THE IMPACT OF HOUSE PRICES ON CONSUMPTION IN SOUTH AFRICA: EVIDENCE FROM PROVINCIAL-LEVEL PANEL VARs

Beatrice D. Simo-Kengne*, Rangan Gupta** and Manoel Bittencourt***

Abstract

This paper provides an empirical analysis of the role of house prices in determining the dynamic behaviour of consumption in South Africa using a panel vector autoregression (PVAR) approach to provincial level panel data covering the period of 1996 to 2010. With the shocks being identified using the standard recursive identification scheme, we find that the response of consumption to house prices shock is positive, but short-lived. In addition, we find that a positive shock to house price growth has a positive and significant effect on consumption, while the negative impact of an anticipated house price decrease causes an insignificant reduction in consumption. This suggests that house prices exhibit an asymmetric effect on consumption, with the positive effect following an increase in house prices being dominant in magnitude in comparison to a decline in consumption resulting from a negative shock to house prices.

Keywords: House prices, consumption, panel vector autoregressions

JEL classification: C33 - E21 - E31 - R31

1. Introduction

Besides its leading role of providing shelter, houses can be used as collateral since they represent an important component of household's wealth. Due to these specific features of housing, house prices play an important role in formulating both consumption and investment decisions. Because consumption is a significant component of Gross Domestic Product (GDP), effect of house prices on consumption, serves as a key link between the housing market and economic activity. Understanding the implications of house price

* Department of Economics, University of Pretoria, Pretoria, 0002, South Africa, email: beatrice.simo_kengne@up.ac.za

** To whom correspondence should be addressed. Department of Economics, University of Pretoria, Pretoria, 0002, South Africa; email: rangan.gupta@up.ac.za.

*** Department of Economics, University of Pretoria, Pretoria, 0002, South Africa; email: manoel.bittencourt@up.ac.za.

dynamics on consumption is therefore of considerable interest in addressing housing market issues.

The Permanent income Hypothesis (PIH) states that consumption spending is determined by expected lifetime resources. Accordingly, an increase in house prices results in higher wealth, which in turn, allows homeowners to spend more. In other words, homeowners are more likely to increase their consumption as home values increase. However, the positive response of consumption to house price changes has been found not to be obvious. While the collateral effect is inconclusive about the aggregate effect of house prices on total consumption, recent theoretical models have recognised the role of down-payments and transaction costs in explaining why households may spend less when real estate prices increase (Phang, 2004; Engelhardt, 2006). On the other hand, one can argue that renters become poorer following an increase in house prices, which may result in a decrease in demand for housing as well as non-housing goods. Overall, the theoretical effect of higher house prices on total consumption expenditure appears ambiguous; hence the dynamic relationship between house prices and consumption should be investigated empirically.

The purpose of this paper is to provide an empirical analysis of the role of house prices in determining the dynamic behaviour of consumer spending in South Africa. It further investigates whether consumption exhibits symmetric responses to positive and negative house price shocks. Within a panel vector autoregressive (PVAR) framework, we make use of four variables namely, inflation, real consumption, real house prices and the nominal mortgage rate spanning the period 1996-2010 to address the dynamics of house price spillover on consumption in South Africa. This methodology exploits variations in the geographical distribution of housing wealth as well as differences in consumer behaviour among the South African provinces. The usual recursive (Cholesky) identification scheme is employed in order to isolate the dynamic responses of a particular shock. Although not structurally interpretable, the results from the Choleski decomposition do not rely on strong assumptions that are necessary in more sophisticated models such as sign-restrictions or long-run and short-run restrictions models.

The empirical importance of housing wealth is yet to be widely explored in developing countries. This study contributes to the discussion by relying upon provincial data which are more informative. South Africa comprises of nine provinces[1] which differ substantially in terms of economic development. Since housing market varies greatly with macroeconomic conditions including the structure of institutions, important unobserved differences exist among provincial housing markets and over time. Our methodology is able to capture the dynamic effects of shocks by allowing for these unobserved individual heterogeneities which might cause serious bias in the estimates.

A number of key results emerge: The aggregate effect of house price shock on consumption is positive and short-lived. Once we distinguish between the positive and negative shocks, we find that consumption responds positively and significantly to expected increases in house prices. However, the negative response of consumption when house prices are expected to decline appears to be insignificant. These results highlight the asymmetric effect of house price on consumption. The story behind this finding seems to suggest that a decrease in house prices changes the distribution of welfare towards the renters who tend to become owners and away from the owners who feel poorer. When house values are decreasing, current homeowners (especially those who are "net long" in housing) expect future decline and hence tend to save more (Engelhardt, 1996). Some of the decreased consumption made by current owners could be offset by increased consumption of renters who face lower mortgage payment allowing them to increase their consumption spending.

