A Time-Varying Approach to Analysing Fiscal Policy and Asset Prices in South Africa*

Rangan Gupta** Charl Jooste# Kanyane Matlou♣

Abstract

This paper studies the interplay of fiscal policy and asset prices in a time varying parameter VAR. Using South African data since 1966 we are able to study the dynamic shocks of both fiscal policy and asset prices on asset prices and fiscal policy. This enables us to isolate specific periods in time to understand the size and sign of the shocks. The results seem to suggest that at least two regimes exist in which expansionary fiscal policy affected asset prices. From the 1970's until 1990 fiscal expansions were associated with declining house and slightly increased stock prices. The majority of first decade of 2000 had asset prices increasing when fiscal policy expanded. On the other hand, increasing asset prices reduced deficits for the majority of the sample period, while the recent financial crises had a marked change on the way asset prices affect fiscal policy.

Keywords: TVP-VAR, countercyclical fiscal policy, stock prices, house prices

JEL Classification: C11, C15, C32, H30, H61

* We would like to thank Jouchi Nakajima for many helpful comments. The usual disclaimer applies.
** To whom correspondence should be addressed. Department of Economics, University of Pretoria, Pretoria, 0002, South Africa. Email: rangan.gupta@up.ac.za.
# Graduate student, department of Economics, University of Pretoria, Pretoria, 0002, South Africa.
♣ Graduate Student, Department of Economics, University of Pretoria, Pretoria, 0002, South Africa.

1. Introduction

The recent global financial crisis demonstrates that boom/bust cycles in asset prices can dramatically affect macroeconomic stability, especially output and price stability. Hence, the importance of monetary and fiscal policy in sustaining economic growth during and after the financial crisis has become a dominant area of study. Analysts typically focus on monetary policy to consider the linkages between economic policy and asset markets.[1] Whilst monetary policy dominated the field of academic and policy discussions on controlling elements of the business cycle, fiscal policy has become key after monetary policy reached the zero interest rate lower bound and became ineffective in stimulating demand during the recent recession (Feldstein, 2009). Large and persistent fiscal stimulus, however, can lead to long-term unsustainability of sovereign finances as seen when analysing current government bond markets (Schuknecht *et al.*, 2009). Researchers need to disentangle this effect, however, from the mess left by financial institutions in Europe and the US. Furthermore, this may lead to business cycle de-synchronization (Rafiq and Mallick, 2008; Mallick and Mohsin, 2007, 2010) or negatively affect the nexus between monetary and financial stability (Castro, 2011; Granville and Mallick, 2009; Sousa, 2010a).

The behaviour of asset markets and their prices emerges as an important factor for the decision making of financial institutions, homeowners and consumers, businesses, and policy makers. The linkages between the financial market and the banking system, the housing sector, and the credit market produced strong and powerful effects in the course of the financial turmoil (Afonso and Sousa 2011). According to the European Central Bank (ECB, 2010), a variety of mechanisms exist through which asset prices can affect consumption spending. For example, a wealth effect working through consumers and a "*q*- effect"[2] working through businesses can affect asset prices. Housing bubbles, which arose in most developed and emerging-market countries prior to the financial crisis, led to unsustainable borrowing by homeowners to finance consumption against "seemingly" permanent increases in their equity holdings. If *q* increases as a result of an increase in equity prices, the firm can raise more capital by issuing new equity. This makes it more attractive for firms to raise new capital, thus increasing investment demand, which may, in turn, lead to higher prices for goods and services. Additional effects can stem from residential property prices, which, via higher wage demands by workers, may lead to increases in both the prices of goods and services and, therefore, consumer prices. Finally, movements in asset prices can significantly affect business and consumer confidence. Hence, researchers now focus their attention on the relationship between macroeconomic variables, wealth, and asset returns (see Sousa, 2010b, 2010c; Afonso and Sousa, 2011, 2012; Agnello and Sousa, forthcoming; Peretti *et al.*, forthcoming; and Simo-Kengne *et al.*, forthcoming a for detailed literature reviews).

Our understanding of the transmission of fiscal policy innovations to asset markets is limited, however, exists because of the few studies concentrating on US and industrialized European markets (e.g., Afonso and Sousa, 2011; Agnello and Sousa, forthcoming, and references cited therein). Various channels exist whereby fiscal policy can affect stock and housing markets (Afonso and Sousa,

[1] For detailed international literature reviews on studies involving monetary policy and asset prices, see Bjørnland and Leitemo (2009), Iglesias and Haughton (2011), Gupta *et al.*, (2012a, b), and Bjørnland and Jacobsen (forthcoming).

[2] Tobin's *q* equals the ratio of the stock market value of a firm to the replacement cost of its capital.

2011; Agnello and Sousa, forthcoming). For instance, fiscal policy can influence stock markets via its effect on sovereign risk spreads. These spreads, in turn, reflect the financing capacity of government as well as investor expectations. When the markets deem that fiscal policy is stable, then an inflow of capital causes the exchange rate to appreciate and subsequently to reduce pressures on central bank authorities to raise interest rates. Since demand for government bonds strengthen, the overall bond yield curve falls, which affects the stock market. Increasing public deficits through the government's wage bill, however, can lead to a deteriorating lending environment, as this could lead to an increase in the demand for credit that pushes interest rates higher. Consequently, the present discounted value of the cash-flows generated by stocks falls, the markets require a higher risk premium, and stock prices shrink. Finally, unsound fiscal policies can prompt a loss in the confidence of home-currency assets and generate a rebalancing of asset portfolio composition away from domestic assets toward foreign assets.

