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Analysis of short- and long-run interactions between the stock market and prices of different sizes of properties in South Africa

Abstract

Stock and property markets are regarded as investment alternatives and the interaction between these two markets has been established. However, there is a debate on whether this interaction starts from the property market, as explained by the credit-price effect, or from the stock market, as explained by the wealth effect. This study used monthly observations, rolling from January 2004 to December 2014, to analyze the interactions between stock and property markets in South Africa. The VAR model and Johansen co-integration approach were used to capture the short- and long-run relationships between the South African stock market index and the property prices for small, medium and large houses. Findings of this study revealed that there is a long-run relationship between the stock market and property prices for small and medium houses; while there was no long-run interaction between the stock market and prices of large houses. This study further found that the wealth effect explains the interaction between stock market and prices of small and medium houses; while the credit-price effect explains in the interaction between stock market and prices of large houses. This study concluded that the interactions between the two markets tend to change with the size of houses in the property market.

Key words: stock market, property market, housing price, VAR, co-integration, South Africa.
JEL Classification: G10.

Introduction

The property market in African countries has grown tremendously as investors are attracted by the ever-increasing population (Global Property Guide, 2015). Property has been an excellent investment particularly for risk adverse investors who are not concerned about liquidity. This is the opposite of the stock market which is more suitable for investors who are willing to accept risk in order to maximize returns (Marx, 2010). Thus, assets in both the stock market and the property market are regarded as investment alternatives and can be included in different investors' portfolios. There is a popular theory that investors' aim is to diversify their portfolios such that unsystematic risk is completely eliminated by not only investing in stock but also including assets from other markets such as the property market (Apergis & Lambrinids, 2011). In theory, the link between these two variables can be explained by the credit-price effect, which entails that changes in the property market leads to changes in the stock market or by the wealth effect, which suggests that the stock market influences the property market.

Studies have been conducted to determine the nature of the relationship between the stock market and the property market in developed countries (for example Okunev & Wilson, 1997; Quan & Titman, 1997; Liow, 2006; McMillan, 2011) and developing countries (for example Kapopoulos & Siokis, 2005; Sim & Chang, 2006; Lean & Smyth, 2012). Results from these studies are mixed. Some studies found that the two markets are co-integrated; while others found that the two markets are segmented, meaning that they are not connected in any way. In terms of the causal relationship some studies support the wealth effect that causality moves from the stock market to the property market; whereas others support the credit-price effect that causality moves from the property market to the stock market. Thus, there appears to be no empirical consensus on the nature of the relationship between the stock and the property markets.

In the South African context, studies on the effect of stock returns on the property market were conducted by Kwangware (2009) and Aye, Balcilar and Gupta (2013). However, these studies did not test whether the relationship between these markets change with the size of the houses. Thus, the current study brings a new angle of testing whether the size of properties affects interaction between the stock and the property markets. The specific objective of this study is therefore to establish the short- and long-run relationships between the South African stock market and the property prices for small, medium and large houses.

1. Literature review

1.1. Theories explaining the relationship between stock and property markets. There are different ways of explaining the relationship between the stock and the property markets. The first way to explain this relationship is through wealth effect. The wealth effect suggests that when the share value of individuals' assets is increasing, the demand on other asset classes will increase (Kapopoulos &

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Siokis, 2005). This effect suggests that when stock prices increase, the demand for real estate assets will increase and this would result in increases in the prices of assets in the property market. The wealth effect thus suggests a positive long-run or co-integrating relationship between the two markets and also implies that changes in the stock market lead to changes to the property market. Another way to explain the wealth effect is through the portfolio adjustment effect, by Markowitz (1952). This effect suggests that the increase in stock prices increases the share of individuals' portfolios in the stock market and this encourages individuals to rebalance their portfolios by selling stock and buying other asset types such as property.

The second theoretical explanation of the relationship between the stock and property markets is the credit-price effect. The credit-price effect focuses on the balance sheet position and the value of collateral for credit constrained firms (Kapopoulos & Siokis, 2005). As property market assets can be used as credit collateral, an increase in the value of the property prices reduces the cost of borrowing and hence credit-constrained firms will be able to borrow more money. Similarly, a decrease in the value of properties reduces the value of firms with well-valued properties and this leads to an increase in costs of borrowing for such firms (Kapopoulos & Siokis, 2005). Thus, credit-price effect supports a positive long-run relationship between stock and property markets with changes in property prices causing changes in stock prices.

