The Long-Run Relationship between Consumption, House Prices and Stock Prices in South Africa: Evidence from Provincial-Level Data

Nicholas Apergis
Department of Banking and Financial Management,
University of Piraeus, Greece
napergis@unipi.gr

Beatrice D. Simo-Kengne
Department of Economics
University of Pretoria, Pretoria, South Africa
beatrice.simo_kengne@up.ac.za

Rangan Gupta
Department of Economics
University of Pretoria, Pretoria, South Africa
rangan.gupta@up.ac.za

September 2013

Abstract. This paper empirically examines whether strong increase in housing and stock prices over the past decades has helped sustain consumption across provinces in South Africa over the period from 1995 to 2011. Based on available data, we implement panel cointegration techniques which allow us to circumvent the data restrictions, providing that observations are pooled across provinces. The empirical results provide strong evidence that household consumption adjusts to both house price and stock price fluctuations. More interestingly, the increase in consumption due to house price appreciation (housing wealth effect) is found to be smaller than that generated by the rise in stock prices (stock market wealth effect); possibly suggesting a high stock market capitalization in South Africa. Additionally, we find bidirectional causality between consumption and both forms of wealth in the long-run; implying that changes in consumption can predict housing and stock price movements and vice versa. Further, the long-run elasticity of income with respect to consumption is found to be not significantly different from unity, therefore corroborating the permanent income hypothesis. .

Keywords: Housing and stock market wealth effects, consumption, panel cointegration; South African provinces

JEL Classification: C23, E21, G12

1. Introduction

The low savings rate driven by high levels of consumption spending and the strong housing cycle over the last decades are two economic facts that spark new interest on the wealth effect in

South Africa. More importantly, with an increasing homeownership rates as well as world's stock market capitalisation, emerging economies including South Africa play a key role for the global macroeconomic and financial stability. At the national level, annual changes in nominal house prices range from -0.13% to 27.92% between 1994 and 2011. This pattern has borne a relatively close resemblance to consumer spending with a strong growth in 2005 (5.75%) followed by a sharp decrease in 2009 (-0.02%). Besides housing, stock market is the second major source of South African household wealth. It accounts for 49.95 % of household's total assets and 61.59% of household's net worth (SABC, Quarterly Bulletin 2012). While conventional macroeconomic models are favourable to the importance of asset wealth in stimulating household spending, there is a concern that a slowdown of equity prices may lead to the decrease in consumption spending and subsequently the economic recession. On the other hand, lower growth in asset prices might boost household savings by reducing their consumption relative to current income (Rapach and Strauss, 2006). Understanding the effects of housing and stock wealth on consumption behaviour is therefore of considerable interest for the business cycle assessment, hence, motivating the present study.

The wealth effect on consumption has been extensively studied in the literature[1] and mixed conclusions have been reported depending on the sources of wealth as well as the methodology used. Yet a consensus has emerged on the need to distinguish between wealth categories (De Bonis and Sylvestrini, 2012). According to Dreger and Reimers (2012), the difference in consumption response to different wealth categories may be attributable to specific features associated to each form of wealth. For instance, housing represents both a consumption and investment good. As such, an increase in house prices increases not only homeowner's wealth but also the cost of housing services (Poterba, 2000). Thus, raising the value of the owner-occupied housing could not necessary foster the propensity of a household to spend more on non-housing goods and services unless that household is moving into a less expensive house, hence, enabling the realised gain. However, this complexity does not hold for the stock market wealth which tends to directly affect the aggregate budget constraint. Moreover, Rapach and Strauss (2006) point out that diverse wealth categories are likely to have different effects on consumption due to the so called "psychology of framing". This considers that households

[1] See, Simo-Kengne *et al.* (forthcoming a) for a detailed review.

separate their wealth into different "mental accounts" so that consumption response to changes in financial wealth can differ from that arising from changes in housing wealth. Additionally, Aoki *et al*. (2004) indicate that if homeowners are optimistic about economic prospects, they are likely to borrow to finance consumption and housing investment as housing represents a secured collateral. Thus, an increase in house prices is expected to have more impact on aggregate consumption than stock wealth since the volume of housing transaction due to house price increases is correlated with consumption of goods that are complementary to housing such as furniture, appliances, etc (Aoki et al., 2004)

Alternative reasons to expect different consumption responses from different forms of wealth include the relative distributions across income groups. Distinct from housing wealth which is generally spread over the population (Mishkin, 2007), stock wealth is concentrated among wealthy households (Brady and Stimel, 2011); resulting in a highly skewed distribution of stock ownership and hence a small equity wealth effect for most households (Poterba, 2000). Recently, Peltonen *et al.* (2012) highlight that the level of financial development is important in determining the different reaction of consumption to different asset shocks. Accordingly, stock market wealth effect is likely to be more prominent in financially developed countries due to the increasing access of households to financial assets and hence the rise in stock market capitalisation. In contrast, housing is likely to be the most held asset in countries with low level of financial development; causing a stronger housing wealth effect (Peltonen *et al.*, 2012). However, like many emerging economies, South Africa has witnessed the increase in both homeownership rates and stock market capitalisation which has possibly translated into the rise in both housing and stock market wealth effects. But, since foreign investments grow as emerging economies integrate, one may argue that national consumption spending may or may not reflect the national asset price development as part of the extracted equity is used to finance consumption in the investors' countries. Therefore, the relative distribution of asset categories across national and foreign investors may determine the relative magnitude of each form of wealth effect on consumption.

