Fiscal Policy Shocks and the Dynamics of Asset Prices: The South African Experience

Goodness C. Aye*, Mehmet Balcilar, Rangan Gupta*,**

Charl Jooste*, Stephen M. Miller† and Zeynel Abidin Ozdemir††

* Department of Economics, University of Pretoria, Pretoria, 0002, SOUTH AFRICA.
****** Department of Economics, Eastern Mediterranean University, Famagusta, NORTHERN CYPRUS, via Mersin 10, TURKEY.
† **Corresponding author**. Department of Economics, University of Nevada, Las Vegas, Las Vegas, Nevada, 89154-6005 USA. Email: stephen.miller@unlv.edu. Tele.: +1-702-895-3969
†† Department of Economics, Gazi University, Besevler, 06500 Ankara, TURKEY.

Abstract

This study assesses how fiscal policy affects the dynamics of asset markets, using Bayesian vector autoregressive models. We use sign restrictions to identify government revenue and government spending shocks, while controlling for generic business cycle and monetary policy shocks. Using South African quarterly data from 1966:Q1 to 2011:Q2, we find that fiscal spending shocks affect stock prices more than house prices. Both spending and revenue shocks affect stock prices whereas only revenue shocks affect house prices.

Keywords: Bayesian Sign-Restricted VAR, fiscal policy, housing prices, stock prices.

JEL Classification: C32, E62, G12.

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. With an abrupt economic downturn, and an end to the Great Moderation, the business cycle re-emerged as a pressing issue. This current crisis and its aftermath forced macroeconomists to reflect seriously on their understanding of the macroeconomy.

The housing and stock markets traditionally lead business cycle movements (Stock and Watson 2003; Leamer 2007; and Gupta and Hartley forthcoming), although the stock market frequently gives false signals. The onset of recessions in the post-WWII period typically occurs when the central bank ends an expansion by raising interest rates to subdue inflation. Higher interest rates cause a hiccup in the housing and stock markets and they turn down prior to the overall decline in economic activity.

Research on the linkages between economic policy and asset markets typically focuses on monetary policy (Bjørnland and Leitemo 2009; Sousa 2010a, forthcoming a, forthcoming b; Iglesias and Haughton 2011; Castro and Sousa 2012; Gupta *et al.* 2012a, 2012b; and Bjørnland and Jacobsen forthcoming). Whilst monetary policy dominates the field of academic and policy discussions on controlling elements of the business cycle, fiscal policy becomes key when monetary policy reaches the zero interest rate lower bound such as during the Great 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, von Hagen, and Wolswijk 2009). Researchers need to disentangle this effect, however, from the financial crisis experienced in Europe and the US. Furthermore, this may lead to business cycle de-synchronization (Mallick and Mohsin 2007, 2010 and Rafiq and Mallick

2008) or negatively affect the nexus between monetary and financial stability (Granville and Mallick 2009; Sousa 2010a; and Castro 2011).

The behaviour of asset markets and their prices emerges, once again, 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 produce strong and powerful effects during financial turmoil (Afonso and Sousa 2011). 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; Peretti, Gupta, and Inglesi-Lotz 2012; and Simo-Kengne, Bittencourt, and Gupta 2012 for detailed literature reviews).

Our understanding of the transmission of fiscal policy innovations to asset markets is limited, however. The few existing studies concentrate on the US and industrialized European markets (e.g., Afonso and Sousa 2011, 2012; Agnello and Sousa 2011, forthcoming and Agnello, Castro, and Sousa 2012). Various channels exist whereby fiscal policy can affect stock and housing markets (Afonso and Sousa 2011, 2012). Fiscal policy can influence stock markets via its effect on sovereign risk spreads. It can also affect housing markets directly through various taxes and subsidies on home ownership as well as indirectly through effects on macroeconomic variables that influence the housing market. Hence, we should not neglect the role of fiscal policy in explaining both housing market developments and stock market dynamics.

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) and the importance of asset markets over the business cycle (Iacoviello 2010, 2011 and Afonso and Sousa 2011, 2012), an important gap in the literature exists regarding the empirical relationship

between fiscal policy actions and developments in asset prices, especially in emerging market economies. This study concentrates on South Africa, where non-housing wealth (housing wealth) contributes 49.95 percent (31.13 percent) of household's total assets and 61.59 percent (38.41 percent) of household's net worth in 2011 (Aye, Balcilar, and Gupta. forthcoming). Recent research finds evidence of significant spillovers onto consumption and output from not only the stock market, but also the housing market (Aron, Muellbauer, and Murphy 2006; Das, Gupta, and Kanda. 2011; Ncube and Ndou 2011; Aye, Gupta, and Modise 2012; Peretti, Gupta, and Inglesi-Lotz 2012; and Simo-Kengne, Gupta, and Bittencourt forthcoming). Also, the time-varying approaches of Aye, Gupta, and Modise (2012) and Peretti, Gupta, and Inglesi-Lotz (2012) show that 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.* 2013).

Authors use various identification schemes to identify monetary policy shocks, fiscal policy shocks, and business cycle shocks. Sims (1972, 1980) promotes the use of a vector autoregressive (VAR) method to capture the monetary and fiscal policy stance. Analysts use the innovations in a monetary aggregate or an interest rate to measure the monetary policy shock. Uhlig (2005) identifies a monetary policy shock by directly imposing sign restrictions on impulse responses of chosen variables for a few periods just after the shock. Mountford and Uhlig (2009) extend Uhlig (2005) and identify fiscal policy shocks as a government revenue or government spending shocks by imposing sign restrictions on the VAR's impulse responses, while controlling for business cycle and monetary policy shocks.

