

# BUBBLES IN SOUTH AFRICAN HOUSE PRICES AND THEIR IMPACT ON CONSUMPTION

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## ***Abstract***

This study tests for house price bubbles in the South African housing market using quarterly data from 1969:Q2 to 2009:Q3, based on the unit root test developed by Phillips, Wu, and Yu (2010). The findings indicate house price bubbles in the aggregate, large, medium, and small-middle segments, but not in the luxury and affordable segments. Next, symmetric and asymmetric versions of an Error Correction Model (ECM) are used to investigate the spillover effects from the housing sector onto consumption. Results indicate significant and asymmetric spillovers, with consumption responding significantly to house price deceleration, although there is no evidence of the effect being higher during the bubble period.

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The recession in the United States in the recent past has stimulated widespread interest in research on the housing market and the macroeconomy. Economists have started to believe that movements in the associated housing markets are not just the consequences of movements in the economy, but in fact provide important impulses to business cycle fluctuations (Iacoviello, 2009). Leamer (2007) strongly argues that housing *is* the business cycle. Further, the Federal Reserve Chairman Ben Bernanke (2008), in his introductory remarks at a conference on Housing and Mortgage Markets in 2008, indicated that “Housing and housing finance played a central role in precipitating the current crisis.”

Thus, the growth in the literature concerning the effects of spillovers from the housing market on to the real sector of the economy is hardly surprising (e.g., Green, 1997; Ng and Schaller, 1998; Catte, Girouard, Price, and André, 2004; Case, Quigley, and Shiller, 2005; Iacoviello, 2005, 2009; Leamer, 2007; Ghent and Ownyang, 2009; Pavlidis, Paya, Peel, and Spuru, 2009; Iacoviello and Neri, 2010). Indeed, research on housing is no longer confined to “real estate economics,” but has become part of mainstream economics. It is only fair to say that research on housing-related issues can no longer be dubbed as a niche topic anymore. The spillovers from the housing sector onto the real sector of the economy have gained more importance over time, and are concentrated on consumption (Iacoviello and Neri, 2010), given that consumption is the most dominant component of the Gross Domestic Product (GDP). In addition, there is evidence of strong comovement between house prices and consumption (Aoki, Proudman, and Vlieghe, 2004; Ludwig and Slok, 2004;

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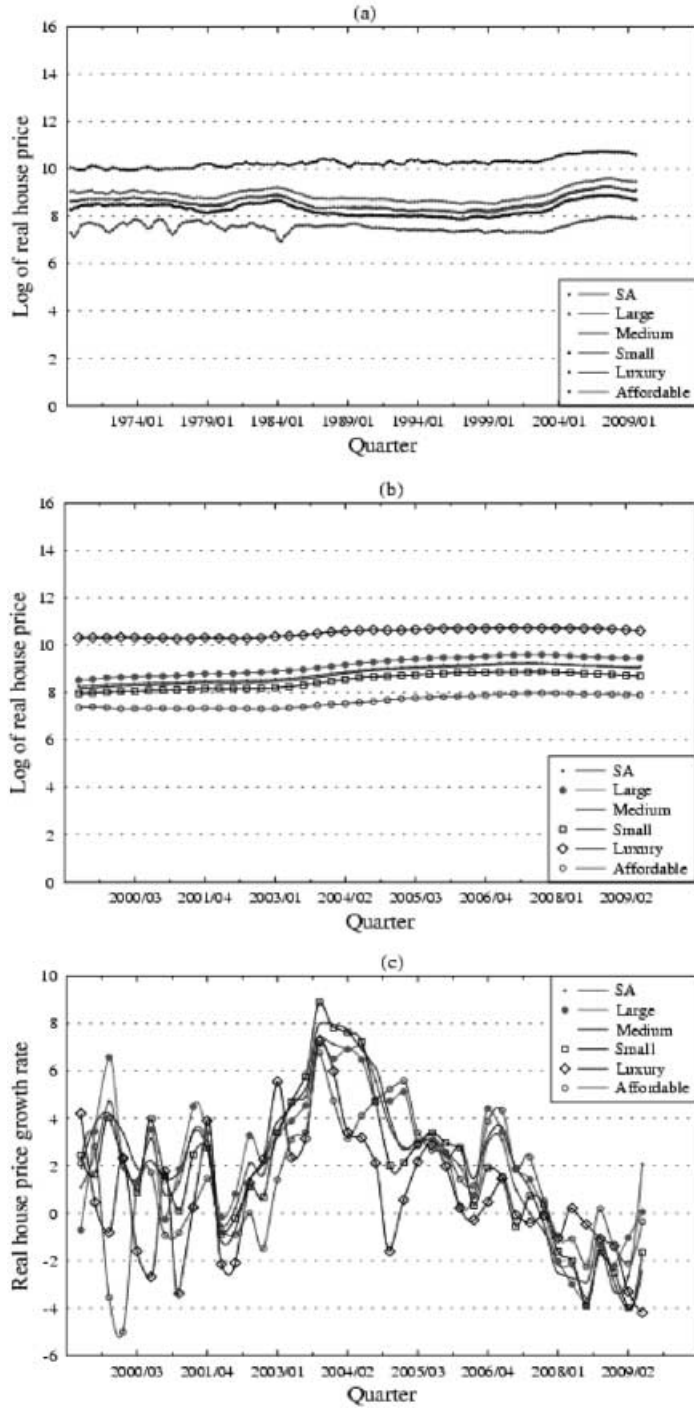
Christensen, Corrigan, Mendicino, and Nishiyama, 2009; Iacoviello, 2011). Rapach and Strauss (2006) indicate that consumption reacts more vigorously to variations in the housing wealth than fluctuations in the stock market wealth. Ng and Schaller (1998) and Pavlidis, Paya, Peel, and Spiru (2009) contend that house price bubbles account for an important share in the fluctuation in consumer expenditure.

