Economic policy framework and asset price dynamics

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Introduction

Economic policy making is characterised by a constant search for the optimal framework which provides both nominal and real stability. Today the general consensus is that economic policy should be organised around stable rules. On the monetary side, maintaining price stability is the only and exclusive concern of monetary authorities. This exclusivity is guaranteed through some kind of "contract" which defines the numerical objective and protects the independence of the central bank from external influences. On the fiscal side, fiscal authorities are increasingly constrained in the use of their instrument. Caps to public expenditure growth, reduction of taxation and different forms of balance budget rules limit the level of distortions in the allocation of resources introduced by fiscal deficit and taxation. This policy mix is a very classical one: The role of economic policy is to provide a stable monetary and fiscal environment which minimizes distortions to private sector decision making. In doing so, monetary and fiscal stability should promote both monetary and macroeconomic stability.

The South African economic policy is modeled on similar criteria. The inflation targeting monetary framework is supported by a prudent fiscal behaviour that has produced a substantial increase in fiscal revenues, rationalisation of fiscal expenditure and an overall reduction of the fiscal burden. This combination has undoubtedly achieved a high degree of economic stabilisation against a volatile international economic environment.

After having achieved a stable monetary environment, economic policy makers everywhere are confronted with an increase in the frequency and magnitude of asset prices movements[1]. The consensus is that asset prices movements are driven by exogenous shocks to productivity or expectations, and by internal market dynamic. In the model of Bernanke et al. (2000), the main driving force to asset prices overshooting is credit market imperfections. The interaction between "irrational exuberance" and credit market imperfections creates a boom that is self-reinforcing, until some other shock does not change private sector evaluation of asset worth, reverting the process. In the way down both credit market imperfections and monetary policy play a contractionary role, exacerbating the correction itself.

This seems a fair description of asset price booms experienced in many countries in the past few years. This has prompted some commentators to argue that central banks should target asset price explicitly (among others Checchetti et al., 2000, and recently Borio et al. 2002), but this position is a minority one (again Bernanke et al.,2000). It is widely believed that monetary policy should not deal with asset prices directly, but only as a predictor of future inflation (or deflation).

It is less clear if it is possible to extend this interpretation of asset price volatility to emerging-countries' experience: First, if emerging countries are successful in promoting growth and productivity, they experience an asset price boom due to increased optimism about the future of the economy. Asset price dynamic is just the symptom of an underlying transformation of the economy. Nevertheless asset price volatility can have serious implications for the allocation of resources, in the balance sheet of the private sector and in income and wealth distribution. These effects can be particularly serious if expectations are not fulfilled in the future.

The objective of the paper is to indicate some framing of the analysis of the relation between economic policy framework and asset price dynamics. The question which prompts this analysis is: Why, in a time of stable, sustainable and credible fiscal and monetary policy, are financial crises still possible, and even more frequent? Could it be that we experience more financial instability because we have a policy framework which targets nominal and fiscal stability?

[1] For the South African experience with asset price variability in the last 10 years, see Nel and Mbeleki (2005).

We think that the issue should be analyzed starting from what the relevant policies produce in terms of expectations and the private sector budgets. Some authors have analysed similar issues, For example Schmitt-Grohe et al. (2000) look at the effect of the balance budget rule on price determination and real stability; and Gilchrist and Lehahy (2002) look directly at the relation between monetary policy and asset prices in a standard New Keynesian IS/AS with credit constraints. Their results show the unclear evidence that monetary policy should target asset prices to reduce macroeconomic volatility. A lot of authors have reviewed the efficiency of monetary policy rules of Taylor type which tend to be robust to a large series of macroeconomic conditions.

In this paper we look at two instances where the policy framework matters. First we look at the relation between asset prices and inflation targeting regime. If an inflation targeting regime is credible, expected inflation is constant, and any shock will be transmitted to the real economy, affecting real interest rates, investment and capital accumulation. Second we want to introduce in the set-up a disciplined fiscal policy, in line with the South African experience. The effect of disciplined fiscal policy is to change the marginal rate of substitution between present and future consumption. This affects interest rates and prices, and through that, asset price evaluation.

The paper is organised as follows: In the next section we present a simple analytical model to develop some intuition about the interaction between monetary policy and asset prices; in the following section we do some policy simulations using a New Keynesian AD/AS model calibrated to mimic basic characteristics of the South African economy. After that, we will repeat the same exercise introducing fiscal policy in the framework: First we look at some theoretical hypothesis derived from the Fiscal Theory of Price Determination, and after that we use a calibrated model derived from Woodford (1996) to analyse the interaction between inflation targeting, fiscal discipline and asset prices. The final section concludes.

