The interaction between property returns and the macroeconomy: Evidence from South Africa

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ABSTRACT

A study on the interactions between property returns and the macro-economy in the UK provides contrasting results with those based on the American economy which forms the basis for this research (Brooks and Tsolacos 1999). This study therefore employs a vector autoregressive models to establish the interactions between macroeconomic and financial variables on the South African economy, a proxy for developing and transitional economies. Property assets have generally been viewed as value-growth assets due to their inflation tracking nature. Values of property-based assets may be measured through direct measures and/or equity-based measures. The two different methods of measuring the value of property-based assets available are shrouded with drawbacks although equity-based measures are theoretically preferred. This study uses direct measures to determine the impulse response functions and variance decompositions on the rate of short-term nominal rates, long-term and short-term interest differentials, inflation rate and household debt/ disposable income in South Africa.

Key words: property returns; macroeconomic; vector autoregressive; granger causality; impulse responses

1. Introduction and background

Real estate investment and finance has traditionally been classified as an illiquid asset class by portfolio managers. With the evident of innovation and architecture in financial markets however, real estate investments have become more liquid and popular in modern financial economics with the Real Estate Investment Trusts (REITs) and Property Unit Trusts (PUTs) leading the pack. Real estate investments may take different forms such as agriculture, commercial, industrial and residential portfolios. Due to the traditional illiquid nature, it has become axiomatic in financial economics to regard any form of real estate investment as a hedge against inflation. As such, we observe the overinvestment in residential houses by financial institutions on subprime clients in the US prior to 2007. Such investments led to the housing bubble which cascaded to the subprime crisis that was subsequently termed the 'Great Recession'(Krugman 2009). The trend in financial markets, in particular deposit taking banks, in financing housing projects in the economy drives the academic need to investigate the interconnections between the housing market and the macroeconomic and financial factors. Obviously, we know that financing real estate is part of financial intermediation which entails channeling savers deposits to other participants in the financial system including individuals, businesses, institutions, and governments that want to finance real-estate investments (Melicher and Norton 2011). Financing real estate investments entails the capital formation process which drives the neoclassical economic theory of financial intermediation. Now, South Africa has a well regulated financial market but is not insulated from macroeconomic and financial shocks which have serious repercussions on the housing market. These shocks may emanate from changes in monetary and foreign exchange policies, real per capita GDP, fiscal policy shifts, employment, affordability, political changes etc. We observe that the housing market in South Africa suffered a dip during the 2008-9 recessions, a period when global financial markets suffered a huge slump in investment returns.

2. Aims and objectives

The aim of this study is to establish the association between house prices and macroeconomic factors in South Africa. Accordingly, our objectives are to:

i. establish whether any association exists between house prices and macroeconomic and financial factors in South Africa;
ii. determine the direction of association between house prices and macroeconomic an financial factors in South Africa;
iii. determine the extent to which macroeconomic and financial factors impact on house prices in South Africa.

We expect the following outcomes from the study:

I. No association exists between house prices and macroeconomic factors.
II. An association exists between house prices and macroeconomic factors and if so, is it positive or negative?
III. Macroeconomic and financial factors influence house prices in South Africa.

3. Review of literature

The majority of studies on house prices and macroeconomic factors have been conducted in developed countries where financial innovation is high. A study which sought to develop a forecasting model for South African house prices was conducted in 2005 (Clark and Daniel 2006). The study considered eleven variables which are the All Share Index (ALSI), prime rate of interest, gross domestic product, building plans approved, business confidence, motor vehicle sales, household debt/disposable income, rand/dollar exchange rate, Gold and oil prices, and transfer costs. Further, Clark and Daniel used quarterly data based on house prices in the 80m2-400m2 size categories, valued less than R2 million rand and all data converted into real terms with a base year of 2000. In their study, Clark and Daniel used all factors that could possibly impact on house prices, and found a negative relationship between interest rates, exchanges rates and house price growths. Also they found a positive relationship between lagged stock market returns, GDP, transfer costs and house price growths.