In addition to the wealth and the credit-price effects, the relationship between the stock and property prices can also be explained through the changes in households' income. When the value of firms increases, the employees are subject to profit-related remuneration such a bonuses (Lean & Smyth, 2012) and such remuneration boosts households' financial position. Given that property assets are both consumption and investment goods, an increase in households' financial position leads to an increase in the demand for real estate assets which eventually increases properties' prices (Lean & Smyth, 2012). This means that the causality relationship between the two markets flows from the stock market to the property market. This is in line with the idea that changes in stock prices lead to changes in the property price because property is not as liquid as the stock market and its prices may be sluggish compared to that of the stock market (Okunev, Wilson & Zurbruegg, 2000). Thus, the property market adjusts slowly to changes in the economic determinants, the stock market reacts first and the reaction of the property market takes place thereafter.

1.2. Review of empirical studies. Previous studies on the relationship between the property and stock markets depended on a number of methodologies including contemporaneous correlation, co-integration, regressions, and causality tests and the results were found to be different even when similar methodologies were used. Early studies (Ibbetson & Siegal, 1984; Hartzell, 1986; Giliberto, 1990; Gyourko & Keim, 1992; Worzala & Vandell, 1993; Myer & Web, 1993) that attempted to examine the relationship between stock and property markets in developed countries such as the United Kingdom and United States of America produced contradicting results. Giliberto (1990), Gyourko and Keim (1992), Myer and Web (1993) and Liow (1998) found that a positive relationship exists between the two markets; while Ibbetson and Siegal (1984), Hartzell (1986) and Worzala and Vandell (1993) found that a negative correlation exists between the two markets.

Quan and Titman (1999) found that there is a strong positive relationship between the stock and property market across 17 developed and developing countries. This was also confirmed by Reilly et al. (2012) who found a positive relationship between small capitalization stocks and property markets in the USA. Additionally, other studies (Okunev & Wilson, 1997; Quan & Titman, 1999; Ling & Naranjo, 1999; Apegris & Limbrinids, 2007) used co-integration to test the long-run equilibrium relationship between the two markets in developed countries and found that the stock and property markets are co-integrated. This was confirmed by studies (Kapopoulos & Siokis, 2005; Sim & Chang, 2006; Lean & Smyth, 2012) that found the existence of a long run relationship between the two markets in developing countries. However, there are also studies (Schnare & Struyk, 1976; Goodman, 1978; Liu et al., 1990; Geltner, 1991) that found a none co-integrating relationship between the two markets.

With regards to the causal link between the two markets, most studies did not find evidence supporting the causal relationship between the two markets. Only few studies addressed the causal relationship for both the developed and developing countries. Ibrahim (2010) and Lean and Smyth (2012) tested the causal relationship between the two markets in developing countries, using data from Malaysia and Thailand, and concluded in favor of the wealth effect that causality moves from the stock market to the property market. On the other hand, Okunev et al. (2000), Case, Quigley and Shiller (2006), Sim and Chang (2006), Liow (2010), and McMillan (2011) found that the housing prices lead the stock prices and hence concluded in favor of the credit-price effect. Thus, there is no empirical census on the relationship between the two markets and further analysis will shed more light on this topic.

2. Methodology

2.1. Data. This paper utilized 132 monthly observations for a period of 11 years beginning from January 2004 to December 2014. The JSE All Share Index (ALSI) was used as a representative of the South African stock prices and the Housing Price Index (HPI) of large, medium and small houses as representatives of the property prices. The stock prices were analyzed against the housing price index in each size of properties. Data are gathered from the McGregor Bureau Financial Analysis (BFA) database and all variables were transformed into logarithms in order to standardize or normalize them (Gujarati, 2004). Throughout this paper, the stock market prices are represented by ALSI and Housing Price Index by HPI, with large size by "large HPI", medium size by "medium HPI" and small size by "small HPI".

2.2. Model specification. The main purpose of this study is to detect the long-run and short-run relationships between the stock and housing prices and an appropriate model as a starting point to test this dynamic framework is a VAR model. The VAR model for this study is as follows:

$$ALSI_t = C_1 + \sum_{i=1}^{q} \beta_{1i} HPI_{t-i} + \sum_{i=1}^{q} \theta_{1i} ALSI_{t-i} + e_{1t}, \quad (1)$$

$$HPI_t = C_2 + \sum_{i=1}^{q} \beta_{2i} HPI_{t-i} + \sum_{i=1}^{q} \theta_{2i} ALSI_{t-i} + e_{2t}, \quad (2)$$

where C_1 and C_2 are constants. q is the number of lags that the analysis uses for each of the variables. β_{1i} and β_{2i} are coefficients for the lags of *HPI*; while θ_{1i} and θ_{1i} are coefficients for lags of *ALSI* in the model e_{1t} and e_{2t} are stochastic error terms, also known as residuals or shocks in VAR model. Thus, three VAR models were estimated.