The remainder of the paper is structured as follows. Section 2 provides a review of the relevant literature. Section 3 presents the empirical methodology, while Section 4 discusses the data and results. Finally, Section 5 concludes.

2. Relevant literature

Neoclassical economic theory has established the role of wealth in the consumption function. The PIH, as suggested by Friedman (1957), states that consumers' spending in a single period is partly explained by their expected future stream of income known as "permanent income". This is later extended to the life cycle theory by Ando and Modigliani (1963) who argue that consumption is a function of expected income and net wealth. A simple formulation of the wealth-income hypothesis suggests that consumers will distribute

[1] The South African provinces are namely: Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West and Western Cape.

increases in anticipated wealth over their life cycle and that the marginal propensity to consume out of wealth should increase. More specifically, life cycle theory conjectures that consumers borrow against future income while still young, then build wealth and repay debts before retirement age, and ultimately spend out their wealth and government transfer payments during retirement years. However, this theory does not address the question of whether different forms of wealth should have different effects on consumption spending.

Empirical literature has made significant innovations by decomposing wealth into two or more components; the common approach being to distinguish between corporate equities and one or more other components of wealth (Belsky and Prakken, 2004). Using various modelling approaches, many studies including Case *et al.* (2005); Bayoumi and Edison (2003) have, however, reported larger wealth effects for real estate than other forms of wealth. The following reasons have been stated explaining why home equity might exhibit differences in wealth effects: First, because housing wealth is viewed as permanent and certain; homeowners who are liquidity constrained may spend based on their future expectations (Case *et al.*, 2005). Second, households can borrow against home equity at favourable rates relative to unsecured debt, in order to finance consumption and investment. Third, housing represents an important anchor for household wealth since nominal decreases in home values are quite unusual. Finally, housing accounts for a substantial share of total household net wealth; making house prices a key determinant in the formulation of consumption decision (Belsky and Prakken, 2004). This suggests that housing wealth might play a dominant role in determining consumer spending.

Focusing exclusively on housing wealth, many efforts have been made to estimate the effects of housing wealth on consumption. The standard setting consists of estimating the Marginal Propensity to Consume (MPC) out of wealth using a consumption function. Although few studies (such as Evans, 1967; Phang, 2004; Koivu, 2010) come to the conclusion that wealth should not be included in the consumption function either implicitly or explicitly, many of them have confirmed the strong comovement between house prices and consumption.

Evidence based on micro data is provided by Campbell and Cocco (2007) who make use of repeated cross-sections of household expenditure data and regional home price information. They estimate a small MPC out of housing wealth for young homeowners, and a large MPC for old homeowners. Mian and Sufi (2009) use land topography-based housing supply elasticities as exogenous shock in house prices. They rely on home equity-based borrowing mechanism and find that in response to changes in home values, existing homeowners increase their borrowing significantly to finance consumption and home improvements. Gan (2010) studies the relationship between housing wealth and household consumption using a large panel data set and show that households with multiple houses have much stronger consumption response. He advocates the importance of precautionary savings as the main driver of the consumption effect of house prices and concludes that even in the absence of refinancing and a relaxation of the credit constraints, housing wealth can have a substantial impact on consumption growth.

Studies using aggregate data provide additional explanation of the housing wealth effect. Case *et al.* (2005) find that one unit increase in housing wealth raises consumption by roughly eleven points in a panel of developed countries. Dvornak and Kohler (2007) use state-level panel data to estimate the effect of changes in different component of wealth on consumption in Australia. They conclude that consumption is significantly determined by both housing wealth and stock market wealth in the long run. Muellbauer and Murphy (2008) support this conclusion by arguing that housing collateral and down-payment constraints play an important role in understanding the link between house price variations and consumption. These results are similar to the findings by Iacoviello and Neri (2010) that rely upon a more efficient framework in which both consumption and housing wealth are endogenous.

While the evidence from structural VAR confirms the strong and persistent response of consumption to house price shock in the US and the euro area (Musso *et al.,* 2011), doubt is casted on the power of changes in house prices to explain the time-series path of consumption. Iacoviello (2011) points out that house prices and consumption are driven by common factors which explain a large portion of the comovement between the two variables rather than the wealth effect. He concludes that it is crucial to control for common factors such as liquidity constraints when assessing the dynamics of house prices and consumption. Attanasio *et al.* (2011) come to the same conclusion by arguing that the direct effect of credit liberalisation on consumption is more likely to overestimate the housing wealth effect. Thus, it seems reasonable to expect only a small net housing wealth effect on aggregate consumption.

