Monetary Policy in a Small Open Economy with High Unemployment

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Abstract

In this paper we investigate the implications of adopting an inflation-targeting framework when the unemployment rate is high in a small open economy. For this purpose, we formulate a small open-economy macro-model with hysterisis in the labour market. We find that the optimal Taylor rule is robust to real exchange rate, aggregate demand and productivity shocks. However, in the context where the unemployment rate is high, the robustness to demand shocks is equivalent to trapping the economy at a high unemployment rate equilibrium. We then formulate alternative simple rules that retain the desirable properties of the optimal Taylor rule, but increase the power of demand-management policies to affect the unemployment rate. Contrary to many authors, we find that such rules call for an independent response of the central bank to real exchange rate fluctuations, and are significantly superior to the optimal Taylor rule.

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1. Introduction

A number of developing countries and emerging markets have now adopted inflation targeting as a framework for monetary policy. Yet some of these countries have high structural unemployment rates. One question that has not been addressed in the monetary policy literature is the implications of inflation-targeting in the context where the unemployment rate is in the double-digit range[1]. The consensus view in macroeconomics within which many inflation-targeting central banks operate, summarized by Taylor (1997) and emphasized by Svensson (2003), says monetary policy cannot have long run effects on the growth rate of output and the rate of employment. In this view, the growth rate of output in the long run is determined by the growth rate of labour productivity and the labour force. The seminal models such as the ones in Svensson (1997, 1999), Ball (1999) and Clarida, Gali and Gertler (1999) among others, fall within this view.

There has however been a growing literature that discusses the forces behind the movement of the long run unemployment rate. One interesting finding from this

[1] Discusssions about the desirability of inflation targeting hardly mention the labour market conditions of developing countries and emerging markets. For example the extensive discussion in Agenor (2000), the presentation by Taylor (2000) and the recent IMF survey by Batini et.al. (2006) do not address this question.

literature, for example in Gordon (1997) and in Ball and Mankiw (2002), is that the long run unemployment rate can fluctuate at a comparable frequency to the actual rate of unemployment. According to Gordon (1997), "when applied to Europe or to the United States in the Great Depression, however, fluctuations in the NAIRU seem too large to be plausible and seem mainly to mimic movements in the actual unemployment rate". This opens the possibility that demand shocks, and hence monetary policy, may be affecting the natural rate to a larger extent than the consensus view suggests.

The observation by Gordon (1997) appears to give support to Tobin's (1980) view that "short run demand management affects long-run supply" and that "it is possible that there is no natural rate, except one that floats with actual history". The latter point was later taken up by Buiter and Miller (1983) in their analysis of anti-inflationary policies, and further developed in Blanchard and Summers (1986) in their analysis of European unemployment. Ball (1999) provides further evidence of the long run effects of aggregate demand, and hence monetary policy, on employment by generating hysterisis in the labour market. The notion of labour market hysterisis was also used by Mankiw (2001) to describe movements in the long run unemployment rate and alluded to by Blanchard (2003) as a strong candidate explanation behind the long run non-neutrality of monetary policy[2].

According to Blanchard (2003) monetary policy can have long run real effects because the potential output of an economy depends on the economy's level of fixed capital. Since the rate of fixed capital accumulation depends, among other factors, on the real interest rate, a monetary policy that maintains a persistently high real interest rate will lower the rate of fixed capital accumulation. This would in turn lower the growth rate of potential output. Empirical support for this mechanism is provided by Logeay and Tober (2003) and Semmler and Zhang (2004) in the context of the Euro-Area. The importance of capital accumulation in the evolution of long run unemployment has also been noted by Tobin (1980), and empirically investigated by Bean (1989).

In this paper we consider the dynamic effects of monetary policy on the rate of employment. Specifically we study the implications of inflation-targeting within the context of high structural unemployment in an emerging market. Emerging markets are well known to exhibit unconventional dynamics when subjected to macro-shocks. One prominent shock to which these economies are vulnerable is the exchange rate shock. As noted by Krugman and Taylor (1978), Larrain and Sachs (1986), Kamin and Rogers (1997) and Ahmed et.al. (2001) exchange rate depreciations may have contractionary effects on output. Depreciations may have income distributive effects that adversely affect aggregate demand in these economies. Furthermore, as noted by Krugman (2000) and Acosta, Flaschel and Semmler (2004), emerging markets with dollarized debts may also suffer from adverse balance sheet effects which lower the creditworthiness of firms, and therefore depress investment. These adverse effects are usually accompanied by high inflation rates.

[2] Alternative models that deliver the long-run non-neutrality of monetary policy are provided in Akerlof, Dickens and Perry (1996, 2000), Lundborg and Sacklen (2003), Graham and Snower (2001) and Karanassou, Sala and Snower (2003) among others.

These dynamics are ignored in most macro-models used for monetary policy analysis. For example, in the seminal model of Ball (1999), Batini and Haldane (1999) and comments by Svensson (2003) the real exchange rate is assumed to enter positively in the IS curve. This assumption may be inappropriate when applied to many developing countries and emerging markets. Besides the inflationary implications of exchange rate depreciations, a policy of "benign neglect" of exchange rate fluctuations may be costly (Mishkin, 2000). The real exchange rate plays a prominent role in resource allocation, and has potential to shape the economic structure in these economies. Allowing it to fluctuate without some explicit policy smoothing may lead to poor outcomes. A simple Taylor rule, whilst implicitly reacting to real exchange rate depreciation (Taylor, 2001), may not be sufficient to deliver desirable outcomes in these economies.

In this paper, we formulate a macro-model to analyze the dynamics of employment and monetary policy within the context of a small open economy. Our reference economy is South Africa. South Africa's Labour Force Survey (September, 2005) reports that the unemployment rate is 26.7%. When discouraged work-seekers are included the figure rises above 40%. In this context the central bank adopted an inflation targeting framework in 2000. Like many countries that adopted this framework, South Africa's inflation rate has been falling way before the adoption of inflation targeting (Levine, Natalucci and Piger, 2004). From a time series perspective the adoption of inflation targeting may be justified on the basis that this framework best anchors inflation expectations and also locks-in the disinflationary gains that have been achieved over the years. However in the light of Tobin's (1980) comments, Blanchard and Summers (1986) and Mankiw (2001) this policy framework may be equivalent to anchoring the economy around a high unemployment rate trap.

In so far as employment is the central focus, our model is similar to the one in Estrella and Mishkin (1999), later used by Portugal, Madallozzo, and Hillbrecht (1999). But it differs with their model in substantial ways. The model we present in this paper explicitly considers the role of the real exchange rate in driving inflation and employment. Unlike conventional policy analysis models, we do not approach the data with a prior that real exchange rate depreciation has expansionary effects on employment.

Following the literature on labour market hysterisis, we allow the capacity rate of employment to move adaptively following the actual rate of employment[3]. We use this model to explore macroeconomic adjustment in response to shocks, under alternative policy frameworks. We also investigate simple policy rules that can lift the economy's capacity rate of employment, whilst at the same time making economy to be robust against adverse real exchange rate shocks.

The paper is structured as follows: section 2 presents a structural macroeconomic model and derives various policy rules given different policy goals of the central bank,

[3] We should point out that this is not the only way in which hysterisis can arise. Semmler, Greiner and Zhang (2005, Chapter 7) show that non-quadratic preferences of the central bank may generate multiple equilibria, and hence hysterisis.

section 3 presents estimations of the structural model, section 4 investigates the stability properties of the optimal and simple rules and also explores rules that are capable of lifting the capacity rate of employment, and section 5 is the conclusion.

2. A monetary model with endogenous capacity rate of employment

In this section we formulate a macro-model with endogenous capacity rate of employment. This capacity rate of employment varies over time by following the actual rate of unemployment in an adaptive fashion. The speed with which capacity adapts to actual developments is slow relative to actual developments. Such a specification can be found in Buiter and Miller (1983), and is reminiscent of the comments by Tobin (1980). This in essence is hysterisis in the labour market. By affecting the actual employment rate, monetary policy in this context has an effect on the long run employment rate.