The use of cointegration is very common in the wealth-consumption literature. This methodology allows identifying the long-run relationship between consumption and permanent income including asset wealth. Focusing essentially on the two major forms of wealth (i.e. real

and financial wealth), recent studies have confirmed the role of assets' wealth in driving consumption spending. Some of these studies detect larger effects for housing wealth (Case *et al*., 2005; Rapach and Srauss, 2006; Dregers and Reimers, 2012) while others document larger effects for stock market wealth (Dvornak and Kholer, 2007; De Veirman and Dunstan, 2008; De Bonis and Sylvestrini, 2012). In an attempt to explain the observed difference, some authors advocate the role of institutional factors (Ludwig and Slok, 2004; Carrol *et al*., 2006), while others emphasize the estimation techniques (Case *et al*. (2005). Accordingly, Case *et al*. (2005) indicate that the long-run responsiveness of consumption to housing wealth is likely to be insignificant due to multicollinearity between the wealth components in a time series setup, and hence, pointed to the importance of the cross-sectional dimension in the examination of the wealth effect.

Against this backdrop, this paper uses the panel cointegration procedure by Pedroni (2000) to examine the wealth effect stock and housing prices on consumption across nine provinces in South Africa, and check whether the contradictory evidence on the strength of these two measures of wealth can be reconciled when allowing for regional information. Unlike traditional panel cointegration techniques which assume that cross-sections are independent, this methodology controls for heterogeneity as well as cross-sectional dependence, hence, providing efficient inferences from the results. The rest of the paper is structured as follows. Section 2 reviews the relevant literature on wealth effects in South Africa. Section 3 presents the cointegration procedure applied. Section 4 describes the data and discusses the empirical findings, while section 5 concludes.

2. Existing literature

In contrast to the substantial literature on wealth effect in developed countries, there is relatively small evidence that focuses on developing countries; the major reason being the data restriction (see Simo-Kengne *et al*., forthcoming a for further details). As far as South Africa is concerned, there are several studies, primarily time-series in nature, that have focussed on the impact of either house prices or stock prices on consumption. Das, *et al*. (2011), Ncube and Ndou (2011), Peretti *et al*. (2012), Simo-Kengne *et al*. (forthcoming a), and Aye *et al*. (forthcoming a, b) are the most recent South Africa-based papers investigating the impact of either housing prices or

stock prices on consumption. For instance, Das *et al*. (2011), used the Phillips *et al*. (2011) unit root test and the Error Correction Model (ECM) to test for housing bubbles and their effect on consumption. They concluded that there is an asymmetric relationship between house prices and consumption, with it reacting considerably to rapid increased in house prices but barely to a rapid declines. Simo-Kengne *et al*. (forthcoming a) used a panel vector autoregressive (PVAR) model and Cholesky decomposition scheme to evaluate the effect of house price shocks on provincial-level consumption from 1996 to 2010. Their findings corroborated the results of Das *et al*. (2011). Peretti *et al*. (2012) used a time-varying VAR to investigate the relationships between interest rates, growth in real house prices and growth in consumption, and found that the effect on consumption of a positive house shock persisted for more than a year. As in Peretti *et al*. (2012), Aye *et al*. (forthcoming a) also used a time-varying VAR to examine the relationships between interest rates, growth in real stock prices and growth in consumption. Stock prices were found to have a positive relationship with consumption with the most significant effect of a positive stock price being observed at the one quarter-ahead horizon. However, barring Aron and Muellbauer (2013) and Aye *et al*. (forthcoming b), none of the above-discussed studies, examined the relative roles of financial and housing wealth (prices) on consumption in South Africa. Aron and Muellbauer (2013) indicated that much of the empirical literature assessing the wealth effect of house prices on consumption is marred by poor controls for the common drivers of both house prices and consumption. Given this, the authors suggested an empirical model for South Africa grounded in theory, and with more complete controls than generally used. The estimates suggested that in South Africa, the marginal propensity to spend out of housing wealth appears to exceed that for illiquid financial wealth, but is less than that out of net liquid assets. Further, unless one accounted for the role of financial liberalization, housing wealth did not significantly affect consumption. Aye *et al*. (forthcoming b) compared the effects of real house price and real stock price movements on consumption decisions in South Africa using a structural VAR model, with structural shocks being identified using both short-run and long-run restrictions. This study, unlike Aron and Muellbauer (2013), indicated that house prices have a larger impact on consumption than stock prices with the latter having a short-lived, but significant effect.[2] So, in other words, while house prices are economically more important,