Although the response of consumption to house price shock has been extensively studied in developed countries, the comparative analysis in terms of asymmetric effect of house price shocks has received less attention. In this paper, we compare the consumption responses to positive and negative house price shocks in a developing country. Given the procyclical behaviour of real estate prices and consumer expenditures, there are good reasons to conjecture that negative house prices shock will lead to a decrease in consumption. In fact, another formulation of wealth effect is that, when a shock leads to decreasing housing prices, there will be a decline in household's net worth. The induced decrease in wealth will reduce the demand for consumption goods and thereby the household's consumption spending. In other words, consumption effect of housing wealth is expected to be symmetric. However, this is not obvious as the decline in home values is favourable to renters' welfare which could translate into an increase in the demand for consumption. Moreover, because of the so called "savings puzzle" whereby eldery owners may consume less after their retirement age (Banks *et al*., 1998), the wealth effect is not evident. It is therefore interesting to investigate the consumption effect of a fall in South African house prices.

Our study relates to the literature by arguing that unobserved heterogeneities are much prominent on housing markets. Failure to account for this heterogeneity could lead to biased estimates. One of the drawbacks of earlier studies (with notable exceptions) on housing dynamics is that the methodology used simply captures common factors that drive the variables together. Moreover, findings from developed countries cannot be generalised to developing nations. We follow Goodhart and Hofmann (2008) in employing PVAR-methodology which better addresses the issue of unobserved heterogeneity by correcting for fixed effects. This approach exploits variations in the geographical distribution of housing wealth as well as spatial differences in consumer behaviour. In contrast to Goodhart and Hofmann (2008), who focus on output, we consider consumption, since consumption effect of house prices represents a key link between housing market and economic activity. To the best of our knowledge, this is the first attempt to analyze the impact of house prices on regional consumption in South Africa. The only other study that relates to our current work is the paper by Das *et al.,* (2011). In this paper, the authors used a single equation error correction model to analyze the impact of national housing price spillovers on national consumption. This study also hinted at a possible asymmetric effect. However, being at the national-level, it failed to account for heterogeneity in the level of economic activity across the provinces when housing shocks hits the regions. But, more importantly, it did not provide the path of the effect on consumption following housing shocks. Also, being a single equation model, issues of endogeneity could not be completely accounted for.

3. Methodology

Vector autoregression, though atheoretical, is a parsimonious and useful tool kit for economists. It is commonly applied in macroeconomics to assess dynamic relationships between time series. By treating all the variables in the system as endogenous, VAR approach does not require any a priori assumptions on the behaviour of variables in the model. This technique should equally apply to a panel framework. Unlike individual regression, the panel set up involves different cross-sections which are typically characterised by the individual heterogeneity. It is therefore inappropriate to apply the traditional VAR to panel data.

This study exploits the impulse response function using a panel-data vector autoregressive (PVAR) approach to analyze regional housing market spillovers on regional provincial consumption. In addition to the well known benefit of modelling the joint dynamics and causal relations among a set of variables, this technique has the advantage to account for unobserved individual heterogeneity which improves the consistency of the estimates. Therefore, the baseline model incorporates fixed effects designed to capture specifics of cross-sections.

Consider a first order panel VAR given by:

$$X_{it} = A_0 + A_1 X_{it-1} + f_i + d_{p,t} + \varepsilon_{it} \quad (1)$$

where X_{it} is the vector of endogenous variables for province *i* and year *t*. It includes the annual changes of the log of consumer price index (inf), log of real consumption (cm), the nominal mortgage rate (mr) and log of real house prices (hp). The autoregressive order of one was chosen because of the limited time series length of the dataset. Besides, most coefficients of the VAR were, understandably, in significant at longer lags.

The implementation of the PVAR[2] approach requires the underlying structure to be the same for all cross-sections; thereby imposing pooling restrictions across units. However, the introduction of the individual fixed effects denoted by f_i helps to relax these restrictions. Further, the "Helmert transformation" is applied so as to avoid bias due to mean-differencing procedure which is commonly used to purge fixed effects. The "Helmert procedure", known as forward mean-differencing, helps to preserve the orthogonality between transformed variables and lagged regressors which will be used as instruments in the estimation of VAR coefficients by system GMM (Love and Zicchino, 2006).

Because of its flexibility, panel-data approach also allows for unit-specific time dummies. Added to Equation (1), these dummies denoted by $d_{p,t}$ capture aggregated macroeconomic shocks that may affect provincial housing markets in the same way. It is useful to mention that our specification assumes ε_{it}, the vector of residuals to be independent and identically distributed (*iid*). However, this assumption is likely to be violated in practice; that is, the innovations may still be contemporaneously correlated. To address this issue, Sims (1980) suggests a recursive causal ordering of variables in the VAR based on their degree of exogeneity. In this study, the ordering of variables reflects the framework provided by Demary (2009) in which housing market is set to react directly to all shocks. It is also in line with the literature on monetary policy transmission for which the business cycle variable is ordered after the inflation but before the interest rate. This procedure relies on Choleski decomposition which assumes the orthogonalisation of shocks. Further, we distinguish between positive and negative shocks which are captured respectively by positive and negative values of house price changes (hpp, hpn). This is achieved by setting two dummies variables $d_{i,t}^{p}$ equal to one for the positive values of real house price changes and equal to zero for negatives values, while $d_{i,t}^{n}$ is specified conversely. We refer to the interaction terms $d_{i,t}^{p} \times hp$ as hpp and $d_{i,t}^{n} \times hp$ as hpn. Thus, X_{it} is either a four- variable vector in (*inf, cm, mr, hp*) or a five-variable vector in (*inf, cm, mr, hpp, hpn*).