The model is given by equations (1)-(7). All variables, other than inflation rates and interest rates, are to be interepreted as natural logs. Eqs (1) and (2) represent the wage-price spiral of the economy. In (1) price inflation is determined by a weighted average of the productivity-adjusted nominal wage inflation and past inflation. The first term captures cost-push pressures from the labour market, and the second term represents backward-looking expectations of the inflation rate. The last term captures the effect of import prices on domestic inflation, through the rate of real exchange rate depreciation. This term can be justified by referring to imported inputs, or the relative attractiveness to producers of foreign markets relative to domestic markets. The reduced supply to domestic markets creates a domestic supply shortage in the goods market, which translates into an increase in price inflation.

$$\pi_t = \alpha(\pi_t^w - \chi_t) + (1-\alpha)\pi_{t-1} + \delta\Delta q_{t-1} \quad (1)$$

$$\pi_t^w = \phi\pi_{t-1} + \beta_w(e_{t-1} - e_{t-1}^*) + \beta_\chi \chi_t + \pi_0^w \quad (2)$$

$$e_t = e_t^* + \gamma(e_{t-1} - e_{t-1}^*) - \varphi(r_{t-1} - \pi_{t-1} - \tilde{r}^f) + \theta\Delta q_{t-1} \quad (3)$$

$$e_t^* = e_{t-1}^* + \beta_{e^*}(e_{t-1} - e_{t-1}^*) \quad (4)$$

$$q_t = q_{t-1} - \omega(r_t - \pi_t - \tilde{r}^f) + \sigma_t \quad (5)$$

$$\chi_t = \chi_0 + \vartheta_\chi \chi_{t-1} \quad (6)$$

$$\sigma_t = \vartheta_\sigma \sigma_{t-1} \quad (7)$$

Eq. (2) determines nominal wage inflation. Workers in the first instance look at past price inflation in setting nominal wage demands. Secondly their wage demands are conditioned by the state of the business cycle, which is captured by the deviation of the actual employment rate e_t from the capacity rate e_t^*. A slack in the goods market shows itself as under-utilization of existing capacity, and firms lay off workers. Thus the bargaining position of workers deteriorates. The third term captures labour productivity growth, which workers seek to appropriate in their wage demands. The last term π_0^w is the target nominal wage inflation set by workers, and reflects the bargaining strength of workers in the labour market.

Eq. (3) is the open-economy version of the IS curve in the model by Estrella and Mishkin (1999). The gap between the actual rate of employment and the capacity rate is determined demand factors. The lagged employment gap term captures sluggish adjustment of employment, which may be rationalised by invoking labour market frictions such as hiring and firing costs. The second term captures the real interest rate effect on aggregate demand. Specifically, the increase in the real interest rate differential lowers aggregate demand and hence the rate of employment. The variable $\tilde{r}^f$ denotes the foreign real interest rate augmented by the deterministic component of the risk premium. The last term is the exchange rate effect, which can either have a positive or negative impact on the employment rate as discussed above.

Eq. (4) determines the capacity rate of employment as in Buiter and Miller (1983), and Mankiw (2001). The capacity rate of employment e_t^*, is assumed to move adaptively in response to the actual rate at a speed β_{e^*}. The rationale for this behaviour is that, since the employment rate depends on the state of aggregate demand, a persistent drop in demand will discourage firms from adding on to productive capacity. Sooner or later they would engage in capacity scrapping and thus reduce their capacity rate of employment (Bean, 1994).The capacity rate is assumed to move at a relatively slow speed compared to the actual rate. However as Ball and Mankiw (2002) and Gordon (1997) note, it is possible for the capacity rate to exhibit substantial high-frequency variation.

Eq. (5) is the real exchange rate equation similar to the one in Ball (1999). The real exchange rate appreciates with an increase in the real interest rate differential. The term σ_t captures factors such as investor confidence and expectations about the exchange rate depreciation. At the steady state of the model we therefore have σ_t=0. Eqs (8) and (9) determine the growth rate of productivity and the evolution of the exogenous factors that affect the real exchange rate.

We derive the reduced form expression for the price inflation rate by eliminating the productivity adjusted wage-inflation rate to obtain:

$$\pi_t = \psi\pi_{t-1} + \alpha\beta_w\left(e_{t-1} - e_{t-1}^*\right) + \delta\Delta q_{t-1} + \alpha\left[\pi_0^w + \left(\beta_\chi - 1\right)\chi_t\right] \tag{8}$$

Where $\psi = \left[1 - \alpha(1-\phi)\right] > 0$. Thus as long as $\left(\beta_\chi - 1\right) < 0$, productivity shocks will reduce the inflation rate, and the impact of demand pressures on the inflation rate is now dependant on the flexibility of the nominal wage β_w over the business cycle. That nominal wage flexibility is destabilizing in this model can be seen by following the transmission and propagation of a demand shock. A demand shock will create a positive employment rate gap. With high nominal wage flexibility, the price inflation rate rises by a relatively large amount. This depresses the real interest rate and leads to further employment expansion. However this instability may be contained if the upward pressure on the real exchange rate has a sufficiently strong and negative impact on the employment rate. Such instability may nevertheless require appropriate monetary policies to contain. In many developing countries, high inflation rates co-exist with high unemployment rates. An institutionally determined nominal wage rigidity may therefore be advisable if these high unemployment rates are to be overcome.

5. Monetary policy rules

5.1 Optimal Policy Rules

In this section we explore monetary policy rules when the central bank has different target variables, based on the economic structure we have specified above. We start with the situation where the central bank has a mandate to stabilize the inflation rate around its target π^*, to ensure that the employment rate is close to capacity, and to smooth exchange rate fluctuations as suggested in Mishkin (2001). With quadratic preferences, the central bank posesses a loss function of the following form:

$$L_t = \frac{\lambda_\pi}{2}\left(\pi_t - \pi^*\right)^2 + \frac{\lambda_e}{2}(e_t - e_t^*)^2 + \frac{\lambda}{2}\left(\Delta q_t\right)^2 \tag{9}$$

Where $0 \geq \lambda_j \leq 1$ is the relative weight placed on target variable *j* in the central bank's loss function. Therefore we have $\sum \lambda_j = 1$. We notice from the structure of the model that the central bank can only affect the employment gap and the inflation rate with a one-period lag, whilst the real exchange rate is affected contemporaneously. We have to also emphasize that the central bank's mandate as it relates to employment, is to stabilise the actual employment rate around the capacity rate. The capacity employment rate itself is not the target variable. For simplicity we assume that labour productivity grows at a constant rate, and so we drop the associated time index. Letting $(1-\psi)\pi^* = \alpha\left[\pi_0^w + \left(\beta_\chi - 1\right)\chi\right]$, where π^* is the inflation target and $\tilde{e}_t = \left(e_t - e_t^*\right)$ we obtain the following equations:

$$\pi_{t+1} - \pi^* = \psi\left(\pi_t - \pi^*\right) + \alpha\beta_w\tilde{e}_t - \delta\omega\left(r_t - \pi_t - \tilde{r}\right) + \delta\sigma_t \tag{10a}$$

$$\tilde{e}_{t+1} = \gamma\tilde{e}_t - \left(\varphi + \theta\omega\right)\left(r_t - \pi_t - \tilde{r}\right) + \theta\sigma_t \tag{10b}$$

As in Clarida, Gali and Gertler (1999), the central bank's problem is a discretionary one in the sense that the policy instrument affects inflation and the employment gap one-period ahead, but cannot have effect thereafter unless the central bank re-sets the instrument in the following period. The optimal policy rules of the central bank is therefore given by:

$$r_t = \pi_t + \tilde{r}^f + \frac{\rho\lambda_\pi\delta}{\lambda_q\omega}\left(\pi_{t+1} - \pi^*\right) + \frac{\rho\lambda_e\left(\varphi + \theta\omega\right)}{\lambda_q\omega^2}\tilde{e}_{t+1} + \frac{1}{\omega}\sigma_t \tag{11}$$

All else at the steady state, when the inflation rate is projected to be above target next period, the central bank must raise the nominal interest rate. The implications of this policy is that the projected employment rate will fall and the real exchange rate will appreciate. However from (4) this implies that the capacity rate of employment two periods ahead will decline. The implication of this behaviour for the economy is that if shocks to the inflation rate are persistent, monetary policy would be such that the employment rate is persistently below capacity and by the time the inflation shock has died out, the capacity rate of employment would have shifted downwards. The opposite is of course the case if negative shocks (such as productivity shocks) hit the inflation rate.

Many emerging markets are subject to large real exchange rate shocks. These shocks are usually persistent because investors may take time to change perceptions about the riskiness of the economy. The persistence of the risk premia for emerging markets in turn induce persistence in the real interest rate both from the standpoint of fighting persistent inflation and from the standpoint of stabilizing the real exchange rate. The interaction between real exchange rate shocks, specifically shocks to the risk premia, and interest rate setting by the central bank may thus lead to persistent unemployment in many emerging markets. Rule (11) also captures the empirical findings by Mohanty and Klau (2004) that most emerging market central banks react strongly to exchange rate movements. With $\omega < 1$, rule (11) implies that the nominal interest rate must move more than proportionately to real exchange rate shocks.

We may express the optimal interest rate rule as a Taylor-type rule following Estrella and Mishkin (1999). From (10a) and (10b) we have the following open-economy interest rate policy:

$$r_t = \pi_t + \tilde{r}^f + \left[\frac{\rho\lambda_\pi\delta\omega\psi}{\Omega}\right](\pi_t - \pi^*) + \frac{\Theta}{\Omega}\tilde{e}_t + \frac{\Phi}{\Omega}\sigma_t \tag{12}$$

Where:

$$\Omega = \rho\lambda_\pi\delta^2\omega^2 + \rho\lambda_e(\varphi + \theta\omega)^2 + \lambda_q\omega^2, \Theta = \rho\lambda_e(\varphi + \theta\omega)\gamma + \alpha\beta_w\rho\lambda_\pi\delta\omega$$
$$\Phi = \theta\rho\lambda_e(\varphi + \theta\omega) + \lambda_q\omega + \rho\lambda_\pi\delta^2\omega$$

It should be noted immediately from (12) that in the context of an endogenous capacity rate of employment, a demand stimulus may be severely crippled by monetary policy if $\frac{\Theta}{\Omega}$ is very large. As soon as the demand shock occurs, the interest rate rises by a relatively large amount and if $(\varphi + \theta\omega)$ is also sufficiently large then the demand shock will be quickly reversed over time. Similarly monetary policy may induce high unemployment in response to positive inflation shocks.

