Economic Policy Framework and Asset Price Dynamics

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Abstract

This paper looks at the interaction between macroeconomic instability and the economic policy framework of inflation targeting and fiscal discipline. The main conclusion is that we need to analyse closely the possibility that the kind of instability an economy experiences is endogenous to the policy framework selected. With inflation targeting and fiscal discipline, expected inflation becomes an exogenous variable, and any shock to expectations, either coming from demand or supply effects, will result in a movement of real variables (real interest rate, investment, capital accumulation, asset prices). Economic policy is therefore still a trade off between real and nominal instability.

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1. 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

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taxation . This policy mix is a very classical one: the main role of economic policy is to provide a stable monetary and fiscal environment, which minimizes distortions to private sector decision making. In reducing distortion to private sector decision making, monetary and fiscal stability should promote both monetary and real macroeconomic stability.

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

After having achieved a stable monetary environment, economic policy makers everywhere are confronted with an increase in frequency and magnitude of asset prices movements. 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 Bernake 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, which exacerbate the correction itself .

This seems a fair description of asset prices booms experienced in many countries in the last few years. This has prompted some commentators to argue that Central Banks should target asset price explicitly (among others Cecchetti et al, 2000, and recently Borio et al 2002), but this position is a minority one (again Bernake and Gertler 2000 is the contribution of reference).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 prices volatility to the emerging countries experience: first, if they are successful in the objective to promote growth and productivity, all emerging countries should experience a significant increase in asset prices due to increase optimism about the future of the economy. asset price dynamic is just the symptom of an underlying transformation of the economy. This does not mean that asset price variability does not represent a potential policy problem. Asset price volatility can have serious implication in the field of allocation of resources, balance sheet of the private sector, income and wealth redistribution and more. This can be particularly serious if expectations are not fulfilled in the future.

The objective of the paper is not to indicate some framing of the analysis of the relation between economic policy framework and asset price dynamics. The question which prompt this analysis is: why, in a time of stable, sustainable and credible fiscal and monetary policy frameworks, financial crisis are still possible, and even more frequent? Could it be that we experience more financial instability *because* we have a policy framework which target nominal and fiscal stability?

We think that the issue should be analyzed starting from what the policies followed produced on expectations and on the private sector budgets. Some authors have analyzed similar issues, For example Schmitt-Grohe et al (2000) look at the effect of balance budget rule on price determination and real stability. Moreover a lot of authors have reviewed the efficiency of monetary policy rules of Taylor type(Taylor

1997).

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 transferred as a real shock, affecting real interest rates, investment and capital accumulation. Secondly we want to introduce in the set up fiscal policies, in the tradition of the Fiscal Theory of Price Determination. The advantage of doing that is that in this set up fiscal policy is not nullified by the Ricardian Equivalence proposition. The effect of disciplined fiscal policy is to change the marginal rate of substitution between present and future consumption. This affect interest rates and prices, and through that, asset prices evaluation.

The paper is organised as follows. In the next section we develop some intuition about the interaction between monetary policy and asset prices, first using a small theoretical model and after doing some policy simulation using a New Keynesian AS/AS calibrated to mimic basic characteristics of the South African economy. After that, we 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 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.

2. Monetary Policy and Asset Prices

To illustrate the argument consider the simple model used by Woodford (2000) in monetary policy analysis:

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

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 income and real interest rate. The coefficients satisfy, $\alpha, \gamma > 0$ and ε_t and η_t are supply and demand shock respectively with the usual stochastic properties of zero mean and finite variances σ_ε^2 and σ_η^2. The CB's instrument is the nominal interest rate. The system is augmented by a simple asset prices equation as

$$
q_t = E_t q_{t+1} - \varphi_0 \left(i_t - E_t \pi_{t+1} \right) + \varphi_1 y_t + \upsilon_t \tag{3}
$$

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 productivity shock[1]. 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.

