



University of Pretoria
Department of Economics Working Paper Series

**Financial Liberalisation and the Effectiveness of Monetary Policy
on House Prices in South Africa**

Kasai Ndahiriwe

University of Pretoria

Rangan Gupta

University of Pretoria

Working Paper: 2008-03

February 2008

Department of Economics

University of Pretoria

0002, Pretoria

South Africa

Tel: +27 12 420 2413

Fax: +27 12 362 5207

<http://www.up.ac.za/up/web/en/academic/economics/index.html>

**FINANCIAL LIBERALISATION AND THE EFFECTIVENESS OF MONETARY
POLICY ON HOUSE PRICES IN SOUTH AFRICA**

Kasai Ndahiriwe^{*}

and

Rangan Gupta^{**}

^{*} Graduate Student, Department of Economics, University of Pretoria, South Africa. Contact details: E-mail: kasaind@yahoo.fr, Phone: +27 787 434 335, +250 08 825 932.

^{**} To whom correspondence should be addressed. Associate Professor, University of Pretoria, Department of Economics, Pretoria, 0002, South Africa. Contact details: E-mail: rangan.gupta@up.ac.za, Phone: +27 12 420 3460, Fax: +27 12 362 5207.

ABSTRACT

This paper investigates the effectiveness of monetary policy on house prices in South Africa, before and after financial liberalisation, with financial liberalisation being identified with the recommendations of the De Kock Commission (1985). Using both impulse response and variance decomposition analysis performed on SVARs, we find that, irrespective of house sizes, during the period of financial liberalisation, interest rate shocks had relatively stronger effects on house price inflation. However, given that the size of these effects were nearly negligible, the result seems to indicate that house prices are exogenous, and, at least, are not driven by monetary policy shocks.

Keywords: Financial Liberalisation; Impulse Response; Variance Decomposition; Structural Decomposition.

JEL Classification: C01, C32, E52.

1. INTRODUCTION

In the last four decades or so, South Africa, just like many industrialized and developing countries, has experienced wide changes in house prices. It is generally believed that changes in monetary policy have been an important factor behind the inflation and deflation of house prices. In addition, it is also agreed that financial liberalisation may have played a direct role in these fluctuations (International Monetary Fund, 2000, Iaocoviello and Minetti (2003)). But little, if not nothing, seems to be known, especially for South Africa¹, on the possible (indirect) role that financial liberalisation could have had in affecting the sensitivity of house prices to monetary policy decisions. This paper takes a preliminary step in investigating this issue. Note, following Ludi and Ground (2006) and Du Plessis *et al.* (2007), liberalisation of the domestic financial sector in South Africa has been identified with the recommendations of the De Kock Commission (1985) which suggested the abandoning of quantitative controls in favour of market-based instruments.

The main aim of this analysis is to deduce whether monetary policy plays an important role in affecting house price inflation in South Africa, and, whether or not, the result is sensitive to deregulations in the financial market. The importance of the analysis lies in determining whether house price inflation is purely exogenous, i.e., explained only by itself, or is determined by monetary policy actions. The question is particularly relevant for South Africa given its inflation targeting framework, and with housing being an

¹ The only other evidence of the effect of monetary policy on house prices, before and after financial liberalisation, can be found in Iaocoviello and Minetti (2003) in their analysis of European housing markets.

important component of the Consumer Price Index (CPI).² Moreover, recent studies on housing market, business cycles and monetary policies, by Iacoviello (2002) and Iacoviello and Minetti (2007) indicates that the housing market might have an important role to play in the monetary transmission mechanism, especially, the bank-lending channel of monetary policy. Hence, our analysis also aims to form the prelude to more elaborate analyses of the credit channel of monetary policy³ in the South African context, by accounting explicitly for the role of housing market and financial liberalisation. Note movements in the housing market are likely to play an important role in the business cycle. This is not only because housing investment is a very volatile component of demand (Bernanke and Gertler, 1995), but also because changes in house prices tends to have important wealth effects on consumption (International Monetary Fund, 2000) and investment (Topel and Rosen, 1988). Hence, if we do find worthwhile impact of monetary policy shocks on house price inflation, it would make a strong case for analysing the credit channel of monetary policy in South Africa by incorporating variables relating to the housing market.

To investigate the effects of monetary policy shocks on house prices, and the sensitivity of the same in the pre- and post-periods of financial liberalisation, we estimate a structural VAR (SVAR) model over two subsamples, namely 1967Q1 to 1983Q3 and

² See Appendix 1.

³ See Sichei (2006) and Ludi and Ground (2006) for analyses of the credit channel of monetary policy in South Africa. While Sichei (2006), using GMM estimation on bank-level panel data, finds the credit channel to be active, Ludi and Ground (2006), finds no such evidence based on a Vector Error Correction (VEC) framework.

1983Q4 to 2006Q4⁴, using data on the growth rate of GDP, real Treasury bill rate (nominal Treasury bill rate less the percentage change in CPI), and real house price inflation (percentage change in the real house price measured by the housing price index deflated by the CPI). Once, the SVAR is estimated, we use impulse response and variance decomposition analyses to investigate the impact of financial liberalisation on the effect of monetary policy on housing prices. Note, given that the housing market in South Africa is quite different based on house-sizes we are looking at (Burger and van Rensburg (2007) and Gupta and Das (2008))⁵, we carry out the analysis separately by using data for prices of large-, medium- and small-sized houses, besides, prices for all-sized houses. To the best of our knowledge, this is the first attempt to analyse the effectiveness of monetary policy on the South African housing market in pre- and post periods of financial liberalisation.⁶ The rest of the paper is organized as follows: Section 2 discusses issues related to financial liberalisation in the South African housing market. The empirical methodology and the findings are presented in Section 3, while, Section 4 offers some concluding remarks.

⁴ See Du Plessis *et al.* (2007) for an explanation of the break-up of the sample period.

