiple bubble episodes. The initial minimum fraction point in equation 2, where $r_w = r_0$, is arbitrarily selected, thereafter the sample window is expanded forward until

$$r_w = r_1 = 1$$

The recursive ADF test is defined as: ADF_{rk} , for all k $\in (r_0, r_1)$

From the recursive ADF test statistic produced, the supremum value can then be identified and used to test the null hypothesis of a unit root against its right tailed alternative hypothesis by comparing the test statistic to the critical values. If the null hypothesis is rejected, then the series can be considered mildly explosive, indicated by $\delta_{r1,r2} > 1$.

The generalised form of the SADF approach (the GSADF) is defined in equation 3, the GSADF approach employs a variable window width procedure which enables the start and end points to alternate within a predefined range, $[r_0, 1]$. This enables the multiple starting and ending points to be consistently identified and date-stamped. The starting points of an explosive period are identified when the backward SADF series crosses over the critical value series from below and similarly the end point of an explosive period are identified as the point where the backward SADF series once again crosses over the critical value series from above. Thus an explosive period can be identified as the period in which the backward SADF series is above the critical value series. An explosive period ca be formally defined as:

$$r^e = inf_{r_2} \in [r_0, 1] r_2 : BSADF_{r_2} > cv_{r_2}^{\beta T}$$

$$r^f = inf_{r_2} \in [r_e, 1] r_2 : BSADF_{r_2} > cv_{r_2}^{\beta T}$$

Where $cv_{r_2}^{\beta T}$ is the $100(1-\beta_t)$ critical value of the sup ADF statistic based on $[Tr_2]$ observations. β_t is set to a constant 5% value. The $BSADF(r_0) for r_2 \in [r0, 1]$ is the backward sup ADF statistic that correlates to the GSADF statistic:

$$GSADF(r_0) = sup_{r_2} \in [r_0, 1] BSADF_{r_2}(r_0)$$

5. Results

The results of the recursive GSADF procedure shows period of explosivity within the housing prices of South Africa. These periods are shown when the BSADF, blue line, exceeds the critical values as shown by the red line. Figure4 shows that there were two periods that can be classified as housing bubbles.