Monetary policy and asset prices

To illustrate the argument consider the simple model used by Clarida et al. (1998) in monetary policy analysis:

$$\pi_t = E_t \pi_{t+1} + \alpha y_t + \varepsilon_t \qquad (1)$$
$$y_t = E_t y_{t+1} - \gamma \left(i_t - E_t \pi_{t+1} \right) + \eta_t \qquad (2)$$

where (1) is a New Keynesian Phillips curve relation in which present inflation is a function of the private sector expectations of inflation one period ahead and output gap and (2) is an inter-temporal "IS" relation, where the output gap is a function of expected future output gap and real interest rate. The coefficients satisfy, $\alpha, \gamma > 0$ and ε_t and η_t are supply and demand shocks respectively with the usual stochastic properties of zero mean and finite variances σ_ε^2 and σ_η^2. The central bank's instrument is the nominal interest rate. The system is augmented by a simple asset prices equation as

$$q_t = E_t q_{t+1} - \phi_0 \left(i_t - E_t \pi_{t+1} \right) + \phi_1 y_t + \upsilon_t \qquad (3)$$

In Equation 3 deviations of asset prices, q_t, from some generic equilibrium value are a function of future expected movement of asset prices, real interest rate and output gap, plus υ_t which is a generic shock to asset evaluation with the usual stochastic properties[2].

Equation 3 can be solved forward to give the classical asset prices formulation that present prices are a function of all the expected stream of future income and policy responses.

[2] This formulation is somehow arbitrary, although it follows common specifications of assets prices in macro models (see for example Batini and Haldane, 1999, and Leitemo and Soderstrom, 2005, in which an equation like (3) represents real exchange rate. For an overall review of asset prices in macroeconomic models, see Soderlind, 2003).

The central bank operates after knowing the shocks. Because we are interested on the effect of policy design on asset price dynamics, we confront two policy regimes: Strict inflation targeting and nominal income targeting. The easiest way to illustrate the policy making set-up is to follow Guender (2002) and assume that the policy maker sets a fixed nominal target for the sum of the ultimate goal variables: The real output gap and the rate of inflation.

$$z^* = [\theta y_t + \pi_t] = 0 \quad (4)$$

where the parameter θ indicates the relative weight the policy maker attaches to the output gap and the rate of inflation. For θ=0, the policy maker follows a strict inflation targeting regime, where the target is equal to zero for simplicity. Inserting Equations 1 and 2 in 4 and solving for i_t we obtain the interest rate reaction function, that is:

$$i_t = \frac{1}{\gamma\theta}(E_t\pi_{t+1} + \alpha y_t + \varepsilon_t) + \frac{1}{\gamma}(E_t y_{t+1} + E_t\pi_{t+1} + \eta_t) \quad (5)$$

This reaction function demonstrates that the policy maker will react fully to demand shocks (or expectations shocks), while it will react to supply shocks only as long as it has real output control as an objective. Substituting the policy rule in the IS and AS relationships, we obtain:

$$\pi_t = \frac{\theta}{\theta+\alpha}(E_t\pi_{t+1} + \varepsilon_t) \quad (6)$$

$$y_t = -\frac{1}{\theta+\alpha}(E_t\pi_{t+1} + \varepsilon_t) \quad (7)$$

Equations 6 and 7 show the behaviour of output and inflation once the policy rule is imposed. Notice the inverse relation between output, expected inflation and supply shocks. Demand shocks are totally offset by policy actions. To solve the model we try implicit solutions of the following kind:

$$y_t = -\phi_1\varepsilon_t$$

$$\pi_t = \phi_2\varepsilon_t$$

Thus it follows that the solution implies $E_t\pi_{t+1}=0$ and $E_t y_{t+1}=0$. Substituting these solution conditions in (6) and (7) and matching coefficients, we have:

$$\pi_t = \frac{\theta}{\theta+\alpha}(\varepsilon_t) \quad (8)$$

$$y_t = -\frac{1}{\theta+\alpha}(\varepsilon_t) \quad (9)$$

It follows that the variances of the policy targets are:

$$Var(\pi_t) = \frac{\theta}{\theta+\alpha}\sigma_\varepsilon^2 \quad (10)$$

$$Var(y_t) = -\frac{1}{\theta+\alpha}\sigma_\varepsilon^2 \quad (11)$$

These variances depend on the relative weight θ that targets have in the loss function of the central bank. For a strict inflation targeting regime (θ=0), the variance of inflation is minimised at the expenses of greater real output variation. The same trade-off is evident in the use of the instrument. From equation (5) and conditions $E_t\pi_{t+1}=0$ and $E_t y_{t+1}=0$, we have:

$$i_t = \frac{1+\alpha\theta}{\gamma(\theta+\alpha)}\eta_t + \frac{1}{\gamma(\theta+\alpha)}\varepsilon_t \quad (12)$$

and

$$Var(i_t) = \left(\frac{1+\alpha\theta}{\gamma(\theta+\alpha)}\right)^2 \sigma_\eta^2 + \left(\frac{1}{\gamma(\theta+\alpha)}\right)^2 \sigma_\varepsilon^2 \qquad (13)$$

For fixed inflation targeting, θ=0, the policy maker controls perfectly the level of inflation, using more aggressively its instrument. This increases output variability, now destabilised by movement of real interest rate motivated by inflation control. The higher the importance given to real output stability, the higher inflation variability will be and the lower the instrument variability will be in response to shocks to the Phillips curve. On the other hand, the variability in the use of the instrument in response to demand shocks is negatively correlated to the importance given to output stabilisation only if α<1.