⁵ See also Kang and Stulz (1997), Choe *et al.* (1999), Dahlquist *et al.* (2003) and Christoffersen *et al.* (2006).

⁶ It must be pointed that our analysis is different from that of Iacoviello and Minetti (2003) in at least two regards: First, unlike, Iacoviello and Minetti (2003), we explicitly take account of the stationarity of the variables, and use a SVAR and not a simple VAR, and; Second, we also check for the robustness of our analysis by looking at house price inflation of alternative house sizes, besides, all houses, as in Iacoviello and Minetti (2003).

2. FINANCIAL LIBERALISATION IN THE SOUTH AFRICAN HOUSING MARKET

First of all, it is of outmost importance to identify the trend of the variables in interest namely log of GDP, real interest rate and log of real housing prices. The trends and date of liberalisation is indicated by the position of vertical discontinued lines shown in Figure 1. As is evident from Figure 1, the trends before financial liberalisation and after liberalisation are quite different, especially for the log of real housing prices. Thus, there is a real need for analyzing the impact of financial deregulation on the effectiveness of monetary policy on house prices. An examination of Figure 1 indicates a general downward trend in prices of each house size from 1983Q3, the period marking the end of financial regulation, to approximately the middle of the second half of the 1990s. From then on, the house prices have increased and seem to have reached the average levels of the period of financial regulation.

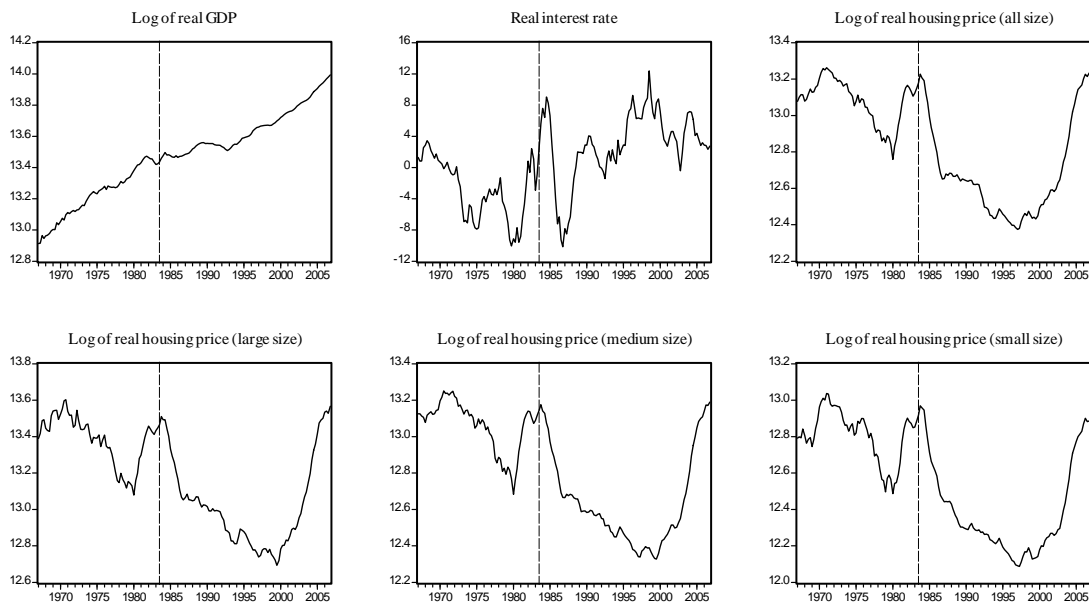


Fig.1: Trend and date of financial liberalization

With the need to use stable structural VARs⁷, based on stationary variables, South African quarterly data on real GDP and real housing prices were transformed into their respective growth rates.⁸ In Figure 2 we now present the movements of the change in the log of GDP (Y), real short-term interest rate (R), and change in the log of real housing price (HP) for all size (_AS), large (_L), medium (_M) and small (_S). Again, as in Figure 1, the date of liberalisation is indicated by discontinued vertical lines.

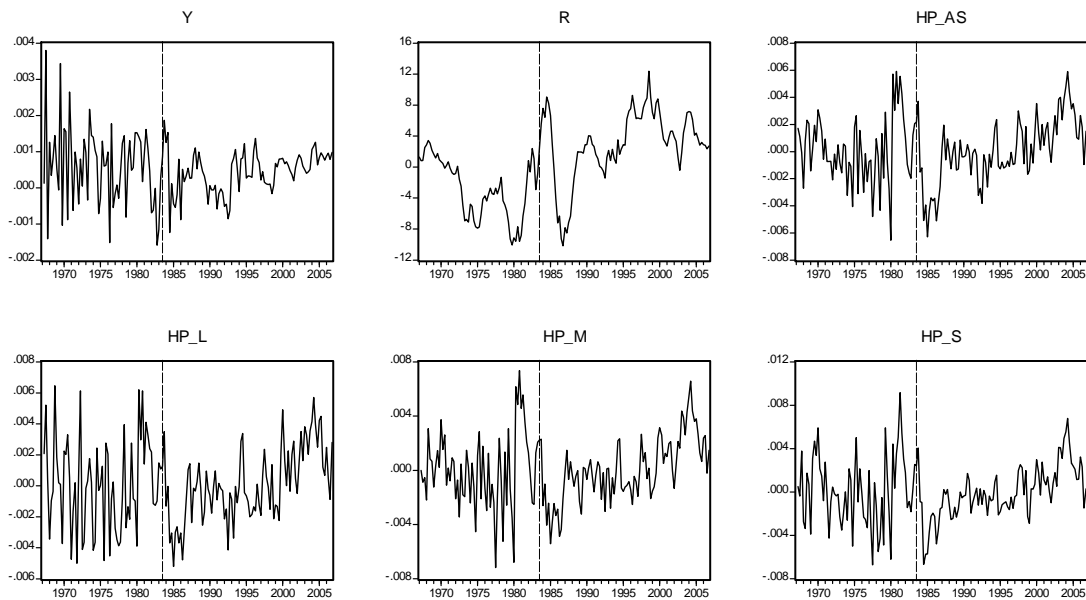


Fig. 2: Trend (using change in log GDP and changes in log HPs) and date of financial liberalization

It can be seen that after financial liberalisation the change in the log of real house prices seems to be less volatile. Although it is not our main aim, it is important to notice that the graphs detect how financial liberalisation in South Africa has led to lesser price volatility in the housing industry. Similar evidence on the reduction of price volatility resulting

⁷ Stability required that no roots should lie outside the unit circle.