Notice that an institutional arrangement that ensures nominal wage rigidity, i.e. $\beta_w = 0$, reduces the interest rate response to the employment rate gap and accordingly allows for some degree of demand accomodation. In fact, it would be optimal to accommodate demand shocks if $\theta < 0$. But the danger with such a policy is that it may lead to inflationary pressures from the real exchange rate channel. Large economies may have the capacity to withstand real exchange rate depreciations without significant inflationary pressures as they are not importing productive inputs. Small open economies on the other hand, run the risk of inducing large exchange rate depreciations which may in turn reverse the employment gains initially garnered via demand expansions, and may also induce high inflationary situations.

A strict inflation targeting framework sets $\lambda_e = \lambda_q = 0$ and the resultant policy rule reads as follows:

$$r_t = \pi_t + \tilde{r}^f + \frac{\psi}{\delta\omega}\left(\pi_t - \pi^*\right) + \frac{\alpha\beta_w}{\delta\omega}\tilde{e}_t + \frac{1}{\omega}\sigma_t \tag{13}$$

Strict inflation targeting brings out clearly the relationship between nominal wage flexibility, monetary policy and unemployment. If β_w is large, monetary policy will be very responsive to demand shocks, which implies that the economy may be trapped at a low level of e_t^*. On the other hand, with an institutional arrangement so that $\beta_w = 0$, the interest rate responds to the inflation gap alone since demand shocks are not transmitted to the inflation rate. Furthermore, high flexibility of the exchange rate serves to reduce the response of the interest rate to demand shocks, exchange rate shocks and inflation shocks because small changes in the interest rate would trigger large exchange rate movements that would reverse these shocks.

A framework that does not target the inflation rate, but seeks to keep the employment level as close as possible to the capacity rate and to stabilize the real exchange rate follows the policy rule specified in (14) below.

$$r_t = \pi_t + \tilde{r}^f + \Psi_e\tilde{e}_t + \Psi_\sigma\sigma_t \tag{14}$$

Where:

$$\Psi_e = \frac{\rho\lambda_e(\varphi + \theta\omega)\gamma}{\rho\lambda_e(\varphi + \theta\omega)^2 + \lambda_q\omega^2}, \Psi_\sigma = \frac{\theta\rho\lambda_e(\varphi + \theta\omega) + \lambda_q\omega}{\rho\lambda_e(\varphi + \theta\omega)^2 + \lambda_q\omega^2}$$

We also mention here that some authors argue that the central bank should target the exchange rate level. For example, Ball (1999) suggests that in a small open economy it may be optimal for the central bank to respond to the real exchange rate. In the frameworks explored above the central bank responds to exchange rate shocks, and not to the real exchange rate as such. For the central bank to implement such a policy, it has to extract the long run real exchange rate level q^* around which to peg the currency. This has been criticised by Bernanke, Gali, and Gertler (2001) on the basis, among others, that there is considerable uncertainty over the estimation of the true q^*. However this criticism is not convincing for any asset price whatsoever since, as Cecchetti et.al. (2000) note, the same uncertainty surrounds estimations of the NAIRU or output gap.

Let the loss function of a central bank with a real exchange rate level target to be as follows:

$$L_t = \frac{\lambda_\pi}{2}\left(\pi_t - \pi^*\right)^2 + \frac{\lambda_e}{2}(e_t - e_t^*)^2 + \frac{\lambda}{2}\left(q_t - q^*\right)^2$$

The interest rate rule associated with this objective function follows naturally from above:

$$r_t = \pi_t + \tilde{r} + \left[\frac{\rho\lambda_\pi \delta\omega\psi}{\Omega}\right]\left(\pi_t - \pi^*\right) + \frac{\Theta}{\Omega}\tilde{e}_t + \frac{\lambda_q \omega}{\Omega}\left(q_{t-1} - q^*\right) + \frac{\lambda_q \omega}{\Omega}\sigma_t \qquad (15)$$

Where Θ and Ω are the same as above. In this instance not only does the central bank respond to exchange rate shocks, it also responds to the deviation of the real exchange rate from target.

For economies with high structural unemployment, it should be noted that the only feasible way to come out of such a situation without inflationary pressures is if there is some favourable exogenous shock that will be sufficiently sustained, such a permanent reduction in the deterministic component of the risk premium or an upward shift labour productivity in the productivity. A favourable shock to the risk premium lowers $\tilde{r}^f$ and thus opens room for the central bank to cut rates without putting pressure on the real exchange rate. From (8), a permanent favourable shock to labour productivity reduces the inflation rate and thus also opens room for an interest rate cut without inflationary pressures.

6. Estimation of the structural model

The data used in estimating the model has already been explained above. We here explain how we conducted the estimations. The capacity rate of employment was derived using the HP-filter. The law of motion for the capacity rate was estimated by taking the difference between the current employment rate and the four-quarter lag of the capacity rate. The exogenous shocks to the exchange rate were extracted by first estimating the exchange rate equation (5), with the four-quarter moving average of the exchange rate as a proxy of expected depriciation and the remaning shocks representing temporary shocks to the risk premium or investor sentiment. The component based on the real interest rate differential was then extracted. An AR(1) process was fitted on the remaining component of the real exchange rate. The estimated deterministic component of the risk premium is 4-percentage points of the real interest rate. The persistence parameter for the stochastic component σ_t is 0.98.

Table 1 gives estimates of the parameters of the model. The productivity-adjusted nominal wage inflation is here found to be quantitatively important in driving price inflation and appears to slightly dominate the lagged inflation rate. The real exchange rate also plays an important role in determining price inflation although the parameter appears to be relative small.

Table1: Estimated parameters of the structural model

price inflation	λ =0.58(0.11)	employment	γ_1 =0.32(0.13)
	δ =0.09(0.014)		φ =0.25(0.055)
wage inflation	ϕ =0.65(0.07)		θ =-0.03(0.019)
	β_w =0.32(0.10)	Employment growth	μ_1 =1.19(0.08)
	β_χ =0.21(0.10)		μ_0 =-0.01(0.002)
	π_0^w =0.057(0.007)	Exchange rate	ω =0.82(0.08)
risk premium	σ_0 =0.04(0.01)	productivity	λ_χ =0.81(1.10)
	λ_σ =0.98(0.08)		χ_0 =0.008(0.004)
Capacity employment	β_{e^*} =0.026(0.027)		

The nominal wage inflation estimation reveals that the coefficient on the productivity term is significantly less than 1. Therefore in the short run workers do not capture most of the productivity gains. The employment rate gap is found to significantly enter the estimation as well and is also quantitatively important. The target rate of inflation is estimated to be 5.7%.

The employment gap equation was difficult to estimate. Using the employment gap as a dependent variable yielded insignificant results, however the change in the employment rate as a dependant variable yielded significant results. These results however, yielded an unrealistically low persistence parameter of the employment gap, which was 0.16. To remedy this situation we estimated the employment gap equation in two stages. Firstly we estimated the change in the employment rate as a dependent variable, using the following equation:

$$\Delta e_t = \gamma_1 \Delta e_{t-1} + (1-\gamma_1)\tilde{e}_{t-1} - \varphi\left(r_{t-1} - \pi_{t-1} - \tilde{r}^f\right) + \theta \Delta q_{t-1} + a_0 \qquad (16)$$

In the second step, we estimated a relationship that relates the change in the employment rate as a function of the employment gap, i.e. we estimated:

$$\Delta e_t = \mu_0 + \mu_1 (e_t - e_t^*) \qquad (17)$$

Combining these two relationships we obtain the following IS-specification:

$$\tilde{e}_t = \left[\frac{1+\gamma_1(\mu_1 - 1)}{\mu_1}\right]\tilde{e}_{t-1} - \frac{\varphi}{\mu_1}\left(r_{t-1} - \pi_{t-1} - \tilde{r}^f\right) - \frac{\theta}{\mu_1}\Delta q_{t-1} \tag{18}$$

Where we have imposed the condition that $\frac{a_0 + (\gamma - 1)\mu_0}{\mu_1} = 0$, for the employment gap to close at the steady state. In addition, the condition for the stability of this difference equation is that $\frac{1+\gamma_1(\mu_1 - 1)}{\mu_1} < 1$. The results of the first and second stages are shown in table 1, from which we get the following IS relationship:

$$\tilde{e}_t = 0.89\tilde{e}_{t-1} - 0.21\left(r_{t-1} - \pi_{t-1} - \tilde{r}^f\right) - 0.025\Delta q_{t-1} \tag{19}$$

The results suggest a strong correlation between the employment gap and the change in the employment rate. For the sample period, when the employment gap is closed the employment rate continues to fall at a rate of 1%. The results also suggest that the depreciation of the real exchange rate has a negative impact on the employment rate, a results which is in line with studies on Latin American economies for example, Kamin and Rogers (1997) and Ahmed et.al. (2001). Lastly the real exchange rate appears to respond strongly to the interest rate differential, with a parameter of 0.82.

