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OPTIMAL MONETARY POLICY UNDER INFLATION TARGETING: IS ZERO THE OPTIMAL PERCEPTION OF INFLATION INERTIA?

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ABSTRACT

Recent research has suggested that in deriving optimal policy under discretion, policymakers should react as if there were no structural inflation persistence in order to improve welfare. This paper considers whether such a strong result extends to an inflation targeting central bank with a more general Phillips curve formulation. The findings indicate that if anything, a central banker that assumes a high degree of inflation inertia is often preferable.

Keywords: optimal monetary policy; discretion; uncertainty; inflation persistence

JEL Classification: E31; E52; E61; E63

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1. Introduction

An increasing amount of research on optimal monetary policy has considered the consequences of intrinsic inflation inertia. The standard New Keynesian Phillips curve (NKPC) as presented in Clarida, Gali and Gertler (1999, CGG henceforth), implies that inflation is a purely forward looking process, but allowing for indexation to past inflation among price setters[2] generates the hybrid NKPC, and hence leads to structural (or intrinsic) inflation persistence.

Nevertheless, the performance of optimal discretionary monetary policy may depend on the correct measure of structural inflation persistence. On this, Fuhrer (1997, 2005) has found that it is lagged inflation that primarily drives the inflation process, whilst CGG (1999) find support for the NKPC specification.

Given that central banks cannot know the value of intrinsic inflation persistence it is important to understand the consequences of misperceptions regarding its values.[3] Walsh (2003) suggests that the monetary authorities should overestimate the degree of intrinsic inflation persistence. In contrast, and more recently, Amano (2007) and Leitemo (2007) have argued not only that welfare – using a structural loss function – would be improved by under-estimating the degree of indexation, but that it would be optimal to assume no indexation at all.

[2] Or alternatively, introducing rule-of-thumb price setters, as in Steinsson (2003). However, the structural loss function is then different.
[3] Levin and Moessner (2005) provide a useful overview.

In the context of an inflation targeting central bank, it would be more appropriate to use an ad hoc loss function rather than a structural one.[4] Moreover, whilst the Calvo formulation has provided an elegant and tractable way of modelling nominal rigidities it does not necessarily represent the actual inflationary process.[5] Consequently, this paper aims to extend the analysis in Amano (2007) and Leitemo (2007) by modifying both the loss function and generalising the Phillips curve.

2. The Model

As in McCallum and Nelson (2004) and in contrast to the Calvo (1983) Phillips curve with indexation, the supply-side block of the model is given by equation (1):

$$\pi_t = \theta\beta E_t\pi_{t+1} + (1-\theta)\beta\pi_{t-1} + \kappa y_t + u_t \qquad 0 \le \theta \le 1 \qquad (1)$$

where β is the discount factor, π denotes the rate of inflation (relative to its steady state), y is the output gap and u denotes an inflationary shock. This formulation has been put forward by Fuhrer and Moore (1995) and Fuhrer (1997) on the grounds that it provides a more realistic characterisation of the data than the NKPC.

Under inflation targeting the central bank's objective is not to maximise the representative agent's welfare function but to achieve its (public) objectives of stabilising

[4] See Svensson (2007), and Tucker (2006) for a central banker's perspective. Moreover Vickers (1998) has suggested that interest smoothing has been the result of optimal policy and not an objective.
[5] See Minford and Peel (2004).

inflation around its target and the output gap.[6] This is represented by the intertemporal loss function

$$Minimise\ (1-\beta)E_t\sum_{s=t}^{\infty}L_s \qquad (2)$$

with the period loss function being given by

$$L_t = \pi_t^2 + \omega y_t^2 \qquad (3)$$

Where $\varpi > 0$, reflects the relative weight of the output gap on the period loss function.[7]

For the purposes of this paper, the central bank perceives the Phillips curve as

$$\pi_t = \hat{\theta}\beta E_t\pi_{t+1} + (1-\hat{\theta})\beta\pi_{t-1} + \kappa y_t + u_t \qquad 0 \le \hat{\theta} \le 1 \qquad (4)$$

where $\hat{\theta}$ denotes the degree of inflation inertia as perceived by the central bank, so that the problem is to minimise (2) subject to (4).[8]

In deriving the relevant optimality condition under discretion, this paper will follow the suggestion by McCallum and Nelson (2004) in using the discretionary concept proposed by CGG (1999) so as to avoid dynamic inconsistency. When the central bank minimises