⁸ The unit root tests have been provided in Appendix 2 and discussed in further details in Section 3.

from financial liberalisation has also been reported by Domowitz *et al.* (1998) for other emerging market economies.

3. EMPIRICAL ANALYSIS

3.1 Empirical Methodology

We use SVARs to assess the impact of financial deregulation on the effectiveness of monetary policy on the prices of different house sizes --- large, medium and small, besides, all sizes considered together. For comparison purpose, we split the data series into two sub samples before and after financial liberalisation, with the former period being captured by 1967Q1 to 1983Q3, and the second running from 1983Q4 to 2006Q4.

To determine if monetary policy affects differently house prices in the two sub samples, we estimate two structural vector autoregressive regressions (SVAR) for each house size. We use quarterly data⁹ to estimate the three variable SVARs, with the variables being ordered in the following way: the growth rate of the real GDP (Y), real short-term interest rate (R) and the growth rate of real house price (HP). According to Iacoviello and Minetti (2003), the aforementioned ordering reflects the possibility that innovations in the interest rate can affect output only with a lag, whereas they can immediately affect the growth rate of house prices. The theoretical justification for this ordering can be found in Iacoviello and Minetti (2003). The authors point out that output takes one period to be

⁹ Data on the real GDP, Treasury bill rate, and the CPI were obtained from the SARB quarterly Bulletins, whereas the information on the house prices was derived from the ABSA Housing Price Review. Note the base year considered for the real GDP and the CPI was the year 2000.

produced, thus, reacting with one-period lag to an interest rate shock, whereas real house prices respond immediately to variations in the real interest rate.

For the second sub sample, political change was viewed as having an immediate and permanent impact. As such, we include a dummy variable¹⁰ that takes on the value of zero prior to 1994Q1 and unity beginning in 1994Q1. The reasonable alternative was to model the impact of political change as a gradually increasing process over the year of 1994. Although the stability of the VARs was not an issue, the latter alternative was providing results with lesser theoretical support. Hence, it was reasonable to use the first alternative which recommended a jump from zero to unity in 1994.

To check for the stationarity in the data, we used Augmented Dickey–Fuller (ADF), the Phillips–Perron (PP), the Dickey-Fuller with GLS detrending (DF-GLS), and the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) tests were conducted for the two sub samples, and the tests found that all the variables are stationary in their levels, except for the real interest in the first sub sample, which was found to be integrated of order one. For each of the eight unrestricted SVARs, we chose one lag since it was found sufficient to induce noise like residuals, according to the Schwarz information criterion.

Following Iacoviello and Minetti (2003), we analyze the impact of deregulation on the effectiveness of monetary policy in the housing market by first contrasting the impulse responses of real house price inflation to monetary policy innovations for two sub

¹⁰ Results are not supported by theory when we do not include the dummy for the South African political change of 1994.

samples capturing the periods of before and after financial liberalisation. Second, a variance decomposition analysis is used to identify the relative importance of the random innovation of monetary policy on the growth rate of house prices for the same two sub-samples.

3.2 Functional Specification

Enders (2004) suggested that when we are not confident that a variable is actually exogenous, a natural extension of the transfer function analysis is to treat each variable symmetrically. Because the longest lag length is unity in each of our three variable models, we have the following first-order system:

$$Y_t = b_{10} - b_{12}R_t - b_{13}HP_t + \gamma_{11}Y_{t-1} + \gamma_{12}R_{t-1} + \gamma_{13}HP_{t-1} + \varepsilon_{yt} \quad (1)$$

$$R_t = b_{20} - b_{22}Y_t - b_{23}HP_t + \gamma_{21}Y_{t-1} + \gamma_{22}R_{t-1} + \gamma_{23}HP_{t-1} + \varepsilon_{Rt} \quad (2)$$

$$HP_t = b_{30} - b_{32}Y_t - b_{33}R_t + \gamma_{31}Y_{t-1} + \gamma_{32}R_{t-1} + \gamma_{33}HP_{t-1} + \varepsilon_{HPt} \quad (3)$$

where (i) Y_t , R_t and HP_t are stationary; (ii) where it is assumed that ε_{yt} , ε_{Rt} and ε_{HPt} are white-noise disturbances with standard deviations of σ_Y , σ_R and σ_{HP} respectively; and (3) where ε_{yt} , ε_{Rt} and ε_{HPt} are uncorrelated white-noise disturbances.

Note that the model can be called a SVAR (or a primitive system) because each of the three variables has a contemporaneous effect on the others. Using matrix algebra, we can write (1)–(3) as follows:

$$\begin{bmatrix} 1 & b_{12} & b_{13} \\ b_{21} & 1 & b_{23} \\ b_{31} & b_{32} & 1 \end{bmatrix} \begin{bmatrix} Y_t \\ R_t \\ HP_t \end{bmatrix} = \begin{bmatrix} b_{10} \\ b_{20} \\ b_{30} \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} & \gamma_{13} \\ \gamma_{21} & \gamma_{22} & \gamma_{23} \\ \gamma_{31} & \gamma_{32} & \gamma_{33} \end{bmatrix} \begin{bmatrix} Y_{t-1} \\ R_{t-1} \\ HP_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{Rt} \\ \varepsilon_{HPt} \end{bmatrix} \quad (4)$$