The capacity rate of employment is, as we stated above, assumed to follow the actual employment rate in an adaptive fashion. The capacity rate of employment is derived using the HP-filtered trend. Since the HP-filtered trend changes slowly relative to the actual rate, we found it empirically appropriate to estimate the change in the HP-filtered trend, defined in terms of the quarter-to-quarter change, on the difference between the current employment rate and the capacity rate four quarters earlier. The speed of adjustment of the capacity rate to the actual rate is 0.026.

Given the parameters in Table 1, we derive optimal policy rules. In computing the optimal rules, we used the following parameter configuration.

Table 2a: Parameter configuration for optimal rules

	Rule 12	Rule 13	Rule14	Rule 15	Taylor
λ_π	0.5	0.8	0.0	0.5	0.8
λ_e	0.3	0.2	0.8	0.3	0.2
λ_q	0.2	0.0	0.2	0.2	0.0

For all rules we set $\rho = 0.95$. Table 2b gives computations of the optimal rules:

Table 2b: Optimal Policy Rules

	Rule 12	Rule 13	Rule14	Rule 15	Taylor
$\pi_t - \pi^*$	0.19	10.80	0.0	0.19	4.03
$e_t - e_t^*$	0.37	2.51	0.79	0.37	3.87
σ_t	1.12	0.34	1.03	1.12	0.13
$q_t - q^*$				1.12	

We observe that rule 12, though based on a policy framework that places more weight on the inflation gap, requires the central bank to be quite aggressive in responding to shocks to the exchange rate. Rule (13) is a strict inflation-targeting rule, it requires a very large response of the nominal interest rate to the inflation gap and only mild responses to exchange rate shocks. Rule (14) is not an inflation-targeting rule. Rule (15) is similar to rule (12), the only difference is that rule (15) responds to the deviation of the real exchange rate level from some target value. Lastly we have also computed an optimal inflation targeting Taylor rule, which is a common rule in the literature.

5. Monetary policy and macroeconomic performance

5.1 Evaluation of optimal policy rules

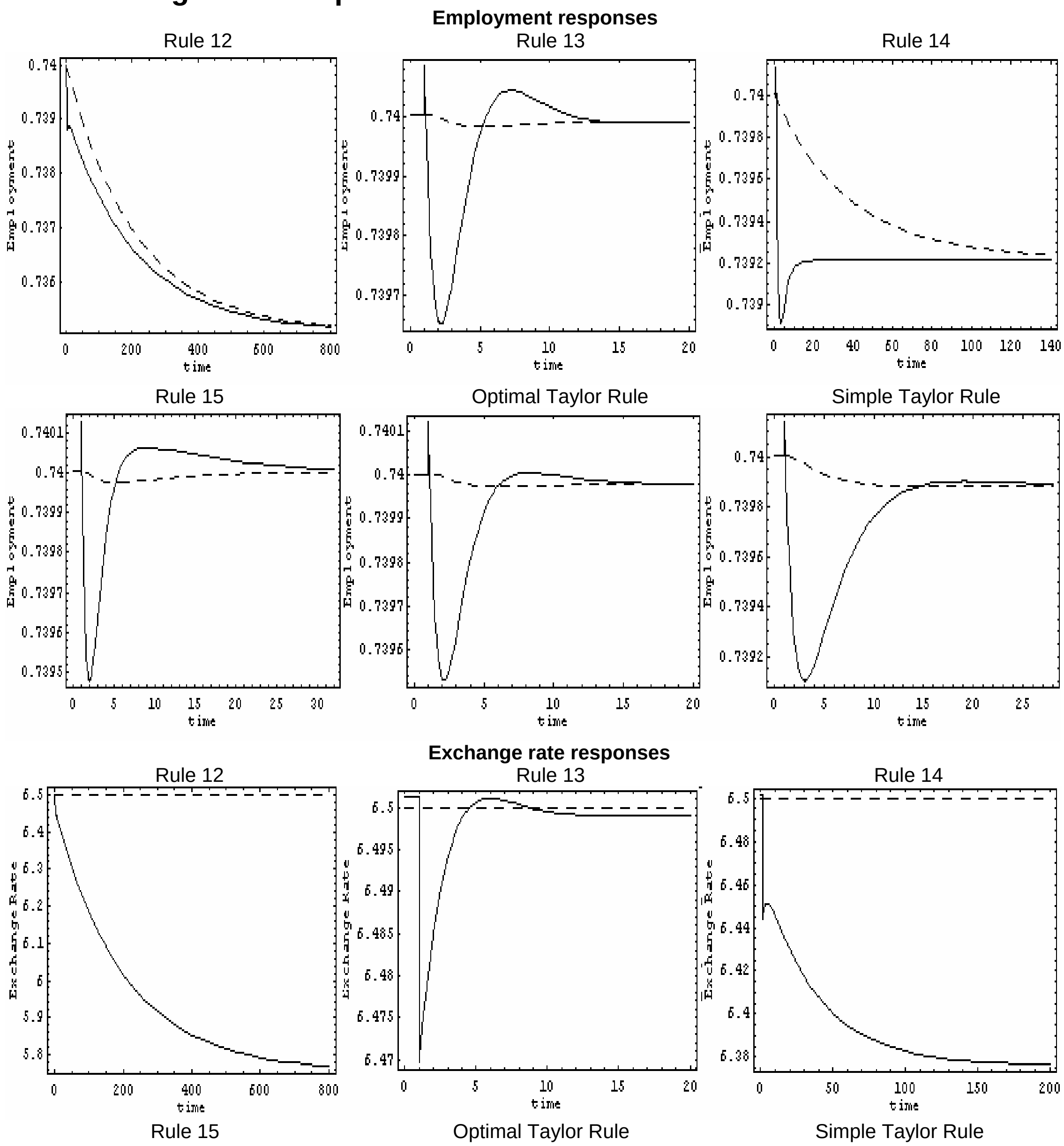
In this section we investigate the role of monetary policy in determining macroeconomic performance in terms of the employment rate, exchange rate stability and the inflation rate. We first illustrate the impact of monetary policy shocks under the optimal rules computed in table 2b. The aim of this exercise is to check whether the responses of macro-variables move in the direction expected from the standpoint of macro-theory. We expect that a contractionary monetary policy shock, i.e. a positive impulsive shock to the nominal interest rate, would immediately generate a contraction in employment and inflation, and an appreciation of the real exchange rate.

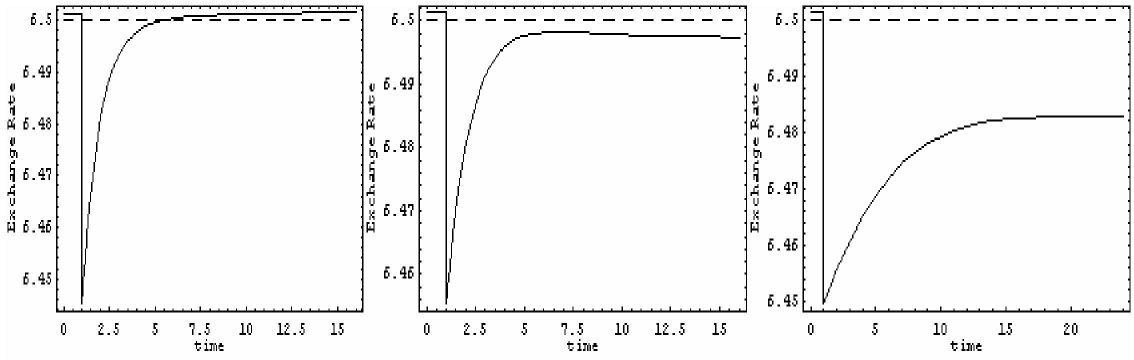
We compare the performance of optimal rules with those of a simple Taylor rule that is characterized by parameters similar to the ones suggested by Taylor (2000):

$$r_t = r^* + 1.5\left(\pi_{t-1} - \pi^*\right) + 0.5\tilde{e}_{t-1} \tag{20}$$

In all the simulations that follow, we have plotted price inflation in solid line and nominal wage inflation in dotted line. In order to facilitate comparison of these two rates, we have scaled down the nominal wage inflation rate by 4.21 percentage points. Figure 1 illustrates the performance of optimal policy rules together with the simple Taylor rule (20) against positive interest rate and exchange rate shocks.