The first stage of estimating a VAR model is to test if each variable is stationary as a non-stationary variable would produce spurious results. The Augmented Dicky Fuller (ADF) test suggested by Dicky and Fuller (1981) was used to test if stock prices and the three different housing prices are stationary. If variables are found to be not stationary at level, then the first difference is used to make them stationary. If the variables become stationary at the first difference I (1), it means that there is a possibility that such variables are co-integrated (Brooks, 2014). Hence co-integration should be evaluated next (Brooks, 2014).

This study followed the Johansen-Juselius (1990) co-integration approach and the number of lags used was selected using the five criteria of lag selection (AIC, SIC, HQC, LR and FPE) suggested by Ivanov and KiIian (2005). The cointegration test indicates whether the VAR model or VECM is used. If variables are not co-integrated, the first difference of the VAR model is used but if they are co-integrated vector error correction model (VECM) is used to capture the short-run adjustment to equilibrium (Muzindutsi and Sekhampu, 2013). The VECM for this study is as follows:

$$\Delta ALSI_t = C_1 + \sum_{i=1}^{q} \beta_{1i} \Delta HPI_{t-i} + \sum_{i=1}^{q} \theta_{1i} \Delta ALSI_{t-i} + \delta_1 EC_{t-1} + e_{1t}, \quad (3)$$

$$\Delta HPI_t = C_2 + \sum_{i=1}^{q} \beta_{2i} \Delta HPI_{t-i} + \sum_{i=1}^{q} \theta_{2i} \Delta ALSI_{t-i} + \delta_2 EC_{t-1} + e_t, \quad (4)$$

where δ_1 and δ_2 are error correction coefficients which capture the adjustments of change in the variables towards long-run equilibrium. After the analysis of the VECM, the Granger causality test, suggested by Granger (1986), was used to identify the direction of the relationship between variables in the short run. Impulse response analysis and variance decomposition were also used to analyze how each of the two variables are affected by their own shocks as well as shocks of the other variable. Before interpreting VECM results, various diagnostic tests such as autocorrelation, heteroscedasticity and normality and parameter stability tests were conducted to check whether the estimated VECM model met the required assumptions.

3. Interpretation of results

3.1. Descriptive statistics and correlations. The descriptive statistics and correlations coefficients are presented in Tables 1 and 2, respectively. *ALSI* has the highest mean of 10.18 with all the *HPI*'s recording approximately similar means with 5.78 for small HPI, 5.87 for medium HPI and 5.89 for large HPI. *ALSI* appears to have a higher deviation from the mean with a standard deviation of 0.42; while *HPI*'s have low standard deviations (0.20 for small HPI, 0.22 for medium HPI and 0.24 for large HPI). All variables have a negative skewness meaning than their distribution are skewed to the left. Finally, the Jarque-Bera test for normality shows that stock prices and housing prices are not normally distributed. Table 2 shows that there is a high positive correlation (coefficients above 0.9) between *ALSI* and each of the *HPI*'s; suggesting that stock and property prices tend to move in the same direction.

Table 1. Descriptive statistics and correlations

	ALSI	Small HPI	Medium HPI	Large HPI
Mean	10.17567	5.789009	5.871152	5.893119
Median	10.25620	5.835848	5.938222	5.950942
Maximum	10.84732	6.079086	6.170384	6.221762
Minimum	9.221143	5.198221	5.215044	5.228699
Std. dev.	0.423171	0.198239	0.220430	0.237147
Skewness	-0.593549	-1.079566	-1.183090	-0.997803
Kurtosis	2.699016	3.531417	3.670727	3.340155
Jarque-Bera	8.248850	27.19342	33.26778	22.53980
Probability	0.016173	0.000001	0.000000	0.000013

Table 2. Correlation coefficients

	ALSI	Small HPI	Medium HPI	Large HPI
ALSI	1.000000			
Small HPI	0.924237	1.000000		
Medium HPI	0.955902	0.977490	1.000000	
Large HPI	0.963600	0.973198	0.996076	1.000000

3.2. Unit root test and lag selection. Results of the ADF test, in Table 3, show that all variables are not stationary at level (p-values > 5%) but become stationary at the first difference (p-values < 5%). This means that all variables are I (1); suggesting that they may be co-integrated. Thus, the next step is conduct the co-integration test to determine whether there is a long-run relationship between stock market and prices of the 3 sizes of property market.