or

$$\begin{aligned} Bx_t &= \Gamma_0 + \Gamma_1 x_{t-1} + \varepsilon_t \\ x_t &= B^{-1}\Gamma_0 + B^{-1}\Gamma_1 x_{t-1} + B^{-1}\varepsilon_t \end{aligned} \quad (5)$$

where:

$$x_t = \begin{bmatrix} Y_t \\ R_t \\ HP_t \end{bmatrix}; B = \begin{bmatrix} 1 & b_{12} & b_{13} \\ b_{21} & 1 & b_{23} \\ b_{31} & b_{32} & 1 \end{bmatrix}; \Gamma_0 = \begin{bmatrix} b_{10} \\ b_{20} \\ b_{30} \end{bmatrix}; \Gamma_1 = \begin{bmatrix} \gamma_{11} & \gamma_{12} & \gamma_{13} \\ \gamma_{21} & \gamma_{22} & \gamma_{23} \\ \gamma_{31} & \gamma_{32} & \gamma_{33} \end{bmatrix}; \varepsilon_t = \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{Rt} \\ \varepsilon_{HPt} \end{bmatrix}$$

It is important to mention that the terms ε_{yt} , ε_{Rt} and ε_{HPt} are pure innovations (or shocks) in Y_t , R_t and HP_t , respectively. With Y , R and HP aligned as variables by 1, 2 and 3 respectively, if b_{ij}^{th} coefficient is different from zero, ε_{jt} has an indirect contemporaneous effect on x_{it} . Note such a system is used to capture the feedback effects, because Y_t , R_t and HP_t are allowed to affect each other.

The above SVAR is different from the VAR in standard form which when presented in reduced-form looks as follows:

$$x_t = A_0 + A_1 x_{t-1} + e_t$$

where: $A_0 = B^{-1}\Gamma_0$; $A_1 = B^{-1}\Gamma_1$ and $e_t = B^{-1}\varepsilon_t$.

It is important to note that the error terms (e_{y_t}, e_{R_t} and e_{HP_t}) are composites of the three shocks $\varepsilon_{y_t}, \varepsilon_{R_t}$ and ε_{HP_t} . In our study, we use the AB-Model (Giannini, 1992), which looks as follows:

$$BA(L)z_t = B\varepsilon_t \quad (6)$$

$$B\varepsilon_t = Ae_t$$

where, A and B are (3 x 3) invertible matrices.

$$B(\varepsilon_t \varepsilon_t')B' = A(e_t e_t')A$$

The structural innovations are assumed to be orthonormal i.e., its covariance matrix is an identity matrix:

$$E(\varepsilon_t \varepsilon_t') = I_n \quad (7)$$

The assumption of orthonormal innovations imposes the following identifying restrictions on A and B.

$$A \Sigma A' = BB',$$

$$\text{where } \Sigma = E(e_t e_t') \quad (8)$$

This imposes a set of $n^2 - \left(\frac{n(n+1)}{2}\right)$ non-linear restrictions on the parameters of the A and B matrices. This leaves one with $\left(\frac{n(n+1)}{2}\right)$ free parameters to be estimated.

Following the identification strategy proposed by Sims (1980), the Choleski decomposition of the 3 x 3 matrices is as follows:

$$A = \begin{bmatrix} 1 & 0 & 0 \\ a_{21} & 1 & 0 \\ a_{31} & a_{32} & 1 \end{bmatrix}, B = \begin{bmatrix} b_{11} & 0 & 0 \\ 0 & b_{22} & 0 \\ 0 & 0 & b_{33} \end{bmatrix}$$

The necessary condition for identification requires, that the maximum number of parameters contained in the two matrices must equal to $\left(\frac{3(3+1)}{2}\right) = 6$. In other words, this condition makes the number of equations equal to the number of unknowns in the system.

The above model corresponds to a recursive economic structure and is just-identified.

Given the above information, we can write the following Choleski decomposition:

$$\begin{aligned} e_{yt} &= b_{11}\varepsilon_{yt} \\ e_{Rt} &= -a_{21}e_{yt} + b_{22}\varepsilon_{Rt} \\ e_{HPt} &= -a_{31}e_{yt} - a_{32}e_{Rt} + b_{33}\varepsilon_{HPt} \end{aligned} \tag{9}$$

As required by the Choleski decomposition, in the system above, all elements above the principal diagonal must be zero.

3.3 Empirical Findings

Figure 3 displays the estimated impulse responses of a contractionary monetary shock, respectively, for the entire sample (1967Q1-2006Q4), the first sub-sample (1967Q1-1983Q3) and the second sub-sample (1983Q4-2006Q4) for houses of all sizes combined together.