On the other hand, another study to establish the determinants of residential house prices in South Africa based on a national model and used eleven variables which are real interest rates, gross national income, household debt to income ratio, net migration, crime, capitalization of the JSE, nominal exchange rate, tourism, real effective exchange rate and foreign direct investment proved to be insightful (Standish et al. 2005). The study shows a negative relationship between the JSE, ratio of debt to disposable income and housing prices, while a positive relationship exists between house prices and foreign direct investment and real gold prices(Standish et al. 2005).

However, a major study conducted in the UK used the vector autoregressive model to establish the impact of economic and financial factors on UK property performance(Brooks and Tsolacos 1999). Their study used the following variables: property returns, rate of unemployment, nominal short-term interest rates, the interest rate spread, unanticipated inflation and the dividend yield. The property returns were based on listed property (equity type) and thus had to regress to remove all significant stock market effects from the real estate return series(Brooks and Tsolacos 1999). Despite using unanticipated inflation, the study found that using actual inflation yielded the same results. In a nutshell, the study by Brooks and Tsolacos found no strong suggestive evidence of any influences of macroeconomic factors on house prices.

Another study modeled economic fundamentals in housing markets in US metropolitan regions and found that income and employment changes were fundamental in housing markets(Hwang and Quigley 2006). The study used real per capita income, employment, per capita transfer payments for unemployment and housing prices to determine which variables were exogenous to house prices. Several other studies have been conducted albeit with conflicting results and conclusions. For instance an investigation into the influence of macroeconomic factors on commercial prices based on US data and concluded that unexpected inflation, short-term interest rates, growth in real per capita consumption and the term structure influences commercial real estate returns(Ling and Naranjo 1997). Another related study found that macroeconomic variables explained about 60

percent of REITs returns(McCue and Kling 1994). Other studies sought to establish the returns between property returns and the stock market(Liu and Mei 1992; Lizieri and Satchell 1997).

Recently, it was established that property tactical asset allocation using ex ante premiums helps predict excess returns in equity REITs(Okunev and Wilson 2008). Furthermore, an examination into the impact of monetary policy shocks on REITS showed that REITs do not react in a manner consistent with market efficiency theory(Bredin et al. 2007). The study was premised on variance decomposition in which a negative significant response to interest rate surprise was found. These two studies were based on listed REITs which are however outside the scope of our study. The findings however, point to the need to further investigate the relationship of property returns and macroeconomic variables.

4. Materials and methods

We use data obtained from McGregor BFA library, South African Reserve Bank(SARB.)Online Statistics, and Statistics South Africa (StasSA) from the first quarter of 1994 to the third quarter of 2011. We use quarterly data of each variable used in the model. The first variable is the property returns (PROP) calculated from quarterly Absa Middle- middle house prices. In calculating the property returns we use smoothed house prices as obtained from Absa House Indices. We select the middle class to take into account their vulnerability to income shocks which could drive them up to the upper class or down to the lower class. The other variables are nominal short-term interest rates (SIR), the interest rate spread (SPREAD), household debt to disposable income ratio (HD), rand inflation (INF). We obtain the debt to disposable income ratio from StatSA. The nominal short-term interest rate is proxied by the 0-3-year listed government bonds obtained from SARB. The spread is the difference between the 10-year and over listed government bonds yield (obtained from SARB) and the 0-3years listed government bonds yield. For both SIR and SPREAD, we calculate quarterly average yields from the published monthly yields. We also calculate quarterly average inflation from monthly inflation figures to arrive at INF.

The theoretical model assumed by this study is:

$$PROP_t = \alpha + \beta_1 GDP_t + \beta_2 SIR_t + \beta_3 SPREAD_t + \beta_4 INF_t + \beta_5 HD_t + \varepsilon_t \quad \text{(i)}$$

where β_i is the coefficient of each respective variable and ε_t is the error term. We use the VAR methodology to examine the relationship between macroeconomic variables and property returns by allowing the interactions with other variables specified in equation (i) above. The VAR methodology relates each variable in the system and its variation to its own past values and those of other variables in the system. According to Brooks and Tsolacos (1999:143) a standard form VAR model with *p* equations is described as:

$$Y_t = \beta + \beta_1 Y_{t-1} + \cdots + \beta_m Y_{t-m} + \mu_t \quad \text{(ii)}$$

where Y is the set (or $p \times 1$ vector) of variables included in the system, the βterms are the sets of coefficients (β_0 is a $p \times 1$ vector of constants),β_1,..., β_m are $p \times p$ matrices of coefficients on lagged variables, m denotes the number of lags of each variable in the equation, and μ_t is a set of error terms which are assumed to be mutually uncorrelated and independent of the Ys. We use unrestricted VAR and the vector of variables Y variables in this study are property returns (PROP), short-term interest rate (SIR), interest rate spread (SPREAD), inflation (INF), and household debt to disposable income (HD).