Table 3. Unit root test results (p-values)

Variables	ALSI	Large HPI	Medium HPI	Small HPI
Level	0.5391	0.3626	0.1842	0.2114
1st difference	0.0000	0.0127	0.0432	0.0109

For lag selection, Table 4 shows that all information criteria (LR, FPE, AIC, SC) selected the maximum number of four lags. Hence, four lags are used in each model.

Table 4. Lag length selection

Lag	LogL	LR	FPE	AIC	SC	HQ
ALSI VS small HPI						
1	599.6485	NA	3.11e-07	-9.307007	-9.217881	-9.270795
2	728.2965	249.2557	4.44e-08	-11.25463	-11.07638	-11.18221
3	813.1660	161.7824	1.25e-08	-12.51822	-12.25084	-12.40958
4	883.5981	132.0602*	4.44e-09*	-13.55622*	-13.19972*	-13.41137*
ALSI VS medium HPI						
1	659.0036	NA	1.23e-07	-10.23443	-10.14531	-10.19822
2	831.8967	334.9804	8.79e-09	-12.87339	-12.69513	-12.80096
3	908.4529	145.9352	2.83e-09	-14.00708	-13.73970	-13.89844
4	964.4397	104.9751*	1.26e-09*	-14.81937*	-14.46287*	-14.67452*
ALSI VS large HPI						
1	667.5142	NA	1.08e-07	-10.36741	-10.27828	-10.33120
2	821.4995	298.3465	1.03e-08	-12.71093	-12.53268	-12.63851
3	891.0057	132.4963	3.72e-09	-13.73446	-13.46709	-13.62583
4	950.3728	111.3132*	1.57e-09*	-14.59957*	-14.24307*	-14.45473*

Note: * indicates lag order selected by the criterion.

3.3. Co-integration results. The Johansen co-integration model was conducted between ALSI and each of the different size of houses and results are presented in Table 5, a, b, and c. Results for co-integration between ALSI and both the small lHPI and the medium HPI are similar, where both Trace and Max-Eigen Statistics accept the null hypothesis of "at most 1" co-integrating equation (p-values > 0.5). Thus, there is one co-integrating equation between the ALSI and both small HPI and the medium HPI; suggesting a long-run relationship between the stock market and prices of small and medium houses. However, p-values of the Trace and the Max-Eigen Statistics are greater than 5%, implying that we accept the null hypothesis of no co-integrating. Thus, there is no long-run relationship between the stock market and prices of large houses.

Table 5. Johansen co-integration test

Null hypothesis No. of CE(s)	Eigenvalue	p-value (Trace)	p-value (Max-Eigen)
a. ALSI VS small HPI			
None	0.134078	0.0072	0.0093
At most 1	0.015885	0.1491	0.1491
b. ALSI VS medium HPI			
None	0.134078	0.0135	0.0145
At most 1	0.015885	0.2103	0.2103
c. ALSI VS large HPI			
None	0.087880	0.1005	0.1122
At most 1	0.011142	0.2275	0.2275

The long-run relationship between the ALSI and prices of small and medium houses is presented by equations in Table 6. In the long run, there is a statically significant positive relationship between stock prices and prices of small and medium houses. When the prices of small houses increase by 1%, the stock prices increases by 0.409%. Regarding the medium sized houses, when the housing prices increase by 1%, the stock prices increase by 0.42%.

Table 6. Long run relationship equations

Equation for ALSI VS small HPI	$small\ HPI_{t-1} = 1.692 + 0.409\ ALSI_{t-1}$
	t-stat [10.2863]
Equation for ALSI VS medium HPI	$medium\ HPI_{t-1} = 1.599 + 0.420\ ALSI_{t-1}$
	t-stat [15.6963]

3.4. Vector error correction. For models with co-integrating equations, small and medium sized houses, the VECM was estimated and results are presented in Table 7 below (with t-values in square brackets). In this table, the coefficient of the EC term is negative and statically significant at the 5% level of significance, in both equations. This shows that there are short-run corrections of deviations from the long-run equilibrium. For small houses, the corrections take place at a slow speed of 0.4% in one month; while in for medium houses 0.7% of deviations is corrected each month. It should be noted that the VECM passed all diagnostic tests.