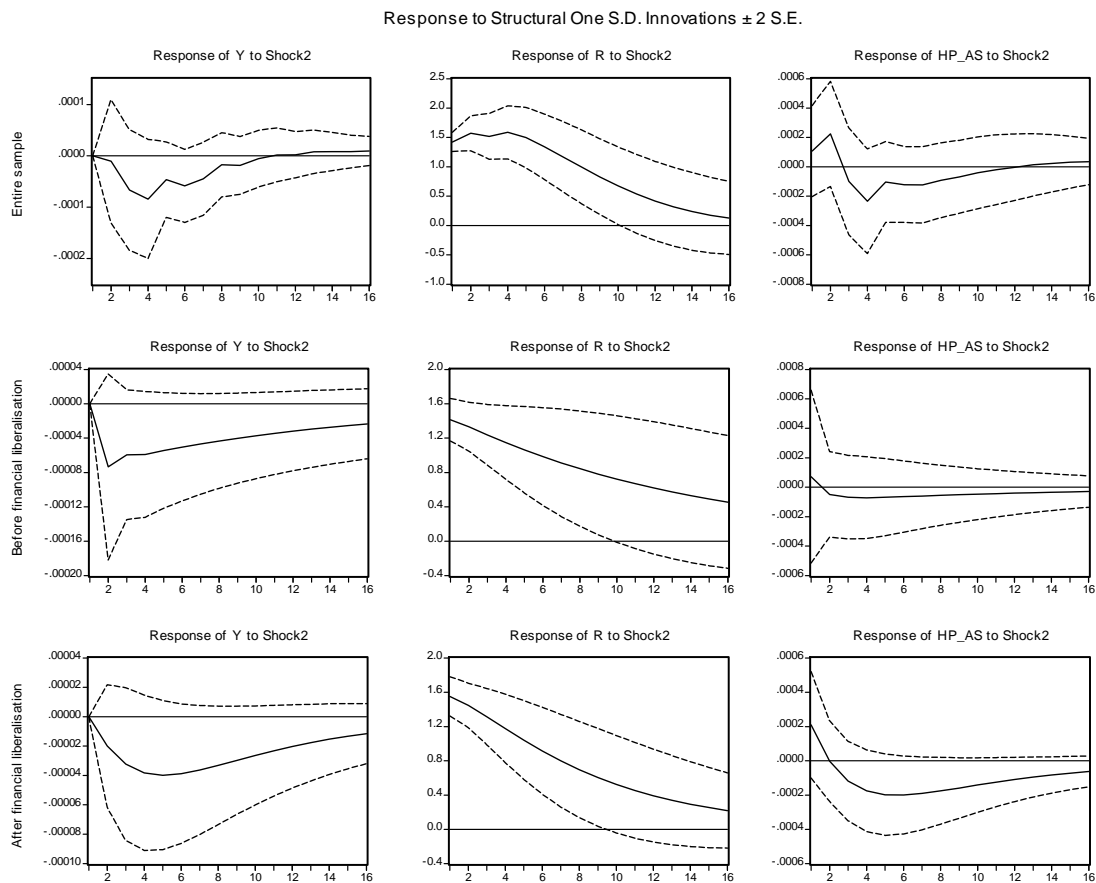


Fig. 3: Impulse responses (all size)

In general, the main findings can be summarized as follows: First, corresponding to a one standard deviation contractionary structural innovation to the interest rate shock, the real Treasury bill rate increases and then falls steadily. This, in turn, causes the growth rate of output to fall initially and then rise, with the size of the effect being quite small.¹¹ Output growth follows a hump-shaped, with the effect being more persistent in the post-liberalisation period compared to the overall sample and the pre-deregulation era. As with the growth rate of output, the effect of a contractionary monetary policy shock on real house price inflation is quantitatively quite small. Interestingly, the initial monetary

¹¹ In terms of the magnitude of the monetary policy shock on output growth, similar results were also found by Du Plessis *et al.* (2007).

contraction causes the real house price inflation to first increase,¹² and then decline steadily reaching initial values after 11 quarters for the entire sample period. The effects are, however much more persistent when one considers the pre- and the post-liberalisation era separately. Importantly, as claimed in the literature, the disinflation in the real house price is relatively more pronounced in the second sub-sample corresponding to the post-liberalisation period.

So, as far as, monetary policy effectiveness vis-à-vis financial liberalisation is concerned, the results support the thesis that during the period of financial liberalisation interest rate shocks had more powerful effects on the real house price inflation. Figure 4 indicates that, on average, a contractionary monetary policy is found to affect the inflation rate of house prices more in the second sub-sample in terms of both the magnitude and the persistence of responses. Following a monetary contraction, after an initial increase in real house price inflation for a period ranging from one to three quarters, there is a persistent decrease in the same, which, in turn, tends to last for more than two years for the sub-samples. The results are robust across different house sizes, though, understandably, the contractionary effect on real house price inflation of large houses tends to be smaller in magnitude when compared to medium- and small-sized houses,

¹² This result is in line with the price puzzle. Note the effect is small and temporary, possibly insignificant, but still puzzling. As pointed out by Walsh (2000), one most commonly accepted explanation for such a puzzling movement of real house price inflation is a reflection of the fact that, perhaps, the variables included in the SVARs do not span the complete information set to the monetary authority in setting the interest rate.

since large-sized house prices tends to be much more stable in general (Burger and van Rensburg (2007) and Gupta and Das (2008)).