The way this economic policy formulation interacts with asset prices can be seen just by substituting (9) and (12) in (3). After some simplifications, this gives the following asset price equation:

$$q_t = E_t q_{t+1} - \phi_0 \frac{1+\alpha\theta}{\gamma(\theta+\alpha)} \eta_t + \frac{\phi_0 + \gamma\phi_1}{\gamma(\theta+\alpha)} \varepsilon_t + \upsilon_t \qquad (14)$$

Asset prices respond to variability in real interest rates and present income, together with expected variability of fundamentals in the future (represented by $E_t q_{t+1}$). The variance of asset prices will be a function of the monetary policy framework, as can be shown by calculating the following variance.

$$Var(q_t) = Var(E_t q_{t+1}) - \left(\phi_0 \frac{1+\alpha\theta}{\gamma(\theta+\alpha)}\right)^2 \sigma_\eta^2 + \left(\frac{\phi_0 + \gamma\phi_1}{\gamma(\theta+\alpha)}\right)^2 \sigma_\varepsilon^2 + \sigma_\upsilon^2 \qquad (15)$$

From (15) it is evident that the variance of asset prices is an inverse function of θ, the weight given to the income objective. A strict inflation-targeting regime eliminates nominal variability and magnifies real variability. Asset prices being a reflection of expectations about future movement of real variables, their variability is maximised as well[3].

We have shown how in a simple model of monetary policy determination, the monetary policy framework selects where to locate instability. Given a certain set of shocks hitting the economy, fixing one dimension of our multidimensional problem just shifts instability towards the other dimension. Adding asset prices to the model just makes this point more evident. The instrument does not absorb the shocks hitting the target, it just shifts the energy of the shock to some other variable, in this case asset prices. Nominal stability is therefore not a sufficient condition to obtain real stability. On the contrary, given the nature of the shocks and of the economic structure, they could work in the opposite direction.

Asset price dynamics and monetary policy in a calibrated model

The previous analysis only illustrates the possible endogeneity of asset price dynamics to the policy framework. In this part we use a calibrated New Keynesian model to analyse further the issue and the optimal response of monetary policy to productivity and expectations shocks, once considering explicitly the possible influence of asset prices. The model we use is a typical New Keynesian model with habit formation, as in Fuhrer (2000).

Aggregate demand

$$y_t = \lambda_1(y_{t-1}) + (1-\lambda_1)E_t y_{t+1} - \gamma(i_t - E_t \pi_{t+1}) + \delta q_t + \varepsilon_t \qquad (16)$$

[3] The point that strict inflation targeting could be destabilising is not new: Bernanke et al. (2000) show that a policy with a higher weight on output should contribute more towards improving welfare relative to a strict inflation targeting rule or a rule including asset prices.

Aggregate supply

$$\pi_t = \lambda_2(\pi_{t-1}) + (1-\lambda_2)E_t\pi_{t+1} + \alpha y_t + u_t \quad (17)$$

Asset prices

$$q_t = E_t q_{t+1} - \varphi_0(i_t - E_t\pi_{t+1}) + \varphi_1 y_t + \upsilon_t \quad (18)$$

Interest rate reaction function

$$i_t = \mu(i_{t-1}) + (1-\mu)[\phi_\pi(\pi_t - \pi^*) + \phi_y(y_t) + \phi_q(q_t)] \quad (19)$$

The aggregate output is determined in the short run by demand and is forward looking, but with considerable inertia (λ). The model is extended introducing asset prices (q_t) in the aggregate demand equation, as in Leitemo and Soderstrom (2005). The monetary policy reaction function is of the Taylor type with a possible focus on asset price control if $\phi_q > 0$. The model is calibrated using the underlying microstructure of a New Keynesian model, adjusted to match approximately some properties of South African data. Table 1 displays numerical values of the baseline calibration.

Table 1: Baseline calibration

γ=0.5	φ_0=0.3
α=0.4	φ_1=0.3
δ=0.1	μ=0.1
λ_1=0.8	φ_{π}=0.5
λ_2=0.8	φ_{y}=1.5

Tables (2) and (3) show the empirical properties of the calibrated relative to basic South African quarterly data for the period 1999 – 2006. We choose this period of reference because it (loosely) corresponds to the move towards inflation targeting and it is free from the stabilisation imperative of the previous time periods. The model generates comparable volatilities in inflation, output and interest rate but not comparable variability of asset prices. Because the asset prices of reference are share prices, we would expect to observe a lower variability for a more general class of asset. Two characteristics of the parameterisation are noticeable: A very low level of inertia in the monetary policy rule μ, and a very high level of inertia in output and inflation processes, λ[4].