Figure 1: Responses under nominal interest rate shocks





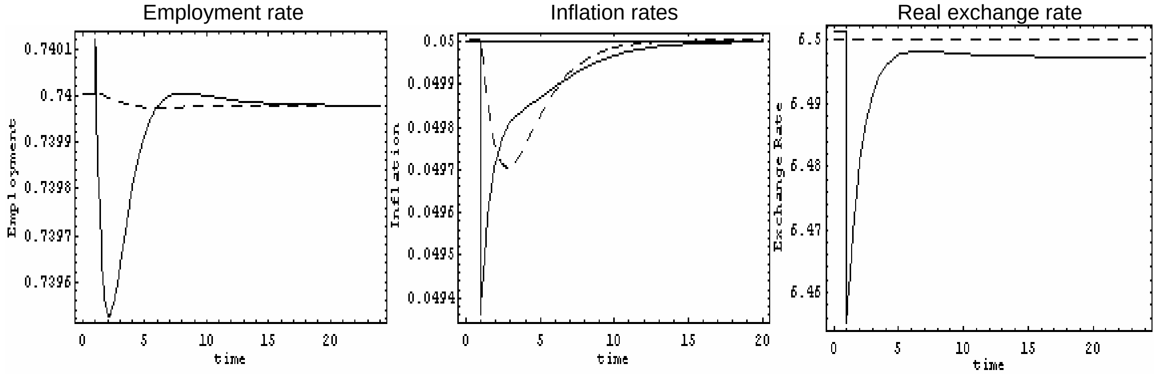
For rule (15), which targets the level of the real exchange rate, we found that the economy returns back to its initial employment rate after a nominal interest rate shock. This contrasts with all the optimal rules illustrated in figure 1. However the downward shift in the capacity rate of employment is very small for the optimal Taylor rule, the rule for strict inflation targeting and the simple Taylor rule. Looking at real exchange rate responses, we observe that the optimal Taylor rule and the strict inflation targeting rule are superior. Since in the literature, for example Svensson (1997) and Ball (1999), strict inflation targeting is usually not preferred, we focus our attention on the optimal Taylor rule, where the central bank places more weight on inflation stabilization and a non-zero weight on employment stabilization. In our case, these weights are $\lambda_\pi = 0$ and $\lambda_e = 0.2$ respectively.

We want to test the robusteness of the optimal Taylor rule to nominal interest rate shocks, demand shocks and real exchange rate shocks. We then compare the performance of this policy rule to the rule that does not target the inflation rate, rule (14). Figure 2 illustrates the results under the optimal Taylor rule. A percentage point shock to the nominal interest rate generates a disinflation accompanied fall in the employment rate. The real exchange rate strengthens as a result of the increase in the nominal interest rate. Nominal interest rate shocks on price inflation disappear after 5 years under this rule, whereas the effect on the employment rate dies after 2 years.

Figure 2: Responses under the optimal Taylor rule

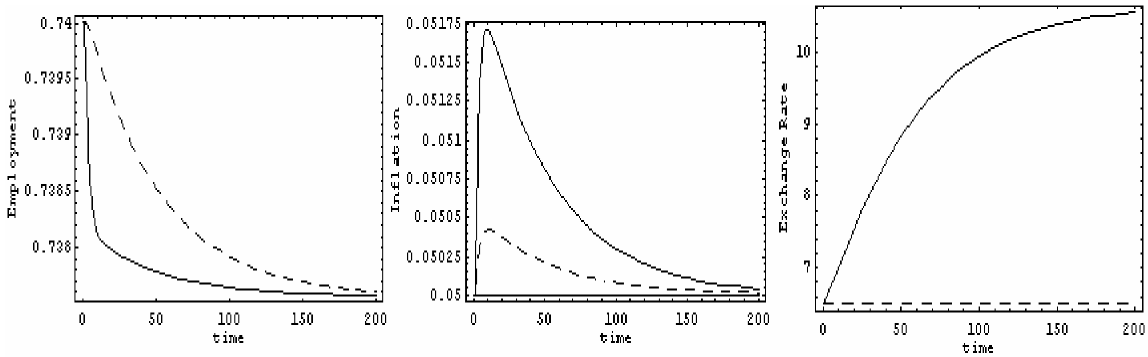
Nominal interest rate shocks

Employment rate | Inflation rates | Real exchange rate



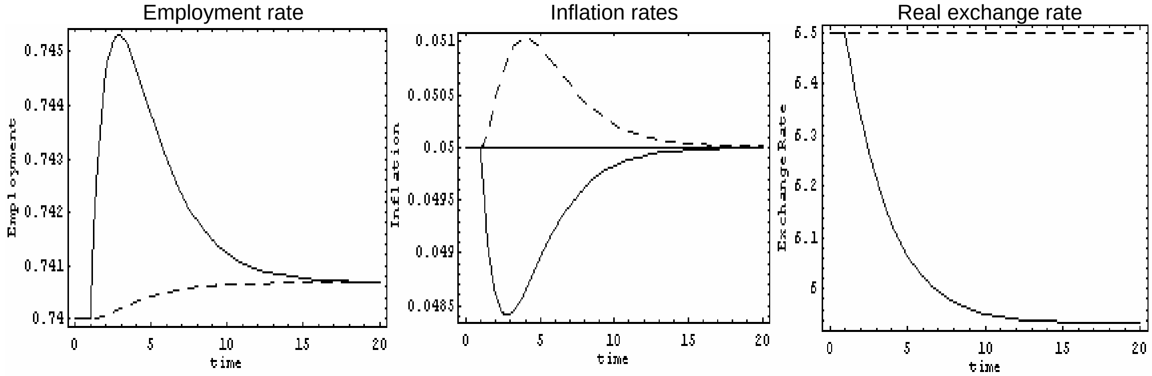
Real exchange rate shocks

Employment rate | Inflation rates | Real exchange rate



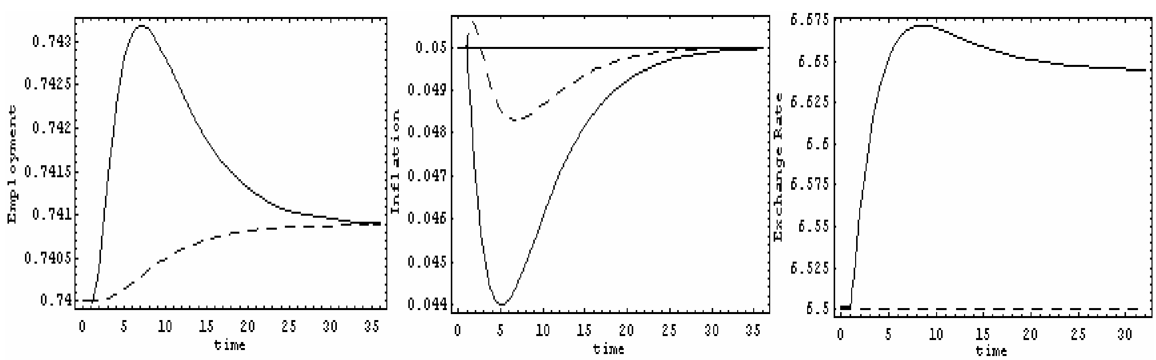
Demand shocks

Employment rate | Inflation rates | Real exchange rate



Productivity shocks

Employment rate | Inflation rates | Real exchange rate



A positive shock to the real exchange rate leads to employment contraction, a depreciation of the real exchange rate from R/$6.5 towards R/$11. The inflation rates exhibit hump-shape behaviour, and the effect of shocks to the inflation rates are persistent. We should mention here that the qualitative dynamics of the economy under real exchange rate shocks under this rule to some extent follows the actual economic history of the South African economy over the sample period. Over this period, the South African economy suffered from persistent real exchange rate depreciation accompanied by the contraction in the employment rate. There was however a disinflation process under way over the decade.

Positive demand shocks are found to lead to employment expansion, but this is less than 0.1%. The inflation rates move in opposite directions initially. The reason is that demand shocks drive the employment gap upwards and therefore put upward pressure on the nominal wage inflation rate. However the nominal interest rate responds aggressively as a result, which then leads to real exchange rate appreciation to just below R/$5, bringing down the price inflation rate. The aggressive response of the nominal interest rate to the inflation and employment gaps is the reason behind the apparent impotence of demand shocks. This is the argument put forward by Ball (1999) in his assessment of employment performance across European countries. Ball found that countries with restrictive monetary policies were the worst performers in terms of employment.