Using the method of Mountford and Uhlig (2009), this paper examines the effects of fiscal policy shocks, controlling for business cycle and monetary policy shocks, on stock and house prices, and macroeconomic activity, for South Africa from 1966:Q1 to 2011Q2. Besides

stock and house prices, we follow Mountford and Uhlig (2009) in choosing the other variables in the VAR -- real household consumption, real non-residential investment, real GDP, total government expenditure, total government revenue, the real wage, the 3-month Treasury bill rate, and the consumer price index (CPI)[1]. Given the uncertainty, and mostly, unavailability of information about the elasticity of economic activity with respect to fiscal policy variables, we implement the approach of Mountford and Uhlig (2009) over the one taken by Afonso and Sousa (2011), Agnello, Castro, and Sousa (2012), and Agnello and Sousa (forthcoming) in identifying the fiscal policy shocks. Further, Mountford and Uhlig's (2009) sign restriction approach allows us to go beyond the standard (anticipated and unanticipated) government revenue and spending shocks and explore fiscal policy scenarios such as deficit spending, a deficit financed tax cut, and balanced budget fiscal spending policy.

A few studies (e.g., Du Plessis, Smit, and Sturzenegger 2007, 2008 and Jooste, Liu, and Naraidoo 2012) employ various models to analyse simultaneously the effects of business cycle, monetary policy, and fiscal policy shocks on output, consumption, inflation, and interest rates in South Africa. To the best of our knowledge, this 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 de Jager 2001; Coetzee 2002; Prinsloo 2002; Durham 2003; Hewson and Bonga-Bonga 2005; Alam and Uddin 2009; Chinzara 2010; Mangani 2011; Muroyiwa 2011; and Mallick and Sousa 2012, forthcoming). On the other hand, we know of only four studies – Gupta, Jurgilas, and Kabundi (2010), Kasai and Gupta (2010), Ncube and Ndou (2011) and Simo-Kengne *et al.* (2013) - that analyse the role played by the housing market in the monetary policy transmission

mechanism. 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. Our findings include the following. Government spending shocks affect stock prices more than house prices. Both government spending and revenue shocks affect stock prices whereas only government revenue shocks affect house prices.

The rest of the paper unfolds as follows: Section 2 outlines the identification procedure of Mountford and Uhlig (2009) and describes the data and their sources. Section 3 presents our empirical results. Finally, Section 4 concludes.

2. IDENTIFICATION PROCEDURE AND DATA DESCRIPTION

2.1 ECONOMETRIC METHOD

The identification of fiscal shocks confronts the researcher with several issues (Mountford and Uhlig 2009). First, changes in fiscal variables combine the effects of exogenous policy shocks and endogenous responses to shocks in other macroeconomic variables, such as business cycle and monetary policy shocks. To address this issue, we first identify business cycle and monetary policy shocks and then construct the fiscal policy shocks such that they lie orthogonal to these policy shocks calculated in the first stage.

Second, the meaning of a fiscal shock to researchers receives less consensus than a monetary policy shock, which most researchers will concede amounts to an unexpected increase (decrease) in the interest rate. We follow Mountford and Uhlig (2009) and define two types of fiscal shocks – government revenue and government spending shocks.

Table 1: Identifying Sign Restrictions

	Gov. Revenue	Gov. Spending	GDP, Cons, Non-Res Inv	Interest Rate	CPI, Real Wage	Asset Prices
Non-Fiscal Shocks						
Business Cycle	+		+			
Monetary Policy				+	-	
Basic Fiscal Policy Shocks						
Government Revenue	+					
Government Spending		+				

Note: This table shows the sign restrictions on the impulse responses for each identified shock. `Cons' stands for Private Consumption and `Non-Res Inv' stands for Non-Residential Investment. A "+" means that the impulse response of the variable in question is restricted to be positive for four quarters following the shock, including the quarter of impact. Likewise, a "-" indicates a negative response. A blank entry indicates that no restrictions have been imposed.

Table 1 summarizes our identifying sign restrictions on the impulse responses. Following standard practice in VAR models with shocks identified via sign-restrictions, we do not impose any restrictions on how the variables of concern, mainly house and stock prices, respond to shocks. As in Mountford and Uhlig (2009), we define a business cycle shock as a shock that jointly moves output, consumption, non-residential investment, and government revenue in the same direction for four quarters after the shock[2]. This orthogonality assumption on the responses of output and government revenue precludes the possible linkage of unexpected tax cuts, thereby positive co-movements of government revenues and output come from a short-term "Laffer Curve" or "fiscal consolidation" effect from a surprise rise in taxes. That is, the orthogonality assumption prevents a fiscal consolidation that leads to higher government revenue and to an expanding economy from appearing in our analysis as a fiscal shock[3].

A monetary policy shock drives the interest rate up and the price level and the real wage rate down for four quarters after the shock. Uhlig (2005) makes similar identifying restrictions. We also construct the monetary policy shock such that it lies orthogonal to the business cycle shock, which, in turn, allows us to filter out the effects of these shocks on the fiscal variables.

That is, we attempt to purge the fiscal shocks of endogenous responses to business cycle and monetary policy shocks.

We identify fiscal policy shocks only through restricting the impulse responses of the fiscal variables, coupled with the requirement that they lie orthogonal to both business cycle and monetary policy shocks. That is, the two basic fiscal shocks, government spending and government revenue shocks, use restrictions only on the government expenditure and revenue variables, with responses restricted for one year after shock[4].

2.2 DATA DESCRIPTION

The data on components of South African national income (consumption, non-residential investment, GDP, total government expenditure and total government revenue) and the nominal compensation of employees (nominal wage income) come from the *Quarterly Bulletins* of the South African Reserve Bank. The data on the 3-month Treasury bill rate, the consumer price index (CPI), and the All Share Stock Index (ALSI) come from the IMF's International Financial Statistics database. The house price index comes from the Amalgamated Bank of South Africa (ABSA). Given that the house price data start in 1966:Q1, our analysis uses data from 1966:Q1 to 2011:Q2, even though the other variables are available from 1960 onwards. We express all components of national income and the compensation of employees in real per capita terms, transforming their nominal values by dividing by the CPI and population (interpolated from their annual values), while we express stock and house prices in real terms by dividing them with the CPI. The population comes from the World Bank's World Development Indicators. For data available at monthly frequencies (interest rate, CPI, ALSI, house price index), we take the arithmetic average of the monthly observations to produce our quarterly observations. We

exclude transfer payments from the measure of government expenditure, since we expect the former to vary over the business cycle. Data for the transfer payments comes from the South African Reserve Bank as well.