[2] Note that, Das *et al*. (2011), discussed above, besides analyzing the role of house prices on consumption, also indicated that real stock prices affect consumption significantly both in the short- and long-runs. However, this study

stock prices have a statistically significant impact. Overall, based on these two studies by Aron and Muellbauer (2013) and Aye *et al*. (forthcoming b), one cannot concretely conclude of the dominance of these two competing wealth variables in the economic sense. However, statistically, both these studies tend to suggest that, at the aggregate-level, financial wealth has a bigger impact on consumption than housing wealth in South Africa.

More recently, Peltonen *et al.* (2012) study the wealth effects in emerging economies including South Africa. They distinguish between financially developed and underdeveloped countries and conclude that financial wealth is stronger for countries with high level of financial development due to the rise in stock market capitalisation. Despite the use of panel econometric techniques, this cross country study fails to account for regional specific effects as well as regional dependence within country. The present study contributes to the discussion of the relative importance of housing and financial wealth by relying upon South African provincial data, which is believed to be more informative. Besides the cross-regional heterogeneity of housing markets (Burger and van Rensburg, 2008), economic conditions prevailing during a house price shock are not necessarily the same across the regions. Additionally, economic situations in regions are likely to be non-aligned with national economic conditions (Simo-Kengne *et al*., forthcoming a), reflecting the fact that markets are not all relatively strong or weak at the same time. Given this, analysis needs to be carried out at a disaggregated (regional level), to correctly identify the role of house prices on consumption. In fact, as provincial housing markets integrate, economic agents have the chance to hedge consumption risks across provinces by holding a provincially diversified portfolio of housing assets. While the stock market is uniform for the provinces, housing markets have been shown to be driven by local developments (Simo-Kengne *et al.*, forthcoming b), implying that the provincial dimension could play a role in explaining the consumption pattern. Hence, for reasons of heterogeneity in the geographical distribution of housing wealth, spatial differences in consumer behaviour, different prevailing economic conditions across the South African provinces, which are possibly non-aligned with national

---

did not analyze/compare the dynamics (future path) of consumption following a shock in the asset prices. Also, since the paper was dealing with the effect of housing bubbles on consumption, it was more concentrated on examining the effect of house price acceleration or deceleration rather than real house price returns. Hence clearly, it is not possible to compare the magnitudes of the effect of real housing and stock returns on consumption from the work of Das *et al*. (2011).

economic conditions, one cannot assume the national level results will also hold at the regional level without formally investigating the house price-consumption relationship.

3. Empirical methodology

The permanent income hypothesis provides the rationale that private consumption responds to changes in permanent income including asset wealth and human wealth. While housing wealth *(HW)* and stock market wealth *(SW)* are the two major forms of asset wealth, human wealth is assumed to be essentially determined by labour income *(Y)*. More specifically:

$$C = f(HW,SW,Y) \tag{1}$$

Under the assumption that households smooth their consumption over their life time, an increase in wealth will shift consumption plan upwards in each period of the remaining life time, resulting in a stable long-run relationship between consumption and the total resources. The existence of a stable long run relationship between consumption and resources implies that these variables are cointegrated meaning that their linear combination is stationary as deviations are mean reverting. Standard time series tests have been proven to have low power against stationary alternatives (Campbell and Perron, 1991). In this respect, panel tests appear more adequate since they offer gains in power by relying on a broader set of information.

At a provincial level, a long-run consumption function can therefore be specified as follows:

$$c_{i,t} = \alpha_i + \beta_{i,hw} hw_{i,t} + \beta_{i,sw} sw_{i,t} + \beta_{i,y} y_{i,t} + \varepsilon_{i,t}, \quad i = 1,...,N \quad \text{and} \quad t = 1,...,T \tag{2}$$

where $c_{i,t}$, $hw_{i,t}$, $sw_{i,t}$ and $y_{i,t}$ are the log-levels of consumption, housing wealth, stock market wealth and income in province *i*, respectively and $\varepsilon_{i,t}$, the idiosyncratic term.

One major attraction of the panel cointegration methodology is its ability to mitigate the issue of small sample limitations encountered with conventional non-stationary methods (Pedroni, 2000). Unlike the first generation panel unit root and cointegration tests which assume cross-section homogeneity, Pedroni (2000) developed seven different statistics to test for panel cointegration

which account for heterogeneity across cross-sections. As indicated earlier, South African provinces are characterised by important socio economic disparities including demographics, institutions, land availability, income, unemployment and other local factors. Pesaran and Smith (1995) indicate that allowing for heterogeneity avoids the bias that can arise from pooling estimations, hence, providing a more accurate picture of the underlying relationship.