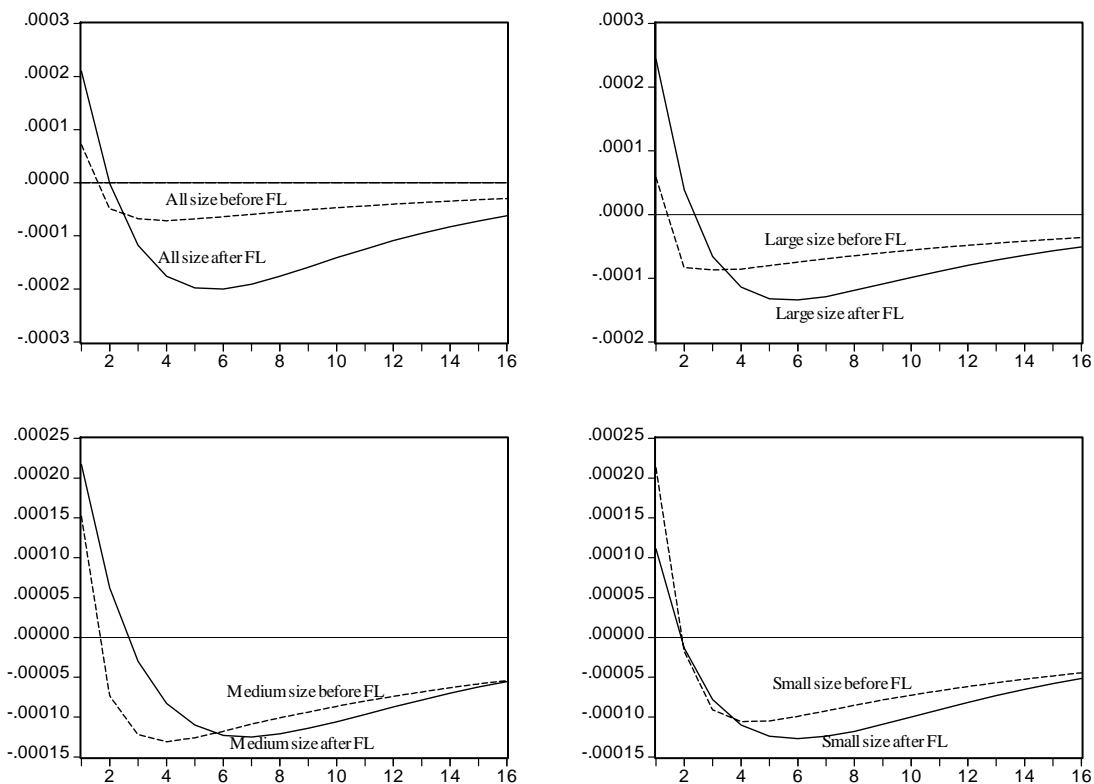


Fig. 4: Impulse responses' comparison for the two sub samples

A related, but a different question is: To what proportion does the Treasury bill rate shocks contribute to the volatility of real house price inflation in the two subperiods? To answer this question, we resort to the variance decomposition analysis. The results are shown in Fig. 5, which for each quarter, essentially plots the fraction of the n-step-ahead forecast error variance of real house price inflation explained or caused by the real interest rate shocks. Note, again we compare the results across the before and after periods of financial liberalisation. Here as well, the results are in line with those from the impulse response analysis. We find that the share of the variation in real house price inflation, accounted for by the monetary policy shock measure, is larger at all horizons in

the post-liberalisation period, but again the fraction of the forecast error variance explained by the interest rate shock is relatively small.

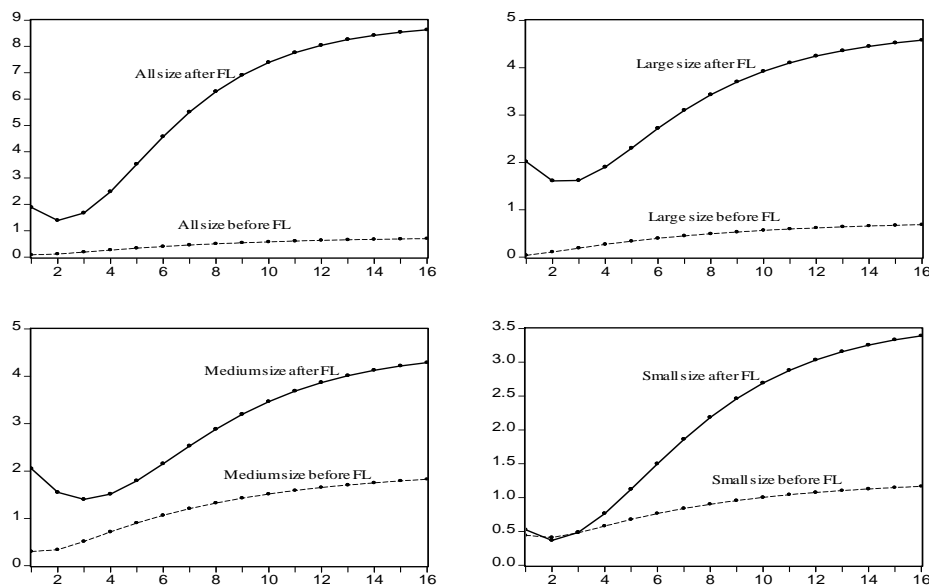


Fig. 6: Variance decomposition for different size

Altogether, the results broadly support the thesis that during the period of financial liberalisation interest rate shocks had more powerful effects on the inflation of relative price of houses. However, these effects are quite small in magnitude. As Appendix 3 shows, most of the forecast error variance in the inflation of real house price comes from the shock to itself.

CONCLUSION

This paper investigates the effectiveness of monetary policy on housing prices before and after financial liberalisation, with financial liberalisation being identified with the recommendations of the De Kock Commission (1985), which suggested the need to abandon quantitative controls in favour of market-based instruments. To account for differences of the effects of monetary policy between the pre- and post-periods of

financial liberalisation, the data is divided into two sub-samples, namely, 1967Q1 to 1983Q3 and 1983Q4 to 2006Q4. Using both impulse response and variance decomposition analysis performed on a Structural VAR (SVAR) model, we find that financial liberalisation has resulted in a regime shift by increasing the effectiveness of monetary policy on house price inflation. No matter what the size of the houses are, empirical results show that after financial liberalisation the response of inflation in real house prices was much more prominent for innovations in the monetary policy, measured by real Treasury bill rate. It is also found that the dynamics in growth rate of real house prices exhibit more persistence under deregulated market following an interest rate shock. However, and, perhaps, more importantly, these effects are quite small in magnitude.

The paper indicates that movements in house prices are sensitive to monetary policy shocks, but the magnitude of these effects are quite modest. So, as far as, analysing whether the credit channel of monetary policy in South Africa might be operative through the housing market, does not seem to be quite promising, at least if one is to take the results of the preliminary analysis seriously. Nevertheless, this should not stop future analyses on the transmission mechanism of monetary policy involving the credit channel to incorporate the housing market explicitly, besides the role of financial deregulation. But as of now, the paper does seem to indicate that given that monetary policy effects on house prices are marginal, even though being more pronounced and persistent under financial liberalisation, the SARB's ability to control real house price inflation, and, more importantly CPI via the housing market is unlikely to work. In other

words, with house prices weakly dependent on monetary policy, and, being explained mostly by itself, house price inflation is most likely an exogenous variable.