The Bayesian VAR methodology of Sims and Uhlig (1991) and Uhlig (2005) remains robust in the presence of non-stationarity variables. In addition, it does not force the variables to exhibit a long-run relationship (cointegration) between them, but it does not prevent it from occurring. Therefore, this study uses the variables in the VAR model in levels. The VAR system consists of the 10 variables (real per capita GDP, real per capita consumption, real per capita government expenditure, real per capita government revenue, real per capita wages, real per capita non-residential investment, the 3-month Treasury bill rate, the real stock market index, the real house price index, and the CPI series) at quarterly frequency from 1966:Q1 to 2011:Q2 with 6 lags (chosen by the Schwartz Bayesian Information Criterion). The VAR specification does not include a constant or time trend and uses the natural logarithm for all variables except the interest rate, where we use the percentage level. We use seasonally adjusted series. As previously noted, this study follows the identification procedure proposed by Uhlig (2005) and Mountford and Uhlig (2009) for determining the shocks with the zero restriction based on the penalty functions for impulse responses of some variables in the benchmark VAR model for some period. We identify the shocks for each draw from the posterior and the 16^{th}, 50^{th}, and 84^{th} quantiles.

3. EMPIRICAL RESULTS

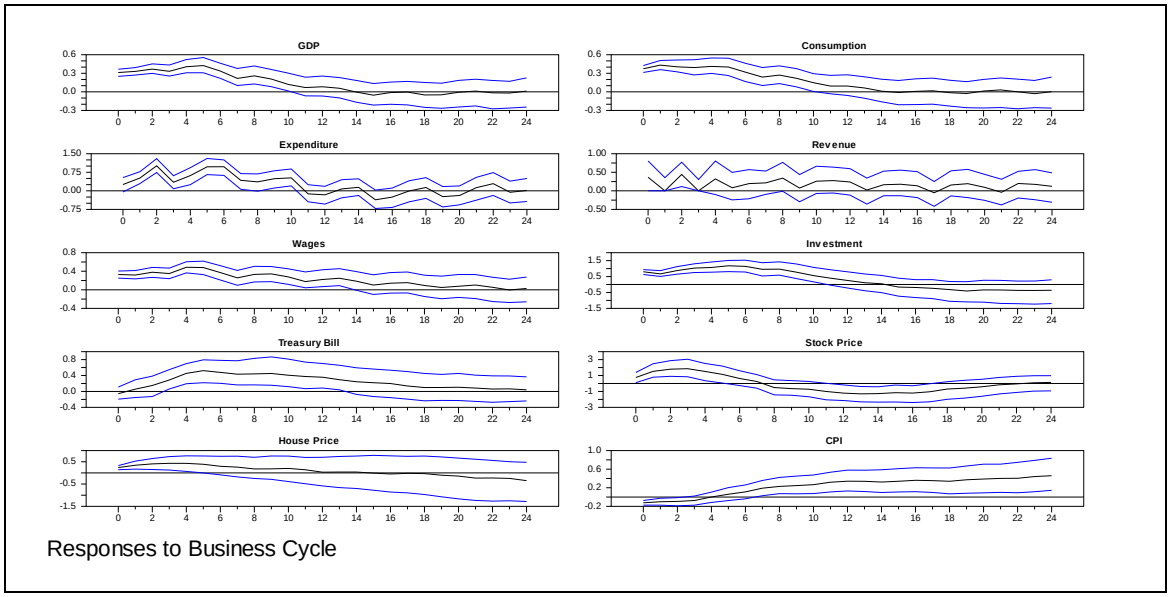
Figures 1 to 4 illustrate the results of the impulse responses of the series to the shocks. That is, the impulse responses for these fundamental shocks appear in these figures, where we plot the impulse responses of all 10 variables to each shock[5]. The figures plot the 16^{th}, 50^{th}, and

84th quantiles of these impulse responses, calculated at each horizon between 0 and 24 quarters after the shocks (Uhlig (2005) and Mountford and Uhlig 2009).

3.1 BUSINESS CYCLE SHOCKS

To begin, we determine the effects of a business cycle shock and analyse the impulse responses of the different variables included in the system (See Figure 1). While the real stock price index responds positively and significantly through the first year and a quarter after the shock, it exhibits a significantly negative response in the fourth year. Intuitively, during the expansion period, traders expect higher future dividends and lower discount rates. As a result, the real stock price index increases. Whereas nearly 4 years after the initial business cycle shock, investors must expect lower future dividends and so the risk on equity investment increases. As a result, the real stock price index decreases.

Figure 1: Impulse Responses: Business Cycle Shock



The real house price index also exhibits a significant positive response to the business cycle shock during the first year and a quarter. In the typical response of a perfect capital market, one initially expects overshooting of house prices followed by a gradual adjustment towards the long-run equilibrium level.

Note that the response of the real house price index to a business cycle shock differs from that of the CPI. The initial response of the CPI to a positive business cycle shock is significantly negative for two quarters, as predicted by the standard neoclassical macroeconomic theory. The CPI, however, responds positively and significantly to a positive business cycle shock after a year and a half through the end of the impulse period, probably due to increased demand.

Government expenditure and revenue respond positively and significantly to the shock for about three years for expenditure whereas only for a couple of quarters for government revenue. The response of government revenue probably reflects the effect of automatic stabilisers. A positive business cycle shock improves the various tax bases, in this case GDP, which should associate with an improvement in revenue collection (see Schoeman and Swanepoel 2003). Fiscal policy, especially expenditure, exhibited largely procyclical movements prior to 2002 (see Du Plessis, Smit, and Sturzenegger 2007). Post 2002, fiscal policy was geared towards more countercyclical outcomes -- debt reductions and running primary surpluses. The business cycle shock to fiscal expenditure displays this behaviour over time. Thus, this impulse response could change with different sample specifications.