Fiscal policy can also affect housing markets. For example, taxes on housing capital gains and the imputed rental housing value, fiscal subsidies and value added taxes (VAT) on purchases of new houses, and the tax deductibility of mortgage payments and housing rents can affect housing prices via their effects on households' disposable income and the demand of houses. An indirect effect of fiscal spending through the wage bill and government infrastructure spending can lead to both increases and decreases in the demand for homes. More broadly, the deterioration of the fiscal stance and uncertainty about the long-run sustainability of public finances can affect long-term interest rates and negatively impinge on the financing conditions for mortgages, pushing housing prices downwards. Hence, we should not neglect the role of fiscal policy in explaining both housing market developments and stock market dynamics.

As discussed above, changes in stock or housing prices can influence consumption. However, it is the variation in the financial and housing wealth that can produce substantial variation in personal savings. When the corporate sector does not compensate the change in household savings, it is then left for the government to allow for a variation in its own savings and, thereby, to smooth the fluctuations in national saving that originates from movements in asset prices. Also, Blake et al. (1998) and Lossani and Tirelli (1994) suggest that fiscal policy rules can be designed to steer national wealth to its target value point to accommodate wealth expansions when the wealth level is below a certain target value. Moreover, a tax increase may reduce the incentive to accumulate wealth since it reduces the incentive to earn income and increases the incentive to consume, which will have negative repercussions for the whole economy. Under such assumptions, time-varying models that account for the "state" of the economy and the "state" of asset values are useful to disentangle the relationship between fiscal policy and wealth dynamics.

In terms of the effects of asset price shocks on fiscal policy, Eschenbach and Schuknecht (2002) conduct an empirical study of changes in real estate and asset price changes on the fiscal balance across 17 OECD countries. The paper finds that asset prices affect fiscal balances through the revenue channel; capital gains, turnover related taxes as well as wealth effects and their impact on consumption are found to have an impact on the fiscal balance. The study finds that, on average, a 10% change in real estate and stock prices have a similar effect on the fiscal balance as a 1% change in output. Tagkalakis (2010) augments a fiscal policy reaction function with financial variables for OECD countries. Looking at the impact on the fiscal balance, current expenditure and current revenue, the author finds that an increase in asset prices has a positive impact on the fiscal balance.

Furthermore, the paper finds that residential price changes play a bigger role in their effect on the budget balance, compared to commercial property price and equity price changes. Agnello et al., (2012) look at the impact of asset market developments on fiscal policy. Employing both linear and non-linear specifications, the study estimates a fiscal policy rule that includes financial, as well as housing wealth. The authors find that in the linear specification, spending does not react to asset prices, but taxes and the primary surplus fall in reaction to a rise in stock prices, and rise when house prices increase. Declining asset prices are also associated with declining revenue collections, especially where capital and dividend taxes apply. Any ramp up in listed company profits will result in a higher dividends tax while increasing house prices will increase revenue collected from capital gains.

Despite the large number of studies analysing the macroeconomic effects of fiscal policy (see Mountford and Uhlig, 2009 and Afonso and Sousa, 2012 for detailed reviews), the importance of asset markets over the business cycle (Afonso and Sousa, 2011 ; Agnello and Sousa, forthcoming, and Iacoviello, 2010, 2011), and the feedback of asset prices to fiscal policy (refer to Agnello et al., 2012 for a detailed review), an important gap in the literature exists regarding the empirical relationship between fiscal policy actions and developments in asset prices and in turn, the possible feedback from asset prices to fiscal policy stance, especially in emerging market economies. This study concentrates on South Africa, given our familiarity with the economic structure of the economy. In South Africa, non-housing wealth (housing wealth) equals 49.95 per cent (31.13 per cent) of household's total assets and 61.59 per cent (38.41 per cent) of household's net worth in 2011 (Aye *et al.*, forthcoming). Hence, it is not surprising that recent evidence (Aron and Muellbauer, 2006; Das *et al.*, 2011; Ncube and Ndou, 2011; Simo-Kengne *et al.*, 2012, forthcoming a; Peretti *et al.*, forthcoming; and Aye *et al.*, 2012) of significant spill-overs onto consumption and output from not only the stock market, but also the housing market. Also, as highlighted by the time-varying approaches of Peretti *et al.*, (forthcoming) and Aye *et al.*, (2012), the South African economy began slowing by the end of 2007, as the stock and housing markets entered deep bear markets (Venter, 2011 and Simo-Kengne *et al.*, forthcoming b).

In spite of declining interest rates since October 2008, the housing market, in particular, remains weak and asset markets, in general, experienced much volatility. This paper attempts to contribute to the existing literature, and hence our main contribution, by focussing on the consequences of fiscal policy /asset price shocks on asset prices/fiscal policy in specific periods and over different regimes. This study focuses on the interplay of South African asset prices and fiscal policy. Time varying parameters in a model which links these variables in a simultaneous setup enables a bird's eye view of certain events and periods. In particular, we analyse not only the effects of fiscal policy shocks, but also look at asset price shocks to understand its impact on fiscal variables, and to the extent that we find a link between them, we look at the magnitude and the persistence of the effects.