We use the Bayes information criterion (BIC) or the Schwarz information criterion (SIC) to determine the lag length. The BIC is algebraically demonstrated as:

$$BIC(p) = \ln\left(\frac{SSR(p)}{T}\right) + (p+1)\frac{lnT}{T}, \quad \text{(iii)}$$

where SSR(p) is the sum of squared residuals of the estimated autoregression (*p*).

The BIC is based on the interpretation of the size R square to justify the inclusion of an additional lag. Schawarz's Bayesian Information Criterion (BIC) is mainly recommended for quarterly data analysis that has a sample size of less than 120 observations (Ivanov and Kilian 2001). Since the VAR approach requires that each series be trend stationary, we shall subject each series to the Augmented Dickey-Fuller (1979) stationarity tests. Thus failure to reject the null hypothesis that a series contains a unit root will lead us to first differencing the series for use in the VAR model.

5. Results and Discussion

First we conduct confirmatory data analysis which entails joint unit root and stationarity tests. In doing this we perform the Augmented Dickey-Fuller Tests in which we find that each series contains a unit root and hence we first difference each series. After first differences we fail to reject the null hypothesis that each series is

stationary. Since each series is integrated of order I(1), we test for possible cointegrating relationships in the sequence using the Johansen (1991) cointegration tests of which we reject the null hypothesis that *n*cointegrating relationships exists in the sequence. The maximum lag length from BIC is 1 lag. Given this, we resort to the vector autoregressive approach to establish the interactions between the variables.
We test for exogeneity of the variables from the VAR output and find the results in table 1.

Table 1: VAR Granger Causality Results
Dependent variable: PROP

Excluded	Chi-sq	Df	Prob.
LOGHD	23.30884	4	0.0001
INF	5.738394	4	0.2196
SIR	7.577822	4	0.1083
SPREAD	7.870277	4	0.0964
All	45.45077	16	0.0001

We find that only the PROP equation is significant compared to the rest of the variables. Table 1 shows Granger causality running from property returns to household debt / disposable income and to the SPREAD. The PROP equation shows that household debt/disposable income and the interest rate spread have an explanatory power for the dependent variable. Jointly, all variables have an explanatory power for the property returns at 5 percent significant level. We however, find no relationship at all in the other equations. Thus from our VAR sequence, we use PROP is the dependent variable and LOGHD, INF, SIR and SPREAD as exogenous variables in the equation.

The variance decomposition in table 2 shows determine what proportions of the changes in the real estate series can be attributed to changes in lagged explanatory series.

Table 2: Variance decomposition for the property returns residuals

Quarter ahead	S.E.	PROP	LOGHD	INF	SIR	SPREAD
1	0.010582	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.013557	92.53659	0.439183	4.215111	1.601976	1.207142
3	0.014614	79.64849	0.787596	13.08485	4.495937	1.983130
4	0.015369	72.21862	1.239653	20.27883	4.469867	1.793032
5	0.016234	66.99400	1.823270	20.98852	5.172771	5.021432
6	0.017437	64.47067	5.419729	18.21544	5.541205	6.352957
7	0.018531	59.54015	10.16309	17.35274	5.615428	7.328597
8	0.019813	52.60988	16.32463	17.47413	5.233872	8.357483
9	0.020857	47.77637	22.06680	17.13824	4.866863	8.151723
10	0.021452	45.23235	26.00268	16.42797	4.612665	7.724333

We find from table 2 above that in the fourth quarter inflation accounts for 20 percent of the variations in property returns or house prices in South Africa while other variables contribute a combined 8 percent in the same period. However, by the 10^{th} quarter, household debt/income contributes the largest (26 percent), followed by inflation (16 percent) and the balance by the other variables. In line with Brooks and Tsolacos' (1999) findings, we find that the interest rate spread (SPREAD) contributes more to the variations in property returns compared to short-term interest rates (SIR).