The Pedroni Fully Modified Ordinary Least Squares (FMOLS) methodology is based on either a within-dimension or between-dimension statistics. Within-dimension based statistics are referred as panel cointegration statistics, while between-dimension statistics are termed as group-mean cointegration statistics. He extends the two step residual-based strategy of Engle and Granger (1987) to develop the panel cointegration tests. These tests are based on the null of no cointegration and work with the assumption of heterogeneous panels. The major advantage of Pedroni test is that it allows for individual member-specific fixed effects, deterministic trends and slope coefficients. The FMOLS approach proposes a convenient method for estimating and testing hypotheses about common cointegrating vectors in a manner that is consistent with the degree of heterogeneity both across time and across provinces, which is our case here. Moreover, the methodology addresses a key source of cross provinces heterogeneity: this source of heterogeneity manifests itself in the familiar fixed effects form by reflecting differences in mean levels among the variables of different individual provinces of the panel (i.e. they are modelled by including individual specific intercepts). This proposition holds in case that the provinces dimension is large enough comparatively to the time dimension, which, however, is not our case here. Alternatively, in cases such as ours in which the time dimension is much larger than the cross-section dimension the methodology makes use of an asymptotic covariance weighted GLS approach to deal with such dynamic cross sectional dependence for the case in which the time series dimension is considerably larger than the cross sectional dimension, which is our case here.

The methodology involved in testing for cointegration among a set of variables is discussed below with respect to the model used in this study. The variables from the long-run cointegrating vector are said to be cointegrated if the error term ($\varepsilon_{i,t}$) is a stationary process. Hence, testing for cointegration among variables requires that a regression of the following form is performed on the residuals from the long-run cointegrating vector:

$$\varepsilon_{i,t} = \rho_i \varepsilon_{i,t-1} + \omega_{i,t} \quad (3)$$

The null is $\rho_i = 1$ and implies that $\varepsilon_{i,t}$ has a unit root. Based on the estimation of (3), seven different statistics are calculated. Panel-v, panel-rho, panel-PP and panel-ADF are based on the within-dimension while, group-rho, group-PP and group-ADF are based on the between dimension of the panel. In the within-dimension framework, the null of no co-integration is given as $H_0 : \rho_i = 1$ for all i, against, the alternative of $H_1 : \rho_i = \rho < 1$ for all i. The alternative hypothesis implies that there is cointegration among all the variables in the panel. By contrast, the null hypothesis pertaining to between-dimension framework is defined as $H_0 : \rho_i = 1$ for all i against the alternative of $H_1 : \rho_i < 1$ for at least one i. Thus, the between-dimension test is less restrictive and allows for heterogeneity across members. In case of within-dimension test, a common value for all cross section is imposed, i.e. $\rho_i = \rho$ ..

Once cointegration has been established among the relevant variables, the model is estimated utilizing the FMOLS technique, also proposed by Pedroni (2000). According to Pedroni (2000), standard OLS estimation of a panel will lead to an asymptotically biased estimator, because the estimates would be dependent on the nuisance parameters that are associated with the dynamics of the underlying system. He argues that only in case of exogeneity of the regressors and homogenous dynamics across the individual members of the panel, the OLS estimates are unbiased. The FMOLS estimator accounts for both serial co-relation and endogeneity problems, and hence is preferable to simple OLS estimation. An additional merit of using FMOLS techniques is that it allows for the country-specific fixed effects to be heterogeneous while estimating long run relationships (Pedroni, 2000). Pedroni (2000) argues that the t-statistic for group mean panel FMOLS offers more flexible alternative hypothesis than pooled FMOLS because the former is based on the between-dimension as opposite to within-dimension of the panel: Thus it estimates the co-integrating vectors for a common value under the null hypothesis, while under the alternative hypothesis, the values for the co-integrating vector are allowed to vary across groups. Finally, the methodology also deals with the problem of cross-sectional dependence. Cross-sectional dependence may be the result of business cycles and other common factors across regions. The FMOLS estimator (by estimating first individual

coefficients across regions and then taking their average) allows for cross-sectional dependencies that potentially arise from multiple unobserved common factors across regions, while it permits the individual responses to these factors to differ across regions.