This paper builds on the work of Aye et al. (2012) that uses a sign-restriction approach to capture the effects of fiscal policy shocks on asset prices.[3] The theory-based sign-restriction method

[3] A few studies (e.g., Du Plessis *et al.*, 2007, 2008 and Jooste *et al*., 2012) employ structural VARs and vector error-correction (VEC) models, time-varying VARs, and dynamic stochastic general equilibrium (DSGE) models to analyse simultaneously the effects of business cycle, monetary policy, and fiscal policy shocks on

allows this paper to identify shocks, such as tax announcements and anticipation effects, on the macro economy. The authors separate their results into expected and unexpected fiscal policy changes which overcome problems of correctly identifying the shocks. The study shows that an unanticipated and anticipated government revenue shock leads both house prices and stock prices to decline. Anticipated government revenue shocks impact stock prices more negatively and has a more persistent impact. The impact of an unanticipated government spending shock has hardly any effect on house prices. Stock prices respond positively. However, anticipated government spending shocks increase house prices, but reduce equity prices. Our paper will benchmark the results against Aye et al. (2012) for South Africa. The rest of the paper unfolds as follows: Section 2 describes the empirical methodology while Section 3 describes the data transformations and empirical results. Finally, Section 4 concludes

2. Empirical Methodology

A vector autoregression (VAR), proposed by Sims (1980), has become a popular technique used in econometric analysis and is adaptable to a vast array of economic settings (Baltagi, 2011). In this study, a TVP-VAR model with stochastic volatility is used. The TVP-VAR is common in the analysis of macroeconomic issues and allows us to capture the time-varying nature of the underlying structure in the economy in a flexible and robust manner (Nakajima, 2011). The parameters in the VAR specification are assumed to follow a first order random walk process, thereby incorporating both temporary and permanent changes to the parameters. The inclusion of stochastic volatility is an important aspect in this TVP-VAR model. In many situations, a data-generating process of economic variables seems to have drifting coefficients and shocks of stochastic volatility. In that case, the application of a time-varying parameter model but with constant volatility may result in biased estimations of the time-varying coefficients, since a possible variation of the volatility in disturbances is ignored. The TVP-VAR model with stochastic volatility avoids this misspecification and reflects simultaneous relations among variables of the model and heteroscedasticity of the innovations (Primiceri, 2005). Although stochastic volatility makes the estimation difficult due to the intractability of the likelihood function, the model can be estimated using Markov Chain Monte Carlo (MCMC) methods in the context of a Bayesian inference. Measuring the responses over time lends

output, consumption, inflation, and interest rates in South Africa. To the best of our knowledge, Aye et al., (2012) is the first study to analyse simultaneously the effects of these shocks on South African asset prices. That said, the literature on the effect of monetary policy on asset prices in South Africa includes numerous studies. A number of those studies examine the effects of monetary policy on equity prices (returns) in South Africa (Smal and Jager, 2001; Coetzee, 2002; Prinsloo, 2002; Durham, 2003; Hewson and Bonga-Bonga, 2005; Alam and Uddin, 2009; Chinzara, 2010; Mallick and Sousa 2011; Mangani, 2011; and Muroyiwa, 2011), mainly based on (structural) VAR models and, at times, panel data approaches that include South Africa. On the other hand, we know of only four studies -- Kasai and Gupta (2010), Gupta *et al.*, (2010), Ncube and Ndou (2011), and Simo-Kengne *et al.*, (2012c) -- that analyse the role played by the housing market in the monetary policy transmission mechanism, using the effect of monetary policy shocks on house prices in structural, factor-augmented, and Markov-switching VAR models. These studies generally show that contractionary monetary policy leads to lower stock and house prices. Our study, thus, extends the literature on business cycle and policy shocks in South Africa by considering the effects of these shocks simultaneously on asset prices, in particular, and the macroeconomy, in general.

insight into the timing aspect of government shocks on asset pricesand analyses periods in which shocks were most significant. This variation over time can for example help to explain how fiscal shocks relate to assets during booms and busts, and more recently, the financial crisis.

Following Nakajima (2011), this paper estimates a time-varying parameter VAR model with stochastic volatility of the form:

$$y_t = c_t + B_{1t} y_{t-1} + ... + B_{st} y_{t-s} + e_t, \quad e_t \sim N(0, \Omega_t), \tag{1}$$

for $t = s+1, \ldots, n,$ where y_t is a $(k \times 1)$ vector of observed variables, $B_{1t}, ..., B_{st}$ are $(k \times k)$ matrices of time-varying coefficients, and Ω_t is a $(k \times k)$ time-varying covariance matrix. A recursive identification scheme is assumed by the decomposition of $\Omega_t = A_t^{-1}\Sigma_t\Sigma_t A_t^{'-1}$, where A_t is a lower-triangle matrix with diagonal elements equal to one, and $\Sigma_t = \text{diag}(\sigma_{1t}, \ldots, \sigma_{\kappa t})$. Let us define β_t as the stacked row vector of $B_{1t}, ..., B_{st}$; a_t is the stacked row vector of the free lower-triangular elements of A_t; and $h_t = (h_{1t}, ..., h_{kt})$ where $h_{jt} = \log \sigma_{jt}^2$. The time-varying parameters are assumed to follow a random walk process:

$$\begin{aligned} \beta_{t+1} &= \beta_t + \upsilon_{\beta t}, \\ a_{t+1} &= a_t + \upsilon_{at}, \\ h_{t+1} &= h_t + \upsilon_{ht}, \end{aligned} \qquad \begin{pmatrix} \varepsilon_t \\ \upsilon_{\beta t} \\ \upsilon_{at} \\ \upsilon_{ht} \end{pmatrix} \sim N \left(0, \begin{pmatrix} I & 0 & 0 & 0 \\ 0 & \Sigma_\beta & 0 & 0 \\ 0 & 0 & \Sigma_a & 0 \\ 0 & 0 & 0 & \Sigma_h \end{pmatrix} \right),$$

for $t = s+1, \ldots, n,$ with $e_t = A_t^{-1}\Sigma_t\varepsilon_t$ where Σ_a and Σ_h are diagonal, $\beta_{s+1} \sim N(\mu_{\beta o}, \Sigma_{\beta o})$, $a_{s+1} \sim N(\mu_{ao}, \Sigma_{ao})$, and $h_{s+1} \sim N(\mu_{ho}, \Sigma_{ho})$.[4] A Bayesian inference is used to estimate the TVP-VAR models via MCMC methods. The goal of MCMC methods is to assess the joint posterior distributions of the parameters of interest under certain prior probability densities that are set in advance. We assume the following priors, as in Nakajima (2011): $\Sigma_\beta \sim IW(25, 0.01I)$, $(\Sigma_\alpha)_i^{-2} \sim G(4, 0.02)$, $(\Sigma_h)_i^{-2} \sim G(4, 0.02)$, where $(\Sigma_\alpha)_i^{-2}$ and $(\Sigma_h)_i^{-2}$ are the *i*-th diagonal elements in Σ_α and Σ_h respectively. IW and G denotes the inverse Wishart and the gamma distributions respectively. For the initial set of the time-varying parameter, flat priors are set such that: $\mu_{\beta o} = \mu_{ao} = \mu_{ho} = 0$ and $\Sigma_{\beta o} = \Sigma_{ao} = \Sigma_{ho} = 10 \times I$.

Data description

Three variables are used in the analysis, with the sample period covering 1966:Q1-2012:Q2. We source the government's budget balance data from the South African Reserve Bank (where

[4] For a comprehensive analysis of the TVP-VAR methodology and the estimation algorithm, refer to Nakajima (2011).

government revenue is subtracted from government expenditure and expressed as a percent of GDP), Bloomberg for the All Share Index and Amalgamated Bank of South Africa for the house price index. Both the asset prices are expressed in real terms by deflating the respective nominal series by the CPI index. Note that all the variables were obtained in their seasonally adjusted form. Log values of real house and stock prices are differenced to induce stationarity, and are also and standardised so that we can compare the magnitude of effect of fiscal policy across the two asset prices, and also, the differences in the size of the feedback of the two asset prices on fiscal policy behaviour. We use *house, BB and JSE* as short hand for the house price index, the budget balance and the Johannesburg Stock Exchange All Share Index. The variables pass the usual unit root tests namely, Based on all the standard unit root tests, namely, Augmented Dickey-Fuller (1981) (ADF), Phillips-Perron (1988), Dickey-Fuller test with generalized least squares detrending (DF-GLS), the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) (1992) test; the Elliot, Rothenberg, and Stock (ERS) (1996) point optimal test, the Ng-Perron (2001) modified versions of the PP (NP-MZt) test and the ERS point optimal (NP-MPT) test. The stable[5] TVP-VAR is estimated based on two lags, as was unanimously suggested by all the popular lag-length tests, namely, the sequential modified LR test statistic, the Akaike information criterion, the Schwarz information criterion, applied to a constant parameter VAR.[6] Accounting for stationarity and lags, our effective sample period start from 1966:4.

Empirical Results

The posterior estimates were obtained after 10000 samples were drawn, with the first 1000 draws discarded. These posterior estimates for the means, along with those for the standard deviations, the 95 per cent credibility intervals[7], the convergence diagnostic (CD) due to Geweke (1992) and the inefficiency factors are presented in Table 1[8]. The 95 per cent credibility intervals include the estimates for the posterior means, and the CD statistics do not allow us to reject a null hypothesis of convergence to the posterior distribution at a significance level of 5 per cent. In general, the inefficiency factors are relatively low. We can thus conclude that the MCMC algorithm is an efficient method of producing the posterior draws.

[5] The constant parameter VAR is found to be stable as all roots were found to lie within the unit circle.

[6] Complete details of the unit root, stability and lag length tests are available from the authors upon request.

[7] 'Credibility intervals are used in the Bayesian paradigm as opposed to 'confidence' intervals which belong in the frequentist realm.