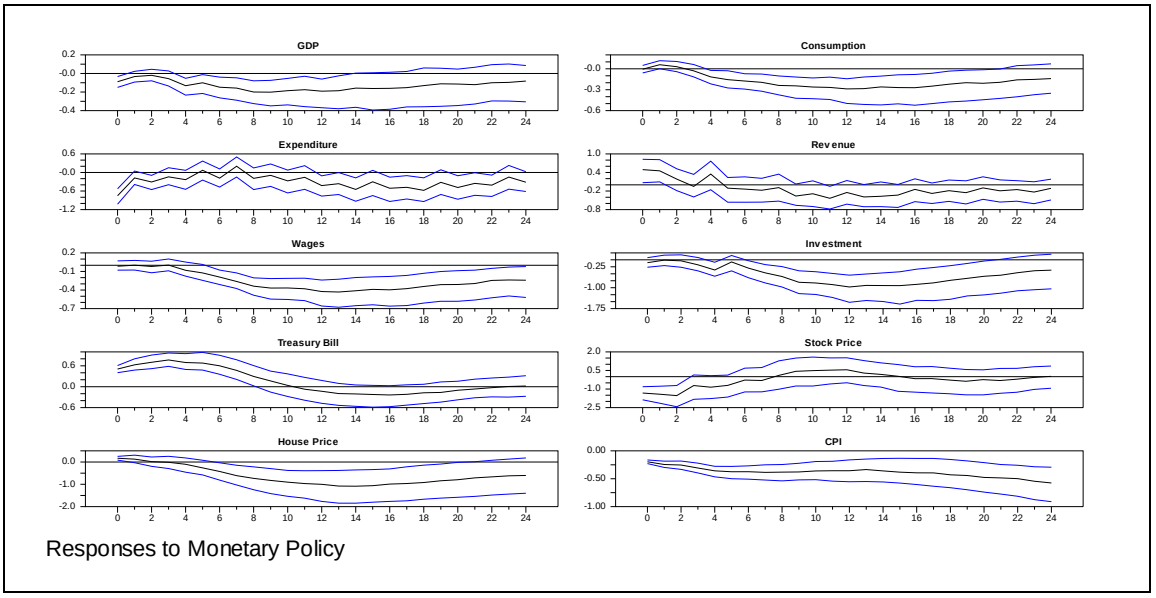
After the business cycle shock, wages and the Treasury bill rate respond positively and significantly in the first three to three-and-a-half years, although the response of the Treasury bill rate only becomes significant after the first two quarters. The responses of GDP, consumption,

and non-residential investment to the business cycle shock remain significantly positive for about two-and-a-half years.

3.2 MONETARY POLICY SHOCKS

This subsection examines the effect of the monetary policy shock on the variables considered in this study. The impulse responses of the different variables included in the system appear in Figure 2.

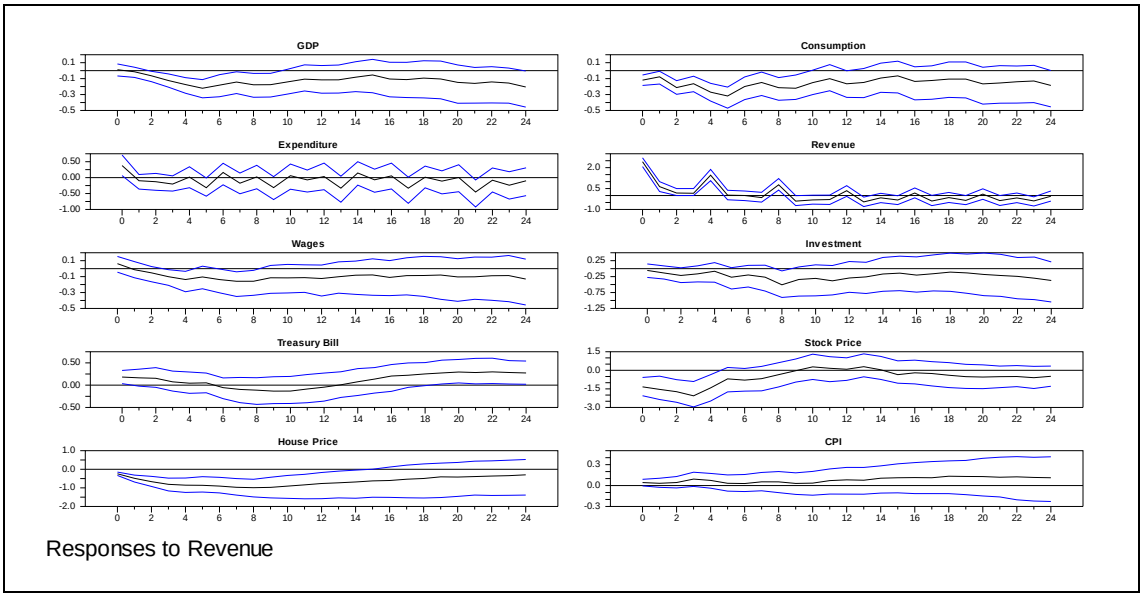
Figure 2: Impulse Responses: Monetary Policy Shock



Consistent with theory, the real stock price index exhibits a significantly negative response through the first year. Intuitively, this response corresponds to the standard present-value evaluation principle. The monetary policy shock produces a negative effect on economic activity and, hence, on future cash flows as well as the increase in the discount factor that valuates those flows.

The existing literature documents that house prices respond positively to improved credit market conditions, revealing the importance of the relationship between monetary policy, especially its effect on credit conditions, and house prices. In our analysis, the initial response of house prices to monetary policy shocks presents a puzzle. The real house price index responds with a small significantly positive response for the first quarter. The response of the real house price index, however, becomes negative and significant in years three through five. Small-scale VAR models, like ours, commonly produce this so-called *house price-puzzle* (Andre, Gupta, and Kanda 2012), where house prices respond positively initially following a positive interest rate shock. Kasai and Gupta (2010) and Simo-Kengne *et al.* (2013) also observe this outcome for South Africa. Gupta, Jurgilas, and Kabundi (2010) argue that with house prices depending on large number of factors, small-scale VAR models cannot account for the true dynamics of house price movements. These authors suggest moving to large-scale models like FAVAR models or large-scale Bayesian VAR models, which can incorporate the information from hundreds of variables. In fact, they show that the puzzle no longer exists when one examines monetary policy shocks in a FAVAR model that include 246 variables for the South African economy. Also, more recently, Simo-Kengne *et al.* (2013) indicate that the *house price puzzle* probably occurs during a bull-market in house prices while analysing the effects of a contractionary monetary policy using a Markov-switching VAR model. Given that economic agents are pessimistic about the future in a bull market, the initial positive effect possibly reflects a short-lived reluctance of home sellers to realize losses during a downturn due to loss aversion (Genesove and Mayer 2001).