[6] See Svensson (2002).
[7] In the UK the weight on output stabilisation would be expected to be low, see Tucker (2006).
[8] The IS equation is ignored for this problem, as it is assumed that the output gap is the policy instrument (via the central bank's effects on output through nominal interest rates).

its loss function, it takes into account that it will behave in the same way each period. Hence $E_t\pi_{t+1}$ in (4) will be replaced by $\eta_{\pi\pi}\pi_t$, where $\eta_{\pi\pi}$ represents the elasticity of inflation with respect to the previous period's inflation rate, obtained from the minimum state variable solution.[9] Therefore, as shown by McCallum and Nelson (2004) the optimality condition is given by

$$\pi_t = -(\omega/\kappa)[(1-\beta\hat{\theta}\eta_{\pi\pi})y_t - \beta^2(1-\hat{\theta})E_t y_{t+1}] \qquad 0 \le \hat{\theta} < 1 \qquad (5)$$

or

$$\pi_t = -(\omega/\kappa)y_t \qquad \text{if } \hat{\theta} = 1 \qquad (5')$$

It is also important to point out that since (5) represents the central bank's optimal policy when it believes that the Phillips curve is given by (4), the component $E_t y_{t+1}$ should represent the policymaker's expectations of future output gap, rather than being the solution to the interaction between the central bank's beliefs and the actual Phillips curve.

The focus of this paper is to consider whether making particular assumptions regarding the value of perceived inflation inertia will lead to particular welfare (in terms of the loss function) outcomes.

[9] The component on the error term is not included as it is assumed to be white noise. It is also important to note that the particular values of $\eta_{\pi\pi}$ are obtained assuming that the central bank can correctly observe the

3. Results

This paper will assume that $\beta = 1$, so that the central bank's objective becomes the minimisation of the unconditional weighted variance of inflation and the output gap.[10] Initially, the values of 0.01 and 0.05 will be used for ϖ and κ, respectively, although different values will also be used below to assess the robustness of the results.

To determine the effects of the central bank assuming different degrees of inflation inertia in the model comprised of equations (4) and (5) the results can be seen in Figure 1. The value of the loss function is given by the vertical axis, and the horizontal axis represents the government's belief concerning the persistence of inflation, with each curve in the diagram representing a different real Phillips curve (a different value of θ)

Two main results emerge from the figures. First, the consequences of varying $\hat{\theta}$ are largest when inflation is predominantly backward looking. In these cases it really does matter for the central bank's loss function what the believed degree of persistence of inflation is. In contrast, when inflation is primarily forward looking the central bank's perception of θ, whilst having an effect on the loss function, is of a lower magnitude.

degree of intrinsic inflation persistence.

[10] Svensson (2007, p. 194) defends the choice of unity for the discount factor.