The impulse response functions below further galvanize these results.

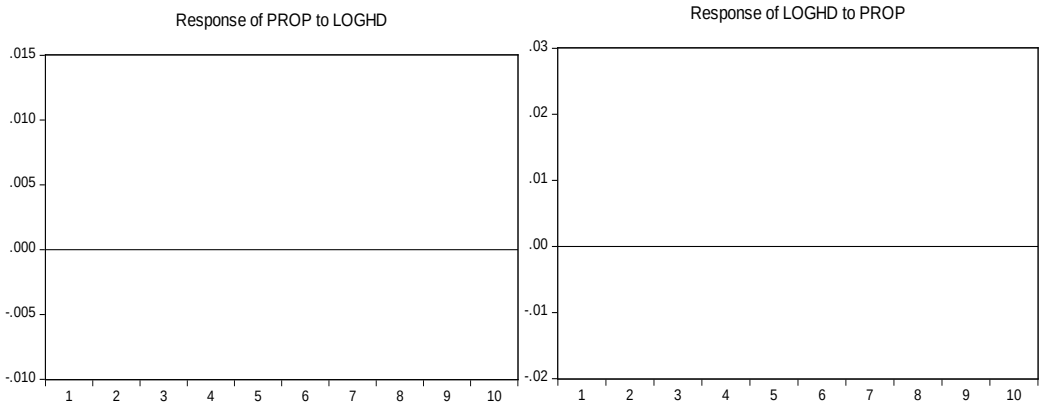

Figure 1(a). Innovations in household debt/income **(b). Innovations in Property returns**

We find from figure 1(a) that property returns respond negatively to a unit shock on household debt/ disposable income ratio. Thus a positive unit shock in household debt/disposable income leads to a decline in property returns. This confirms findings by Standish et al (2005) that a negative relationship exists between household debt/disposable income and house prices. Thus our findings suggest in the short run, as household debt/ disposable income rises, property returns also rise as shown in figure 1(a). However, in the long-run, increases in household debt/disposable income lead to decreases property returns. Figure (b) suggests that innovations in property returns lead to increases in household debt/ disposable income ratios. This confirms our theoretical model that households tend to acquire more debt that to take advantage of rising property returns in the economy in line with the neoclassical economic theory of financial intermediation.

Figure 2 (a) and (b) show how property returns respond to a unit shock in short-term interest rates (SIR) and vice versa respectively.

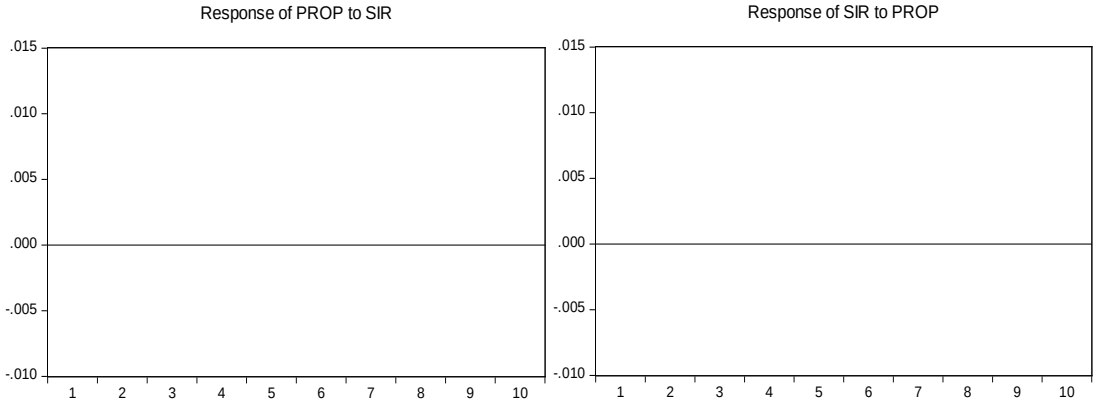

Figure 2(a). Innovations in short-term interest rates **(b). Innovations in Property returns**

Figure 2(a) shows that a negative unit shock in short-term interest rates leads to a negative response in property returns in line with Brooks and Tsolacos (1999) and McCue and Kling (1994). However, the impact is small and dies out in the 10^{th} quarter which also corresponds with findings by the above authors. Conversely, a positive unit shock in property returns leads to a positive impact on short-term interest rates. This could be attributable to the fact that as property returns rise; more funds are channeled to the housing industry thereby prompting short-term interest rates to rise.