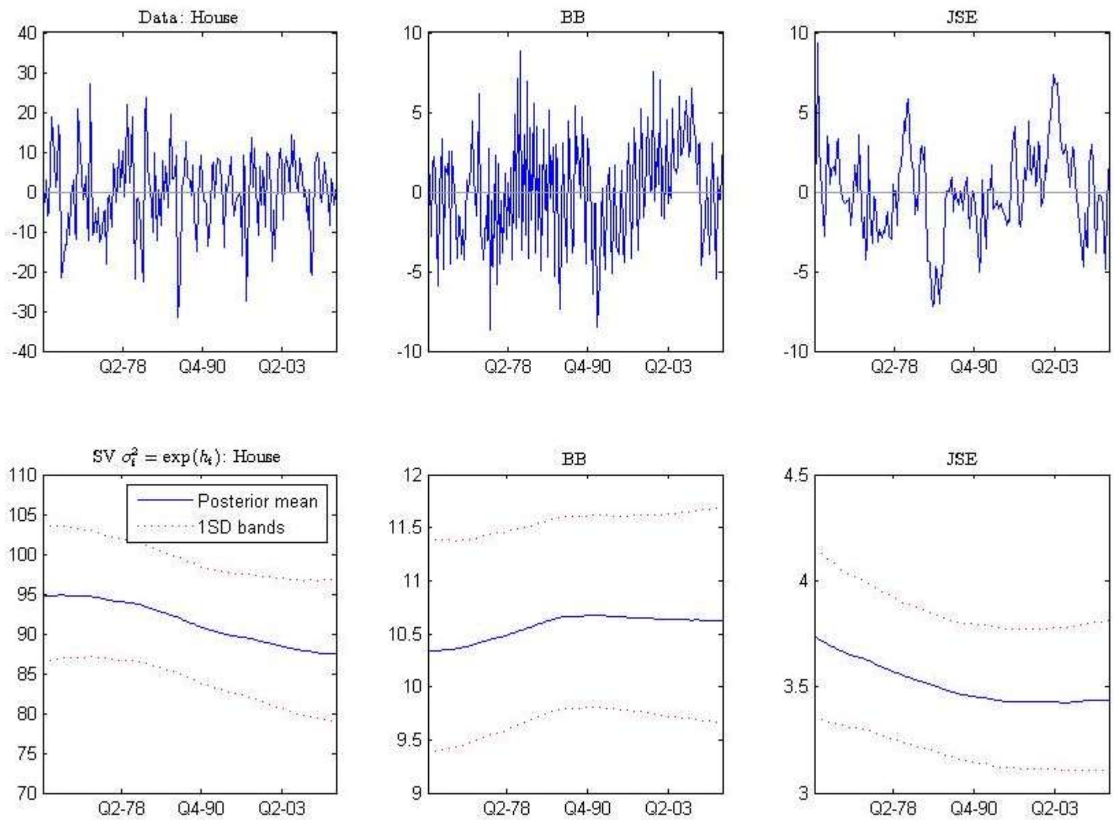
[8]Geweke (1992) suggests the comparison between the first n0 draws and the last n1 draws, dropping out the middle.
draws, to check for convergence in the Markov chain. The CD statistics are computed as follows:$CD = (\bar{x}_0 - \bar{x}_1)/\sqrt{\frac{\hat{\sigma}_0^2}{n_0} + \frac{\hat{\sigma}_1^2}{n_1}}$ where $\bar{x}_j = (\frac{1}{n_j})\sum_{i=mj}^{mj+nj-1} x^{(i)}$ where $\bar{x}_j$ being the i-th draw and $\frac{\hat{\sigma}_j^2}{n_j}$ is the standard error of $\bar{x}_j$ respectively for j=0, 1. If the sequence of the MCMC sampling is stationary, it converges to a standard normal distribution. We set $m_0 = 1$, $n_0 = 2000$, $n_1 = 5001$ and $n_2 = 5000$. $\hat{\sigma}_j^2$is computed using a Parzen window with bandwidth $(B_m) = 500$. The inefficiency parameter is defined as $1 + 2\sum_{i=1}^{B_m} \rho_i$, where $\rho_i$is the sample autocorrelation at lag s, which is computed to measure how well the MCMC chain mixes.

Table 1: Selected estimation results

Parameter	Mean	Stdev	95% Intervals	CD	Inef
$(\Sigma_\beta)_1$	0.0374	0.0094	[0.0240,0.0596]	0.134	48.31
$(\Sigma_\beta)_2$	0.0271	0.0049	[0.0192,0.0383]	0.237	30.12
$(\Sigma_a)_1$	0.0538	0.0142	[0.0336,0.0911]	0.099	52.26
$(\Sigma_a)_2$	0.0499	0.0114	[0.0329,0.0779]	0.938	26.80
$(\Sigma_b)_1$	0.0826	0.0389	[0.0431,0.1886]	0.142	183.30
$(\Sigma_b)_2$	0.0800	0.0342	[0.0398,0.1725]	0.862	156.84

Note: The estimates of Σ_β and Σ_a are multiplied by 100.

Figure 1: Posterior estimates for the stochastic volatility of the structural shock



Note: Top panel presents the data values. Bottom panel depicts the posterior mean estimates (solid line) and 95 percent credible intervals (dotted lines) for stochastic volatility of a structural shock.

Figure 1 plots the posterior estimates of stochastic volatility for each of the variables used in the TVP-VAR. The estimates for the stochastic volatility shock hint to at least two regimes; one characterised by a pre-1990 era and one of a post 1990 era. Coincidentally this shift overlaps with South Africa's democratic transition with the release of Nelson Mandela. The non-steady stochastic volatility justifies the use of a TVP-VAR model to capture possible regime and period specific changes.