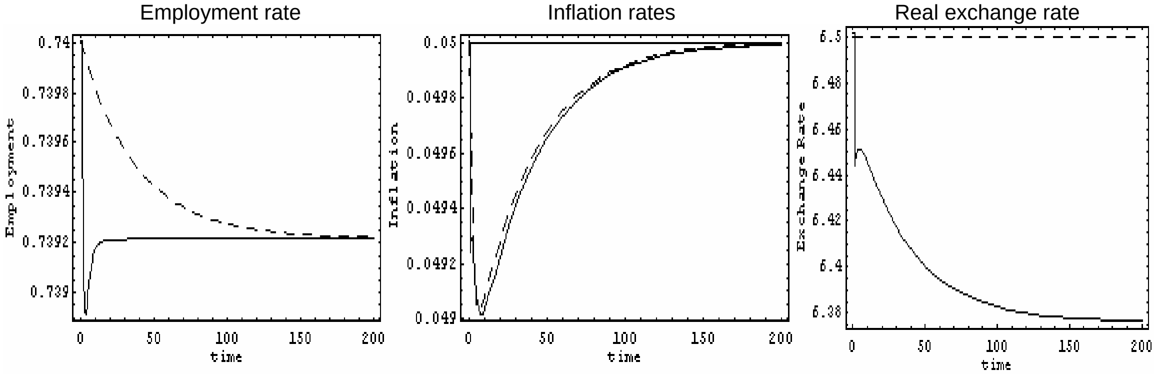
Lastly, productivity shocks have modestly expansionary effects on employment. A 1 percentage shock to labour productivity raises the employment rate from 74% to 74.09%. There is disinflation as a result in both nominal wages and prices. The nominal interest rate falls in the process. The interaction between nominal interest rate and price inflation adjustments generates a fall in the real interest rate. Given the foreign risk-adjusted real interest rate, the real exchange rate depreciates from R/$6.50 to R/$6.65.

We now proceed to evaluate the robustness and performance of the non-inflation targeting policy rule, rule (14). The results under such a rule are illustrated in figure 3. The disinflation due to a positive nominal interest rate shock is persistent compared to the optimal Taylor rule. In fact broadly shocks are more persistent under this rule than under the optimal Taylor rule. Under rule (14) the economy is more vulnerable to real exchange rate shocks. A percentage point shock to the real exchange rate leads to a fall in the unemployment rate from 74% to 71.5%. Notice that in response to a real exchange rate shock, there is disinflation. The reason is that an exchange rate shock leads to a positive response of the nominal interest rate, which affects the employment gap negatively. This in turn leads to nominal wage and price disinflation, which more than counters the inflationary pressures from the real exchange rate.

Figure 3: Responses under the non-inflation targeting rule

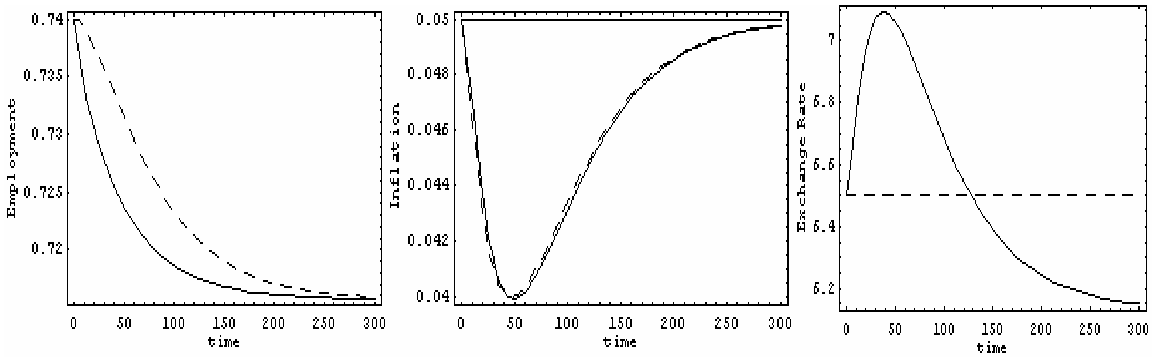
Nominal interest rate shocks

Employment rate | Inflation rates | Real exchange rate



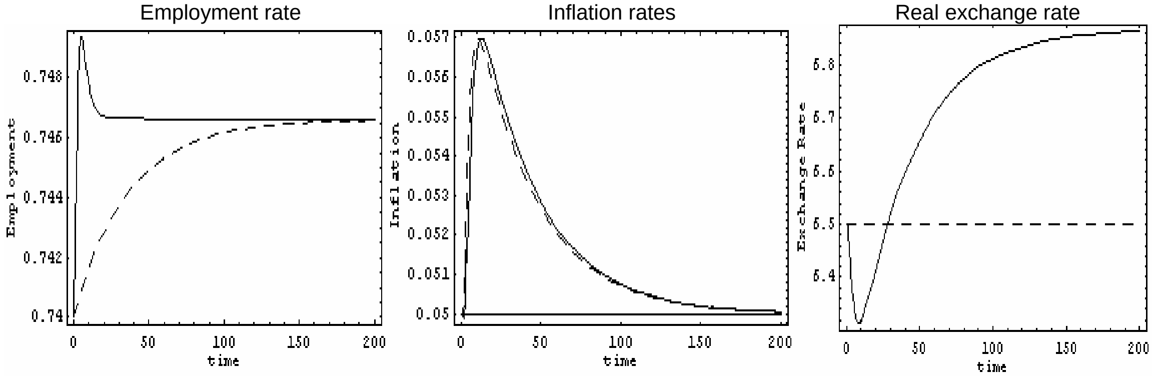
Real exchange rate shocks

Employment rate | Inflation rates | Real exchange rate



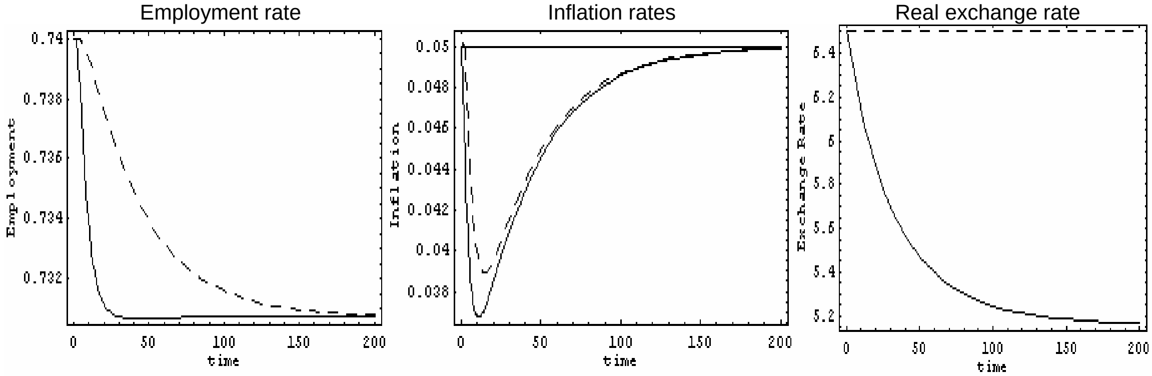
Demand shocks

Employment rate | Inflation rates | Real exchange rate



Productivity shocks

Employment rate | Inflation rates | Real exchange rate



Notice that under demand shocks, the economy operating with rule (14) has employment more responsive than under the optimal Taylor rule. The capacity rate of employment rises by 0.46%. The inflation rate peaks at 5.5%, whilst the real exchange rate depreciates just above R/$6.80. The behaviour of the real exchange rate under rule (14) is more realistic across all shocks, yet for the optimal Taylor rule the real exchange rate rises towards R/$11 in the long run when it is shocked.

Assessment of these rules shows that (a) monetary policy shapes the extent to which aggregate demand interventions are potent in changing the situation in the labour market, (b) policy rules that do not target the inflation rate but place greater weight on the employment gap than on real exchange rate depreciation make the employment rate more vulnerable to real exchange rate shocks. However rules that do not target the inflation rate give greater potency to aggregate demand interventions in affecting the employment rate. In other words, anti-inflationary policies may constrain the economy to a low level employment rate. Using these findings as a benchmark, we in the next section design simple policy rules that are robust to the 3 shocks considered, but which allow for expansionary demand policies to have greater impact on the employment rate.

5.2 Simple policy rules for improved labour market performance

The major problem with the optimal Taylor rule is that it makes demand shocks impotent in stimulating employment. As Clarida, Gali and Gertler (1999) noted, such rules are designed to offset demand shocks. Therefore in the event that the unemployment rate is high, and the central bank uses a Taylor rule as a guide, the central bank would effectively be locking the economy in a high unemployment rate equilibrium as figure 2 illustrates. The advantage of the optimal Taylor rule however, is that it makes the economy robust to real exchange rate and interest rate shocks. Based on our estimations, a 1 percent real appreciation of the exchange rate produces 0.2 percentage point increase in the employment rate in the long run. However an increase in aggregate demand that increases the employment rate by 1 percentage point, increases the capacity rate of employment by 0.05 percentage points.

Simulating all the optimal rules, we find that as long as monetary policy responds either to the inflation gap or the output gap and not to real exchange rate depreciation, demand shocks have little impact on employment. Anti-inflationary policies of this sort thus make the economy resistant to shocks that are to a large extent beyond the control of the central bank (in this instance real exchange rate shocks), but these policies also make the economy resistant to shocks that are to a large extent within the control of domestic authorities (in this instance demand shocks). Our aim is to design simple policy rules that raise the sensitivity of the economy to demand shocks, and thus increasing the power of domestic demand policies to affect employment, whilst at the same time yielding the benefits of the optimal Taylor rule in terms of robustness of the economy to real exchange rate shocks. It turns out that two such rules can be formulated as variants of inflation and non-inflating targeting policy rules. These rules are given by the following equations:

$$r_t = r^* - 1.86\sigma_{t-1} + 2\Delta q_{t-1} \qquad (21)$$

$$r_t = r^* + 0.415\left(\pi_{t-1} - \pi^*\right) + 0.1\tilde{e}_{t-1} + 0.14\Delta q_{t-1} \qquad (22)$$

The simulation results for these two rules are illustrated in figure 4. For each macroeconomic shock, we display impulse responses under each rule. The first row of diagrams under each shock displays impulse responses under rule (21), and the second row displays impulse responses under rule (22).