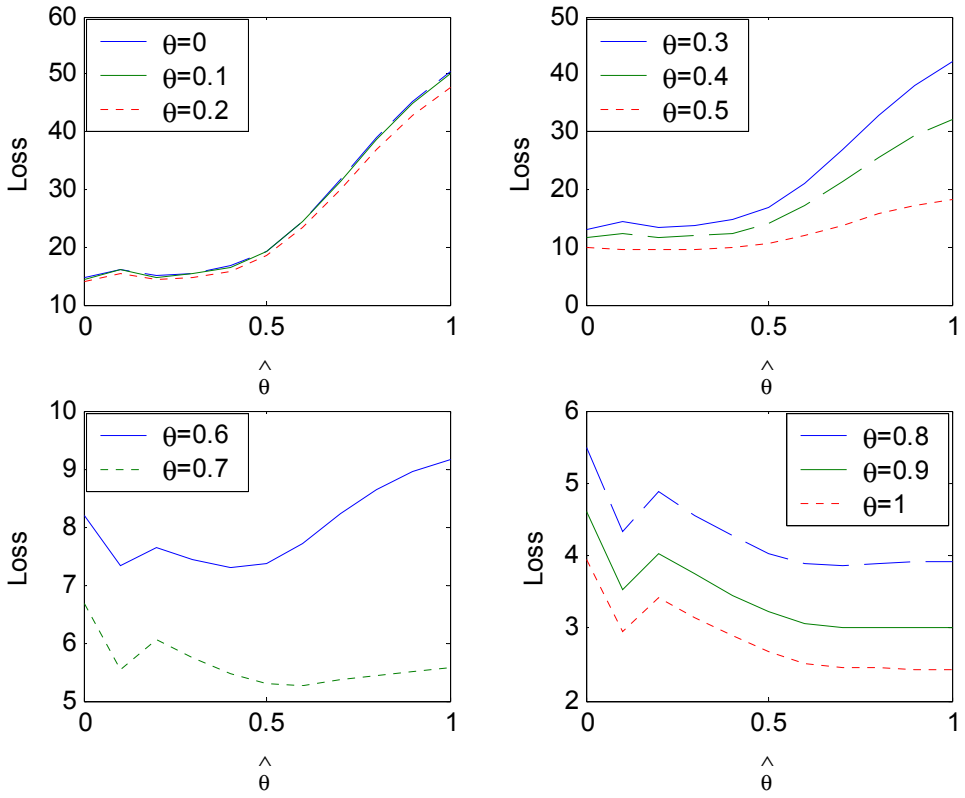

Figure 1 Caption: Loss functions under alternative perceptions of inflation. Each curve denotes one particular actual Phillips curve. Values used: $\kappa = 0.05$ *and* $\varpi = 0.1$.

Secondly, in contrast to Amano (2007) and Leitemo (2007) where regardless of the degree of actual persistence in the Phillips curve it was always optimal (under discretion) for the central bank to disregard inflation inertia in (4), the results of this paper indicate that this is not always the case. If inflation is dominated by its backward looking component, then it is optimal to assume that θ is zero, whereas in all other case it is best to overestimate the degree of structural inflation persistence slightly. The only exception occurs with the NKPC, in which case loss is minimised when the central bank assumes (correctly), that inflation is purely forward looking.

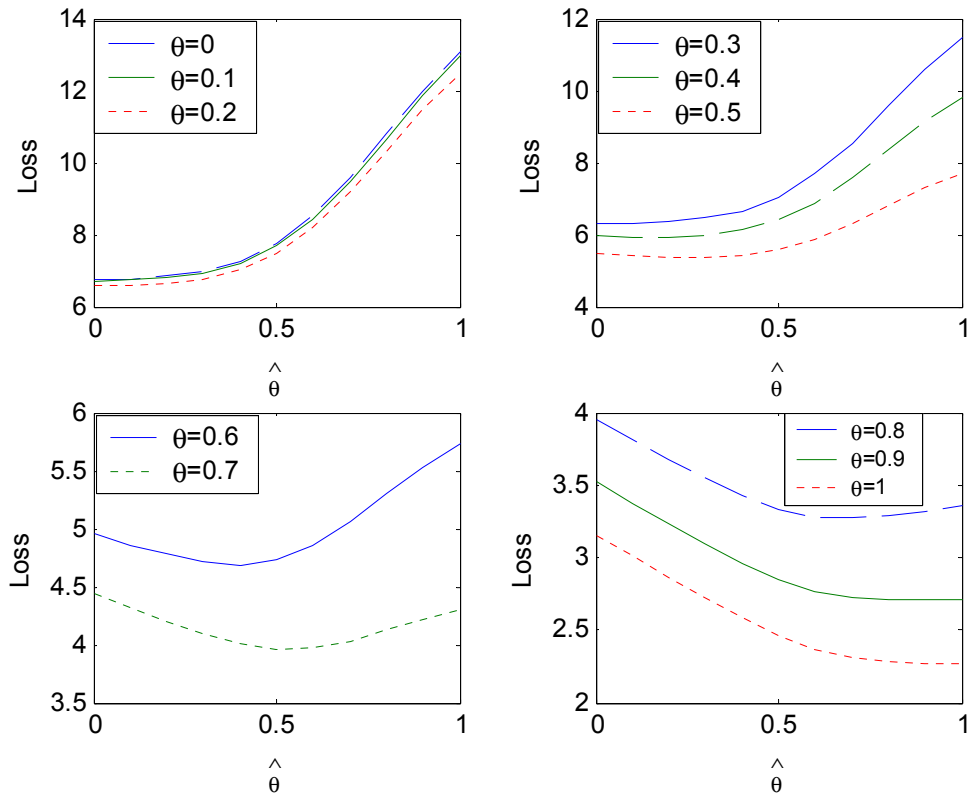

Figure 2: See notes for Figure 1. Values used: $\kappa = 0.1$ *and* $\varpi = 0.1$.