Impulse responses are used as a tool to capture the macroeconomic dynamics in the estimated VAR system. For a standard constant parameter VAR model, the impulse responses are drawn for each set of two variables, whereas for a TVP-VAR model, the impulse responses can be drawn in an additional dimension, as the responses are computed at all points in time using the time-varying parameters. There are several ways to simulate the impulse responses based on the parameter estimates of the TVP-VAR model. Following Nakajima (2011), we compute the impulse responses by fixing an initial shock size equal to the time-series average of stochastic volatility over the sample period, and using the simultaneous relations at each point in time, for considering the comparability over time. We identify the three structural shocks (housing demand, fiscal policy and stock demand (portfolio)) using a recursive or Choleski identification scheme, as obtained based on the lower-triangular matrix A_t. We order the variables as follows: *House, BB and JSE* following Agnello and Sousa (2011). The ordering of the two asset prices relative to the fiscal policy instrument is quite intuitive: The stock price is ordered last as it refers to assets that are traded in markets where auctions take place instantaneously. While, the housing price was ordered first in the system to account for the fact that housing markets are inherently sticky and so housing prices do not immediately reach the equilibrium after a shock. Then there is a "time-to-build" argument suggesting that it takes time for developers to bring new houses to the market or to work out of inventories when demand increases. Further, the matching between buyers and sellers requires time, and finally, one needs to also account for important transaction costs inherent to trading housing up or down.

To compute the recursive innovation of the variable, the estimated time-varying coefficients are used from the current date to future periods. Around the end of the sample period, the coefficients are set constant in future periods for convenience. Although a time series of impulse responses for selected horizons or impulse responses for selected periods are often exhibited in the literature, one could draw a three-dimensional plot for the time-varying impulse responses.

Figure 2 plots the mean impulse response function of asset prices in reaction to a shock in fiscal policy. Contemporaneous fiscal policy shocks are analysed over different horizons, over time and in terms of magnitude. House prices responds with a lag due to the VAR ordering. House prices respond mainly positive regarding a fiscal policy shock. As discussed earlier, negative tax shocks have wealth effects that could lead to a higher demand of assets. This can also occur with a rise in government spending, especially when spending is concentrated around wage increases. Its amplitude varies over time with the most significant impact being during the financial crisis in 2010 (with a multiplier of 0.4). The impulse responses of house prices peak four quarters ahead before dissipating. Apart from the late 1980's and the shock in 2009/10, house price responses were relatively short lived (6 quarters). In comparison, equity price responses are rather mute following a budget shock. In terms of size, the initial impact is largest (the multiplier is not significantly bigger than 0.5 over towards the end of the sample period). Increases are quickly met with a decline in equity prices which would suggest that markets are quick to adjust to any fiscal news. Accumulating over the impulse horizon reveals that fiscal shocks have a negligible impact on stock prices. It is also interesting to note that the contemporaneous impact of fiscal shocks on equity prices tapered down since the 1970's with an initial impact of close to 1. From Figure 2 it becomes clear that house prices respond more starkly compared to equity prices following a fiscal shock. The shock also lasts longer on house prices. Quite surprising is that house prices responded more than equity prices during the 2008/09 financial crisis. One hypothesis could be that the financial crisis represented a liquidity and solvency problem more relevant for asset classes such as houses than investments into the equity market.

This study also looks at the impact of shocks in stock and house prices on the government's budget balance. *A priori,* one would expect that an increase in asset prices will lead to higher tax revenues through property and capital gains taxes which should lead to a contracting budget deficit. The channels through which asset price shocks effect the budget balance is rather complex and requires a detailed decomposition of expectations, output and interest rates. For one, equity price increases could exert upward pressure on government bond interest rates if there is a substitution away from bonds. This in turn will lead to a rising deficit. After a period government would collect revenue from dividend pay outs which should reduce the deficit. In essence the shock of asset prices to the balance relies on the net effect revenue gains minus the effect of a potential increase in debt service costs. Figure 3 show that higher house prices had a negative and significant effect on the budget deficit (deficit reducing) throughout our sample and at various horizons. Although the contemporaneous impact seems constant, the impact was largest during the financial crisis. House price shocks also lasts for almost two years (in 2008-2012) compared to a relatively short-lived outcome in the 1970's and 80's. One of the reasons why house price shocks had a larger impact on the balance is due to modernisation processes of municipalities and tax collecting authorities which made collecting taxes more efficient. This part of our sample was also coincidentally associated with South Africa's, and for that matter the majority of the Western world, housing boom period. House price shocks during this period are slightly more persistent and have a bigger impact on the budget deficit. However, during the financial crisis house price shocks had a smaller impact of the deficit.

Finally, the right hand side of Figure 3 shows the propagation of stock price shocks to the budget balance. The impact of stock price shocks on the budget deficit varies between positive and negative during different horizons. The period during the financial crisis highlights that a rise in equity prices increased the deficit. As shown by Aye et al. (2012) asset price shocks lead to an increase in interest rates. The interest rate channel could be used to motivate how equity price shocks could lead to an increase in the budget deficit, especially if it causes a substitution away from bonds to equities. That being said, stock price shocks have only a transitory impact on the budget as the shocks dissipate already after 6- 8 quarters.