Table 2: Business cycle statistics – Baseline Calibrated Model vs data

Standard deviation	Model	ZA (1999 – 2006)
Inflation	2.9	3.1
Output	3.4	2.57
Interest rate	3.3	2.4
Asset prices (real)	9.5	17.3

From Table 2 it is noticeable that the actual standard deviation of interest rate is lower than the one implied by a typical Taylor rule parameterisation, i.e φ_y=1.5, although not extremely so. In general the standard deviation produced by the model closely follows the one derived from the data. Asset prices are less volatile than the empirical share prices used for the calibration: This is not surprising if we consider that the asset price equation in the model is a proxy for a wide range of different asset categories of which share prices are probably the most volatile. Correlation coefficients between the variables of interests are more difficult to calibrate: The model generates the direction of the correlation that can be found in the data, except for the inflation/output correlation, that is totally absent in the data (as noted by Du Plessis, 2005).

[4] For the relationship between structural inertia and inertia in the monetary policy rule, see Leitemo (2001).

Table 3: Business cycle statistics – Baseline Calibrated Model vs data

Correlation coefficient	Model	South Africa (1999-2006)
Inflation/output	-0.6479	0.046398
Inflation/interest rate	0.9494	0.70281
Inflation/share prices	-0.9350	-0.34733
Interest rate/output	-0.3854 -	0.52856
Interest rate/asset prices	-0.7968 -	0.72135
Output/asset prices	0.7757	0.67272

We will use this calibrated model to analyse the relationship between monetary policy and asset price dynamics. We will analyse two kinds of shocks, productivity and expectation shocks, and three kind of monetary policy rules: a classical Taylor Rule; a Taylor rule; a Taylor rule with greater emphasis on real income targeting; and finally a Taylor rule augmented with an explicit asset price targeting.

Productivity shocks – a case for no-intervention

The first experiment is to analyse the response to a productivity shock under three alternative monetary policy settings. In the first one the central bank follows a traditional Taylor Rule (TR), with parameters $\phi_\pi = 1.5$ and $\phi_y = 0.5$ in the monetary policy reaction function. In the second scenario, the central bank puts more weight on controlling output (real income targeting – RIT), which results in a coefficient $\phi_y = 0.5.$ in the third one (TR+A) the central bank targets directly asset prices and in the monetary policy reaction function, $\phi_q = 0.5.$ Table 4 illustrates the response of the model.

Table 4 – Productivity shock – (λ=0.8)

Standard deviation	TR	RIT	TR+A
Inflation	0.029	0.05	0.17
Output	0.035	0.03	0.07
Assets	0.095	0.1	0.15
Interest rate	0.04	0.05	0.18
Losses	0.002	0.003	0.03

The performance of the model shows a significantly higher volatility of all the variables once the inflation objective is compromised. This is reflected in the loss function analysis, where the loss function is

$$L_t = \sum_{\tau=0}^{20} 0.99^\tau \left\{ \pi_{t+\tau}^2 + y_{t+i}^2 \right\} \tag{20}$$

Clearly modified Taylor rules do not produce gain in any dimension of the problem. What is noticeable is that most of the inefficiency of targeting asset prices in this model comes from its strong backward dynamic. If we consider a pure forward looking version of the model (with λ=0), the theoretical understanding developed in the previous part comes to the fore.

Table 5: Productivity shock – no inertia (λ=0)

Standard deviation	TR	RIT	TR+A
Inflation	0.026	0.042	0.06
Output	0.027	0.023	0.01
Assets	0.089	0.77	0.065
Interest rate	0.026	0.039	0.06
Losses	0.001	0.002	0.004