Table 7. Estimates of VECM equations (small HPI and medium HPI)

ΔALSI VS *Δsmall HPI*			*ΔALSI* VS *Δmedium HPI*		
	Δsmall HPI$_t$	*ΔALSI$_t$*		*Δmedium HPI$_t$*	*ΔALSI$_t$*
EC	-0.004886	-0.027157	*EC*	-0.007649	0.181541
	[-2.78520]	[-0.42904]		[-3.75895]	[1.36640]
ΔsmallHPI$_{t-1}$	2.615901	-0.082093	*Δmedium HPI$_{t-1}$*	2.364953	8.028170
	[30.4371]	[-0.02647]		[26.3760]	[1.37134]
ΔsmallHPI$_{t-2}$	-2.907899	0.449514	*Δmedium HPI$_{t-2}$*	-2.376483	-13.54809
	[-14.0377]	[0.06014]		[-11.4842]	[-1.00274]
ΔsmallHPI$_{t-3}$	1.573308	-0.657816	*Δmedium HPI$_{t-3}$*	1.155325	7.001435
	[7.70749]	[-0.08931]		[5.74543]	[0.53327]
ΔsmallHPI$_{t-4}$	-0.339228	0.427665	*Δmedium HPI$_{t-4}$*	-0.231916	0.475338
	[-4.19936]	[0.14672]		[-2.87729]	[0.09032]
ΔALSI$_{t-1}$	0.001105	-0.088494	*ΔALSI$_{t-1}$*	0.000462	-0.052744
	[0.42119]	[-0.93479]		[0.30666]	[-0.53612]
ΔALSI$_{t-2}$	0.001162	0.088429	*ΔALSI$_{t-2}$*	0.002155	0.112858
	[0.44867]	[0.94619]		[1.46137]	[1.17207]
ΔALSI$_{t-3}$	0.006160	0.118934	*ΔALSI$_{t-3}$*	-0.001114	0.131529
	[2.39462]	[1.28124]		[-2.75898]	[1.37266]
ΔALSI$_{t-4}$	-0.005012	0.139151	*ΔALSI$_{t-4}$*	0.000655	0.165096
	[-2.90852]	[1.46831]		[2.45283]	[1.74827]
C	0.000263	0.008316	*C*	0.000524	-0.005594
	[1.76463]	[1.54923]		[3.64260]	[-0.59597]

3.5. Short-run relationships. *3.5.1. Granger causality test.* The short-run relationships between the variables were tested by the coefficients of the lags in the VECM, the pairwise Granger causality test, impulse response and variance decomposition analyses. Results of the Granger causality test presented in Table 8 show that the null hypothesis that ALSI does not Granger cause small HPI is rejected (p-value > 5%). Thus, there is a unidirectional causality that moves from ALSI to small HPI. The results of medium HPI against ALSI are similar to those of small HPI against ALSI, which implies that causality moves from stock prices to prices of small and medium houses. This is similar in VECM results where lags of stock market seem to have a significant effect on small and medium houses. The results for large HPI against ALSI show that the null hypothesis that large HPI does not Granger cause ALSI is rejected at the 5% level of significance. This means that, in large houses, the causality moves from the property market to stock market and this is similar to the results of the first difference of the VAR model.

Table 8. The Pairwise Granger causality tests

Null hypothesis:	F-Statistic	p-value
∆small HPI does not Granger cause ∆ALSI	0.03207	0.9980
∆ALSI does not Granger cause ∆small HPI	3.59104	0.0084
∆medium HPI does not Granger cause ∆ALSI	0.77054	0.5465
∆ALSI does not Granger cause ∆medium HPI	4.72294	0.0014
∆large HPI does not Granger cause ∆ALSI	2.86856	0.0261
∆ALSI does not Granger cause ∆large HPI	1.32293	0.2654

3.5.2. Impulse response analysis. Results of impulse response functions for each of the relationships are presented in Figures 1, 2 and 3. In Figure 1, a positive shock to small HPI causes a steady and just above zero reaction to ALSI. However, a positive shock on ALSI causes a significant exponential increase in small HPI. Figure 2 shows that ALSI does not respond to shocks from medium HPI; while there is a positive reaction of medium HPI to ALSI shock. These results confirm Granger causality results that change in stock prices lead to change in prices of small and medium houses. In Figure 3, large HPI does not react to a shock from ALSI for the first three months but the reaction starts increasing thereafter and becomes steady after the sixth month. ALSI seems to significantly react to a shock from large HPI, suggesting that changes in prices of large houses lead to changes in the stock market as shown by the Granger causality test.