As indicated in Panels A and B in Exhibit 1, though not as drastic as the recent decline in U.S. house prices, real house prices in the five major segments of the South African housing market, namely, luxury, large-middle-segment, medium-middle-segment, small-middle-segment, and affordable, and the combined middle-segment<sup>1</sup> depict a relatively flat positive trend in recent years, starting around 2003:Q2. In fact, the growth rate in real house prices, as shown in Panel C has generally had a negative trend between 2003:Q2 and 2009:Q2. An important question is then whether such a movement in house prices is the result of a bubble in the market? The term “bubble” in economics refers to the increase in the price of an asset beyond the level required by economic fundamentals (Lansing, 2007). John Loos (a strategist at First National Bank, one of the major financial service institutions in South Africa) argues that house prices in South Africa were “grossly undervalued” during the late 1990s and the boom was mainly a “normalization” (*Pretoria News*, February 4, 2010: “House prices increasing but analysts are split on outlook” by Ethel Hazelhurst). Such a statement, though unlikely to be based on any econometric modeling, tends to suggest that the slowdown in the housing market is more likely due to the recession witnessed by the economy in general and not a bubble.

Against this backdrop, this paper attempts to: (1) statistically test for the existence, emergence, and bust of house price bubbles in five segments and the aggregate middle segment of the South African housing market, based on the unit root test developed by Phillips, Wu, and Yu (2011); (2) analyze the size of the spillover of house price acceleration and deceleration and the impact of bubbles, if detected, on the growth rate of consumption using an Error Correction Model (ECM) developed by Pavlidis, Paya, Peel, and Spiru (2009); and (3) following Apergis and Miller (2006), investigate if there exists possible asymmetric effects of house price acceleration and deceleration on consumption. It must be realized that the size of tangible or non-financial assets is a significant component in a household’s portfolio, and accounted for 29.40% and 21.68% of total household assets and wealth respectively, in South Africa (South African Reserve Bank, 2010). Although these numbers are not as large compared to the U.S. economy, which happens to be respectively, 37.78% and 47.92% (Iacoviello, 2011), they most certainly cannot be ignored. The literature on housing market spillovers, discussed above, has thus far only been restricted to the U.S. and Europe, and this paper provides a first look at the impact of housing on consumption in the context of an emerging economy.

In addition, from a policy perspective, Pavlidis, Paya, Peel, and Spiru (2009) argue that the existence of a bubble in a housing market should concern monetary authorities because of the possible effect of the bubble on consumption. This, in turn, has led to recent discussions on whether central banks should target house price inflation (e.g., Finocchiaro and von Heideken, 2007; Taylor, 2007; Jarocinski and Smets, 2008; Pàriès

**Exhibit 1**  
**Real House Prices and Real House Price Growth Rates in South Africa**



and Notarpietro, 2008; Vargas-Silva, 2008a,b; Demary, 2009; Andre, 2010; Bernanke, 2010) in the U.S. and European contexts, as well as for South Africa (Naraidoo and Ndahiriwe, 2010; Naraidoo and Paya, 2010).

The rest of the paper is organized as follows: Section 2 discusses the methodology, Section 3 presents the data and results for both the test for bubbles and the impact of house prices on consumption and finally Section 4 concludes.

## METHODOLOGY

While there is a huge literature (Gurkaynak, 2005) on ways to detect bubbles in asset prices, this study uses the methodology outlined in Phillips, Wu, and Yu (2011), since it not only detects the existence of bubbles, but also helps in identifying the dates corresponding to the start and end of the bubble.

According to Phillips, Wu, and Yu (2011), a bubble, defined as the increase in the price of an asset beyond the level required by economic fundamentals (Lansing, 2007), exists when the null hypothesis ( $H_0$ ) of unit root is rejected against the alternative hypothesis ( $H_1$ ) of an explosive series based on the regression:

$$s_t = \mu + \phi s_{t-1} + \sum_{j=1}^J \xi_j \delta s_{t-j} + \varepsilon_{s,t}, \quad (1)$$

where  $s_t$  is the asset (house) price;  $\varepsilon_{s,t} \rightarrow N(0, \sigma_s^2)$ ;  $H_0 : \phi = 1$ ;  $H_1 : \phi > 1$ . The Akaike Information Criterion (AIC) was used to select the appropriate lag length,  $J$ .

The Phillips, Wu, and Yu (2011) unit root test consists of two tests: a right-side Augmented Dickey-Fuller (ADF) test and a sup Augmented Dickey-Fuller test, which involves recursively estimating equation (1) i.e., estimating equation (1) for some fraction of the entire sample,  $r_0$ , and then successively adding one more observation. Under the null hypothesis, the test statistics for the right-side and sup Augmented Dickey-Fuller tests, denoted by  $ADF_r$  and  $\sup_{r \in [r_0, 1]} ADF_r$ , respectively, are defined as follows:

$$ADF_r = \frac{\int_0^r W dW}{\int_0^r W^2} \quad (2)$$

$$\sup_{r \in [r_0, 1]} ADF_r = \sup_{r \in [r_0, 1]} \frac{\int_0^r W dW}{\int_0^r W^2}, \quad (3)$$

where  $W$  is a Brownian motion, and  $r \in [r_0, 1]$  represents a fraction of the whole sample, which is set to 0.25 (Pavlidis, Paya, Peel, and Spuru, 2009). Note  $ADF_1$  would correspond to the  $t$ -statistic of the test developed for the full-sample.