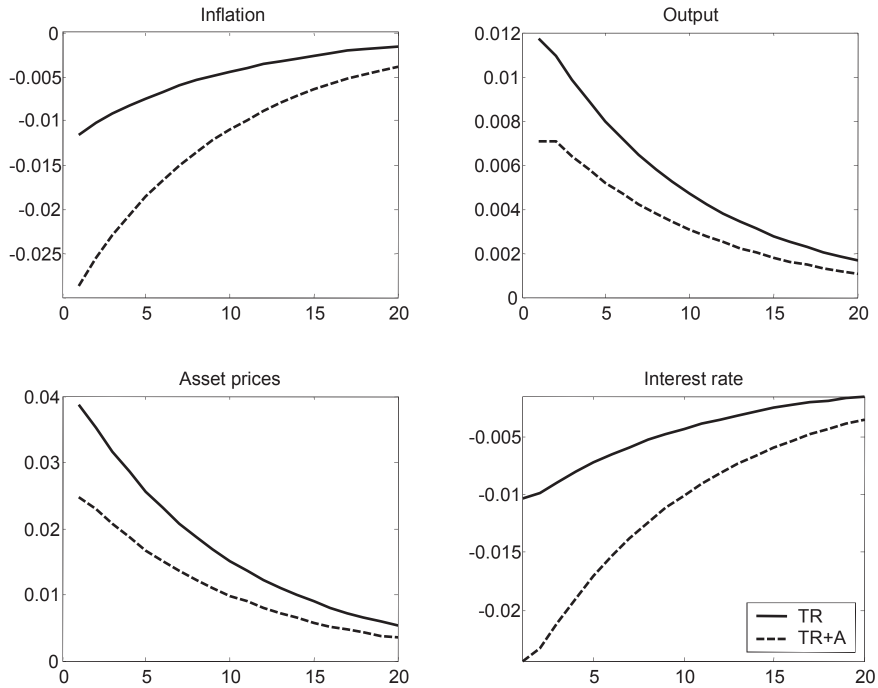

Figure 1: Response to productivity shock - Taylor Rule vs asset targeting

In Table 5, asset targeting and income targeting are de facto substitutes. Reducing asset price volatility requires a reduction in real income volatility, and therefore a redirection of monetary policy away from price control as its ultimate objective. As is often the case, this redirection does not seem desirable.

Anticipated versus mistaken productivity shocks

In the context of the model and the shock analysed here, the problem of controlling asset prices is a second-order problem. Targeting asset prices directly is not justified if asset prices movement reflects underlying shocks (Bernanke and Gertler, 2000). On the other hand, asset prices have the characteristics to "anticipate" future shocks. Expectations of future productivity growth will have a real effect on the economy through asset price evaluation. This "expectational" shock will have policy consequences independently of the future realisation of the predicted shock. It is arguable that these expectational shocks are more important in an emerging-country situation, for the innate uncertainty about future economic dynamic but also for the potential of over-optimism. In this section we analyse how the previous monetary policy rules operate in confronting expectational shocks. We will analyse two kind of shocks – an anticipated productivity shock which will be realised 4 periods ahead and an anticipated productivity shock that fails to materialise[5].

Table 6: Productivity shock – losses with inertia (λ=0.8)

	TR	RIT	TR+A
Anticipated	38.7	64.7	355.8
Anticipated but not realised	0.64	106.2	0.8

Table 7: Productivity shock – losses without inertia (λ=0)

	TR	RIT	TR+A
Anticipated	72.33	101.38	192.8
Anticipated but not realized	24.83	39.05	90.6

[5] I thank Ippei Fujiwara (2006) for providing the Dynare algorithm.

The main suggestion is that a further instrument should be introduced. Monetary policy alone cannot deal with a multiple objective loss function without compromising the optimal result in one dimension.

Fiscal theory of price determination and the real effects of budget balances rules

The second issue we want to analyse is the relation between "conservative" fiscal rules and asset price dynamics. Introducing fiscal policy in this set-up is not a straightforward process. The reason is that there is no consensus on the way fiscal policy should be treated. On the one hand the fiscal policy narrative is dominated by the so-called Ricardian equivalence theorem (Barro, 1974). In this context fiscal policy has no role in determining the economic equilibrium, as any fiscal policy action will be reverted some time in the future. On the other hand, fiscal policy is considered so central in economic policy making (at least for its destabilising properties) that a series of strict rules has been imposed across the world to limit its use. Recent research (Woodford, 1996; 2003, Sims, 1995 and Bergin, 1997, among many others), building on previous works of Leeper (1991), has renovated the interest in the analysis of fiscal policy and its interrelation with monetary policy.

The main innovation introduced by these contributions is that the interrelation between fiscal policy on the one side, and monetary policy and the private sector on the other, manifests itself through changes in the level of prices to achieve public sector solvency, independently of the institutional arrangements between fiscal and monetary authority. Variables like net government liabilities and expectations regarding the stream of future surpluses are given an immediate role in the determination of the equilibrium price level. The basic model is a model of excessive deficits. If the government's solvency condition is not satisfied at a particular point in time (i.e. if the stream of current and expected future surpluses does not pay the existing debt), the evaluation of private wealth will change accordingly, producing an increase in consumption and prices which will reduce the real value of outstanding nominal government liabilities so that the solvency condition will hold.

Most of the fiscal theory of price determination evolves around the possibility that the government carries out policies which do not guarantee solvency of the public sector. Arguably the case of excessive fiscal debt is not the only case of fiscal policies inconsistent with intertemporal equilibrium. The logic of the fiscal theory of price determination can be applied to a common disciplined fiscal policy, which does not include a permanent budget deficit. In recent years there has been increasing pressure for national government to achieve a balance budget, defined in term of secondary budget. Balance budget rules in the United States of America were introduced and were even more strict than the Europen Stability Pact (at least on paper). This is a typical response to a perceived inability to control: As a fixed money growth rule was the response to uncertainty about the effects of monetary policy, so the response to the possibility of loss of control of debt accumulation has been the imposition of fiscal rules, which reduces the scope for discretionary fiscal policy.