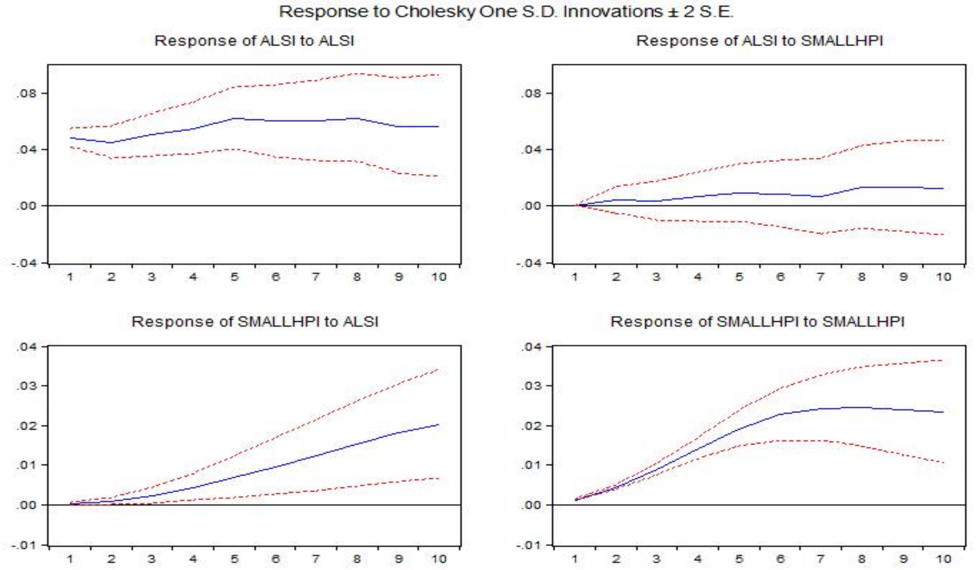

Fig. 1. Impulse response functions results (*Stock VS smallHPI)*

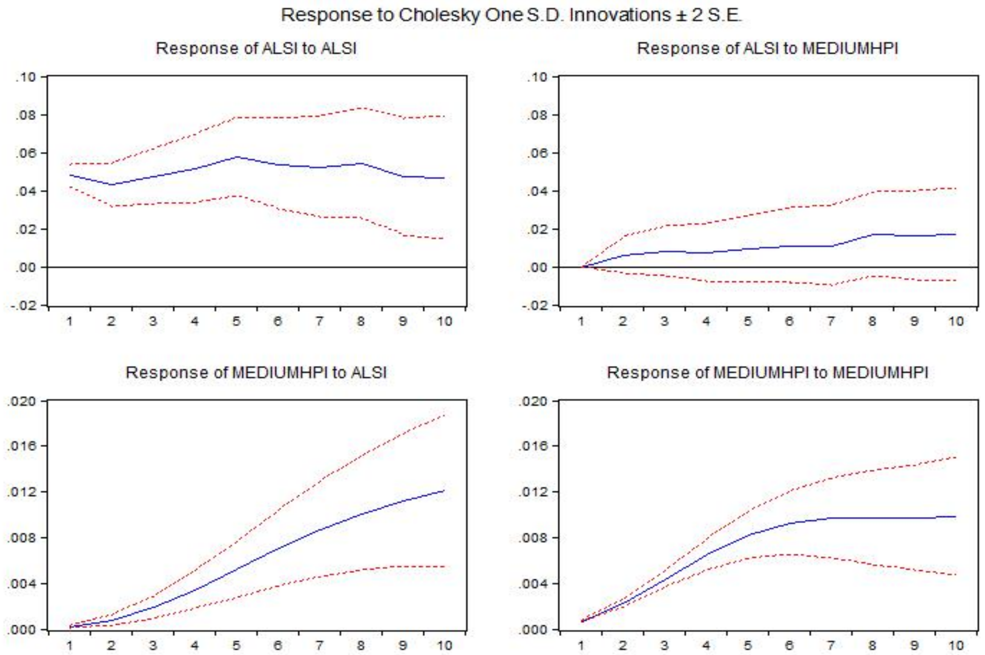

Fig. 2. Impulse response functions results (*Stock VS mediumHPI*)