REFERENCES

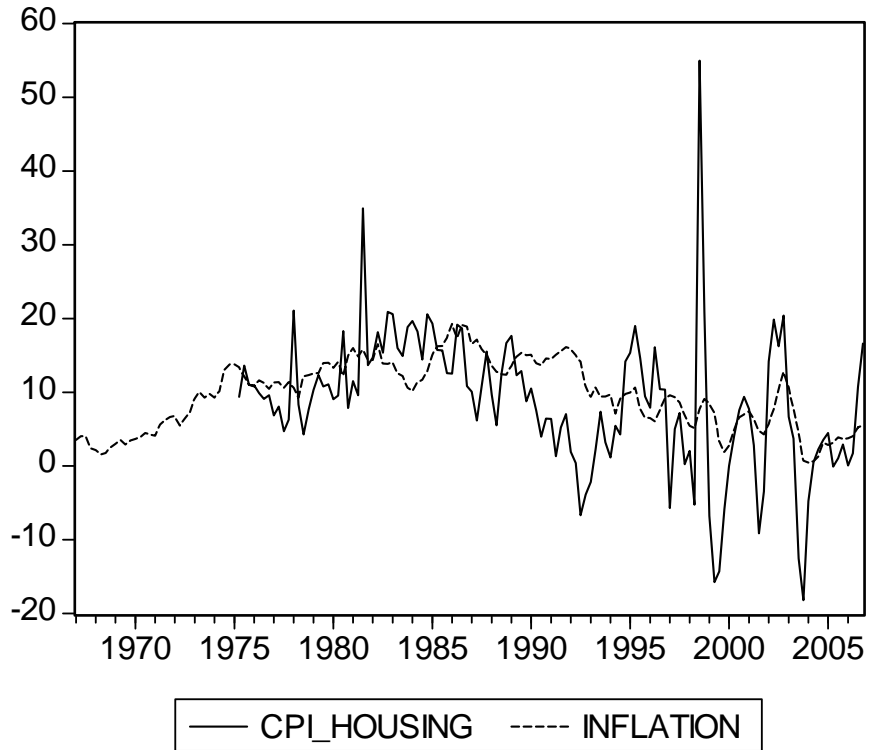
- Bernanke, B., and Gertler, M. (1995): “Inside the Black Box: the Credit Channel of Monetary Transmission”, *Journal of Economic Perspectives*, 9(-), pp. 27–48.
- Burger, P., and van Rensburg, L. J. (2007): “Metropolitan House Prices in South Africa: Do they Converge?” *Working Paper*, Department of Economics, University of Free State, South Africa.
- Choe, H., Kho, B.C., Stulz, R.M. (1999): “Do foreign investors destabilize stock markets? The Korean experience in 1997”, *Journal of Financial Economics*, 54(-), pp. 227-264.
- Dahlquist, M., Pinkowitz, L., Stulz, R.M. and Williamson, R. (2003): “Corporate governance and the home bias”, *Journal of Financial and Quantitative Analysis*, 38(-), pp. 87-110.
- De Santis, G., and Imrohorglu, S. (1997): “Stock Returns and Volatility in Emerging Financial Markets”, *Journal of International Money Finance*, 16(4), pp. 561–579.
- Domowitz, I., Glen, J., and Madhavan, A. (1998): “International Cross-Listing and Order Flow Migration: Evidence from an Emerging Market”, *Journal of Finance*, 53(6), pp. 2001–2027.
- Du Plessis, S., Smit, B. and Federico S., (2007): “Identifying Aggregate Supply and Demand Shocks in South Africa”, *Working Papers No. 11/07*, Stellenbosch Economic, South Africa.
- Enders, W. (2004): *Applied Econometric Time Series*. 2nd Edition, US: John Wiley & Sons.

- Giannini, C. (1992): *Topics in Structural VAR Econometrics*. New York: Springer-Verlag.
- Gupta, R., and Das S. (2008). "Spatial Bayesian Methods for Forecasting House Prices in Six Metropolitan Areas of South Africa", *South African Journal of Economics*, Forthcoming.
- Iacoviello, M. (2002): "House Prices and Business Cycles in Europe: A VAR Analysis", *Working Paper No. WP540*, Department of Economics, Boston College, US.
- Iacoviello, M., and Minetti, R. (2007): "The Credit Channel of Monetary Policy: Evidence from the Housing Market", *Journal of Macroeconomics*, Forthcoming.
- Iacoviello M. and Minetti R. (2003): "Financial liberalisation and the sensitivity of house prices to monetary policy: theory and evidence", *The Manchester School*, 71(1), pp. 20-34.
- International Monetary Fund. (2000): *World Economic Outlook: Asset Prices and the Business Cycle*, May.
- Isaksson, A. (2001): "Financial liberalisation and price stability in Kenya", *Journal of Policy Modeling*, 23(5), pp. 503-510.
- Ludi, K. L., and Ground, M. (2006): "Investigating the Bank-Lending channel in South Africa: A VAR Approach", *Working Paper No. 2006-04*, Department of Economics, University of Pretoria, South Africa.
- Kang, J. K. and Stulz, R. M. (1997): "Why is there a home bias? An analysis of foreign portfolio equity ownership in Japan", *Journal of Financial Economics*, 46(-), pp. 2-28.

Sichei, M. M. (2005): “Bank-Lending Channel in South Africa: Bank-Level Dynamic Panel Data Analysis”, *Working Paper No. 2005-10*, Department of Economics, University of Pretoria, South Africa.

Topel, R.H., and Rosen, S. (1988): “Housing Investment in the United States”, *Journal of Political Economy*, 96(-), pp. 718–740.

Walsh, Carl, E., (2000): *Monetary Theory and Policy*. Cambridge: MIT Press.