The central bank operates after knowing the shocks. Because we are interested on the effects that policy design has 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.

$$z^* = [\theta y_t + \pi_t] = 0 \tag{4}$$

where the parameter θ indicates the relative weight the policy maker attaches to the output gap and the rate of inflation. For $\theta = 0$, 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 rule, that is:

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

or

$$i_t = \frac{1}{\gamma\theta}\left(\pi_t\right) + \frac{1}{\gamma}\left(E_t y_{t+1} + E_t\pi_{t+1} + \eta_t\right) \tag{6}$$

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:

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

$$\pi_t = \frac{\theta}{\theta + \alpha}\left(E_t\pi_{t+1} + \varepsilon_t\right) \tag{8}$$

Equations (7) and (8) show the behavior of output and inflation once the policy rule is imposed. Notice the output response negatively to expected inflation and to supply shocks. Demand shocks are totally offset by policy actions. To solve the model we try implicit solutions of the following kind:

$$y_t = -\phi_1\varepsilon_t \tag{9}$$

$$\pi_t = \phi_2 \varepsilon_t \tag{10}$$

Thus it follows that the solutions implies

$$E_t \pi_{t+1} = 0 \tag{11}$$

$$E_t y_{t+1} = 0 \tag{12}$$

substituting these solutions conditions in (7) and (8) and matching coefficients, we have:

$$y_t = -\frac{1}{\theta + \alpha} \varepsilon_t \tag{13}$$

$$\pi_t = \frac{\theta}{\theta + \alpha} \varepsilon_t \tag{14}$$

It follows that the variances of the policy targets are:

$$Var\left(y_t\right) = \left(\frac{1}{\theta + \alpha}\right)^2 \sigma_\varepsilon^2 \tag{15}$$

$$Var\left(\pi_t\right) = \left(\frac{\theta}{\theta + \alpha}\right)^2 \sigma_\varepsilon^2 \tag{16}$$

These variances depend on the relative weight that the targets have on the policy rule. For a strict inflation targeting regime, 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 (6) and conditions (11) and (12) we have that:

$$i_t = \frac{1 + \alpha\theta}{\gamma\left(\theta + \alpha\right)} \eta_t + \frac{1}{\gamma\left(\theta + \alpha\right)} \varepsilon_t \tag{17}$$

and

$$Var\left(i_t\right) = \left(\frac{1 + \alpha\theta}{\gamma\left(\theta + \alpha\right)}\right)^2 \sigma_\eta^2 + \left(\frac{1}{\gamma\left(\theta + \alpha\right)}\right)^2 \sigma_\varepsilon^2 \tag{18}$$

For a fix inflation targeting, when $\theta = 0$, the policy maker control perfectly the level of inflation, using more aggressively its instrument. This increases output variability, now destabilized by movement of real interest rate motivated by inflation control. The higher the importance given to real output stability is , 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 stabilization only if $\alpha < 1$.

The way this economic policy formulation interact with asset prices can be seen just substituting (13) and (17) in (3), which gives:

$$q_t = E_t q_{t+1} - \varphi_0 \left(\frac{1+\alpha\theta}{\gamma(\theta+\alpha)} \eta_t + \frac{1}{\gamma(\theta+\alpha)} \varepsilon_t \right) - \varphi_1 \left(\frac{1}{\theta+\alpha} \varepsilon_t \right) + \upsilon_t \qquad (19)$$

and, simplifying

$$q_t = E_t q_{t+1} - \varphi_0 \frac{1+\alpha\theta}{\gamma(\theta+\alpha)} \eta_t - \frac{\varphi_0 + \gamma\varphi_1}{\gamma(\theta+\alpha)} \varepsilon_t + \upsilon_t \qquad (20)$$

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.

$$Var(q_t) = Var(E_t q_{t+1}) + \left(\varphi_0 \frac{1+\alpha\theta}{\gamma(\theta+\alpha)} \right)^2 \sigma_\eta^2 + \left(\frac{\varphi_0 + \gamma\varphi_1}{\gamma(\theta+\alpha)} \right)^2 \sigma_\varepsilon^2 + \sigma_\upsilon^2 \qquad (21)$$

From (21) 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. Being asset prices a reflection of expectations about future movement of real variables, their variability is maximised as well[2].

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 make 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.

3. Asset Price Dynamics and Monetary Policy in a Calibrated Model

The previous analysis only illustrate 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 Furher (2000).