The problem with any balance budget requirement is that the government controls only some of the variables affecting its budget. To see the effect of uncertainty on the budget component, consider a more complete expression of government balance as:

$$B_t + \tau P_t Y_t = P_t G_t + \left(1 + i_{t-1}\right) B_{t-1} - \left(M_t - M_{t-1}\right) \tag{21}$$

where the variables have the usual meaning. A strict balance budget rule requires the expected value of future debt to be constant or reducing, i.e.

$B_t \leq \left(1 + i_{t-1}\right) B_{t-1}$

Applying this rule at its binding constraint, requires taxes to be set equal to expenditure plus interest on outstanding debt minus the seigniorage revenues rebated from the central bank to the government (which for simplicity we consider marginal and set equal to zero), i.e.

$$\tau = \frac{G_t}{Y_t} + (i_{t-1})\frac{B_{t-1}}{P_t Y_t} \tag{22}$$

This formulation certainly respects the intertemporal budget constraint of the government and it is certainly a Ricardian fiscal policy in the Woodford sense. The only issue is that Equation 22 does not represent the way policies are conducted. The requirement of a balance budget requires the government to fix tax rates on the basis of the expected level of expenditure and income. The only variable known with certainty at the moment of fixing the tax rate is the outstanding nominal debt and the interest rate of the previous period. All the other components of the budget constraint are subjected to a degree of uncertainty.

Therefore the problem of the government is to fix taxes such that:

$$\tau_t = E_{t-1}\left[\frac{G_t}{Y_t} + (i_{t-1})\frac{B_{t-1}}{P_t Y_t}\right] \tag{23}$$

where G_t and Y_t are two stochastic variables with $G_t \approx (\overline{G}, \sigma_G^2)$, $Y_t \approx (\overline{Y}, \sigma_Y^2)$, and negative covariances $Cov(Y,G) = \sigma_{GY} < 0.$

This problem is solved with the following tax rate[6]:

$$\tau_t = \left[\frac{\overline{G}}{\overline{Y}} + (r_{t-1})\frac{b_{t-1}}{\overline{Y}}\right] - \left[\frac{\overline{G}}{\overline{Y}^2}\right]\sigma_{GY} + \left[\frac{\overline{G}}{\overline{Y}^3} + (r_{t-1})\frac{b_{t-1}}{\overline{Y}^3}\right]\sigma_Y^2$$

which can be simplified as

$$\tau_t = \left[\frac{\overline{G}}{\overline{Y}} + (r_{t-1})\frac{b_{t-1}}{\overline{Y}}\right] + \Omega$$

where

$$\Omega = -\left[\frac{\overline{G}}{\overline{Y}^2}\right]\sigma_{GY} + \left[\frac{\overline{G}}{\overline{Y}^3} + (r_{t-1})\frac{b_{t-1}}{\overline{Y}^3}\right]\sigma_Y^2$$

and it is strictly positive, given the assumptions on the stochastic characteristics of the different elements. This means that the budget constraint is now equal (in expected value) at

$$E_{t-1}B_t = E_{t-1}\left[\left(\frac{\overline{G}}{\overline{Y}} + (r_{t-1})\frac{b_{t-1}}{\overline{Y}} + \Omega\right)P_t Y_t - P_t G_t - (1+i_{t-1})B_{t-1}\right] \tag{24}$$

$$E_{t-1}B_t = E_{t-1}\left[B_{t-1} - \Omega E_{t-1}(P_t Y_t)\right]$$

or

$$E_{t-1}\left(\frac{B_t}{P_t}\right) = \pi^{-1}\frac{B_{t-1}}{P_{t-1}} - \Omega E_{t-1}(Y_t) \tag{25}$$

[6] This is derived using the properties of expected values of ration of random variables, that is:

$$E\left(\frac{X}{Y}\right) \approx \left(\frac{\mu_X}{\mu_Y}\right) - \frac{1}{\mu_Y^2}cov[X,Y] + \frac{\mu_X}{\mu_Y^2}var[Y]$$

$$var\left(\frac{X}{Y}\right) \approx \left(\frac{\mu_X}{\mu_Y}\right)^2\left(\frac{var[X]}{\mu_X^2} + \frac{var[Y]}{\mu_Y^2} + \frac{cov[X,Y]}{\mu_X\mu_Y}\right)$$

The main characteristics of fiscal rule (25) is that it requires governments to fix taxation *ex ante* so that the probability of the budget *ex post* to be out of balance is minimised. No rule requires an absolute budget balance *ex post* but just a prudential assessment of the path of public expenditure and income growth. It is easy to demonstrate that a rule so described is equivalent to a "permanent" budget surplus. Therefore any debt accumulation at time t is expected to be paid back. At the same time, even without debt, the government is required, by the design of this rule, to be in surplus "on average": This means building up a stock of reserves before implementing extra expenditure. Is this a non-Ricardian policy? Although it is stretching the limit of the Woodford interpretation, we consider this tax policy "non-Ricardian" because it does not respond to macroeconomic conditions prevalent at the time of implementing the policy itself.