Consider rule (21). This rule says the central bank should respond negatively to real exchange rate shocks and more aggressively but positively to real exchange rate depreciation. Based on the structure of the economy, the immediate impact of the depreciation of the real exchange rate on employment is contractionary. According to rule (21) the central bank should reduce the nominal interest rate and therefore stimulate aggregate demand in order to counter the adverse impact of the real exchange rate shock on employment. However, as the real exchange rate depreciates over time, the central bank has to raise the nominal interest rate by more than the initial reduction in order to counter the potentially contractionary effects of the on-going depreciation on employment.

The combination of the real exchange rate shock and the reduction in the nominal interest rate generates inflationary pressures, which are later reversed as the nominal interest rate rises in response to on-going depreciation. As figure 4 illustrates, the real exchange rate approaches R/$11, which matches the performance of the optimal Taylor rule. However rule (21) outperforms the optimal Taylor rule in that the employment rate falls to 73.9 and then reverts back to 74% under exchange rate shocks. In the case of the optimal Taylor rule, the employment rate falls permanently from 74% to 73.8%.

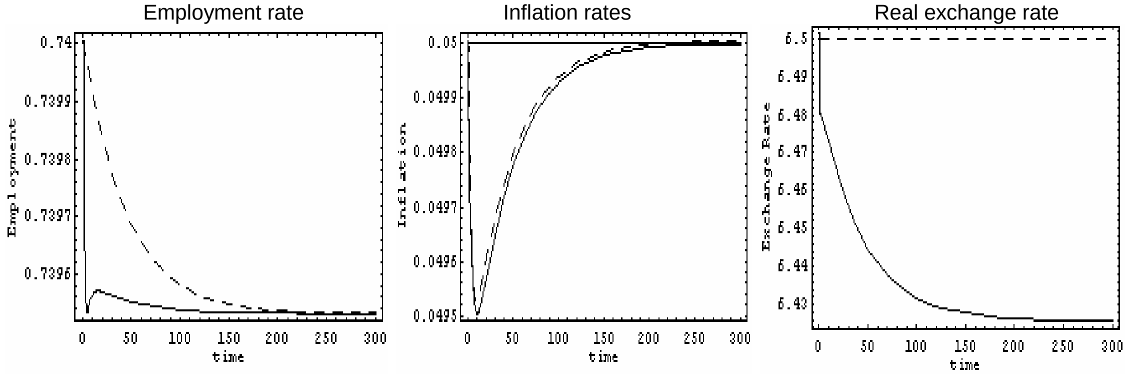
Rule (22) involves inflation targeting with some reaction to real exchange rate depreciation. We should mention that when the central bank does not react to the real exchange rate, the real exchange rate becomes unstable. In general both rules exhibit similar behaviour under real exchange rate shocks. Rule (22) however performs slightly better in terms of the inflation rate, but rule (21) performs better in terms of the employment rate.

Figure 4: Responses under simple policy rules

Nominal interest rate shocks

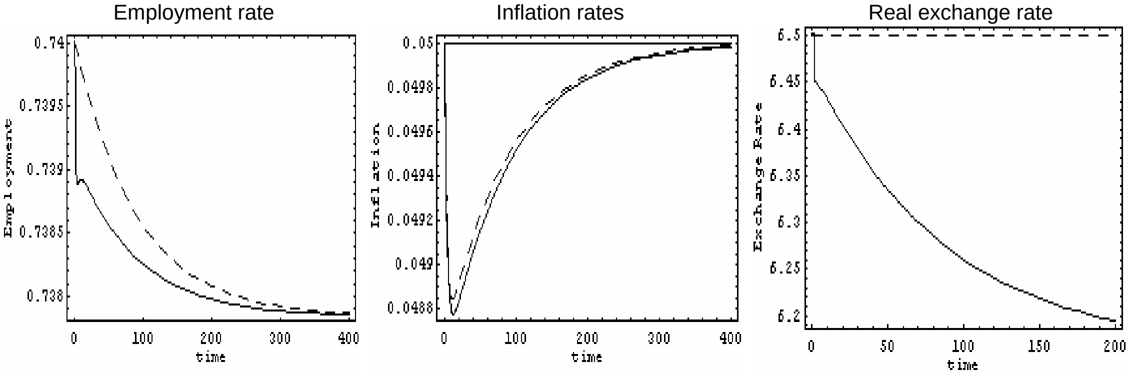
Rule 21

Employment rate | Inflation rates | Real exchange rate



Rule 22

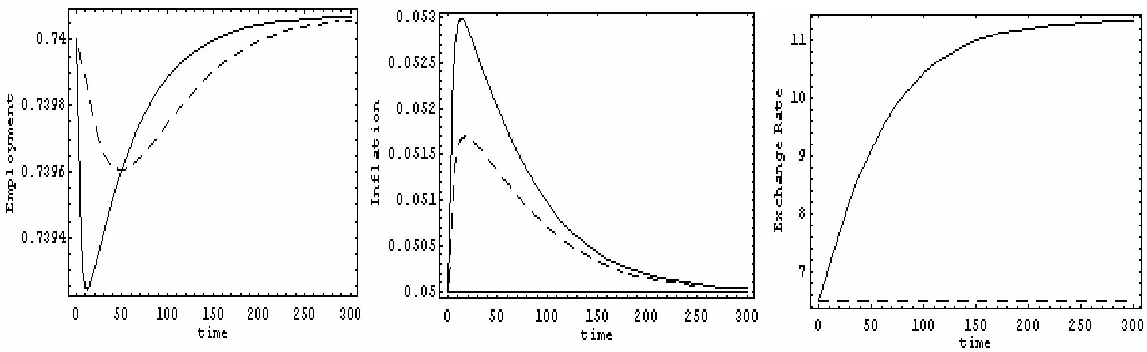
Employment rate | Inflation rates | Real exchange rate



Real exchange rate shocks

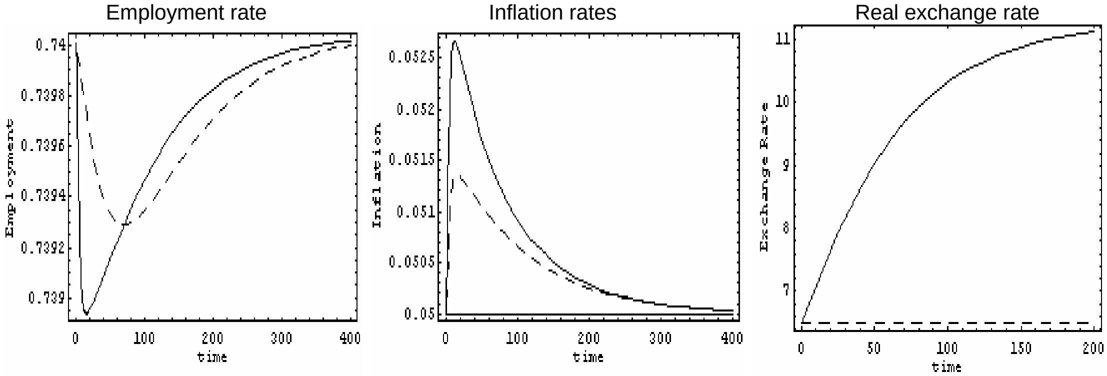
Rule 21

Employment rate | Inflation rates | Real exchange rate



Rule 22

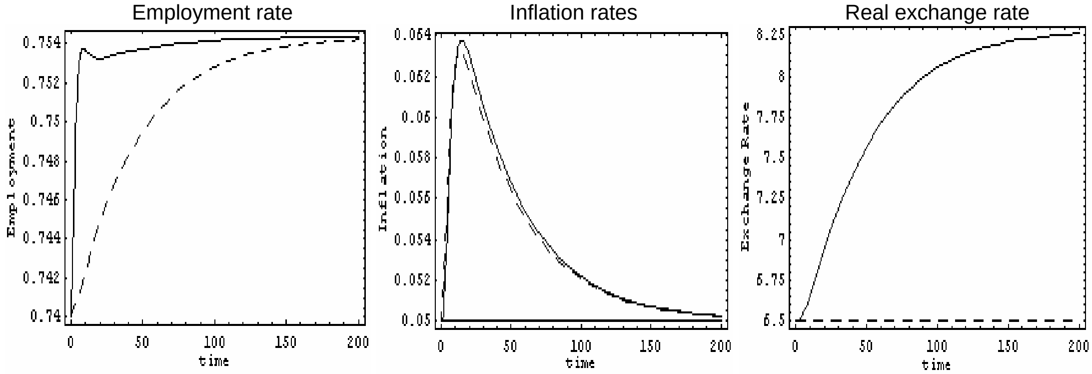
Employment rate | Inflation rates | Real exchange rate