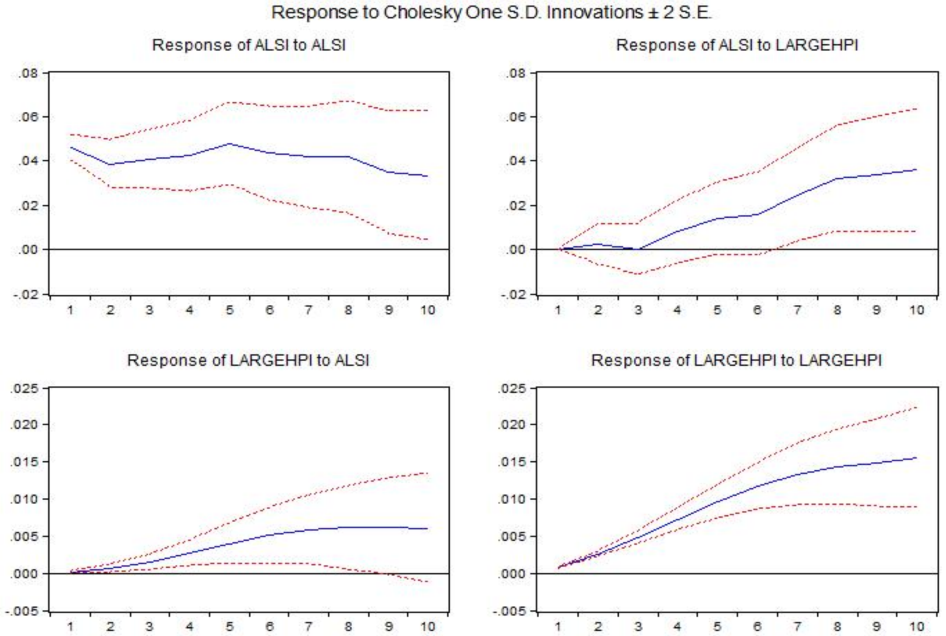

Fig. 3. Impulse response functions results (*Stock VS largeHPI*)

3.5.3. Variance decompositions. Variance decomposition for each of the relationships between the stock market and prices of small, medium and large houses are presented in Tables 9, 10 and 11. The first part of Table 9, shows that small HPI does not affect ALSI significantly. At the 10^{th} period, small HPI explains approximately 0.48% of variance in the ALSI. However, the second part of Table 9 shows that changes in ALSI explain about 23.74% of the variance in small HPI at period 10. This suggests that prices of small houses react to changes in the stock market. In Table 10 medium HPI explains about 2.29% of the variance in ALSI at period 10; while ALSI explain about 41.17% of the variance in the medium HPI. Thus, the short-run effect of the stock market on the property prices is stronger in medium houses than small houses.

Table 9. Variance decomposition (*ALSI VS small HPI*)

Variance decomposition of ALSI:			
Period	S.E.	ALSI	Small HPI
1	0.045745	100.0000	0.000000
2	0.063297	99.97993	0.020074
3	0.077011	99.94007	0.059932
4	0.088681	99.88617	0.113828
5	0.099059	99.82380	0.176205
6	0.108535	99.75782	0.242184
7	0.117339	99.69228	0.307716
8	0.125621	99.63036	0.369638
9	0.133480	99.57434	0.425659
10	0.140990	99.52571	0.474290
Variance decomposition of small HPI:			
Period	S.E.	ALSI	Small HPI
1	0.004309	0.787198	99.21280
2	0.009115	2.131931	97.86807
3	0.014434	3.723624	96.27638
4	0.019988	5.633302	94.36670
5	0.025593	7.878681	92.12132
6	0.031127	10.46016	89.53984
7	0.036509	13.36575	86.63425
8	0.041689	16.57190	83.42810
9	0.046641	20.04362	79.95638
10	0.051358	23.73517	76.26483

Table 10. Variance decomposition (*ALSI VS medium HPI*)

Variance decomposition of ALSI:			
Period	S.E.	ALSI	Medium HPI
1	0.045542	100.0000	0.000000
2	0.062780	99.90597	0.094026
3	0.075959	99.72121	0.278785
4	0.087052	99.47337	0.526629
5	0.096869	99.18648	0.813520
6	0.105827	98.88003	1.119973
7	0.114171	98.56915	1.430854
8	0.122057	98.26507	1.734931
9	0.129586	97.97570	2.024295
10	0.136831	97.70624	2.293756
Variance decomposition of Medium HPI:			
Period	S.E.	ALSI	Medium HPI
1	0.001939	3.354625	96.64538
2	0.004117	8.342084	91.65792
3	0.006571	13.12502	86.87498
4	0.009210	17.99819	82.00181
5	0.011982	22.94631	77.05369
6	0.014856	27.89304	72.10696
7	0.017810	32.75431	67.24569
8	0.020828	37.45625	62.54375
9	0.023899	41.94140	58.05860
10	0.027012	46.16978	53.83022

For large houses, Table 11 shows that large HPI explains about 29.42% of the variance in ALSI at period 10; while ALSI explains 6.65% of the variance in large HPI. This means that stock prices react to change in prices of large houses; while the prices of large houses do not react to changes in stock prices. Overall, variance decomposition shows that prices of small and medium houses are affected by shocks in stock prices; while the stock prices are affected by shocks in prices of large houses. Thus, variance decomposition results are consistent with the Granger causality results.