Within this identification scheme, the impulse response functions are constructed from the estimated PVAR coefficients and their standard errors. Monte Carlo simulations

[2] We make use of the program written by Inessa Love from the World Bank, Research Department—Finance Group, 1818 Hst, NW, MC3-300, Washington, DC 20433, United States.

are then used to generate 5% error bands for the impulse responses which correspond respectively to 5th and 95th percentiles of the 500 bootstraps. Because the impulse responses are being orthogonalised, dynamic responses to a particular shock can, therefore, be isolated. Furthermore, since the impulse response functions generate the expected future path of variables following a particular shock, it becomes interesting to determine how important this particular shock is in explaining the fluctuations of variables in the PVAR system. This will be achieved through variance decomposition.

We are aware of the fact that, with the chosen empirical set-up the dynamic responses delivered via the Cholesky decomposition are not structurally interpretable. This is due to the lack of a theoretical underpinning about the behaviour of the variables under consideration. For instance, a house price shock should be interpreted as an orthogonalized reduced-form shock for which it is not possible to determine whether the underlying structural driving force is a housing-demand or a housing-supply shock. Structural shocks may be identified via the use of more sophisticated identification scheme such as a combination of lung-run and short-run restrictions or sign restrictions as in Andre *et al.* (2011). The implementation of these identification schemes requires imposing some assumptions which would drive us away from our original objective which is to uncover the dynamic relationship between house prices and consumption.

3 Data and empirical results

3.1 Data

Since provincial level data on consumption is not available before 1996, this study makes use of four annual series from the period 1996 to 2010. The Allied Bank of South Africa (ABSA) compiles annual house prices, covering provincial areas. Annual retail sales series, which serves as a proxy for consumption following Zhou (2010) and Zhou and Carroll (2011), have been compiled at a regional level by the Regional Explorer database obtained from the Global Insight South Africa (GISA). Monthly mortgage rate data is sourced from the Statistics South Africa (SSA), which we use to derive annual series by taking an average over 12 months. Series have been deflated using the consumer price index which is drawn from the International Monetary Fund's International Financial Statistics (IFS). To allow for comparative analysis especially when analyzing asymmetric effects of house price changes, all the variables have been standardised by dividing with its respective standard deviations. Note that, our main variables are consumption and house prices. The model also includes the inflation and the mortgage rate to capture the affordability of housing as a consumption and investment good, respectively.

As indicated by Demary (2009), the rise in house prices is likely to increase household's consumption expenditure which in turn leads to inflationary pressures. This justifies the positive relation between house prices and inflation. However, consumption does not always increase as house prices rise (wealth effect). This could be due to the following reasons: (i) If households are not financially constrained, the increase in consumption due to the increase in the value of housing collateral will not take place; (ii) The increase in wealth might not affect consumption because of the precautionary savings; (iii) Changes in the preferences for old households (due to health restrictions, retirement saving) may also justify why the expected increase in consumption following a growth in house prices might not happen.

Furthermore, the increase in house prices is expected to drive up the mortgage payment. However, because growth in house prices raises the value of the collateral, homeowners have the possibility to access bank credits (especially those who were initially not qualified) allowing them to consume more. This increase in credit supply will reduce the mortgage rate (Demary, 2009). Thus, while conventional wisdom suggests a positive relationship between house prices and inflation, there are not clear cut sign-expectations about the effect of house prices on consumption and on mortgage rate.

We use the first-differences of the log values of the variables[3] rather than their log levels, except the interest rate for which we only take the first difference. As indicated in Table 1, our variables in levels exhibit non-stationarity; justifying the transformation of the data in their first difference form. The Fisher-type panel root test is employed. Although the literature on time series offers a wide variety of panel unit root tests, the use of Fisher-type test has become popular for its simplicity, its power over the existing tests and the absence of restriction about the sample sizes (Maddala and Wu, 1999). Moreover, Fisher-type test is suitable for heterogeneous cross-sections as it relies on individual unit root processes. We represent the variables in levels in capital letters and the transformed ones in small letters except the CPI whose transformed form is named inf .

[3] The variables are time demeaned before being differenced.

The results from Table 1 indicate that variables in levels exhibit non-stationarity; justifying the transformation of the data in their first differenced-form. Therefore, we use the first-differences of the log values of the variables[4] rather than their log levels, except the interest rate for which we only take the first difference.