4. Data and empirical results

4.1. Data

The analysis is based on annual data for nine South African provinces (Western Cape, Eastern Cape, Northern Cape, Free State, KwaZulu-Natal, North West, Gauteng, Mpumalanga and Limpopo) over the period of 1995 to 2011. Consumption and income data are provided by Household Income and Expenditure, and Income and Production surveys, respectively, drawn from Standardised Regional database maintained by Quantec. Consumption refers to real per capita final consumption expenditures, while income is proxied by real per capita household current income. Housing wealth and stock market wealth are measured by seasonally adjusted quarterly house price indexes and the Johannesburg Stock Exchange All Share Index, respectively, which then are converted to annual frequencies by averaging the values over the four quarters. Housing data are obtained from Amalgamated Bank of South Africa (ABSA), while data on stock prices and the Consumer Price Index (CPI) used to obtain real house prices and real stock prices are drawn from the International Financial Statistics of the International Monetary Fund (IMF). All series are measured in log-levels.

Note that ABSA categorises the South African housing market into three major price segments, namely, luxury (ZAR 3.5 million – ZAR 12.8 million), middle (ZAR 480,000 – ZAR 3.5 million) and affordable (below ZAR 480,000 and area between 40 square metres - 79 square metres). The middle segment is further categorized into three more segments based on sizes, namely large-middle (221 square metres – 400 square metres), medium-middle (141 square metres – 220 square metres) and small-middle (80 square meters – 140 square meters). Given that regional house prices data are not available for the two extreme segments, we restrict the analysis to the middle segment which allows accounting across income categories. Further, since income and consumption expenditure data at the provincial-level are not based on the alternative housing size categories of the middle-segment, we use the house price of the entire middle-segment for the respective provinces in our analysis.

4.2. Empirical results

The identification of a long-run stable relationship between consumption and wealth requires first to analyse the time series properties of the selected variables as cointegration tests may only be performed on non-stationary panels. Table 1 reports the results of various panel unit root tests for three variables of interest (consumption, income and house prices), namely, the tests developed by Im *et al.* (2003) (IPS test), Levin *et al.* (2002) (LLC test), Hadri (1999) and Fisher-Type test using Augmented Dickey Fuller (ADF) and Phillips-Perron (PP)-test (Maddala and Wu, 1999 and Choi, 2001). With the exception of the Hadri (1999) test whose null hypothesis is that all time series in the panel are stationary, these are all tests with the null of a unit root against the alternative of a stationary panel. Results from all these tests are consistent with the presence of a unit root for the series in the panel at the 1% significance level. Additionally, three standard unit root tests developed by Dickey and Fuller (1981) are used to assess the stationarity property of the stock prices. Their results could not reject the null hypothesis of a unit root (see Table 2). These findings provide the rationale to carry out a cointegration analysis designed to identify the long-run relationship between the variables under study.

Table 3 displays the results of the panel cointegration tests. Both panel and group statistics provide strong evidence in favour of cointegration between consumption and wealth. The cointegrating vector exhibited in Table 4 reports the elasticities with respect to the different components of the consumption function as specified in equation (2). As expected, these elasticities are positive and significant, implying that consumption spending might adjust to asset price fluctuations. More interestingly, the impact of stock prices appears to exceed the housing wealth effect. Furthermore, in line with the permanent income hypothesis, the income elasticity is found not to be significantly different from unity. This parameter is 1.038, indicating that consumption response to income variations is proportional. We conclude that the national savings rate decreases as regional housing markets integrate, resulting in an acceleration of consumption spending and, subsequently, relatively higher long-run economic growth prospects since consumption is the main component of GDP.

It has been shown that housing wealth effects are typically larger than stock market wealth effects in countries with low level of financial development (Peltonen *et al*., 2012). We find that

the marginal propensity to consume out of stock market wealth (0.99) is five times more than that generated by housing wealth (0.184). Therefore, the relatively less response of consumption to house price shocks might suggest a high stock market capitalisation in South Africa. This result is not surprising for an emerging economy since access of households to financial assets increases as the country becomes financially developed. While this finding substantiates the importance of stock market as the primary funding source of consumption expenditure in countries with relatively stable financial system, as indicated earlier, it can also be attributed to the relative distribution of the two assets across national and foreign investors in emerging economies. Consequently, foreign residential investment might be relatively important in South Africa so that equity extracted from the national housing development partly finances consumption in investors' countries and does not entirely fuel the national consumption. This interpretation is plausible providing that recent episodes of financial crisis might have driven foreign investors' interest away from financial asset perceived as risky to housing investment assumed to be risk-free.

Under the assumption that consumption is not weakly exogenous, the established cointegrating relationship can be interpreted as a long-run consumption function. The next step implements the panel causality test to determine the direction of the causality between variables. The short-run causality is determined by the significance of the coefficients for each dependent variable. Results of the Granger-causality test reported in Table 5 provide a strong evidence of a bidirectional causal relationship between consumption and income in the short-run. The Wald F-statistics associated with the coefficients of the lagged changes in income (consumption) in the consumption (income) equation, are significant at the 1% level of significance (Probability=0.00). This is not the case for with the wealth variables which indeed substantiate the evidence of unidirectional causality running from wealth (house and stock prices) to consumption, hence confirming the predictions of the wealth theory. The Wald F-statistics for the coefficients of lagged changes in housing wealth and stock market wealth in the consumption function are significant, while the Wald F-statistics for the coefficients of lagged changes in consumption appear insignificant (high probability) in both house prices and stock prices equations.