A fiscal policy rule like (25) can be expected to produce the following aggregate effects on the economy:

– Downward pressure on prices (reduction of wealth reduces consumption).
– Boost in output because of the contemporaneous reduction in real interest rate.
– Asset prices boom if the downward pressure on prices is persistent .

In the following section we go back to our calibrated model, introducing a fiscal deficit dynamic equation and testing the effect of fiscal stabilisation on the model dynamic. We then analyse the fiscal-monetary policy mix that minimizes losses defined in term of variance of inflation and output.

Monetary rules, fiscal discipline and asset price

The point we want to make is simply that we cannot evaluate the relationship between monetary policy and asset prices without introducing in the analysis the fundamental role played by fiscal policy dynamics. The fiscal theory of price level is just a possible channel of influence. To illustrate how the results of the section "Monetary policy and asset process" change once introducing fiscal policy in the equation, we present a log linear AD-AS model, derived from Woodford (1996) and Clarida et al. (1998). It adds to the standard New-Keynesian model of part (2) an equation for the period-by-period government budget constraint and an explicit money demand equation, because of its effects on the budget itself. The model is as follows:

$$\pi_t = \beta E_t \pi_{t+1} + \kappa y_t + u_t \quad (26)$$

$$m_t = \chi\left[\sigma^{-1} y_t - \left(\beta/(1-\beta)\right) i_t\right] \quad (27)$$

$$y_t = E_t y_{t+1} - \sigma\left(i_t - E_t \pi_{t+1}\right) + \theta_1 d_t + \theta_2 q_t \quad (28)$$

$$i = \phi_1 y_t + \phi_2 \pi_t + \phi_3 q_t \quad (29)$$

$$q_t = E_t q_{t+1} - \varphi_0\left(i_t - E_t \pi_{t+1}\right) + \varphi_1 y_t + \upsilon_t \quad (30)$$

$$d_{t+1} = i + (1/\beta)\left(d_t - \pi_t\right) + \gamma\left(m_{t-1} - m_t - \pi_t\right) \quad (31)$$

Equations (26) and (28) are the forward-looking AS/IS part of the system. d_t is the budget deficit and Equation 31 is the log-linear form of government dynamic budget constraint; Equation 27 is the LM curve, which is now needed to track the relation between government budget constraint and the rest of the model. The calibration of the model follows mainly Woodford (1996) and is in line with the literature.