Figure 2: Impulse response function of fiscal policy following a shock to real house prices

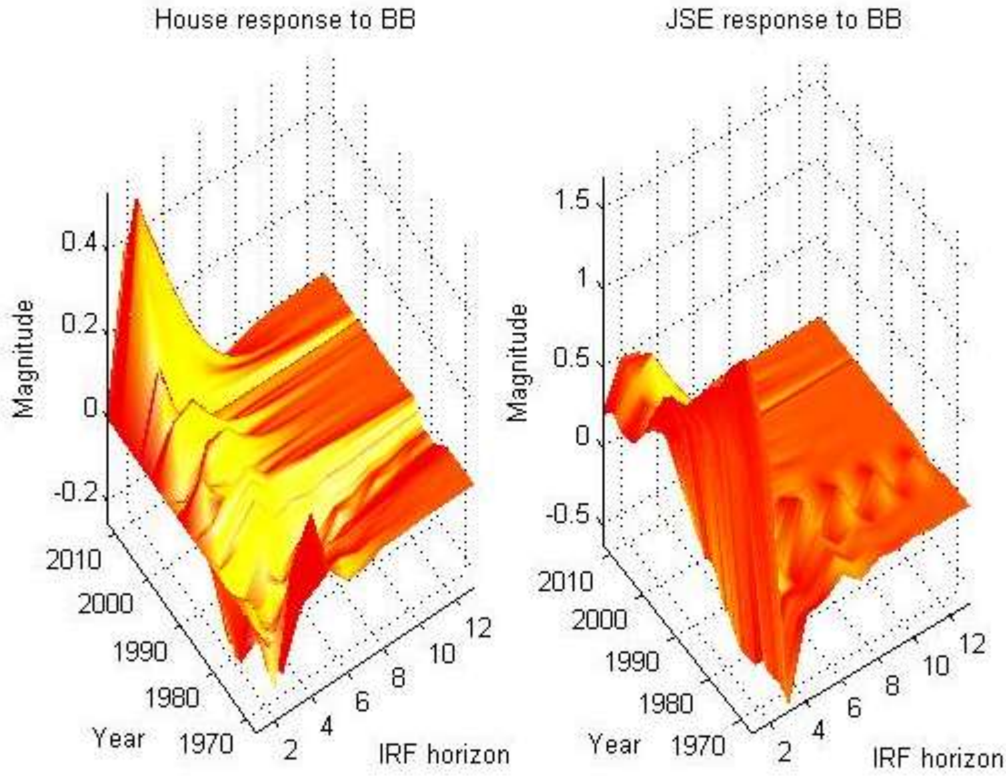
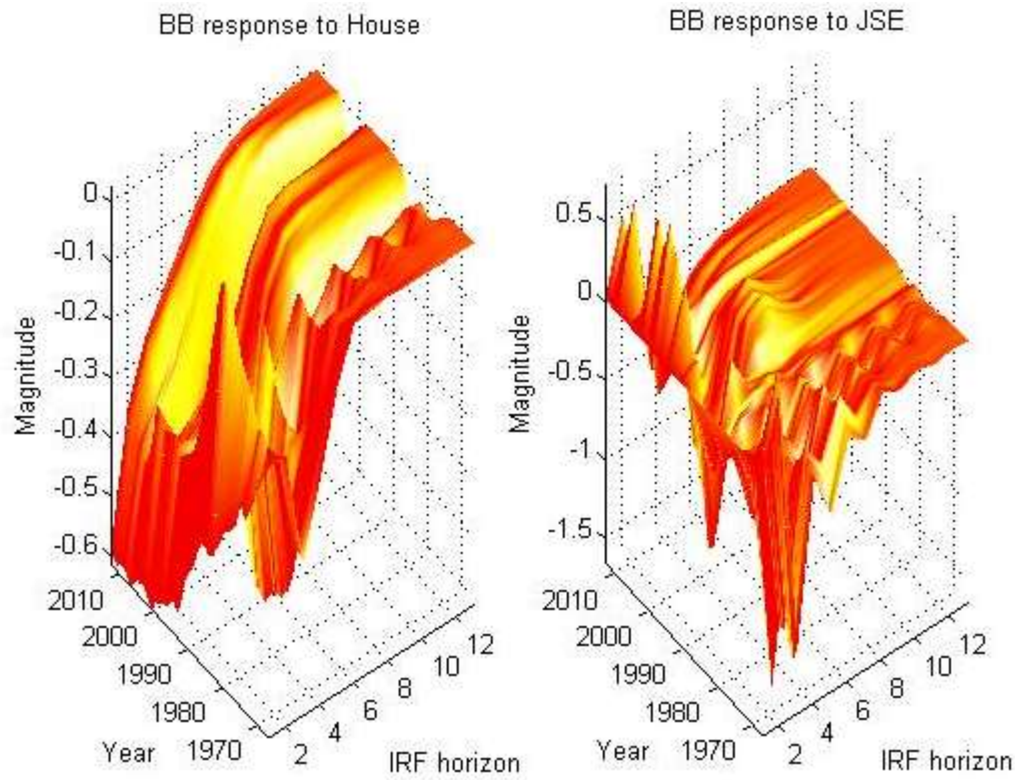


Figure 3: Impulse response function of fiscal policy following a shock to real stock prices



These results are in line with Aye et al. (2012): Expansionary fiscal shocks lead to an increase asset prices, but are only transitory. As mentioned earlier, it could be that markets are quick to adjust when hit by shocks. Usually expansionary fiscal policy finds its way in the public discourse which would allow markets to anticipate fiscal shocks more reliably. This would only strengthen an argument for the short lived response of fiscal shocks. The results show that on average, an expansionary fiscal policy shock has a small impact on house prices (as was the case in Aye et al. (2012) given a spending shock). The impact, however, became more pronounced at the onset of the financial crisis which would suggest that effects are amplified under distressed economic conditions. Furthermore, looking at the impact of fiscal shocks and asset prices could provide a channel through which an explanation can be given for private investment being crowded out when fiscal policy expands. However, this requires a more detailed analysis that is beyond the scope of this study.