Table 1

Fisher-type unit root test results

	Variables			
	CPI	HP	CM	MR
Statistic (Chi square)	8.339	2.593	2.513	10.612
P-value	1.000	1.000	1.000	0.910

Note: High probability means non stationarity.

Table 2

Cross- correlations

	House prices		
	hp	hpp	hpn
inf	-0.118*	-0.189***	0.109
cm	0.61***	0.555***	0.5071***
mr	-0.159*	-0.241***	0.11

Note: The table shows the cross regional average correlations among the variables.
*, ** and *** denotes significance at the 10%, 5% and 1% level respectively.

Given that our empirical set up assumes common causality among variables, we report in Table 2 the correlation matrix. The relatively high cross-correlations suggest similar trending behaviour of the series at the aggregated level. However, these correlations are subjected to econometric issues such as multicollinearity; justifying the need to analyse all the variables within an empirical set up as we do in the following section.

[4] The variables are time demeaned before being differenced.

3.2 Empirical results

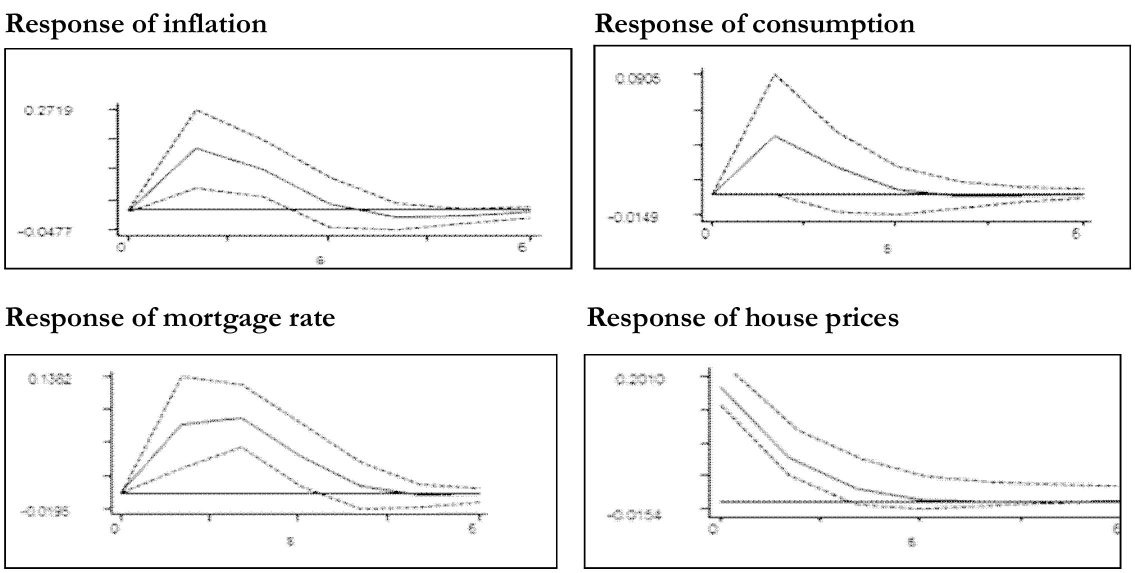
3.2.1 Spillover effects of house prices on consumption

As mentioned earlier, the impulse response functions (IRFs) represent a convenient tool for the analysis of spillover effects. An IRF captures the time profile of the effect of shocks at a given point in time on the expected future values of variables in a dynamic system. Table 3 (in the Appendix of the paper) displays the coefficients of the panel VAR estimation, which we use to construct the IRFs, as indicated in Figures 1 and 2, following a house price shock. The sign of the estimated coefficients are in line with our expectations, and, hence, produces IRFs that are theoretically consistent as well. In the Appendix, looking at third column of both the panels corresponding to the 4- and 5-variables VAR in Table 3, indicates that the signs of the coefficients of aggregate growth in real house price (*hp*) and the positive growth rates of real house price (*hpp*) are significant, at least at the 10 percent level, and have the expected positive signs. However, the coefficient of *hpn*, i.e., the negative growth in real house price is not significant despite having the expected negative sign. Both the mortgage rate and inflation rate have the expected signs, but are insignificant.

The responses of consumption, inflation and mortgage rate to a positive house price shock is portrayed in Figure 1 are compatible with theoretical expectations. We observe that a house price shock of one standard deviation results in a real house prices increase by 0.20% initially staying significant for about 2 and a half years. This is followed by a reversion to the baseline over three years. This pattern is in line with the strong autocorrelation in house prices that may result from predictive expectations. A delayed positive response to consumption take place following the positive house prices shock and peaks after slightly over a year. Although the reversion of the IRF to the baseline matches the one of the house price, this reaction is significant only at the 10% level initially, only to become insignificant after a year. The short-lived increase in consumption by about 0.09% indicates a small net housing wealth effect on consumption in South Africa.