Figure 3(a) and (b) show the remaining impulse responses of the spread and inflation together with their standard errors.

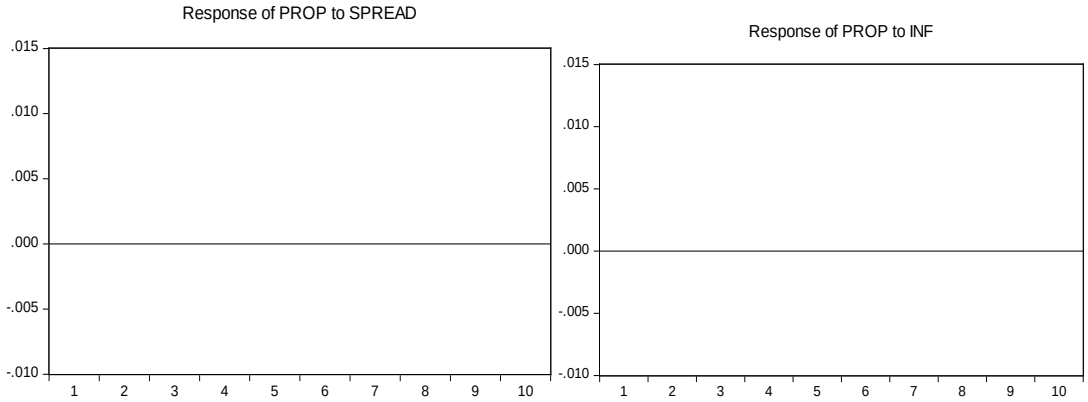

Figure 3 (a) Innovationsin SPREAD **(b) Innovations in Inflation**

In figure 3 (a), we find that a negative shock in long-term spread leads to a negative impact in property returns. This according to Brooks and Tsalacos, indicates that the market expects interest rates to rise in future and hence its effect in captured in lagged values of property returns. This finding is in line with Brooks and Tsalacos (1999). Also a unit shock in inflation will have a negative impact on property returns within 6 quarters and then a positive impact thereafter as depicted by figure 3(b).

6. Conclusions

We have used first difference values of property returns, household debt/ disposable income, short-term interest rates, long-term and short-term interest differential, and nominal inflation in a vector autoregressive model to establish the interactions among the variables. The key variable is property returns in which we use the middle-middle class house prices as a proxy. We find that each series is integrated of order *I*(1) albeit without any cointegating relationship. Thus we use the VAR approach to estimate the relationship between property returns and the rest of the series. The VAR Granger causality results show that property returns are influenced mainly by household debt/disposable income and the long-term and short-term interest differential. These two variables have a strong explanatory power on property returns such that they influence the joint explanatory power of other variables at 5 percent significant level.

The results of our study show that the growth in house prices is influenced by inflation and short-term interest rates in the short run. In the long-run, however, we find that growth in house prices is mainly influenced by household debt/ disposable income followed by the inflation, then the long-term and short-term interest rate differential and finally by short-term interest rates. Thus, we conclude that changes in household debt/ disposable income impacts positively to property returns at least in the short-run and the long-run impact is a decline in property returns. However, our findings suggest that changes in property returns do attract increases in household debt/income in South Africa. On the other hand, we find that variations in short-term interest rates have a small negative impact on property returns in line with existing literature. This also applies to variations in the interest differential which confirms that the market expectations about interest rates filter at lagged property values in line with literature. Finally, inflation plays a major role in property returns, initially impacting negatively on property returns but positively impacting on property returns in the long-run. This confirms the general financial economics axiom that property is a hedge against inflation. The negative impact could be as a result of the country's inflation-targeting monetary policy. Thus as inflation rises, the market expects short-term interest rates to rise but in the long run inflation is captured into house prices.

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