Figure 4: Backward SADF procedure

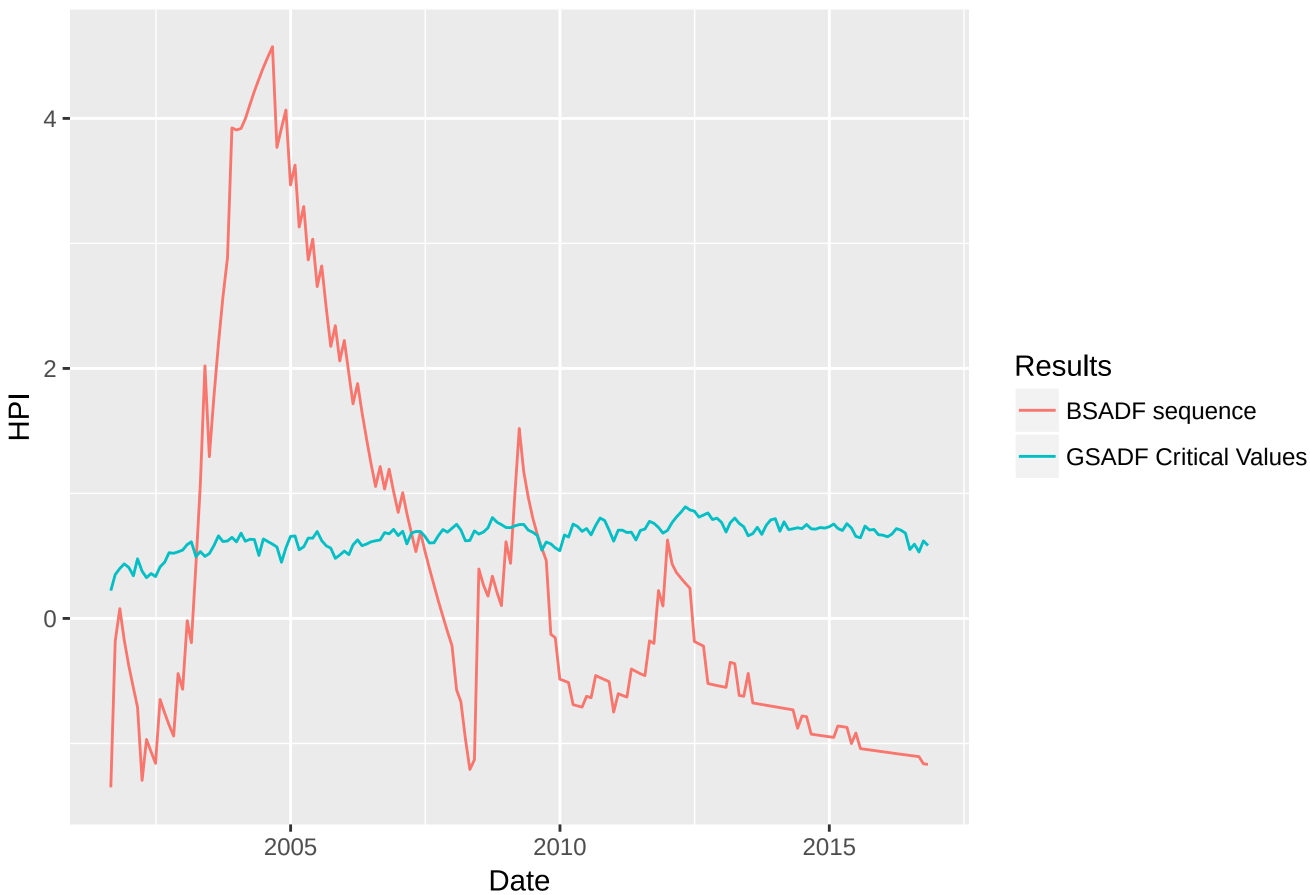


Table 1 provides a summary of the two explosive periods, the longest of which was between 2003 and 2007, just before the Global Financial Crisis.

Table 5.1: GSADF Explosive Periods

Sample:	January 2000 -	November 2016
Included	Observations:	183
Start Date	End Date	Duration (months)
May 2003	April 2007	48
March 2009	August 2009	7

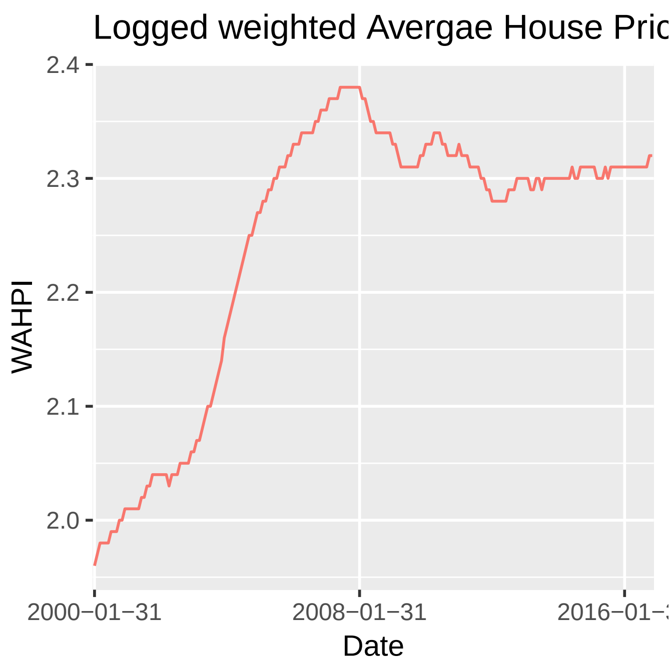
This period coincides with the increasing house prices in the United States along with lowering Fed interest rates as well as the South African housing market boom. A rise in the number of houses purchased by the black middle class increased significantly while the economy was more stable and secure, allowing the economy to grow. Another reason for the large increase was the due to the decrease in transfer duties on properties as well as the increase in housing finance to the lower income households. The reason for the period of explosivity ending was the National Credit Act of 2008 which limited the funds that could be borrowed to households along with increasing interest rates and a slowing of the economy due to the Global Financial Crisis. Following the Global Financial Crisis, the housing market could recover during 2011 and 2012, when quantitative easing was implemented and South Africa was receiving attention from foreign investors, allowing the economy to grow significantly. Even though the mortgage growth was declining to less than 5%, house prices continued to increase. Currently South Africa is experiencing higher interest rates which discourages households to take on mortgages to purchases houses, therefore South Africa is currently experiencing a low demand for houses.

6. Conclusion

This paper set out to identify periods of the South African house explosivity during the period 2000 to 2016 using a weighted average of residential house prices. The fundamental house price was calculated by adjusting for inflation (CPI) and would therefore show the general movements in prices instead of being influenced by the economic cycle. By making use of the recursive GSADF test, the periods of house price explosivity can be identified by plotting the BSADF values against the critical values. The results indicated that there were five periods of explosivity, all due to factors such as a growing black middle income population, the South African economy becoming stable and investors gaining confidence in the market and finally and increase in the demand for mortgages due to low interest rate and inflation levels.

In conclusion, the South African housing market shows volatility in the house prices and periods of explosivity can easily be identified. These periods are all caused by economic events such as the Global Financial Crisis of 2008 as well as the economic cycle of South Africa. Anticipating a housing bubble accurately is unfortunately impossible. Currently, the market is not experiencing a bubble due to political instability and global economic factors that are hindering investors from tying their money into a long-term asset such as the housing market.

7. Appendix



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