Figure 3: Impulse Responses: Government Revenue Shock



3.3 GOVERNMENT REVENUE SHOCK

We construct the government revenue shock to lie orthogonal to the business cycle and monetary policy shocks. In addition, government revenue continues to rise for a year after the shock. Figure 3 shows the results of the impulse responses analysis of the different variables included in the system.

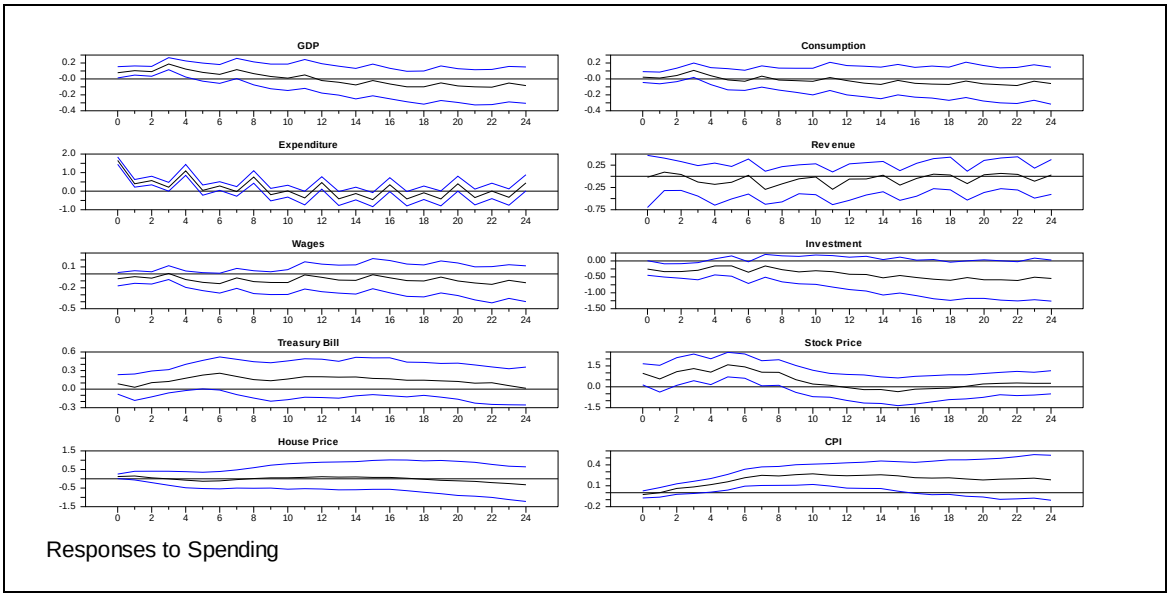
A positive government revenue shock generally creates the expected contractionary effect on the economy. GDP, consumption, non-residential investment spending, and wages fall and remain negative over the entire impulse horizon, although significant decreases only occur in the short run (i.e., two-and-a-half years or less). The revenue shock exerts the largest effect on consumption, followed by GDP. The real house and real stock price indexes fall significantly for about four and 1 years, respectively.

The initial positive response of the Treasury bill rate probably reflects the lower fiscal deficit and the reduced need to borrow funds, thus, lowering Treasury bill prices and raising their

interest rates. Moreover, this positive response of the Treasury bill rate also likely translates into a weaker real stock market price index. The contraction in GDP will also cause a persistent decline in stock prices as the overall economic investment environment weakens. Perhaps a more obvious reason for the stock market decline occurs because households substitute saving away from holding equity to paying higher taxes.

The immediate significant negative response of the real house price index contrasts to the monetary shock, which only affects the real house price index negatively and significantly after a year and a half. This outcome may occur because banks still give preferential rates to households and businesses even with rising interest rates, whereas no tax breaks exist for future homeowners.

Figure 4: Impulse Responses: Government Spending Shock



3.4 GOVERNMENT SPENDING SHOCK

We also construct the government spending shock to lie orthogonal to the business cycle and monetary policy shocks. In addition, government spending continues to rise for a year after the shock. Figure 4 reports the impulse responses results of our eight variables to the government spending shock.

A positive shock to government spending generally produces the expected short-run expansionary effects on the economy. That is, the shock generates significant positive responses in GDP in the short run as well as a significant positive response in the CPI for three years after a delay of one year. On the other hand, consumption spending does not increase significantly, except for the third quarter after the shock to government spending. Finally, non-residential investment spending falls significantly in the short run, as government spending appears to crowd it out.

Similar to Agnello and Sousa (2011), the real house price index hardly responds to a government expenditure shock for the entire impulse response period. Stock prices rise significantly in the short run.

Although the decrease in real wages in response to an increase in government spending over the entire impulse period does not prove significant, Baxter and King (1983), Ramey and Shapiro (1998), and Fatas and Mihov (2001) show that an increase in non-productive government purchases financed by future lump-sum taxes exerts negative wealth effects, raises the quantity of labour supplied at any given wage, and ultimately leads to a lower real wage.

Comparing a negative government revenue shock to a positive government spending shock, the revenue shock generally exerts a larger and more frequently significant effect on the economy than the spending shock.

4. CONCLUSION

This study evaluates the effects of fiscal policy shocks on house and stock price indexes, while controlling for monetary and business cycle shocks using South Africa's quarterly data on 10 variables (real per capita GDP, real per capita consumption expenditure, real per capita government revenue, real per capita government spending, real per capita wages, real per capita non-residential investment, the 3-month Treasury bill rate, the real stock price index, the real house price index, and the CPI) from 1966:Q1 to 2011:Q2. This study follows the identification procedure proposed by Uhlig (2005) and Mountford and Uhlig (2009) for determining the shocks with the zero restriction based on the penalty functions for impulse responses of some variables in the benchmark VAR model for some period. This method uses only the information in the macroeconomic time series of the VAR model together with minimal assumptions to identify fiscal policy shocks. In particular, it imposes no restrictions on the signs of the responses of the key variables of interest — real house and stock price indexes — to fiscal policy shocks.