Table 11. Variance decomposition (*ALSI VS large HPI*)

Variance decomposition of ALSI:			
Period	S.E.	ALSI	Large HPI
1	0.043560	100.0000	0.000000
2	0.058015	98.91010	1.089895
3	0.068776	96.66551	3.334486
4	0.077859	93.53517	6.464828
5	0.086114	89.82974	10.17026
6	0.093945	85.83281	14.16719
7	0.101557	81.77230	18.22770
8	0.109057	77.81267	22.18733
9	0.116493	74.06071	25.93929
10	0.123887	70.57722	29.42278
Variance decomposition of large HPI:			
Period	S.E.	ALSI	Large HPI
1	0.002210	0.356193	99.64381
2	0.004715	0.650891	99.34911
3	0.007551	1.101072	98.89893
4	0.010604	1.671384	98.32862
5	0.013802	2.341991	97.65801
6	0.017098	3.095741	96.90426
7	0.020456	3.916901	96.08310
8	0.023855	4.791022	95.20898
9	0.027277	5.704986	94.29501
10	0.030709	6.647043	93.35296

4. Discussion

The overall findings of this study appear to be valid as they relate well to the current state of South Africa. This study found that small and medium housing prices have a positive long-run relationship with stock prices. This means that when stock prices increase, prices of small and medium houses also increase; hence, there is a directly proportional relationship between the stock market and prices of small and medium houses in the long-run. These findings are similar to those of Okunev and Wilson (1997); Ling and Naranjo (1999) and Apegris and Limbrinids (2007), which focused on the developed countries and found that the stock and property markets are co-integrated. This implies that risk minimizing investors should not include assets from stock market and small or medium size property markets at the same time because when one market is not doing well the other market will also follow a similar trend in the long-run.

The absence of the long-run relationship between stock prices and prices of large houses, suggests that, in the long-run, when prices of assets in one market change, the other market does not react in anyway. Thus, the South African stock prices and prices of large houses seem to be segmented. These findings are similar to those of other studies (Schnare & Struyk, 1976; Goodman, 1978; Liu et al., 1990; and Geltner, 1991) which found no long-run relationship between stock and property markets.

Findings of this study further showed that, there is a short-run relationship between the property and stock markets in South Africa; but this relationship tends to change with the size of houses. For small and medium houses the short-run relationship moves from stock prices to property prices; providing evidence of the wealth effect. This means that when South African stock prices increase, individuals and companies accumulate more wealth which then leads to an increase in demand for small and medium sized houses, and ultimately increase the housing prices. These findings are in line with those of Kapopoulos and Siokis (2005), Ibrahim (2010) and Lean and Smyth (2012) who found that stock prices lead the housing prices and hence concluded in favor of the wealth effect.

For large houses, this study found that short-run changes in property prices lead to changes in stock prices which provides evidence supporting the credit-price effect. The reason behind this kind of relationship is due to the current state of South Africa where inflation is high and this trend is expected to continue. This causes owners of large houses to withdraw their investment on large property and demand more equities which drives stock prices up. This finding is similar to those of Okunev et al. (2000), Case et al. (2006), Liow (2010), and McMillan (2011) who found that changes in housing prices lead to changes in stock prices and hence concluded in favor of the credit-price effect.

Conclusion and recommendations

This study attempted to investigate the relationship between stock prices and prices of small, medium and large houses in the South African context. The VAR model, Johansen multivariate co-integration and Granger causality tests were used to examine the long-run and short-run equilibrium relationships between the South African stock prices and housing prices from January 2004 to December 2014. It established that a long-run relationship only exists between stock prices and prices of small and medium house; while there was no evidence of the long-run relationship between stock prices and prices of large houses. The size of the property was found to have a significant effect on the short-run relationship between the South African stock and property markets. Findings on the short-run relationship between the stock market and property market for small and medium houses supported the wealth effect; while findings on the short-run relationship between the stock market and property market for large houses supported the credit-price effect.

Findings of this study provide vital information about the interaction between assets from the stock market and the property market. For long term investors aiming at constructing a well-diversified portfolio with minimum risk, investors can use an asset from one market as a substitute of another asset in the other market. In other words, these investors cannot include both the stocks and small or medium property in one portfolio as, in the long-run, instability in one market spills over to the other market. However, these investors can include both the large sized property and the stocks in one portfolio as the two assets do not affect each other in the long-run. In the short-run, South African investors should consider the influence of the stock market fluctuations to the small and medium sized properties. For large houses, policy makers should promote policies that maintain stability in the property market as the changes in prices of large houses seem to have an implication on the stock market. Future research can explore how different stocks such as small, medium and large stocks respond to changes in housing prices.

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