Figures 2 and 3, obtained by varying some of the parameters, yield the same conclusions Hence, in contrast to Leitemo's (2007) result, misperceptions on the degree of persistence in inflation do matter. As a rough comparison, if we had assumed a value of 0.99 for β in the results presented above, maintaining a value of inflation 1% above the target every period with the output gap at zero would have resulted in a period loss of $0.63x10^{-5}$. This compares with the loss of $14.6x10^{-5}$ for the model with a value for θ and $\hat{\theta}$ (no misperceptions) of zero, or 23.2 times as large as the cost of maintaining the 1% excess of inflation over the target every single period. In contrast, had the central bank assumed a value for $\hat{\theta}$ of unity, the New Keynesian Phillips curve, the losses would have been

80.3 times as large. Indeed, only when inflation is highly forward-looking is a high value of $\hat{\theta}$ desirable; in all other circumstances assuming a fully backward model does have superior properties, even when there is a small forward-looking component.

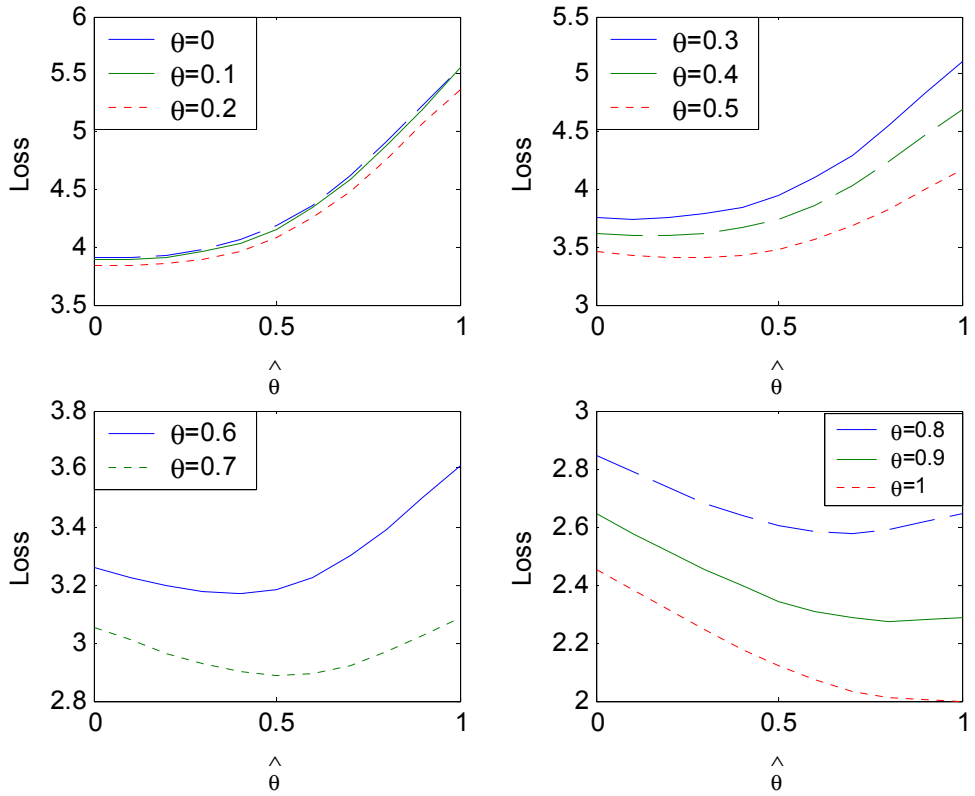

Figure 3 See notes for Figure 1. $\kappa = 0.05$ *and* $\varpi = 0.01$.

However, it is worth pointing out that there is no unique value of perceived inflation that minimises the loss function when the central bank is pursuing a policy of flexible inflation targeting.

4. Conclusion

The degree of structural inflation inertia has important effects for the success of optimal discretionary monetary policy. Recent research has suggested that central bankers should behave as if inflation were a purely forward-looking process, as this yields a better inflation output trade-off. However, when combining an inflation targeting regime that aims to stabilise inflation and the output gap with a more general formulation of the Phillips curve this policy prescription can generally produce the worst results. Optimal policy, in this case, generally suggests over-estimating the extent of structural inflation persistence, and often assuming a fully backward looking Phillips curve.

Lastly, an important result that emerges is that if current hybrid NKPCs are good approximations of reality, so that the structural loss functions would then be applicable, the worst-case scenario occurs when the central bank behaves as if there were a high degree of inflation inertia. In contrast, using an inflation targeting loss function (which may also be best if the microeconomic assumptions are flawed) shows that assuming too little inflation inertia can lead to the worst outcome. Therefore, either inflation targeting is a very robust policy framework or it is an arrangement that can lead to clearly suboptimal outcomes.

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