We find that a positive business cycle shock significantly increases both real stock and real house price indexes for just over one year. A positive (contractionary) monetary shock temporarily decreases the real stock price index and gradually and persistently decreases the real house price index. A positive shock to government revenue also temporarily reduces the real stock price index and persistently decreases the real house price index. A positive shock to government spending does not affect the real house price index, but generates a positive and significant effect on the real stock price index.

While our paper focuses on the role of fiscal policy as a driver of asset price dynamics, one may also question whether asset prices influence fiscal policy. Based on the evidence provided by Das, Gupta, and Kanda (2011), Ncube and Ndou (2011), Aye, Gupta, and Modise

(2012), Peretti, Gupta, and Inglesi-Lotz (2012) and Simo-Kengne, Bittencourt, and Gupta (2012) changes in real stock and real house prices via the wealth effect affect the demand patterns in South Africa. With such adjustments leading to substantial changes in future aggregate demand, the fiscal policymaker could decide to react to such changes for the sake of stability. This argument would justify augmenting the fiscal policy rules, recently estimated for South Africa by Burger *et al.* (2012), with housing and stock prices, something which we leave for future research.

Our empirical results suggest that fiscal spending shocks affect stock prices more than house prices. Both spending and revenue shocks affect stock prices whereas only revenue shocks affect house prices. Given these results, policy makers will find it difficult to strike the right balance between using various fiscal tools to stabilise asset markets. Fiscal policy shocks only affect stock prices in the short run. In addition, stock prices do not respond in the same way as overall non-residential investment spending. Thus, the policy maker should make clear the objectives and understand the economic trade-offs associated with revenue and spending shocks. Monetary policy exerts a more direct effect on asset markets. Contractionary monetary policy shocks immediately lower the real stock price index, but only temporarily, and lower the real house price index with a delay, but with a longer-lasting effect.

The direct wealth affects from changes in taxes seem far more important in setting house prices than spending shocks. The results presented in the paper consider the entire sample period and does not take into account differences between counter and procyclical policy. Future research will attempt to close this gap, specifically focusing on analysing the effect of fiscal policy shocks on asset prices over time and across different regimes. These analyses will shed

further light on the consequences of high debt, procyclical fiscal policy, and uncoordinated fiscal and monetary policy on house prices and equity markets.

ENDNOTES

[1] In addition to these eight variables, Mountford and Uhlig (2009) include consumption and commodity price indexes, replacing our two asset prices.

[2] Also, following Mountford and Uhlig (2009), we identify the business cycle shock by a criterion function, which rewards large impulse responses in the right directions more than small responses and penalizes responses of the wrong sign, since we associate business cycles with the more substantial movements in these variables.

[3] While the financial crisis and Great Recession caused some governments to consider fiscal consolidation as a response, the empirical evidence suggests that successful fiscal consolidations prove few and far between. When success occurs, it comes from idiosyncratic factors. See Miller and Russek (2003) and Guajardo, Leigh, and Pescatori (2011).

[4] We refer interested readers to Appendix A of Mountford and Uhlig (2009) for f Miller and Russek (2003)urther details on the estimation as well as on the implementation of the identification strategies.

[5] We also estimate the forecast-error variance decompositions (FEVDs) based on zero restrictions and the experiment with sign restrictions rather than penalty functions. The estimation results obtained for these yield similar results as the zero restriction approach with penalty functions. The results are available upon request from the authors.

REFERENCES

Afonso, Antonio, and Ricardo M. Sousa. 2011. What are the effects of fiscal policy on asset markets? *Economic Modelling* 28 (4): 1871–1890.

Afonso, Antonio, and Ricardo M. Sousa. 2012. The Macroeconomic effects of fiscal policy, *Applied Economics* 44 (34): 4439-4454.

Agnello, Luca, Vitor Castro, and Ricardo M. Sousa. 2012. How does fiscal policy react to wealth composition and asset prices? *Journal of Macroeconomics* 34 (3): 874-890.

Agnello, Luca, and Ricardo M. Sousa. 2011. Can fiscal policy stimulus boost economic recovery? *Revue Économique* 62 (6): 1045-1066.

Agnello, Luca, and Ricardo M. Sousa. Forthcoming. Fiscal policy and asset prices. *Bulletin of Economic Research*.

Alam, Md. Mahmudul, and Md. Gazi Salah Uddin. 2009. Relationship between interest rate and stock price: empirical evidence from developed and developing countries. *International Journal of Business and Management* 4 (3): 43-51.

Andre, Christophe, Rangan Gupta, and Patrick T. Kanda. 2012. Do house prices impact consumption and interest rate? Evidence from OECD countries using an agnostic identification procedure. *Applied Economics Quarterly*, 58 (1), 19-70.

Aron, Janine, John Muellbauer, and Anthony Murphy. 2006. Housing wealth, credit conditions and consumption. MPRA Paper No. 24485.

Aye, Goodness C., Mehmet Balcilar, and Rangan Gupta. Forthcoming. Long- and short-run relationships between house and stock prices in South Africa: A nonparametric approach. *Journal of Housing Research*.

Aye, Goodness C., Rangan Gupta, and Mampho. P. Modise. 2012. Do stock prices impact consumption and interest rate in South Africa? Evidence from a time-varying vector autoregressive model. Department of Economics, University of Pretoria, Working Paper No. 201224.

Baxter, Marianne, and Robert G. King. 1983. Fiscal policy in general equilibrium. *The American Economic Review* 83 (3): 315-334.

Bjørnland, Hilde. C., and Dag H. Jacobsen. Forthcoming. House prices and stock prices: Different roles in the U.S. monetary transmission mechanism. *Scandinavian Journal of Economics*.