Following Pavlidis, Paya, Peel, and Spuru (2009), an ECM is estimated to investigate the possible effect of house price on consumption. However, the framework differs slightly from the specification in Pavlidis, Paya, Peel, and Spuru (2009), as we explicitly incorporate the role of real interest rate in the model. The investigation began with a general specification, which included four lags of  $\Delta c_t$ , and both contemporaneous and four lags of  $\Delta w_t$ ,  $\Delta y_t$ ,  $\Delta r_t$ , and  $[d(\Delta rhp)]_t$ , and then followed a general-to-specific approach to formulate the following model, which in general, ensures normality, no serial correlation and no heteroscedasticity<sup>2</sup>:

$$\begin{aligned} \Delta c_t = & \beta_0 + \sum_{i=1}^4 \beta_i \Delta c_{t-i} + \beta_5 \Delta w_{t-3} + \beta_6 \Delta y_t + \beta_7 \Delta r_t + \beta_8 [d(\Delta rhp)]_{t-1} \\ & + \beta_9 ec_{m_{t-1}} + \varepsilon_t, \end{aligned} \quad (4)$$

where,  $\Delta$  is the first-difference operator,  $c$  is the log of real consumption (non-durables and services),  $w$  is the log of real all share index,  $y$  represents the log of real personal disposable income, and  $r$  is the real interest rate. The price acceleration (deceleration) term  $[d(\Delta rhp)]_{t-1}$  is defined as  $\Delta rhp_{t-1} - \Delta rhp_{t-2}$ , with  $rhp$  being the log of real house price and  $ec_{m_{t-1}} = c_{t-1} - w_{t-1} - y_{t-1} - r_{t-1}$  represents the error correction term. At this stage, it is important to emphasize three specification issues. First, based on the Trace and Eigen value tests, only one cointegrating vector was obtained between  $c$ ,  $w$ ,  $y$ , and  $r$  and hence, the decision to use an ECM, instead of a Vector ECM (VECM), is well-motivated. Second, even though the use of contemporaneous values of explanatory variables are permissible in an ECM, there is a concern of endogeneity. But, when causality tests were performed, the null that consumption does not Granger cause disposable personal income and interest rate could not be rejected at the 10% level of significance. Realizing the Granger causality tests relate to lagged values of the variables, exogeneity tests were also performed on the cointegrating vector, normalized on output and interest rate individually. The chi-square test statistic found the concurrent values of the real personal disposable income and interest rate to be, in fact, exogenous. Finally, given the weak evidence of normality in certain specifications, the OLS estimates were complimented with Least Absolute Deviations (LAD) estimates. However, the fit of the models, both symmetric and asymmetric, were not only significantly reduced, but strict normality was still not achieved.<sup>3</sup>

Equation (4) is estimated recursively, starting with the period 1969:Q2–1985:Q4 to gain more insight on the spillover from the housing sector onto the real sector of the economy over a sub-sample and the bubble-period, if and once identified by the unit root test of Phillips, Wu, and Yu (2011). Note, a regression is first run for the sub-sample 1969:Q2 (starting point of the sample) to 1985:Q4, then the initial sample is sequentially extended by adding one more observation until 2009:Q3 (end point of the sample) and then the way in which both the coefficients and the respective

### Exhibit 2 Provinces and Metropolitan Areas in South Africa



The source is the Council for Scientific and Industrial Research (CSIR), Pretoria, South Africa.

**Exhibit 3**  
**Unit Root Test for Bubbles**

Category	<i>sup ADF<sub>r</sub></i>	<i>ADF<sub>1</sub></i>
SA	2.3373***	0.9668***
Large	2.3597***	1.3186***
Medium	2.4252***	0.8574***
Small	1.1893*	-0.0516**
Luxury	1.1239	-0.7685
Affordable	-0.2350	-0.8569
Critical Values for Explosive Alternative		
1%	0.60	2.094
5%	-0.08	1.468
10%	-0.44	1.184

Notes: The tests employs the Phillips, Wu, and Yu (2010) unit root test. The table reports the *ADF<sub>1</sub>* and *sup<sub>r∈[r<sub>0</sub>,1]</sub>ADF<sub>r</sub>* tests of the null hypothesis of a unit root against the alternative of an explosive series, with *r<sub>0</sub>* = 0.25. The sample period is 1969:02 to 2009:03. Critical values for the statistic are obtained from table 10.A.2 in Fuller (1996), while the critical values for *sup<sub>r∈[r<sub>0</sub>,1]</sub>ADF<sub>r</sub>* are obtained by Monte-Carlo simulation with 10,000. replications.

\* Significant at the 10% level.

\*\* Significant at the 5% level.

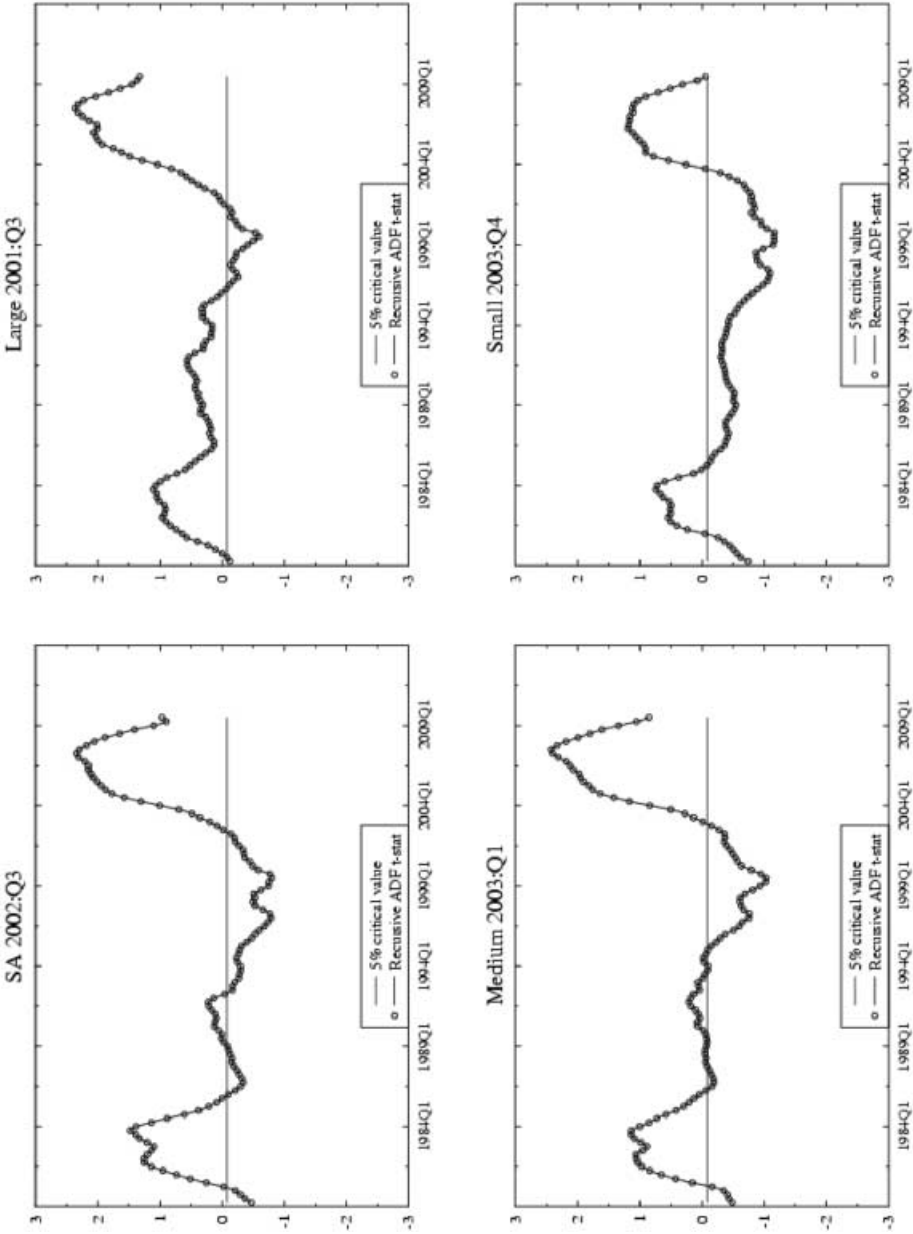
\*\*\* Significant at the 1% level.