APPENDICES**Appendix 1: Trend of the housing CPI inflation and the overall CPI inflation**

Appendix 2: Unit root tests:

Panel A: First sub-sample

Series	Model	ADF		PP Test	DF-GLS	KPSS	Conclusion
		$\tau_\tau, \tau_\mu, \tau$	ϕ_3, ϕ_1				
Y	Intercept & Trend	-9.995***	49.958***	-9.807***	-9.460***	0.056***	Stationary
	Intercept	-9.537***	90.960***	-9.399***	-2.961***	0.252***	
	None	-2.205**	-	-7.763***	-	-	
r	Intercept & Trend	-0.809	1.295	-1.095	-1.153	0.1564**	Non-Stationary
	Intercept	-1.440	2.076	-1.648	-1.264	0.431*	
	None	-1.213	-	-1.364	-	-	
D(r)	Intercept & Trend	-4.372***	10.551***	-6.642***	-6.611***	0.077***	Stationary
	Intercept	-6.563***	43.075***	-6.566***	-6.602***	0.228***	
	None	-6.619***	-	-6.621***	-	-	
HP_AS	Intercept & Trend	-5.905***	17.492***	-5.971***	-5.768***	0.159**	Stationary
	Intercept	-5.901***	34.822***	-5.972***	-5.350***	0.178***	
	None	-5.940***	-	-6.009***	-	--	
HP_L	Intercept & Trend	-6.730***	22.675***	-6.667***	-6.562***	0.175**	Stationary
	Intercept	-6.747***	45.526***	-6.707***	-6.086***	0.231***	
	None	-6.798***	-	-6.760***	-	-	
HP_M	Intercept & Trend	-5.801***	16.843***	-5.826***	-5.878***	0.130*	Stationary
	Intercept	-5.786***	33.479***	-5.808***	-5.828***	0.165***	
	None	-5.831***	-	-5.854***	-	-	
HP_S	Intercept & Trend	-5.821***	16.959***	-5.998***	-5.894***	0.125*	Stationary
	Intercept	-5.849***	34.212***	-5.874***	-5.857***	0.131***	
	None	-5.884***	-	-6.031***	-	-	

*(**)[***] Stationary at a 10(5)[1] % level of significance

Panel B: Second sub-sample

Series	Model	ADF		PP Test	DF-GLS	KPSS	Conclusion
		$\tau_\tau, \tau_\mu, \tau$	ϕ_3, ϕ_1				
Y	Intercept & Trend	-6.530***	21.644***	-6.509***	-3.619***	0.087***	Stationary
	Intercept	-5.685***	32.322***	-5.818***	-2.526**	0.490**	
	None	-4.378***	-	-4.362***	-	-	
r	Intercept & Trend	-3.772**	4.776	-2.596	-1.721	0.103***	Stationary
	Intercept	-2.613*	4.096***	-2.282	-1.591	0.405*	
	None	-2.127**	-	-1.975**	-	-	
HP_AS	Intercept & Trend	-6.180***	19.302***	-6.353***	-3.270**	0.053***	Stationary
	Intercept	-2.411	5.157***	-4.005***	-1.735*	0.906	
	None	-2.423**	-	-4.027***	-	-	
HP_L	Intercept & Trend	-6.075***	18.470***	-6.016***	-5.931***	0.089***	Stationary
	Intercept	-2.509	9.047***	-4.050***	-2.227**	0.942	
	None	-2.513**	-	-4.073***	-	-	
HP_M	Intercept & Trend	-5.225***	13.662***	-5.229***	-5.269***	0.080***	Stationary
	Intercept	-3.604***	12.995***	-3.604***	-2.815***	0.983	
	None	-3.623***	-	-3.623***	-	-	
HP_S	Intercept & Trend	-4.162***	6.172***	-5.307***	-4.718***	0.061***	Stationary
	Intercept	-3.055**	5.218***	-3.365**	-3.428***	0.991	
	None	-3.081***	-	-3.386***	-	-	

*(**)[***] Stationary at a 10(5)[1] % level of significance

Appendix 3: Variance Decomposition of Real House Price Inflation due to Shock 3

Period	HP_AS_BL	HP_AS_AL	HP_L_BL	HP_L_AL	HP_M_BL	HP_M_AL	HP_S_BL	HP_S_AL
1	94.83517	94.35800	93.93543	92.64144	96.58078	95.02577	98.79498	97.12757
2	95.18811	95.71548	93.94731	91.75404	96.57897	96.06006	98.29311	98.00077
3	95.13900	95.67662	93.87543	91.20251	96.42222	96.41500	98.22940	98.01023
4	95.06040	94.93752	93.79502	90.73635	96.21497	96.38377	98.13154	97.74024
5	94.98899	93.92862	93.72679	90.29357	96.02804	96.13959	98.03154	97.37773
6	94.92614	92.90582	93.66723	89.88368	95.86467	95.79774	97.94201	96.99893
7	94.87212	91.99467	93.61586	89.52265	95.72468	95.43204	97.86434	96.64125
8	94.82577	91.23763	93.57146	89.21684	95.60509	95.08481	97.79799	96.32272
9	94.78606	90.63371	93.53312	88.96437	95.50305	94.77650	97.74152	96.04977
10	94.75205	90.16365	93.49999	88.75922	95.41600	94.51397	97.69353	95.82203
11	94.72292	89.80336	93.47137	88.59413	95.34170	94.29653	97.65276	95.63556
12	94.69796	89.52987	93.44663	88.46202	95.27829	94.11979	97.61812	95.48493
13	94.67658	89.32358	93.42526	88.35664	95.22415	93.97803	97.58869	95.36444
14	94.65827	89.16863	93.40679	88.27275	95.17791	93.86540	97.56369	95.26874
15	94.64257	89.05255	93.39083	88.20604	95.13842	93.77652	97.54244	95.19315
16	94.62913	88.96576	93.37704	88.15301	95.10469	93.70673	97.52439	95.13366

Notes: HP_i_j, i = AS, LS, MS, SS; j = AL, BL, where AS = All Sizes, L = Large Size, M = Medium Size, S = Small Size;

BL = Before Liberalisation, AL = After Liberalisation.