Similarly, the long-run causality is given by the significance of the speed of adjustment, i.e. the coefficient of the respective error-correction term. The statistic of the error-correction term in each equation is significant with the expected sign; indicating a long-run bidirectional relationship between consumption and each of its determinants. In the consumption equation which is the equation of interest, the EC value shows a relatively slow speed of adjustment (0.152). Given a deviation of consumption from the long-run equilibrium as defined by the cointegration relationship, income and wealth variables interact in a dynamic relationship to correct the disequilibrium. However, the strong significance of the Wald F-statistics in both the consumption and income equations indicates that these two variables are endogenous in the system. Consequently, when consumption deviates from its long-run equilibrium path, both housing and stock market wealth bear the burden of the short-run adjustment to restore equilibrium. The established long-run bidirectional causality between housing wealth and consumption suggests that no variable leads the other. Hence, it seems that South African consumption exhibits a kind of housing wealth-dependence in the sense that adequate housing development seems to ensure higher consumption demand. The policy implication of our finding is that reduced housing activity may lead to adverse effects on consumption.

5. Conclusion

In this paper, we examined the effect of household real wealth on provincial consumption in South Africa. A panel of nine provinces over a period of sixteen years, allowed for the robust estimation of the long term housing wealth effect on consumption. Our estimation results support a cointegrating relationship between consumption, income and wealth which might be interpreted as a long-run consumption function. We, therefore, estimated the long-run elasticities of consumption with respect to both income and wealth. Housing elasticity was found to be positive and significant, implying that consumption spending adjusts to house price fluctuations. Consistent with the permanent income hypothesis, the income elasticity did not differ from unity. Additionally, the marginal propensity to consume out of stock wealth was found to be larger than that of housing wealth. While, consistent partially with Aron and Muellbaurer (2013), who reported a larger consumption effect of stock prices relative to house prices, our findings however, contradict those of Aye *et al.* (forthcoming b) who found that house prices have a bigger impact on consumption compared to stock prices, though this effect was not significant.

We, however, observe that house prices also have a significant impact on consumption, unlike in both Aron and Muellbaurer (2013) and Aye *et al.* (forthcoming b). Overall, we find that even though both stock and house prices significantly affect consumption, the former effect is economically more significant. Note that, with both Aron and Muellbaurer (2013) and Aye *et al.* (forthcoming b) being studies at the aggregate level, this insignificant responsiveness of consumption to housing wealth could be attributed to the existence of multicollinearity between the wealth components in a time series framework (Case *et al.*, 2005). This, in turn, warrants our decision to use a provincial-level approach to allow for heterogeneity of the housing markets.

Further, the causality analysis performed using a panel ECM showed the presence of bidirectional causality between consumption and income, suggesting that both variables are endogenous. With respect to the wealth variables, there was a unidirectional causality running from both forms of wealth to consumption. We conclude that both housing wealth and stock market wealth bear the burden of the short-run adjustment to resorb the discrepancy when consumption deviates from its long-run equilibrium.

From the policy perspective, these findings highlight the relevance of the housing development to explain the consumption demand. Hence, reduced housing activity may lead to adverse effects on consumption. In other words, policy measures designed to ease the trade-off between consumption and savings should encompass the housing sector. Furthermore, the long-run bidirectional causality between consumption and housing wealth suggests that efficient housing policies should imply the consideration of the direct impact of house prices on household spending and the feedback effect of consumption growth on housing prices. Accordingly, increasing consumption may represent a stimulus rather than an obstacle to residential investment. A positive shock to consumption causes a rise in housing demand which stimulate housing activities. The resulting increase in house prices lead to an increase in homeowners' wealth which may spillover onto the banking system given the collateral role of housing. Rising house prices increase the value of collateral against which homeowner may borrow to consume housing and non-housing goods; thus enabling further increase in both consumption demand and housing activities. Similar interpretation holds for the stock market capitalisation.

Note that in this study, the primary objective was to obtain a long-run consumption function at the regional-level and, in turn, compare the importance of housing and stock market wealth-

effects. It would be interesting to analyze the dynamics (future path) of consumption following house price and stock price shocks through impulse response functions in a panel VAR set-up. In addition, it would also be worthwhile to study if the effects from these two competing wealth variables are asymmetric in nature, i.e., do positive and negative shocks affect consumption by different magnitudes and statistical significance.