Demand shocks

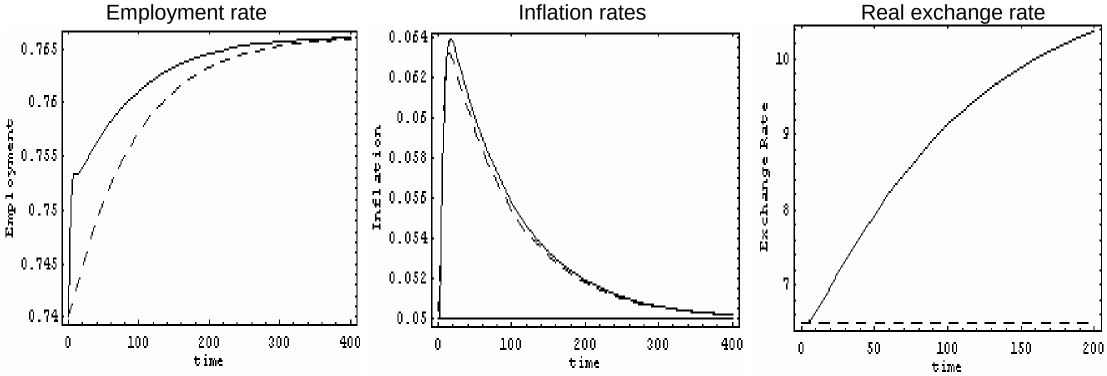
Rule 21

Employment rate | Inflation rates | Real exchange rate



Rule 22

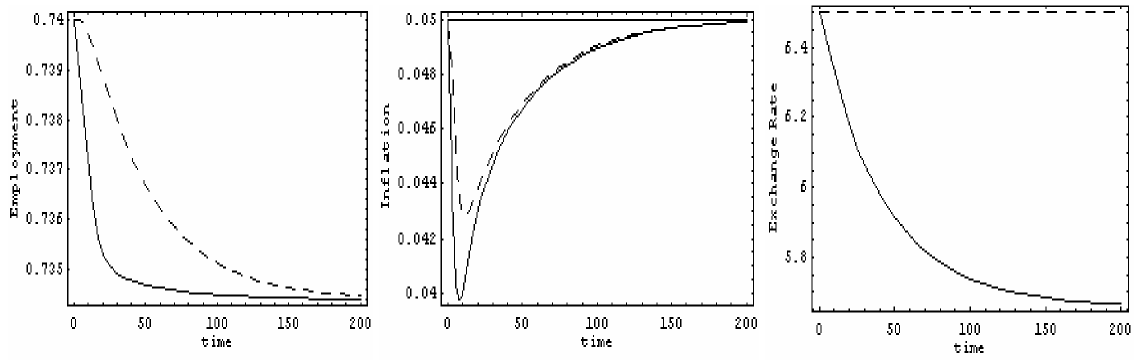
Employment rate | Inflation rates | Real exchange rate



Productivity Shocks

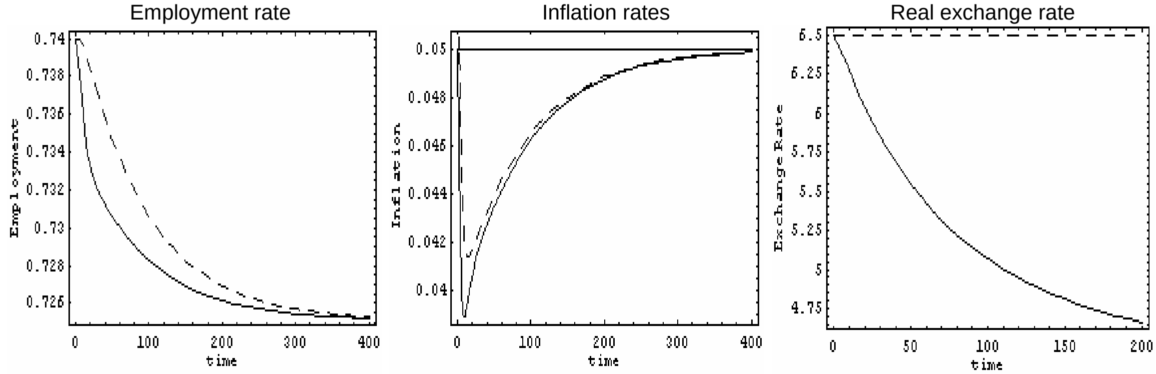
Rule 21

Employment rate | Inflation rates | Real exchange rate



Rule 22

Employment rate Inflation rates Real exchange rate



Positive productivity shocks are contractionary under rules (21) and (22). The employment rate contracts to 73.5%, the real exchange rate appreciates to R/$5.80 and there is disinflation in the process under (21). Under (22) the employment rate falls to 72.5%, there is disinflation and the real exchange rate appreciates to R/$4.50. We mention here, without reporting the results, that from the standpoint of macroeconomic policy, these developments should not pose a problem. What is required is to complement these productivity shocks with demand expansions or vice-versa, as Ball (1999) suggests.

Overall therefore rules such as (21) and (22) are suitable for an economy that is suffering from acute structural unemployment and is trapped at a low capacity rate of employment. They permit demand interventions to have powerful effects on employment, and generate suitable dynamic interactions between productivity and aggregate demand shocks for employment expansion, without unduly putting excessive pressure on the real exchange rate. What is common between these rules is that they both react to real exchange rate fluctuations. Therefore, even if the central bank has an inflation target, it has to systematically respond to real exchange rate fluctuations.

Although our findings are in line with those of many authors reviewed in Taylor (2001) and Leitmo and Söderström (2005) when it comes to the stabilization properties of Taylor rules, we find that such properties may be undesirable when the unemployment rate is very high. Our findings imply that for emerging markets, it may be advisable to have real exchange rate depreciation explicitly targeted in the central bank's policy rule. This is equivalent to what Mishkin (2000) calls "smoothing short-run exchange rate fluctuations that helps mitigate potentially destabilizing effects of abrupt exchange rate changes".

6. Conclusions

Ball (1999), Mankiw (2001) and Blanchard (2003) have suggested that monetary policy can have long run effects on real variables by inducing hysterisis in the labour market. Using a macro-model with hysterisis as suggested by these authors, we have shown that in the context where the unemployment rate is high, optimal inflation-targeting policies may constrain the economy to a low level employment rate trap. We estimate this model using data from an emerging market (South Africa) where real exchange rate depreciation has contractionary effects on employment. The computed optimal Taylor rule, where the central bank responds only to the inflation and employment gaps, is robust against demand and real exchange rate shocks.

With an unemployment rate of 26.7%, this implies that expansionary demand policies to stimulate employment by South African authorities would be weakened. A positive percentage shock to aggregate demand generates 0.05 percentage point increase in the capacity rate of employment. We have also found that a positive percentage labour productivity shock generates a 0.09 percentage point increase in the capacity rate of employment under the optimal Taylor rule. The simple Taylor rule performs nearly as well as the optimal rule, as Williams (2003) found within the context of the FRB/US model.

We then considered simple policy rules that can improve labour market performance whilst at the same time retaining the benefits of the optimal Taylor rule, especially robustness against real exchange rate shocks. We formulated two such policy rules: one which responds negatively to real exchange rate shocks and positively, but more aggressively to real exchange rate depreciation; and another rule that responds positively to the inflation gap, less so to the employment gap, and responds positively to real exchange rate depreciation. Both these rules exhibit qualitatively similar behaviour. The simple rule that features the inflation gap enhances the power of demand interventions to influence the employment rate more than the non-inflation-targeting rule. A percentage shock to aggregate demand raises the employment rate by 1.4 percentage points under the non-inflation targeting rule, whereas the same shock raises the employment rate by 2.5 percentage points under the policy rule that responds to the inflation gap, the output gap and real exchange rate depreciation. Both these rules however exhibit large persistence of shocks compared to the optimal Taylor rule.

The results of this study suggest that, if a central bank operating within the context of high unemployment decides to adopt the inflation-targeting framework, it cannot afford to ignore real exchange rate fluctuations in its instrument setting. This point has been raised by Taylor (2000). Although many authors reviewed in Taylor (2001) do not see an independent role for the real exchange rate in the central bank's policy rule, our finding is that for an emerging market with high structural unemployment, it is important to respond systematically to real exchange rate depreciations. Without such responses, a central bank that follows a simple Taylor-type rule would stabilize the economy at a high unemployment rate trap. Even if policymakers rely on productivity shocks to generate jobs, these shocks would only slightly dent the unemployment situation, if they come by.

The simple rules that enhance the power of demand-management policies in creating jobs are such that productivity shocks have contractionary effects on employment and generate disinflation. This should not pose a problem but should present an opportunity to blend expansionary demand with productivity enhancing interventions, as Ball (1999) suggested.

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