The fact that we seems to have correctly identified a demand shock in housing leading to an increase in house prices is clear from the behaviour of the mortgage rate. The higher demand for housing, results in an increase in the mortgage rate initially. Then, the rise in real estate prices leads to an increase in household's wealth which translates into an increase in the demand for consumption goods. This increase in household's consumption expenditures lead to inflationary pressures, against which economic agents try to protect their wealth by investing in alternative assets including real estate. The induced demand for housing will ensure a persistent effect on real house prices.. The Monetary authority might respond to increasing inflation by raising the money market rate, which in turn, will translate into higher mortgage rates. This line of thinking is vindicated by a second round increase in the mortgage rate, which peaks at about 2 years before starting to revet back to its original level and reaching the baseline around the fifth year following the shock. The effect on the mortgage rate stays significant for about 4 years. The increase in inflation is quite sharp and peaks at about one year after the shock and stays significant for nearly three years and takes nearly six years to die down.

Fig. 1: Impulse responses to orthogonalized one-unit house price shock



Notes: Bold lines show the impulse response of a specific variable following a house price shock. The dotted lines represent % percent errors on both sides generated by 500 Monte-Carlo replications.

Disney *et al.* (2002) suggests that elderly homeowners tend to cut their consumption sharply after retirement; a number of possible reasons being shifts in preferences at retirement, precautionary savings against incapacity and disability, restrictions on consumption imposed by poor health. This has been known as "retirement savings puzzle" (Banks *et al.*, 1998). Moreover, since inflation increases by 0.27% which is more than the rise in the mortgage rate (0.13%), the real costs of financing real estate projects decrease so as to allow renters to save more to become owners. Overall, some of the increased consumption made by current young owners could be offset by the increased savings of both renters and old owners. This is one potential explanation why the consumption response is short-lived.[5]

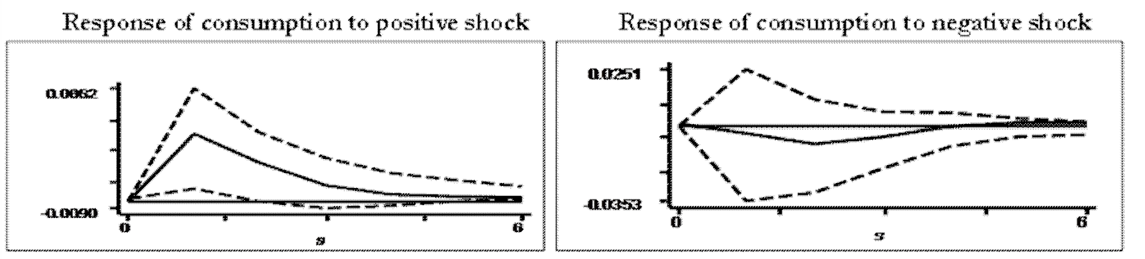
3.2.2 Asymmetric effects of house prices on consumption

Das et al., (2011) provided some evidence of a possible asymmetric effect of house prices on consumption at the national level. In light of this finding, in this section, we compares the response of consumption to a same-sized (one standard deviation) positive and negative house price shocks in Figure 2. An unexpected increase in house prices leads to a significant increase in consumption; confirming the housing wealth effect on consumption. However, a decrease in house prices tends to have no significant effect on consumption, although the sign of the response matches the theoretical expectations. This indicates that house prices changes exhibit an asymmetric effect on consumption. It also highlights the importance of distinguishing between positive and negative house price shocks, since it provides an explanation as to why the dynamic effect on consumption following an overall house price shock fail to produce a significant impact. Understandably, for the overall housing shock, which does not differentiate between the sign of the shocks, the average effect on consumption is a sum of both the positive and negative impact, and hence, tends to cancel out a bit as far as significance goes. However, given that consumption responds more strongly, in absolute value, following a positive real house price shock in comparison to a negative shock, the effect on consumption following an overall house price shock is still positive.[6]

[5] The impulse responses of the model following other shocks, namely aggregate demand (consumption), monetary (inflation) and the interest rate (mortgage rate) shocks, are in line with theory as vindicated by the coefficient estimates in Table 3. These results have been suppressed to save space, but are available upon request from the authors.

[6] The effect of the positive and negative house price shocks on inflation and mortgage rate, as captured by their respective IRFs, are theoretically consistent, which in turn, is expected given the signs of the coefficients in Table 3. These results have been suppressed to save space, but are available upon request from the authors.

Fig. 2: Impulse responses of consumption to positive vs negative real house price shock



Notes: Bold lines show the impulse response of a specific variable following a house price shock. The dotted lines represent % percent errors on both sides generated by 500 Monte-Carlo replications.