*t*-statistics of the house price acceleration (deceleration) are examined. The choice of the date 1985:Q4 coincides with the liberalization of the financial sector in South Africa, following recommendations of the de Kock commission (Ludi and Ground, 2006; du Plessis, Smit, and Sturzenegger, 2007).

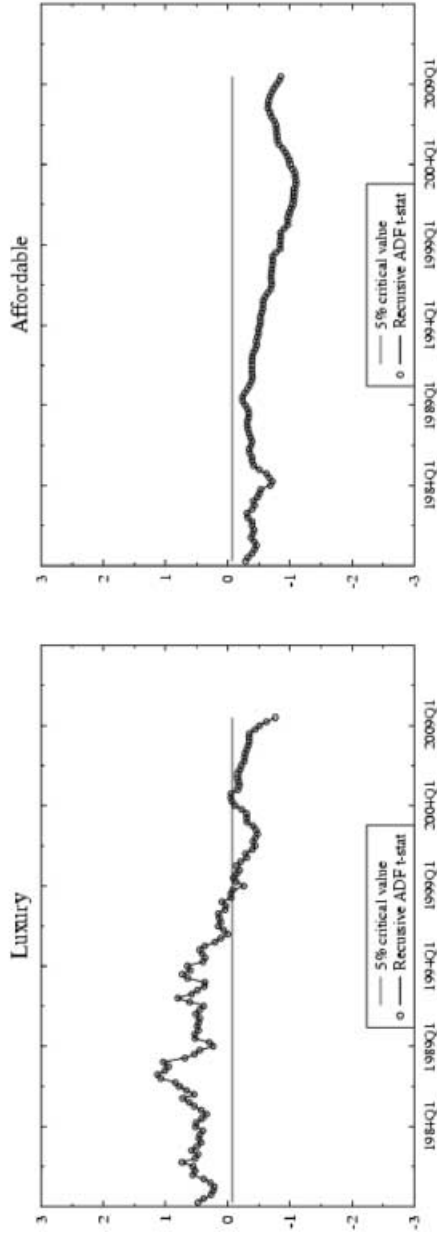
In addition, based on the work of Apergis and Miller (2006), this study investigates possible asymmetric (both positive and negative) effects of all variables and house prices in particular, on consumption, by distinguishing the “plus” and “minus” values for all variables in (4) barring the *ecm<sub>t-1</sub>* term. Ideally one would want to use a non-linear framework to analyze asymmetric effects (e.g., Apergis and Miller, 2004, 2005a, 2005b), although this a topic for future research. The following ECM can be used to measure asymmetric behavior:

$$\begin{aligned}
 \Delta c_t = & \beta_0 + \sum_{j=1}^4 \sum_{i=1}^4 \beta_j \Delta c_{t-i}^{(+)} + \sum_{j=5}^8 \sum_{i=1}^4 \beta_j \Delta c_{t-i}^{(-)} + \beta_9 \Delta w_{t-3}^{(+)} + \beta_{10} \Delta w_{t-3}^{(-)} + \beta_{11} \Delta y_t^{(+)} \\
 & + \beta_{12} \Delta y_t^{(-)} + \beta_{13} \Delta r_t^{(+)} + \beta_{14} \Delta r_t^{(-)} + \beta_{16} [d(\Delta rhp)]_{t-1}^{(+)} + \beta_{17} [d(\Delta rhp)]_{t-1}^{(-)} \\
 & + \beta_{15} ecm_{t-1} + \varepsilon_t.
 \end{aligned}
 \tag{5}$$