References

Aoki, K., Proudman, J. And Vlieghe, G. 2004. House prices, consumption and monetary policy: a financial accelerator approach. *Journal of Financial Intermediation*, 13:414-435.

Aron, J., and Muellbauer, J. (2013). Housing wealth, credit conditions and consumption: Evidence from South Africa. *Review of Income and Wealth*. Online version available at: http://onlinelibrary.wiley.com/doi/10.1111/roiw.12033/abstract

Aye, G.C., Gupta, R., and Modise, M.P. (forthcoming a). Do stock prices impact consumption and interest rates in South Africa? Evidence from a time varying vector autoregressive model. *Journal of Emerging Market Finance*.

Aye, G.C., Gupta, R., Kaninda, A., Nyakabawo, W., and Razak, A. (forthcoming b). House price, stock price and consumption in South Africa: A structural VAR approach. *Corporate Ownership and Control*.

Brady, R. and Stimel, D. 2011. How the housing and financial wealth effects have changed over time. *Working Paper* no. 2011-31, Department of Economics, United States Naval Academy.

Burger, P. and van Rensburg, L.J. (2008). Metropolitan house prices in South Africa: Do they converge? *South African Journal of Economics*, 76(2), 291-297.

Campbell, J.Y. and Perron, P. (1991). Pitfalls and opportunities: what macroeconomists should know about unit roots. In: Blanchard, O.J. and Fisher, S. (eds) NBER macroeconomic annual, MIT Cambridge, 141-201.

Carroll, C. D., Otsuka, M., and Slacalek, J., (2006). How large is the housing wealth effect? A new Approach. *Working Paper* No. 12746, National Bureau of Economic Research.

Case, K., Shiller, R., and Quigley, J., (2005). Comparing wealth effects: The stock market versus the housing market. *Advances in Macroeconomics*, 5, 1-32.

Choi, I. (2001). Unit root tests for panel data. *Journal of International Money and Finance,* 20, 249-272.

Das, S., Gupta, R., and Kanda, P.T. (2011). Bubbles in the South African housing market and their impact on consumption. *Journal of Real Estate Literature,* 19(1):69-91

De Bonis, R. and Sylvestrini, A. (2012). The effects of financial and real wealth on consumption: new evidence from OECD countries. *Applieds Financial Economics,* 22(5), 409-425.

De Veirman, E. and Dunstan, A. (2008). How do housing wealth, financial wealth and consumption interact? Evidence from New Zeland. *Discussion Paper* No. 2008/05, Reserve Bank of New Zeland.

Dickey, D., and Fuller, W., (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica,* 49, 1057-1072.

Dreger, C. and Reimers, H.E. (2012). The long-run relationship between private consumption and wealth: common and idiosyncratic effects. *Portuguese Economic Journal*, 11, 21-34.

Dvornak, N., and Kohler, M., (2007). Housing wealth, stock market wealth and consumption: a panel analysis for Australia. *The Economic Record,* 83, 117-130.

Engle,R.F., and Granger, C.W.J. (1987). Co-integration and error correction: representation, estimation, and testing. *Econometrica*, 55, 251-276.

Hadri, K. (1999). Testing the null hypothesis of stationarity against the alternative of a unit root in panel data with serially correlated errors, *Manuscript*, Department of Economics and Accounting, University of Liverpool, Liverpool

Im K.S., Pesaran, M.H., and Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics*, 115, 53-74.

Levin, A., Lin, C.F., and Chu, C.S.J. (2002). Unit root tests in panel data: asymptotic and finite-sample properties. *Journal of Econometrics,* 108, 1-24.

Ludwig, A., and Slok, T. (2004). The relationship between stock prices, house prices and consumption in OECD countries. *Topics in Macroeconomics*, 4(1), 1-24.

Maddala, G. and Wu, S. (1999). A Comparative study of unit root tests and a new simple test. *Oxford Bulletin of Economics and Statistics*, 61, 631-652.

Mishkin, F. 2007. Housing and the Monetary Transmission Mechanism, *Working Paper,* Finance and Economic Discussion Series, Federal Reserve Board.

Ncube, M. and Ndou, E. (2011). Monetary policy transmission, house prices and consumer spending in South Africa: An SVAR approach. *Working Paper* 133, African Development Bank.

Pesaran, M.H. and Smith, R. (1995). Estimating long-run relationships from dynamic heterogeneous panels. *Journal of Econometrics*, 68(1), 79-113.

Pedroni, P. (2000). Fully modified OLS for heterogeneous co-integrated panels. *Advance Economics* 15, 93-130.

Peretti, V., Gupta, R. and Inglesi-Lotz, R. (2012). Do house prices impact consumption and interest rate in South Africa? Evidence from a Time Varying Vector Autoregressive model. *Economics, Financial Markets and Management*, 7(4), 101-120.