In general, it seems logical to believe that a decrease in house prices changes the distribution of welfare towards the renters who tend to become owners. When house prices decrease, renters face lower mortgage payment which allows them to increase their consumption spending. Conversely, current homeowners (especially those who are "net long" in housing) feel poorer and tend to save more. Some of this decreased consumption made by owners could be offset by increased consumption of renters who feel richer. This interpretation is in line with the finding by Engelhardt (1996) that households facing capital losses are more likely to change their saving behaviour than those experiencing real gains; justifying why the overall effect of a fall in home values on consumption is insignificant.

3.2.3 The role of house prices in explaining consumption: Variance decomposition

This section investigates how much of the variation in consumption is attributable to variations in house prices. This is achieved via the variance decomposition analysis which relies on the forecast error variance to determine the relative importance of house prices shocks.

Table 4 reports the forecast error variance decomposition of house prices in the baseline model together with the two types of the house price shocks (*hpp* and *hpn*) in the alternative model. The variance decomposition presents an alternative way of summarizing the information depicted in the IRFs in Figures 1 and 2. The baseline model, which captures the joint shock, as indicated in the fourth column, suggests that the contribution of house price shock to the variance of consumption is about 2.9% at the 10-year horizon. Further, it shows that house prices shock accounts for 3.2% of the variation in the inflation rate compared to 2.5% in the mortgage rate. As also observed from Figure 2, the effect of the positive house price shock on consumption dominates the effect from the negative shock, with the former explaining 4.2% of the variation in consumption relative to only 0.1% of the same. The positive house price shock also outweighs the negative shock in explaining the variation in house prices itself (45.7% against 11.6%), the inflation rate (3.1% versus 0.4%) and the mortgage rate (3.7% versus 1.7%). Clearly, a positive house price shock affects the dynamics of our model economy much more than a negative house price shock.

Table 4

Variance decomposition

Impact from housing price shock on:	Shocks		Joint house price shocks
	Positive house price shock	Negative house price shock	
Inflation	0.031	0.004	0.032
Consumption	0.042	0.001	0.029
Mortgage rate	0.037	0.017	0.049
House prices	0.457	0.116	0.469

Note: The table reports the percentage of variation in the row variable explained by the column variables in the four- and five-variables VAR model. The variance decomposition is at a horizon of 10 years after the shock.

4. Conclusion

This paper employs a Panel VAR approach on a provincial level data set for South Africa over the annual period of 1996-2010, to show that house prices have a short-lived effect on provincial level consumption in South Africa. However, when we differentiated the overall house price shock into its positive and negative components, we found that a positive house price shock tends to have a significant positive effect on consumption, which outweighs the size of the insignificant negative impact on consumption. This result highlighted that house prices changes exhibit an asymmetric effect on consumption. More generally, it also indicates that there is value in disaggregating shocks, since the overall shock could fail to capture the true effect on the variables of interest.

Appendix

Table 3

Dynamics results

Panel A: 4-VAR	GMM estimates			
	inf(t)	cm(t)	mr(t)	hp(t)
inf(t-1)	0.444(4.07)**	-0.015(-0.46)	0.245(4.05)**	-0.070(-2.07)**
cm(t-1)	0.603(1.49)	0.231(1.49)	0.444(2.10)**	0.165(1.57)
mr(t-1)	-0.681(-3.16)**	-0.054(-0.82)	-0.023(-0.25)	-0.013(-0.22)
hp(t-1)	0.912(2.44)**	0.244(1.67)*	0.455(2.43)**	0.391(4.02)**

	GMM estimates				
Panel B: 5-VAR	inf(t)	cm(t)	mr(t)	hpp(t)	hpn(t)
inf(t-1)	0.441(4.02)**	-0.009(-0.27)	0.233(3.64)**	-0068(-2.54)**	0.0024(0.29)
cm(t-1)	0.589(1.44)	0.251(1.64)*	0.397(1.90)*	0.177(2.04)**	0.005(0.15)
mr(t-1)	-0.689(-3.20)**	-0.041(-0.64)	-0.053(-0.53)	0.060(1.26)	-0.062(-4.36)**
hpp(t-1)	0.839(1.79)*	0.356(2. 21)**	0.194(0.81)	0.436(4.27)**	0.047(1.43)
hn(t-1)	1.117(1.22)	-0.740(-0.22)	1.193(-2.19)**	-0.143(-.085)	0.269(2.70)**

Note: VAR is estimated by GMM, unit-specific and fixed effects are removed prior to estimation. Each of the regressors (inf(t-1), cm(t-1), mr(t-1) and hp(t-1))are being instrumented by its own lags. Reported numbers show the coefficients of regressing the column variables on lags of the row variables. Heteroskedasticity adjusted t-statistics are in parentheses. * and ** denote significance at the 10% and 5% level respectively.