**Exhibit 4**  
**House Price Bubbles: Recursive ADF  $t$ -statistics**



**Exhibit 4 (continued)**  
**House Price Bubbles: Recursive ADF  $t$ -statistics**



**Exhibit 5**  
**Consumption Regression with Symmetric Effects**

	(a)	(b)
$\beta_0$	0.0074*** (4.9833) [0.0015]	0.0082*** (5.1379) [0.0016]
$\beta_1$	-0.0550 (-0.6022) [0.0913]	-0.0781 (-0.6810) [0.1148]
$\beta_2$	0.1630** (2.6037) [0.0626]	0.1079** (1.9808) [0.0545]
$\beta_3$	-0.1434* (-1.9611) [0.0731]	-0.1205 (-1.3176) [0.0915]
$\beta_4$	0.1605** (2.1068) [0.0762]	0.1271 (1.5378) [0.0826]
$\beta_5$	0.0202** (2.2820) [0.0088]	0.0248*** (2.6432) [0.0094]
$\beta_6$	0.1834*** (5.5564) [0.0330]	0.1914*** (6.0202) [0.0318]
$\beta_7$	0.0017*** (2.6770) [0.0006]	0.0011 (1.6218) [0.0007]
$\beta_8$	0.2314*** (3.4769) [0.665]	—
$\beta_9$	-0.0713** (-2.2195) [0.0321]	-0.0827** (-2.3154) [0.0357]
JB	6.6132 [0.0366]	17.3435 [0.000]
BG(4)	1.1379 [0.3411]	0.4751 [0.7539]
ARCH(4)	1.0315 [0.3931]	2.6925 [0.0333]
$\overline{R^2}$	0.3517	0.2852

Notes: The model estimated is:

$$\Delta c_t = \beta_0 + \sum_{i=1}^4 \beta_i \Delta c_{t-i} + \beta_5 \Delta w_{t-3} + \beta_6 \Delta y_t + \beta_7 \Delta r_t + \beta_8 [d(\Delta rhp)]_{t-1} + \beta_9 ecm_{t-1} + \varepsilon_t$$

where,  $\Delta$  is the first-difference operator,  $c$  is the log of real consumption (non-durables and services),  $w$  is the log of real all share index,  $y$  represents the log of real personal disposable income and  $r$  is the real interest rate,  $[d(\Delta rhp)]_{t-1}$  is the price acceleration (deceleration) term

**Exhibit 5 (continued)**  
**Consumption Regression with Symmetric Effects**

defined as  $\Delta rhp_{t-1} - \Delta rhp_{t-2}$ , with  $rhp$  being the log of real house price and  $ecm_{t-1} = c_{t-1} - w_{t-1} - Y_{t-1} - r_{t-1}$  represents the error correction term.  $t$ -statistics are in parentheses, Newey-West robust standard errors are in brackets. JB is the Jarque-Bera test for normality. BG (4) is the Breusch-Godfrey test for serial correlation. ARCH (4) is the heteroscedasticity test for residuals. For the JB, BG (4), and ARCH (4) statistics,  $p$ -values are given in brackets.

\* Significant at the 10% level.

\*\* Significant at the 5% level.

\*\*\* Significant at the 1% level.

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## DATA AND RESULTS

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### Data

This study employs quarterly house price data available from the ABSA's Housing Price Survey. It is one of the largest private financial services institutions in South Africa. The data are collected from both the metropolitan and rural areas of the nine provinces (Eastern Cape, Free State, Gauteng, Kwa-Zulu Natal, Limpopo, Mpumalanga, Northern Cape, North West, and Western Cape) of South Africa. Exhibit 2 presents a map of South Africa indicating the nine provinces and the metropolitan areas, the latter indicated with light shades. The survey categorizes houses in three price segments: luxury (R3.1 million to R11.5 million); middle-segment (R430,000 to R3.1 million), and affordable (below R430,000 and area below 40 m<sup>2</sup>–79 m<sup>2</sup>). The middle-segment is further subdivided into three types based on size: large (between 221 m<sup>2</sup> and 400 m<sup>2</sup>); medium (between 141 m<sup>2</sup> and 220 m<sup>2</sup>), and small (from 80 m<sup>2</sup> to 140 m<sup>2</sup>).

The real house price is computed as the nominal house price divided by headline CPI. The quarterly seasonally adjusted data on real consumption (non-durables and services), real personal disposable income, real all share stock index [used as a measure of financial wealth following Hall, Hondroyiannis, Swamy, and Tavlas (2009)], and the 90-day nominal Treasury bill rate are obtained from the official website of the South African Reserve Bank (SARB). Note, the real interest rate is obtained by subtracting the inflation rate (percentage change of the headline CPI) from the nominal Treasury bill rate. Data availability on all the variables at the time of writing gives a sample period of 1969:Q2 to 2009:Q3. Finally, when estimating the ECM, the house price of the aggregate middle-segment of the market is used to compute the house price acceleration (deceleration) variable, since data on consumption are only available economy-wide and not based on choices of housing category.

### Tests for Bubbles

Exhibit 3 reports the sup ADF, and ADF<sub>1</sub> tests of the null hypothesis of a unit root against the alternative of an explosive root. Using the ADF<sub>1</sub> test (i.e., the test for the

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**Exhibit 6**  
**Consumption Regression with Asymmetric Effects**

	(a)	(b)
$\beta_0$	0.040 (1.4254) [0.0028]	0.0054** (1.8953) [0.0029]
$\beta_1$	0.0705 (0.7235) [0.0975]	0.0954 (0.9150) [0.1043]
$\beta_2$	0.0665 (0.7676) [0.0866]	-0.0463 (-0.5909) [0.0783]
$\beta_3$	-0.1061 (-0.8358) [0.1270]	-0.1272 (-0.9159) [0.1389]
$\beta_4$	0.1198 (1.2173) [0.0984]	0.1145 (1.0004) [0.1144]
$\beta_5$	-0.3401** (-2.5240) [0.1347]	-0.4468** (-2.1221) [0.2105]
$\beta_6$	0.4335** (2.0107) [0.2156]	0.5987*** (3.0342) [0.1973]
$\beta_7$	-0.3413 (-1.0481) [0.3256]	-0.2896 (-0.9903) [0.2924]
$\beta_8$	0.2817 (1.5199) [0.1853]	0.1585 (0.8414) [0.1883]
$\beta_9$	0.0696*** (3.8688) [0.0180]	0.0783*** (4.6930) [0.0167]
$\beta_{10}$	-0.0146 (-0.8743) [0.0167]	-0.0159 (-0.9129) [0.0175]
$\beta_{11}$	0.1919*** (5.0172) [0.0383]	0.2079*** (5.2649) [0.0395]
$\beta_{12}$	0.1924*** (2.9592) [0.0650]	0.2009*** (2.7754) [0.0724]
$\beta_{13}$	0.0016 (1.2847) [0.0012]	0.0004 (0.3156) [0.0012]
$\beta_{14}$	0.0018 (1.5094) [0.0012]	0.0020 (1.6258) [0.0013]