On the other hand, asset price shocks represent a possible increase in revenue collection which should effectively reduce budget deficits. The results in this paper confirm that asset price shocks reduced the deficits. With new modernisation programmes from the revenue collecting authorities and a bigger emphasis and tax broadening, asset price shocks have had a larger impact on the budget post 2000.

3. Conclusion

This paper uses a three variable (stock prices, house prices and government's budget balance) TVP-VAR with stochastic volatility to study the simultaneous impact of fiscal shocks on asset prices, and asset price shocks on fiscal policy. We find that fiscal shocks had a small impact on asset prices which is in line with Aye et al. (2012). The results show that fiscal policy and asset price shocks have varying impacts over time. Furthermore, the results show that extreme economic events such as the recent financial crisis change the impact of these shocks. At times when the budget balance seemed unsustainable, a consolidating budget balances seem to have a positive impact on asset prices while increasing asset prices reduces deficits as tax collections improve. However, as shown in the study of Aye et al. (2012) increasing taxes will limit the amount of revenue collected as it reduces real asset prices. This suggests that consolidation effects, when considering the impact on asset prices, should happen through spending channels.

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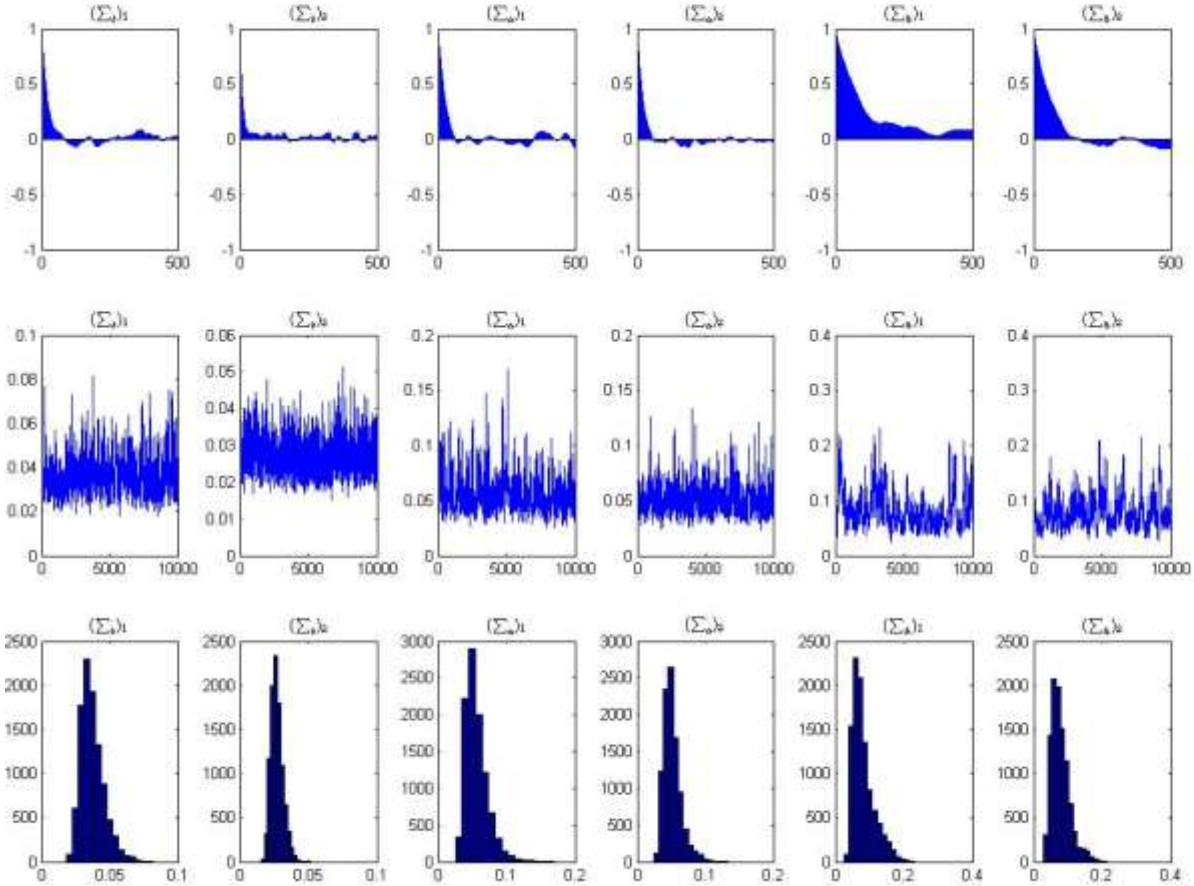
5. Appendix

Figure 6: Moments and posterior distributions



Note: Sample autocorrelations (top panel), sample paths (middle panel), and posterior densities (bottom panel). The estimates of Σ_β and Σ_a are multiplied by 100.