Bjørnland, Hilde C., and Kai Leitemo. 2009. Identifying the interdependence between US monetary policy and the stock market. *Journal of Monetary Economics*, 56 (2): 275-282.

Burger, Philippe, Ian Stuart, Charl Jooste, and Alfredo Cuevas. 2012. Fiscal sustainability and the fiscal reaction function for South Africa: Assessment of the past and future policy applications. *South African Journal of Economics* 80 (2): 209-227.

Castro, Vitor. 2011 Can central banks' monetary policy be described by a linear (augmented) Taylor rule or by a nonlinear rule? *Journal of Financial Stability* 7 (4): 228-246.

Castro, Vitor, and Ricardo M.Sousa. 2012. How do central banks react to wealth composition and asset prices? *Economic Modelling* 29 (3): 641-653.

Chinzara, Ziv. 2010. Macroeconomic uncertainty and emerging stock market volatility: The case for South Africa. Economic Research Southern Africa Working Paper No 187.

Coetzee, Clive E. 2002. Monetary conditions and stock returns: A South African case study. EconWPA, 0205002.

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

Du Plessis, Stan, Ben Smit, and Federico Sturzenegger. 2007. The cyclicality of monetary and fiscal policy in South Africa since 1994. *South African Journal of Economics* 75 (3): 391-411.

Du Plessis, Stan, Ben Smit, and Federico Sturzenegger. 2008. Identifying aggregate supply and demand shocks in South Africa. *Journal of African Economies* 17 (5): 765-793.

Durham, J. Benson. 2003. Monetary policy and stock prices returns. *Financial Analysts Journal* 59 (4): 26-35.

Fatas, Antonio, and IIian Mihov. 2001. The effects of fiscal policy on consumption and employment: Theory and evidence. CEPR Discussion Paper No. 2760.

Feldstein, Michael. 2009. Rethinking the role of fiscal policy. Contributed paper at the January 2009 meeting of the American Economic Association.

Genesove, David, and Christopher. J. Mayer. 2001. Loss aversion and seller behavior: evidence from the housing market. *The Quarterly Journal of Economics* 116 (4): 1233-1260.

Granville, Brigitte, and Sushanta K. Mallick. 2009. Monetary and financial stability in the euro area: Procyclicality versus trade-off. *Journal of International Financial Markets, Institutions and Money* 19 (4), 662–674.

Guajardo, Jaime, Daniel Leigh, and Andrea Pescatori. 2011. Expansionary austerity: New international evidence. IMF Working Paper, WP/11/158.

Gupta, Rangan, and Faaiqa Hartley. Forthcoming. The role of asset prices in forecasting inflation and output in South Africa. *Journal of Emerging Market Finance*.

Gupta, Rangan, Marius Jurgilas, and Alain Kabundi. 2010. The effect of monetary policy on real house price growth in South Africa: A factor-augmented vector autoregression (FAVAR) approach. *Economic Modelling* 27 (1): 315-323.

Gupta, Rangan, Alain Kabundi, Marius Jurgilas, and Stephen M. Miller. 2012a. Monetary policy and housing sector dynamics in a large-scale Bayesian vector autoregressive model. *International Journal of Strategic Property Management* 16 (1): 1-20.

Gupta, Rangan, Marius Jurgilas, Stephen M. Miller, and Dylan van Wyk. 2012b. Financial market liberalization, monetary policy, and housing sector dynamics. *International Business and Economics Research Journa*l 11 (1): 69-82.

Hewson, Michael, and Lumengo Bonga-Bonga. 2005. The effects of monetary policy shocks on stock returns in South Africa: A structural vector error correction model. Economic Society of South Africa Conference, Durban, South Africa. https://www.essa.org.za/download/2005Conference/Hewson.pdf.

Iacoviello, Matteo 2010. Housing in DSGE models: Findings and new directions. In Bandt, O. de; Knetsch, T.; Peñalosa, and J.; Zollino, F., (Eds.), *Housing markets in Europe: A macroeconomic perspective*, Berlin, Hidelberg: Springer-Verlag, 3-16.

Iacoviello, Matteo 2011. Housing wealth and consumption. *International Encyclopedia of Housing and Home*, Elsevier.

Iglesias, Emma M., and Andre Y. Haughton. 2011. Interaction between monetary policy and stock prices: A comparison between the Caribbean and the US. Contributed paper at the Conference on the Economy (COTE) 2011 held at the University of the West Indies, St. Augustine, Trinidad and Tobago in October 2011.

Jooste, Charl., Guangling Liu, and Ruthira Naraidoo. 2012. Analysing the effects of fiscal policy shocks in the South African economy. Department of Economics working paper 2012-06, University of Pretoria.

Leamer, Edward E. 2007. Housing Is the Business Cycle. National Bureau of Economic Research Working Paper 13428, Cambridge, MA.

Kasai, Ndahiriwe, and Rangan Gupta. 2010. Financial liberalisation and the effectiveness of monetary policy on house prices in South Africa. *ICFAI Journal of Monetary Economics* VIII(4): 59-74.

Mallick, Sushanta K., Mohammed Mohsin. 2007. Monetary policy in high inflation open economies: evidence from Israel and Turkey. *International Journal of Finance and Economics* 12 (4): 405–415.

Mallick, Sushanta K., and Mohammed Mohsin. 2010. On the real effects of inflation in open economies: Theory and empirics. *Empirical Economics* 39 (3): 643–73.

Mallick, Sushanta K., and Ricardo M. Sousa. 2012. Real effects of monetary policy in large emerging economies. *Macroeconomic Dynamics* 16 (S2): 190-212.

Mallick, Sushanta K, and Ricardo M. Sousa. Forthcoming. Commodity prices, inflationary pressures, and monetary policy: Evidence from BRICS economies. *Open Economies Review*.

Mangani, Ronald. 2011. Monetary policy, structural breaks and JSE returns. *Investment Analysts Journal* 73: 27-35.

Miller, Stephen M., and Frank S. Russek. 2003. The relationship between large fiscal adjustments and short-term output growth under alternative fiscal policy regimes. *Contemporary Economic Policy* 21 (1): 41-58.