Table 8

Calibration	θ_1=0.1
β=0.95	θ_2=0.1
α=0.3	φ_0=0.5
χ=1	φ_1=0.5
σ=1	γ=0.1

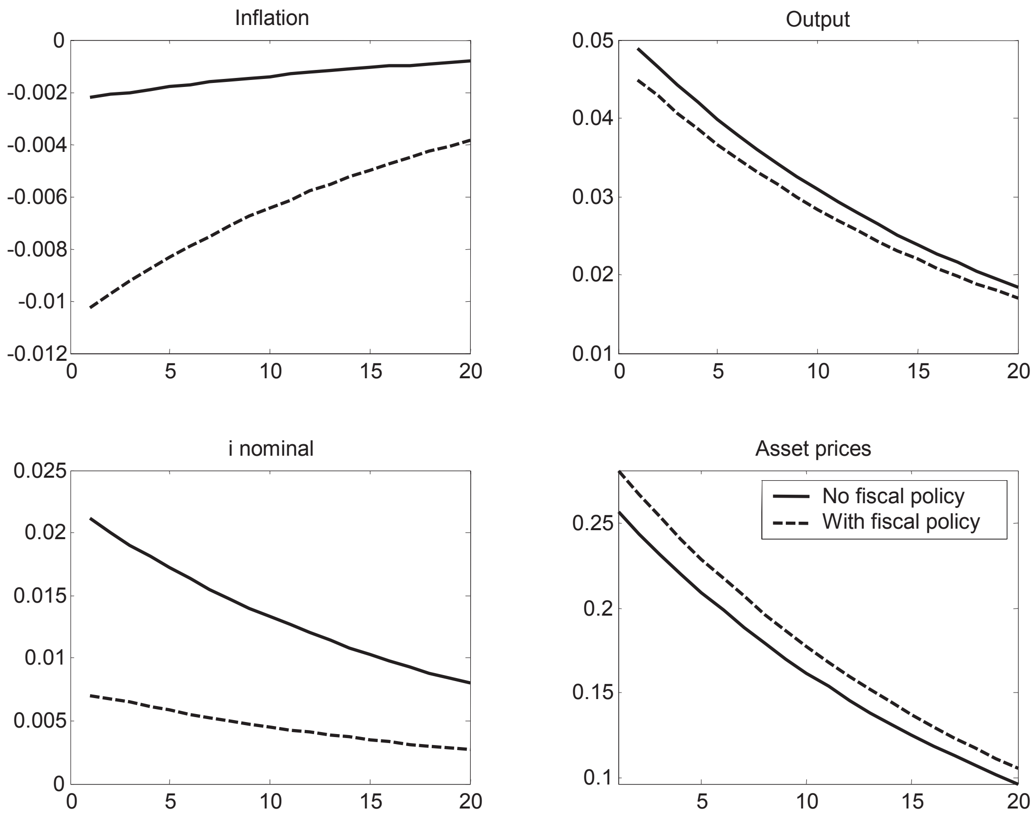

Figure 2: Response to a productivity shock with and without fiscal policy

As shown in Figure 2, introducing fiscal policy in the model changes significantly the dynamic after a productivity shock. The presence of fiscal policy increases both the variability of inflation and of asset prices relative to a Taylor Rule specification. In this model productivity shock affects the balance sheet of all the economic agents and in particular that of the government. A change in evaluation of future income and wealth reduces the relative value of present wealth (and public deficits) producing a reduction in present prices and an increase in asset prices to put the balance sheet trough the economy in equilibrium. This interpretation is confirmed by Figure 3 that shows the impulse response function to a contractionary fiscal shock, when monetary policy follows a simple Taylor rule. Again the effect is traditionally Keynesian in look, but with a significant boom in asset prices, because evaluation of future income now changed.

This part of the analysis suggests that asset prices volatility might be directly linked to the fiscal-monetary policy framework chosen and that any deviation from this framework does not seem to improve economic performances significantly. The next question is: Can fiscal policy target asset prices directly?

Should fiscal policy target asset prices?

Finally we look at the effect of giving fiscal policy the role of controlling asset price variability. This is done introducing a tax on capital gain in the asset price equation, which becomes a subsidy in the case of a reduction in asset prices. Formally the two relevant equations in the model now look as follows:

$$q_t = E_t q_{t+1} - \tau(q_t - q_{t-1}) - \varphi_0(i_t - E_t \pi_{t+1}) + \varphi_1 y_t + \upsilon_t \quad (32)$$

$$d_{t+1} = i + (1/\beta)(d_t - \pi_t) + \gamma(m_{t-1} - m_t - \pi_t) - \tau(q_t - q_{t-1}) \quad (33)$$

This is similar to the proposal of Aron and Muellbauer (2005). The design of this particular fiscal reaction function is only suggestive and requires further refinements. Nevertheless the effect is quite surprising: Asset prices and interest rate and output become more volatile, with only inflation being stabilised. The channel of instability is the increase in variability, and uncertainty in the budget process that the introduction of a "stabilization tax" has produced. Fiscal policy might be a good second instrument but the design of the intervention must be very careful of possible consequences on budget processes. This observation is only preliminary and further analysis is necessary.

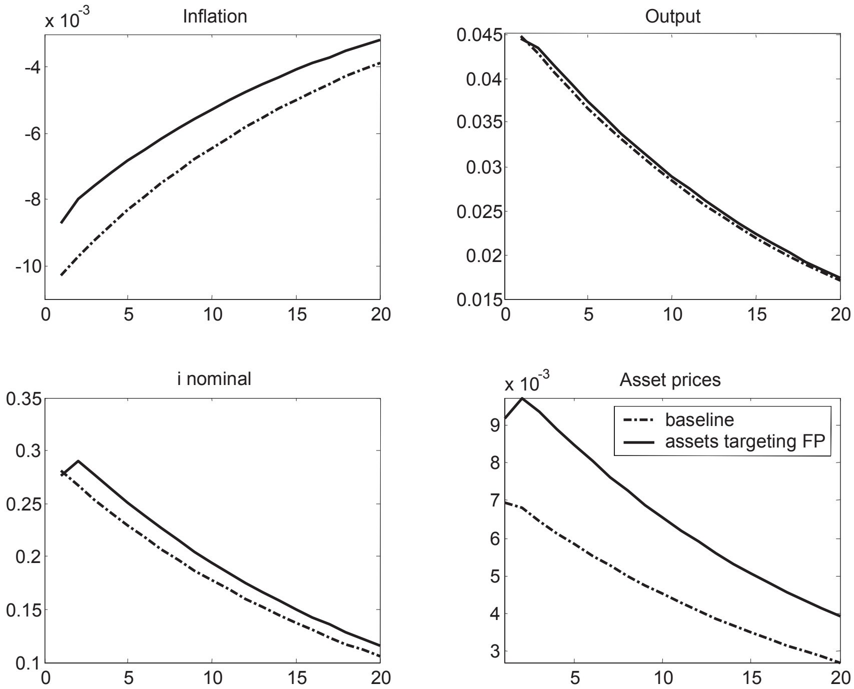

Figure 3: Response to productivity shock with asset targeting fiscal policy

Conclusion

The previous analysis is mainly a suggestion for future research, which should try to anchor analysis of interrelation between economic policy and asset prices to the specific conditions experienced in emerging countries in general and South Africa in particular. At the same time we suggest that the next challenge for economic policy makers is how to live with asset instability, which is a by-product of a correct fiscal and monetary policy mix.

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