Phillips, P., Wu, Y. and Yu, J. (2011). Explosive behavior in the 1990s NASDAQ: When did exuberance escalate asset values? *International Economic Review*, 52(1), 201-206.

Peltonen, T.A., Sousa, R.M. and Vansteenkiste, I.S. (2012). Wealth effects in emerging market economies. *International Review of Economics and Finance*, 24, 155-166.

Poterba, J. M. (2000). Stock market wealth and consumption. *Journal of Economic Perspectives*, 14, 99-118.

Rapach, D.E. and Strauss, J.K. (2006). The long-run relationship between consumption and housing wealth in the eight district states. *Regional Economic Development*, 2(2),140-147.

Simo-Kengne, B.D., Gupta, R. and Bittencourt, M. (forthcoming a). House prices and consumption in South Africa. *Housing Studies.*

Simo-Kengne, B.D., Gupta, R. and Aye, G.C. (forthcoming b). Macro shocks and house prices in South Africa. *Journal of Real Estate Portfolio Management*..

Table 1: Panel unit root tests

IPS Test		
Variables	Without Trend	With Trend
lc	-1.07(3)	-1.51(3)
Δlc	-4.68(2)*	-5.14(1)*
ly	-1.29(3)	-1.53(3)
Δly	-5.26(2)*	-5.69(2)*
lhp	-1.35(4)	-1.77(4)
Δlhp	-5.36(2)*	-5.73(3)*
LLC Test		
Variables	With Trend	
lc	-1.35	
Δlc	-5.34*	
ly	-1.24	
Δly	-5.38*	
lhp	-1.32	
Δlhp	-5.85*	
Hadri (hom) Test		
Variables		
lc	19.22*	
Δlc	1.25	
ly	19.85*	
Δly	1.30	
lhp	18.37*	
Δlhp	1.14	
Hadri (het) Test		
Variables		
lc	15.41*	
Δlc	1.11	
ly	16.48*	
Δly	1.29	
lhp	18.47*	
Δlhp	1.14	
Fisher-ADF		
lc	14.71	
Δlc	81.59*	
ly	15.43	
Δly	92.08*	
lhp	17.78	
Δlhp	92.73*	
Fisher-PP		
lc	11.05	
Δlc	92.55*	
ly	17.18	
Δly	98.36*	
lhp	21.09	
Δlhp	95.62*	

Notes. Numbers in parentheses are the augmented lags included in the unit root test, while Δ denotes first differences.
* denotes statistical significance at 1%

Table 2: Unit root tests for lsp

ADF Test

Levels		First differences	
Without trend	With trend	Without trend	With trend
-1.32(2)	-1.69(2)	-6.27(1)*	-6.55(1)*

DF-WS Test

Levels (trend)	First differences-trend
-1.42(3)	-5.64(1)*

DF-GLS

Levels	First differences
-1.28(2)	-5.76(1)*

Notes. Numbers in parentheses denote the optimal number of lags used in the augmentation of the test regression and were obtained through the Akaike criterion

* indicates that the unit root null hypothesis is rejected at the 1 per cent level.

Table 3: Panel Cointegration Tests

Panel v-stat	30.51282*
Panel rho-stat	-31.76912*
Panel pp-stat	-30.29035*
Panel adf-stat	-10.11408*
Group rho-stat	-31.84639*
Group pp-stat	-32.28828*
Group adf-stat	-11.96650*

Note. * denotes statistical significance at 1%

Table 4: FMOLS Estimates

lc = -0.928 + 1.038 ly + 0.157 lhp + 0.438 lsp

(-5.03)* (-81.3)* (4.46)* (6.83)* $\bar{R}^2 = 0.58$

Notes. T-statistics are reported in parentheses . * denotes significance at 1%

Table 5: Panel Causality Test Results

Dependent Variable	Sources of Causation (Independent Variables) Short-run				Long-Run
	ΔC	**ΔY**	**ΔHP**	**ΔSP**	**ECT**
ΔC	----	51.19 (0.101) [0.00] [0.00]	50.01 (0.159) [0.00] [0.00]	36.99 (0.308) [0.02] [0.00]	-0.152 [0.00]
ΔY	35.12 (0.084) [0.00] [0.00]	----	31.47 (0.191) [0.00] [0.00]	35.93 (0.316) [0.00] [0.00]	-0.023 [0.00]
ΔHP	0.22 (-0.034) [0.64] [0.62]	49.06 (0.177) [0.00] [0.00]	-----	35.19 (0.627) [0.00] [0.00]	-0.077 [0.00]
ΔSP	0.014 (-0.015) [0.91] [0.90]	47.18 (0.163) [0.00] [0.00]	0.97 (0.029) [0.33] [0.32]	----	-0.060 [0.00]

Notes. Figures denote Wald F-tests, value of sums in parentheses, p-values in brackets.