**Exhibit 6 (continued)**  
**Consumption Regression with Asymmetric Effects**

	(a)	(b)
$\beta_{15}$	0.1909 (1.6452) [0.1160]	—
$\beta_{16}$	0.2193** (2.3721) [0.0924]	—
$\beta_{17}$	-0.0693* (-1.8543) [0.0374]	-0.0816** (-2.0881) [0.0391]
JB	5.9812 [0.0503]	12.7108 [0.0017]
BG(4)	1.7591 [0.1407]	0.8349 [0.5052]
ARCH(4)	0.5825 [0.6758]	1.1299 [0.3447]
$\overline{R^2}$	0.3643	0.3237

Notes: The model estimated is:

$$\Delta c_t = \beta_0 + \sum_{j=1}^4 \sum_{i=1}^4 \beta_j \Delta c_{t-i}^{(+)} + \sum_{j=5}^8 \sum_{i=1}^4 \beta_j \Delta c_{t-i}^{(-)} + \beta_9 \Delta w_{t-3}^{(+)} + \beta_{10} \Delta w_{t-3}^{(-)} + \beta_{11} \Delta y_t^{(+)} + \beta_{12} \Delta y_t^{(-)} + \beta_{13} \Delta r_t^{(+)} + \beta_{14} \Delta r_t^{(-)} + \beta_{15} [d(\Delta rhp)]_{t-1}^{(+)} + \beta_{16} [d(\Delta rhp)]_{t-1}^{(-)} + \beta_{17} ecm_{t-1} + \varepsilon_t,$$

where,  $\Delta$  is the first-difference operator,  $c$  is the log of real consumption (non-durables and services),  $w$  is the log of real all share index,  $y$  represents the log of real personal disposable income and  $r$  is the real interest rate,  $[d(\Delta rhp)]_{t-1}^{(+)}$  ( $[d(\Delta rhp)]_{t-1}^{(-)}$ ) is the price acceleration (deceleration) term.  $[d(\Delta rhp)]_{t-1}$  is defined as  $\Delta rhp_{t-1} - \Delta rhp_{t-2}$ , with  $rhp$  being the log of real house price and  $ecm_{t-1} = c_{t-1} - w_{t-1} - y_{t-1} - r_{t-1}$  is the error correction term.  $t$ -statistics are in parentheses, Newey-West robust standard errors are in brackets. JB is the Jarque-Bera test for normality. BG (4) is the Breusch-Godfrey test for serial correlation. ARCH (4) is the heteroscedasticity test for residuals. For the JB, BG (4), and ARCH (4) statistics,  $p$ -values are given in brackets.

\* Significant at the 10% level.

\*\* Significant at the 5% level.

\*\*\* Significant at the 1% level.

full-sample), the test fails to reject the null hypothesis of  $\phi = 1$  in favor of the right-tailed alternative hypothesis of  $\phi > 1$  at the 10% level of significance only for the luxury and affordable segments of the market. Therefore, there is evidence of significant exuberance for the aggregate and the sub-categories of the entire middle-segment, at least at the 5% level of significance. The results are also confirmed by the sup ADF<sub>t</sub> test.<sup>4</sup> The results are expected, given that affordable housing is government provided, and hence, has a controlled and rigid pricing structure. On the other hand, luxury houses are mainly bought by the most affluent citizens, by foreigners, and South African citizens residing abroad, who in general are well-

insured, with their decisions being less likely affected by pricing or other economic fundamentals (Gupta, Jurgilas, and Kabundi, 2010). In addition, the inherent lavish nature of luxury housing makes it a difficult market for quick transactions and movements of buyers and sellers.

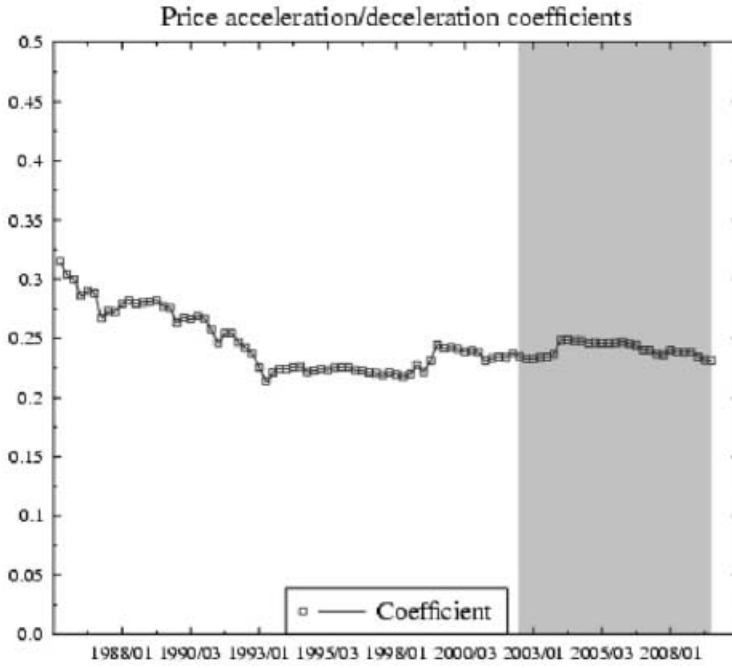
Although both the  $ADF_r$  and  $ADF_1$  tests identify the existence of bubbles in the middle segment of the housing market, the tests cannot detect the origin and possible collapse of the exuberance. For this purpose, Exhibit 4 plots the recursive ADF t-stat and the 5% critical value based on Phillips, Wu, and Yu (2011). As can be seen, the entire of middle segment of South Africa has been experiencing a housing price bubble that started around 2002:Q3. Furthermore, the test identifies the origin of a bubble in the large middle segment starting in 2001:Q3, while the medium-middle and small-middle segments are indicated to have been under the influence of bubbles from 2003:Q1 and 2003:Q4, respectively. When these dates are related to Panel B in Exhibit 1, they seem to be in line with the dates from when the real house prices in the middle segment started to witness a steeper positive trend. More importantly, barring the bubble in the small middle segment, which appears to be close to collapsing by 2009:Q3, none of the other segments bubbles appear close to collapse.