References

Ando, A. and Modigliani F. (1963). " 'The Life-Cycle' hypothesis of savings: Aggregate implications and tests". *American Economic Review*, 53: 55-84.

Andre, C., Gupta, R. and Kanda, P.T. (2011). Do house prices impact consumption and interest rate? Evidence from OECD countries using an agnostic bidentification procedure. *Department of Economics, University of Pretoria, Working Paper Series*, No: 201118.

Attanasio, O., Leicester, A. and Wakefield, M. (2011). Do house prices drive consumption growth? The coincidence cycles of house prices and consumption in the UK. *Journal of the European Economic Association*, 9(3): 399-435.

Banks, J., Blundell, R. and Tanner, S. 1998. Is there a retirement saving puzzle? American Economic Review, 88(4): 769-788.

Bayoumi, T. and Edison, H. (2003). "Is wealth increasingly driving consumption?" *DNB staff Reports, 101, De Netherlandsche Bank*.

Belsky, E. And Prakken, J.(2004). Housing wealth effects: Housing's impact on wealth accumulation, wealth distribution and consumer spending. *Joint Center for Housing Studies, Working Paper*: W04-13.

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

Das, S., Gupta, R., and Kanda, P.T. (2011). Bubbles in South African house prices and their impact on consumption. *Journal of Real Estate Literature*, 19(1): 71-92.

Demary, M. (2009). The link between output, inflation, monetary policy and housing price dynamics. *MPRA paper No. 15978*. http:// mpra.ub.uni-muenchen.de/15978/

Disney, R., Henley, A. And Stears, G. (2002). Housing costs, house price shocks and savings behaviour among older households in Britain. *Regional Science and Urban Economics*, 32: 607-625.

Dvornak, N. And Kohler, M. (2007). Housing wealth, stock market wealth and consumption: A panel analysis for Australia. *The Economic Record*, 83(261): 117-130.

Engelhardt, G.V. (1996). House prices and home owner saving behaviour. *Regional Science and Urban Economics*, 26: 313-336.

Evans, K.M. (1967). The importance of wealth in the consumption function. *Journal of Political Economy*, 67(4): 335-351.

Friedman, M. (1957). A theory of the consumption function.Princeton, N.J.: Princeton University Press.

Gan, J. (2010). Housing wealth and consumption growth: Evidence from a large panel of households. *The Review of Financial Studies*, 23(6).

Goodhart, C. and Hofman, B. (2008). House prices, money, credit and the macroeconomy. *Oxford Review of Economic Policy*, 24(1): 180-225.

Iacoviello, M. (2011). Housing wealth and consumption. *International Finance Discussion Paper,* No. 1027.

Iacoviello, M. And Neri, S. (2008). Housing market spillovers: Evidence from an estimated DSGE model. *American Economic Journal: Macroeconomics* 2(2): 25-64.
Koivu, T. (2010). Monetary policy, asset prices and consumption in China. *Working Paper No. 1240*, European Central Bank.

Love, I. and Ziccino, L. (2006). Financial Development and Dynamic Investment Behaviour: Evidence from Panel VAR. *Quarterly Review of Economics and Finance*, 46:190-210. (doi:10.1016/j.qref.2005.11.007).

Maddala, G.S. and Wu, S. (1999). A comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and Statistics*, Special Issue. 0305-9049.

Mian, A.R. and Sufi, A. (2009). House prices, home equity-based borrowing and the U>S> household leverage crisis. *NBER Working Paper* 15283, *National Bureau of Economic Research*, Inc, August.

Muellbauer, J. and Murphy, A. (2008). Housing markets and the economy: the assessment. *Oxford Review of Economic Policy*, 24(1): 1-33.

Musso, A., Neri, S. and Stracca, L. (2011). Housing, consumption and monetary policy: How different are the US and the euro area? *Journal of Banking and Finance*, 35:3019-3041.

Pesaran, H.H. and Shin Y., (1998). Generalized impulse response analysis in linear multivariate models. *Economics Letters*, (58), 17-29.

Phang, S.Y. (2004). House prices and aggregate consumption: do they move together? Evidence from Singapore. *Journal of Housing Economics*, (13): 101-119.

Tsatsaronis, K. and Zhu, H. (2004), What Drives Housing Price Dynamics: Cross Country Evidence, *BIS Quarterly Review, Bank for International Settlements*, March.

Walentin, K. and Sellin, P. (2010). Housing collateral and the monetary transmission mechanism. *Sveriges Riksbank Working Paper*, No. 239.

Zhou, X. (2010). Essays on U.S. State Level Financial Wealth Data and Consumption Data. *Ph.D. Dissertation*, Johns Hopkins University, Baltimore, Maryland.

Zhou, X and Carroll, C. (2011). Measuring Wealth Effects Using U.S. state Data. Conference on Empirical Macroeconomics Using Geographical Data, Federal Reserve Bank of San Fansisco.