Aggregate Demand

$$y_t = \lambda_1 (y_{t-1}) + (1 - \lambda_1) E_t y_{t+1} - \gamma (i_t - E_t \pi_{t+1}) + \delta q_t + \epsilon_t \tag{22}$$

Aggregate Supply

$$\pi_t = \lambda_2 (\pi_{t-1}) + (1 - \lambda_2) E_t \pi_{t+1} + \alpha y_t + u_t \tag{23}$$

Asset Prices

$$q_t = E_t q_{t+1} - \varphi_0 (i_t - E_t \pi_{t+1}) + \varphi_1 y_t + \upsilon_t \tag{24}$$

Interest Rate Reaction Function

$$i_t = \mu\left(i_{t-1}\right) + (1-\mu)\left[\phi_\pi\left(\pi_t - \pi^*\right) + \phi_y\left(y_t\right) + \phi_q\left(q_t\right)\right] \tag{25}$$

The aggregate output is determined in the short run by demand and is forward looking, but with considerable inertia (λ). The model is extendended introducing asset prices (q_t) in the aggregate demand equation, as in Leitemo and Sodestrom (2001). The monetary policy reaction function is of the Taylor type with a possible focus in 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 South African data. Table 1 displays numerical values of the baseline calibration.

Table 1 : Baseline Calibration	
$\gamma = 0.5$	$\varphi_0 = 0.3$
$\alpha = 0.4$	$\varphi_1 = 0.3$
$\delta = 0.1$	$\mu = 0.1$
$\lambda_1 = 0.8$	$\phi_\pi = 0.5$
$\lambda_2 = 0.8$	$\phi_y = 1.5$

Table (2) and (3) show the empirical properties of the calibrated relative to basic characteristics of South African quarterly data for the period 1999-2006. We choose this period of reference because it (loosely) correspond to the move towards inflation targeting and it is free from the stabilization 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. It is also noticeable two characteristics of the parametrization: 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^3.

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 noticeble that the actual standard deviation of interest rate is lower than the one implied by a typical Taylor rule parametrization, i.e $\phi_y = 1.5$, although not extremely so. In general the standard deviation produced by the model closely follow 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 assets in the model are a proxy for a wide range of different assets, from housing to real exchange rate to share, of which the last is probably the most volatile. Correlation coefficients between the variables of interests are more difficult to calibrate: the model generate the direction of the correlation that can be found in the data, except that for the inflation/output correlation, which in the data is totally absent (as also noted in Du Plessis, 2005).

Table 2 : 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 further the relationship between monetary policy and asset price dynamics. We will analyse two kind of shocks, productivity and expectation shocks, under different monetary policy rules which will igive of more weight to the different objectives of controlling inflation, output and asset prices.

3.1. Productivity Shocks - A Case of for No-Intervention

The first experiment is to analyse the response to a productivity shock under three alternative monetary policy setting. 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 (25). In the second scenario, the Bank puts more weight on controlling output (real income targeting - RIT), which result in a coefficient $\phi_y = 0.5$. in the third one (TR+A) the Bank targets directly asset prices and in the monetary policy reaction function, $\phi_q = 0.5$. Table (3) illustrates the response of the model

Table 3 : - Productivity Shock - $\lambda = 0.8$			
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	**0.0016**	**0.003**	**0.028**

The performance of the model show a significantly higher volatility of all the variable concerned. This is reflected in the loss function analysis, where the loss function is

$$L_t = \sum_{\tau=0}^{20} 0.99^{\tau} \left\{ \pi_{t+\tau}^2 + y_{t+i}^2 \right\} \tag{26}$$

Clearly modified taylor rules do not produce any gain in any dimension of the problem. What is noticeable is that most of the inefficiency of targeting assets in this model comes from the strong backward dynamic of the model itself. If we consider a pure forward looking version of the model (with $\lambda = 0$), the theoretical understanding develop in the previous part comes to the fore.

Table 4 : - Productivity Shock - $\lambda = 0$			
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	**0.0012**	**0.0019**	**0.0037**

[Fig 1 here]

In Table (4), asset targeting and income targeting are de-facto substitute. 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 often the case, this redirection does not seem desirable.