### **Impact of House Prices on Consumption**

Exhibit 5 reports results from the consumption regression equation (4). The real house price acceleration (deceleration) is significant at the 1% level, suggesting that movements in house prices have had a significant positive impact on the movements of consumption over the whole sample period. Furthermore, barring the first insignificant lag and the third significant lag of the growth rate of consumption, all the coefficients are in line with economic theory. Note, though, that the joint influence of these four lags are always positive on current consumption. Interestingly, real interest rate is found to have a small, but significant positive influence on consumption, suggesting the dominance of the income effect over the substitution effect.<sup>5</sup> When compared to equation (4), the fit of the ECM without the house price acceleration (deceleration) term is worsened.

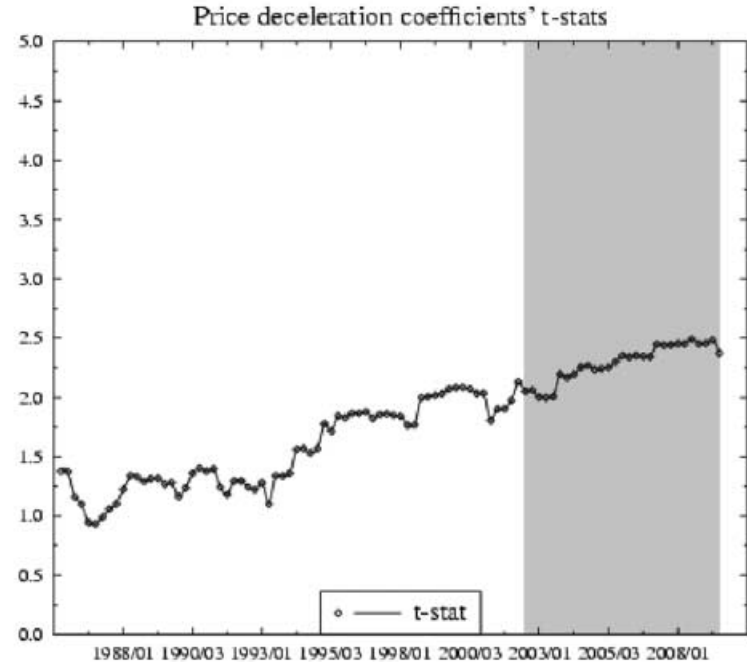
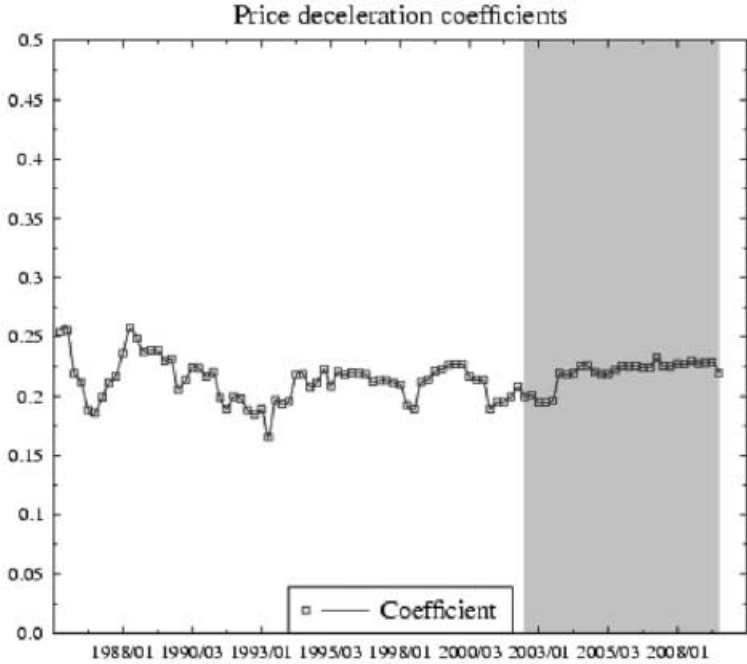
Results from the asymmetric consumption regression equation (5), as reported in Exhibit 6, show that house price deceleration rather than acceleration has a significant effect (at the 5% level) on consumption. The Wald test, though, revealed that the coefficients on the house price acceleration and deceleration are not significantly different.<sup>6</sup> However, the effect of the real interest rate on consumption becomes insignificant under this specification. Furthermore, positive movements in the third lag of the wealth variable and positive movements in the real personal disposable income are found to have a significant effect on consumption. Further, only negative movements in the first and second lag of the consumption growth variable appear to have a significant impact on consumption. The results, in general, highlight the existence of asymmetric movements of consumption to the explanatory variables. As with the symmetric ECM specification, the fit of the asymmetric ECM without the lagged house price acceleration and deceleration terms is reduced relative to the asymmetric ECM, which includes these terms. Finally, in all the specifications, the

**Exhibit 7**  
**Recursive Plots: Spillovers on Consumption**



The shaded region indicates the presence of a bubble according to the Phillips, Wu, and Yu (2010) unit root test.