Mountford, Andrew, and Harald Uhlig. (2009). What are the effects of fiscal policy shocks? *Journal of Applied Econometrics* 24 (6), 960–992.

Muroyiwa, Brian. 2011. Identifying the interdependence between South Africa's monetary policy and the stock market. Unpublished MSc Thesis, Department of Economics and Economic History Rhodes University, Grahamstown, South Africa.

Ncube, Mthuli, and Eliphas Ndou. 2011. Monetary policy transmission, house prices and consumer spending in South Africa: An SVAR approach. African Development Bank Group Working Paper No 133.

Peretti, Vittorio, Rangan Gupta, and Roula Inglesi-Lotz. 2012. Do house prices impact consumption and interest rate in South Africa? Evidence from a time varying vector autoregressive model. *Economics, Management & Financial Markets* 7 (4): 101-120.

Prinsloo, Juanita W. 2002. Household debt, wealth and savings. *Quarterly Bulletin,* South African Reserve Bank.

Rafiq, Mohamed S., and Sushanta K. Mallick. 2008. The effect of monetary policy on output in EMU3: A sign restriction approach. *Journal of Macroeconomics* 30 (4): 1756–1791.

Ramey, Valerie A., and Matthew D. Shapiro 1998. Costly capital reallocation and the effects of government spending. *Carnegie Rochester Conference on Public Policy* 48: 145-194.

Schoeman, Nicolaas J., and Jan A. Swanepoel. 2003. Countercyclical fiscal policy in South Africa: Role and impact of automatic fiscal stabilisers. *South African Journal of Economic and Management Sciences* 6 (4): 802-822.

Schuknecht, Ludger, Jurgen von Hagen, and Guido Wolswijk. 2009. Government risk premiums in the bond market: EMU and Canada. *European Journal of Political Economy* 25 (3): 371–384.

Simo-Kengne, Beatrice D., Mehmet Balcilar, Rangan Gupta, Goodness. C. Aye, and Monique Reid. 2013. Is the relationship between monetary policy and house prices asymmetric in South Africa? Evidence from a Markov-switching vector autoregressive model. *Economic Modelling* 32 (1): 161-171.

Simo-Kengne, Beatrice D., Manoel Bittencourt, and Rangan Gupta. 2012. House prices and economic growth in South Africa: Evidence from provincial-level data. *Journal of Real Estate Literature* 20 (1): 97-117.

Simo-Kengne, Beatrice D., Rangan Gupta, and Manoel Bittencourt. Forthcoming. House prices and consumption in South Africa. *Housing Studies*.

Sims, Christopher A. 1972. Money, income and causality. *American Economic Review* 62 (4): 540-552.

Sims, Christopher A. 1980. Macroeconomics and reality. *Econometrica* 48 (1): 1–48.

Sims, Christopher A., and Harald Uhlig. 1991. Understanding unit rooters: A helicopter tour *Econometrica* 59 (6): 1591–1600.

Smal, Daleen. M., and Shaun de Jager. 2001. The monetary policy transmission mechanism in South Africa. South Africa Reserve Bank, Occasional Paper No 16.

Sousa, Ricardo M. 2010a. Housing wealth, financial wealth, money demand and policy rule: Evidence from the Euro area. *The North American Journal of Economics and Finance* 21 (1): 88–105.

Sousa, Ricardo M. 2010b. Consumption, (dis)aggregate wealth, and asset returns. *Journal of Empirical Finance* 17 (4): 606–622.

Sousa, Ricardo M. 2010c. The consumption–wealth ratio and asset returns: The Euro area, the UK and the US. *Journal of Money, Investment and Banking* 16: 12–29.

Sousa, Ricardo M. forthcoming a. Wealth, asset portfolio, money demand and policy rule. *Bulletin of Economic Research*.

Sousa, Ricardo M. forthcoming b. Linking wealth and labour income with stock returns and government bond yields. *European Journal of Finance.*

Stock, James H., and Mark W. Watson. 2003. Understanding changes in international business cycle dynamics, National Bureau of Economic Research Working Papers, Cambridge MA.

Uhlig, Harald. 2005. What are the effects of monetary policy on output? Results from an agnostic identification procedure. *Journal of Monetary Economics* 52 (2): 381-419.

Venter, John C. 2011. Business cycles in South Africa during the period 2007-2009. South African Reserve Bank, *Quarterly Bulletin* (June 2011): 61–66.

Goodness C. Aye lectures at University of Agriculture, Makurdi, Nigeria. She received her PhD in Agricultural Economics from University of Pretoria, South Africa. Her research interests include macroeconomic policy analysis, agricultural policy analysis, production economics, environmental economics, and poverty issues.

Mehmet Balcilar is Professor of Econometrics at Eastern Mediterranean University and Head of the Department of Economics. He is an advisor to the Republic of Turkey Prime Ministry Disaster and Emergency Management Authority, where he manages research on disaster risk modelling, disaster risk reduction policies, and disaster economics. He received his Ph.D. in Economics from Wayne State University. His research interests encompass econometrics and forecasting, housing and financial markets, macroeconomics, and risk management. He also authored a book on mathematical economics.

Rangan Gupta is a Professor of Economics at the University of Pretoria, South Africa. He received his PhD in Economics from University of Connecticut. His academic interests include mainly monetary theory and policy, business cycles, and time series econometrics.

Charl Jooste is a Senior Economist at the South African National Treasury and a Ph.D. student at the University of Pretoria. Much of his research focuses on the effects of fiscal policy shocks on the macroeconomy.

Stephen M. Miller is a Professor of Economics and former Department Chair in the Lee Business School at the University of Nevada, Las Vegas, USA. Prior to that, he was Professor of Economics and Department Head at the University of Connecticut. He received his PhD in economics from the State University of New York at Buffalo. His research interests span monetary, macroeconomic, and international finance theory and policy; international trade and applied microeconomic theory; financial institutions; and real estate lending.

Zeynel Abidin Ozdemir is an Associate Professor of Economics at Gazi University in Ankara, Turkey. He received his PhD in economics from Cukurova University in 2002. His research interests include econometrics, international finance, and macroeconomics.