3.2. Anticipated versus Mistaken Productivity Shocks

In the context of the model and the shock here analysed, the problem of controlling asset prices is a second order problem. Targeting directly asset prices is not justified if asset prices movement reflects underlying shocks (Bernanke and Getler 2000). On the other hand asset prices have the characteristics to "anticipate" future shocks. Expectations of future productivity growth will have real effect on the economy through asset prices evaluation. This "expectational" shock will have policy consequences independently of the future realization of the predicted shock. It is arguable that these expectational shock 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 operates in confronting expectational shock. We will analyse two kind of shocks - an anticipated productivity shock which will be realized 4 periods ahead and an anticipated productivity shock that fails to materialised[4]

Table 5 : Productivity Shock - Losses - $\lambda = 0.8$

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

Table 6 : Productivity Shock - Losses $\lambda = 0$

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

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

4. 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 prices dynamics. Introducing fiscal policy in this set up is not a straithforward process. The reason is that there is not a consensus on the way fiscal policy should be treated. On 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 sometimes in the future. On the other hand fiscal policy is considered so central in economic policy making (at least for its destabilizing properties) that a series of strict rules have been imposed across the world to limit its use. Recently stream of research (Woodford 1995,1996 Sims, 1993,1995, and Bergin, 1997a, 1997b), building on previous works of Calvo (1990) and Leeper (1991) among others, has renovated the interest in the analysis fiscal policy and its interrelation with monetary policy.

The main innovation introduced by these contributions is that the interrelation between fiscal policy on one side, and monetary policy and the private sector on the other, manifests itself though 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. 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 is evolved around the possibility that the government carries out policies which do not guarantee solvency of the public sector. As argued by Buiter (2000) "to present the world with a theory purporting that a government can fix arbitrary real revenue, spending and money issuance programmes, and that the general price level will somehow adjust to make this programme consistent with the contractual obligations represented by the outstanding stock of public debt, is not conductive to good policy design". Arguibly 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 an increasing pressure for national government to achieve balance budget, defined in term of secondary budget. Balance budget rules in the US were introduced which 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 fix 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 control only some of the variables affecting its budget. To see the effect of uncertainty on budget component, consider a more complete expression of government balance as:

$$B_t + \tau P_t Y_t = P_t G_t + (1 + i_{t-1}) B_{t-1} - (M_t - M_{t-1}) \tag{27}$$

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

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

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.

$$\tau = \frac{G_t}{Y_t} + (i_{t-1}) \frac{B_{t-1}}{P_t Y_t} \tag{28}$$

This formulation certainly respect the intertemporal budget constraint of the government and it is certainly a Ricardian fiscal policy in the Woodford sense. The only issue is that relation (28) does not represents the way policies are conducted. The requirement of a balance budget ask to 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:

$$\tau_t = E_{t-1} \left[\frac{G_t}{Y_t} + (i_{t-1}) \frac{B_{t-1}}{P_t Y_t} \right] \tag{29}$$

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

This problem is solved with the following tax rate[5]:

$$\tau_t = \left[\frac{\overline{G}}{\overline{Y}} + (r_{t-1}) \frac{b_{t-1}}{\overline{Y}} \right] - \left[\frac{\overline{G}}{\overline{Y}^2} \right] \sigma_{GY} + \left[\frac{\overline{G}}{\overline{Y}^3} + (r_{t-1}) \frac{b_{t-1}}{\overline{Y}^3} \right] \sigma_Y^2 \tag{30}$$

which can be simplified as

$$\tau_t = \left[\frac{\overline{G}}{\overline{Y}} + (r_{t-1}) \frac{b_{t-1}}{\overline{Y}} \right] + \Omega \tag{31}$$

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

$$E_{t-1}B_t = E_{t-1}\left[\left(\frac{\overline{G}}{\overline{Y}} + (r_{t-1})\frac{b_{t-1}}{\overline{Y}} + \Omega\right)P_tY_t - P_tG_t - (1+i_{t-1})B_{t-1}\right] \quad (32)$$

$$E_{t-1}B_t = E_{t-1}\left[B_{t-1} - \Omega E_{t-1}(P_tY_t)\right] \quad (33)$$

or

$$E_{t-1}\left(\frac{B_t}{P_t}\right) = \pi^{-1}\frac{B_{t-1}}{P_{t-1}} - \Omega E_{t-1}(Y_t) \quad (34)$$

The main characteristics of fiscal rule (34) is that it requires the governments to fix taxation "ex ante" so that the probability of the budget "ex-post" to be out of balance is minimized. 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 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 (34) can be expected to produce the following aggregate effects on the economy

- Downward pressure on prices (reduction of wealth reduces consumption)

- From equation (7), output is boosted because of the parallel reduction in real interest rate
- Asset prices boom if the downward pressure in 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 stabilization on the model dynamic. We than analyse the Fiscal-Monetary policy mix that minimize losses defined in term of variance of inflation and output.