### Exhibit 8 Recursive Plots: Spillovers on Consumption with Asymmetric Effects



The shaded region indicates the presence of a bubble according to the Phillips, Wu, and Yu (2010) unit root test.

error correction term is always significant and a negative fraction, highlighting that short-run dynamics correct for any possible disequilibrium from the long-run relationship.<sup>7</sup>

Exhibits 7 and 8 show the recursive estimates of the coefficients of the price acceleration (deceleration) from the symmetric model (4) and price deceleration from the asymmetric version of the same (5), respectively. In addition, the Exhibits also plot the way in which the corresponding *t*-statistics of the coefficient has evolved. In both cases, estimates of the coefficients are significant. However, there is no evidence of their effects on consumption being higher during the period of the bubble (starting around 2002:Q4), as observed for the U.S. (Pavlidis, Paya, Peel, and Spuru, 2009). This is mainly due to two reasons: First, based on non-linear Taylor rules, Naraidoo and Ndahiriwe (2010) and Naraidoo and Paya (2010) argue that the SARB carefully considers a financial conditions index, and tries to insulate the economy from adverse movements of the same when setting the interest rate. Note the index was obtained as a weighted average of the real house prices, real effective exchange rate, real stock prices, credit spread, and futures interest rate; second, the National Credit Act (NCA) number 34 implemented in 2005 enforced responsible granting and use of credit, and prohibited reckless awarding of credits (NCA, 2006). In fact, as seen from Exhibit 5, the liberalization of financial markets in South Africa following the de Kock commission's (1985) recommendation, coupled with deregulation of the international capital markets and abolition of exchange rate controls in the early 1980s, possibly caused diversification of investment portfolios, so much so, that the effect of house prices on consumption started to come down since the late 1980s, with financial assets accounting for 70.6% of the total assets in 2009.

## CONCLUSION

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This study tests for bubbles in the South African housing market using the Phillips, Wu, and Yu (2011) unit root test. There is evidence of bubbles in all three subdivisions (large, medium, and small) and the aggregate of the middle segment of the South African housing market. Results for the affordable and luxury segments show no evidence of any housing bubbles. Following Pavlidis, Paya, Peel, and Spuru (2009), when the effect of house price on consumption is examined, there is significant evidence of spillovers from the housing sector to the real sector. However, the effects of the housing market spillover on the real economy do not appear to be higher during the period associated with a bubble. Based on the Error Correction Model framework of Apergis and Miller (2006), which allows incorporation of the asymmetric effects on consumption from the explanatory variables, a significant reaction of consumption on house price deceleration is found, although not for acceleration. This result highlights that the role of housing in shaping consumption decisions cannot be ignored, and is as important in an emerging economy like South Africa as observed for the U.S. and Europe. In addition, the reaction is asymmetric, with the adverse, rather than the positive, movements in house prices affecting consumption significantly, even though the size of responses to positive and negative movements in house price acceleration is virtually indistinguishable.

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Note, the asymmetric model is found to have better in-sample fit relative to the symmetric model. However, as with the symmetric ECM, findings from the asymmetric model also suggest that the effect of the house price deceleration on consumption is not higher during the bubble period. The fact that consumption is not observed to be more responsive to house price acceleration (deceleration) during the bubble period possibly reflects the effect of the NCA (number 34) implemented in 2005 (NCA, 2006) and corroborates the findings of recent studies on the behavior of the SARB in response to movements in asset prices. Based on non-linear Taylor rules, Naraidoo and Ndahiriwe (2010) and Nairadoo and Paya (2010) depict evidence of pronounced discretionary changes on behalf of the central bank to counter the recent adverse movements of a financial index, which includes real property prices besides other asset prices.

This paper takes a first look at the issue of housing price spillovers on South African consumption, using well-known econometric techniques. The aim of the study was to identify whether housing plays any important role in shaping consumption decisions before using more recent sophisticated econometric methodologies to check for both the robustness of the basic results, as well as to go beyond the focus on housing price spillovers on consumption. In this regard, future research on this topic could revisit the question of spillovers in a Vector Autoregressive (VAR) framework, which would allow examination of the effect of a real house price shock on a number of variables, besides consumption. In addition, one might also want to look into the issue in a more general time-varying Factor Augmented VAR (FAVAR) framework, which would account for possible structural breaks in the data, as well as allow examination of whether or not house prices are determined by a large number of macroeconomic variables, over and above the few generally chosen in small-scale VARs due to the curse of dimensionality (Das, Gupta, and Kabundi, 2009, 2010a,b). As for the large number of variables determining the house prices is concerned, one can also use a large-scale Bayesian VAR, which through its estimation method can also handle the degrees of freedom problem. Finally, one should ideally be trying to delve into the issue of spillovers based on a small open economy new Keynesian Dynamic Stochastic General Equilibrium (DSGE) model (e.g., Christensen, Corrigan, Mendicino, and Nishiyama, 2009), which in turn, unlike the VARs, is immune to the Lucas (1976) critique.

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## ENDNOTES

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1. Please refer to Section 3 for further details on the categorization of housing in South Africa.
2. See Exhibits 5 and 6 for further details.
3. All these results have not been reported to save space, but are available upon request from the authors.
4. In addition to analyzing the real house price, we also analyzed the housing rent data for possibility of bubbles. The corresponding values of the  $ADF_1$  and the  $sup ADR_1$  tests were  $-2.8716$  and  $1.1229$  respectively, thus, indicating no evidence of bubbles. In their analysis, Phillips, Wu, and Yu (2011) made a similar observation for the nominal dividends data of the U.S. stock market.

5. The result is not surprising, given ample evidence of the interest inelasticity of savings to interest rate in South Africa. See, for example, Gupta and Uwilingiye (2010) for further details.
6. The results from the Wald tests are available upon requests from the authors.
7. An out-of-sample forecasting exercise indicated that both the symmetric and asymmetric model of consumption specified above outperformed a random walk model, with the latter being considered as a benchmark of consumption behavior based on implications from a version of the Permanent Income Hypothesis (PIH) outlined in Hall (1978) and Gupta and Ziramba (2010). These results are available upon request from the authors.

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