5. 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 section (2) 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:

$$\pi_t = \beta E_t \pi_{t+1} + \kappa y_t + u_t \tag{35}$$

$$m_t = \chi \left[\sigma^{-1} y_t - \left(\beta/(1-\beta)\right) i_t\right] \tag{36}$$

$$y_t = E_t y_{t+1} - \sigma \left(i_t - E_t \pi_{t+1}\right) + \theta_1 d_t + \theta_2 q_t \tag{37}$$

$$i = \phi_1 y_t + \phi_2 \pi_t + \phi_3 q_t \tag{38}$$

$$q_t = E_t q_{t+1} - \varphi_0 \left(i_t - E_t \pi_{t+1}\right) + \varphi_1 y_t + \upsilon_t \tag{39}$$

$$d_{t+1} = i + (1/\beta)\left(d_t - \pi_t\right) + \gamma \left(m_{t-1} - m_t - \pi_t\right) \tag{40}$$

Equations (35) and (37) are the forward looking AS/IS part of the system. d_t is the budget deficit and equation (40) is the dynamic busget constraint of the government, while equation (36) is the money demand equation. The calibration of the model follows Woodford 1999 and it is as shown below

.

$\beta = 0.95$	Discount Rate (from Woodford 1999)
$\alpha = 0.3$	Woodford 1999
$\chi = 1$	Woodford 1999
$\sigma = 1$	Woodford 1999
$\theta_1 = 0.1$	Leitemo and Soderstrom (2001)
$\theta_2 = 0.1$	Hughes Hallet and Viegi (2003)
$\varphi_0 = 0.5$	Leitemo and Soderstrom (2001)
$\varphi_1 = 0.5$	Leitemo and Soderstrom (2001)
$\gamma = 0.1$	Woodford 1999

As shown in Figure (2), simply introducing fiscal policy in the model change significantly the dynamic after a productivity shock. Introducing fiscal policy increases both variability of inflation and asset prices relative to a Taylor Rule specification. In this model in the fiscalist tradition a productivity shock affect the balance sheet of all the economic agents and in particular the government one. 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 increase in asset prices to put the balance sheet trought the economy in equilibrium. This interpetation is confirmed by Fig (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 suggest that asset prices volatility might be directly linked to the fiscal-monetary policy framework choosen and that any deviation from this framework does not seem to improve signifantly economic performances. The next question is: can fiscal policy target asset price directly.

5.1. 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 equation (39), which becomes a subsidy in the case of reduction of asset prices. Formally the two equation in the model now look like:

$$
\begin{aligned}
q_t &= E_t q_{t+1} - \tau \left(q_t - q_{t-1}\right) - \varphi_0 \left(i_t - E_t \pi_{t+1}\right) + \varphi_1 y_t + \upsilon_t && (41) \\
d_{t+1} &= i + (1/\beta) \left(d_t - \pi_t\right) + \gamma \left(m_{t-1} - m_t - \pi_t\right) - \tau \left(q_t - q_{t-1}\right) && (42)
\end{aligned}
$$

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 becomes 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 carefull of possible consequences on budget processes This observation is only preliminary and further analysis is necessary.

[figure 4 here]

6. Conclusions

The previous analysis is mainly a suggestion for future research, which should try to anchor analysis of interralation 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 maker is how to live with asset instability, which is a by product of a correct fiscal and monetary policy mix.

Notes

[1] This formulation is somehow arbitrary, although it follows common specification of assets prices in macro models (see for example Batini and Nelson, 2000, in

which an equation like (3) represents real exchange rates, or Leitemo and Sodestrom 2005).

[2]The point that strict inflation targeting could be destabilizing is not new. Bernake et al (2000) show that a policy with an higher weight on output (what Svensoon called flexible inflation targeting) is welfare improving than both a strict inflation targeting than a rule including asset prices. Our contribution gives some suggestions of why that is the case.

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

[4]I thank Ippei Fujiwara (2006) for providing the Dynare algorithm. See also Beaudry and Portier (2006) for an analysis of expectations shock in business cycle models

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

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

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

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