DEPARTMENT OF ECONOMICS

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Timeless perspective vs discretionary policymaking when the degree of inflation persistence is unknown

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WP 2009 - 14

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Timeless perspective vs discretionary policymaking when the degree of inflation persistence is unknown

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28 September 2009

Abstract

It is often asumed that monetary policy in forward looking models yields higher welfare, measured in terms of the unconditional loss, when it operates under the timeless perspective than under discretion. This paper consider the robustness of such a result in a New Keynesian model when the degree of intrinsic inflation persistence is misperceived by the policymaker. It finds that for reasonable parameter values discretion can be superior to the timeless perspective. The reason for this stems from the fact that the timeless perspective policy varies more with the degree of inflation persistence than does the discretionary policy.

Keywords: discretion, timeless perspective, inflation persistence, uncertainty

JEL Classification: E52, E58

1 Introduction

This paper considers whether the timeless perspective approach to optimal monetary policy remains superior to discretionary policymaking in the presence of parameter uncertainty. This uncertainty is modelled in terms of misperceptions, on the part of the monetary authority, of the degree of intrinsic inflation persistence in a New Keynesian model with a hybrid New Keynesian Phillips curve. Among its key findings, this paper shows that discretionary monetary policy can indeed be superior when a widely used metric, the unconditional loss function, is used. Moreover, this result is derived using reasonable parameter values, unlike previous research that has been critical of the timeless perspective approach.

The work of Kydland and Prescott (1977), and Currie and Levine (1993) have shown the importance of credibility and commitment for policymaking in models with rational expectations. In the absence of some form of enforceable commitment optimal policies will be time inconsistent. However, the alternative time consistent (discretionary) equilibrium in forward looking models results in lower welfare due to the stabilisation bias, whereby inflation is stabilised too little in favour of low volatility in output. Woodford (1999b) has shown that using a standard loss function discretion implies too little inertia in the inflation process; in response to a cost-push shock, the optimal commitment process implies a period of below average inflation in order to fully exploit expectations. By contrast, under discretion the policymaker re-optimises every period so that it is unable to use expectations in order to improve on the inflation-output stabilisation trade-off. Consequently, the discretionary equilibrium results in lower welfare than the optimal commitment policy when these are compared in terms of average outcomes of the conditional expectation of the loss function.

Nevertheless, optimal commitment policies suffer from an initial period problem; with predetermined expectations it is optimal for the policymaker to exploit those expectations in the startup period but to promise never to do so again in the future. As a result, such a perspective to optimal monetary policy has generally been regarded as undesirable. To overcome the initial value problem, whilst still maintaining the benefits of commitment, Woodford (1999a) has put forward the concept of the timeless perspective (TP). The TP policy can be understood as the policy that would be currently in place had the optimal commitment plan begun to be

implemented in the distant past. Such an approach would imply that the effects of the initial period will have already died out, so that they will not be relevant for the optimal policy as it is currently being implemented. This implies that the policy reaction function is constrained to be the same in all periods, including the startup period.

By overcoming the initial period problem the timeless perspective has gained many adherents in the optimal monetary policy literature, to the extent that in much recent research the only commitment approach to policy used is the TP policy.[1] Moreover, the use of the TP for policy analysis by Norges Bank is further evidence of its popularity.

Whilst the TP remains the dominant approach to optimal commitment policies, recent research has highlighted some of its limitations. In particular, by not exploiting expectations in the initial period - in other words, ignoring the first order conditions in the first period that the policy is being implemented - the TP policy yields lower welfare than the optimal commitment policy. On this, Jensen and McCallum (2002) and Blake (2001) show that using the standard criterion for assessing policies, the unconditional expectation of the policymaker's objective function, an alternative policy rule can yield outcomes that are superior to the TP policy, the so called Blake-Jensen-McCallum TP policy.[2] Moreover, with its greater emphasis on short term optimisation, it is also possible for discretion to yield superior outcomes to the timeless perspective equilibrium, as pointed out by Blake (2001) and Sauer (2007). However, their results show that the relative superiority of the discretionary equilibrium arises with implausible parameter values, so that the general result that has emerged is that in forward looking models the TP policy is superior to discretion.

It should be pointed out that the conclusion above is dependent on the welfare criterion being used. Dennis (2008) has argued in favour of using conditional loss to compare alternative policy perspectives. This has the effect of making the loss function, the welfare criterion, dependent on the initial state, in which case it is straightforward to show that there will be states for which discretion is superior to the timeless perspective. This aspect is ignored when the unconditional expectation is used, as the timeless perspective and the optimal commitment policy deliver the same asymptotic equilibrium, hence the same unconditional loss. The issue of what the

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[1]See for example Walsh (2004, 2005b).

[2]Put another way, TP policies are not optimal when view from the timeless perspective.

appropriate perspective for monetary policy should be is also considered by McCallum (2005). He argues that both the timeless perspetive and the Blake-Jensen-McCallum policies possess a key critcal property: continuity. This occurs when a rule implemented at some point after the startup yields a condition that coincides with the condition for that same period that the policy would have specified in previous periods. However, the key difference between the two is that the timeless perspective performs relatively better in terms of responding to shocks whereas the BJM policy is superior on average with regard to transitional effects.

Therefore, despite its limitations and potential for alternative policies to be superior, it is generally considered that when the unconditional loss is used as the measure of welfare, the timeless perspective is superior to discretion. However, is such a conclusion warranted when in the presence of parameter uncertainty? The research cited above has focused on the criteria used to compare alternative policies and the conditions under which one policy perspective is superior to another. However, they have all assumed that the policymaker knows the model's parameter values.

This paper investigates the relative superiority of these two policy equilibria in a New Keynesian model when the policymaker misperceives the degree of intrinsic inflation persistence, and finds that for reasonable parameter values discretion is the more robust policy. Such a modelling approach to analysing parameter uncertainty has been widely employed within the context of optimal monetary policy, but this has been primarily carried out in the context of what the optimal perception of inflation persistence should be.[3] In this regard, using a standard quadratic loss function Walsh (2004), Angeloni et al. (2003) and Coenen (2007) argue that it is better to over-estimate the degree of intrinsic inflation persistence. By contrast, Walsh (2005b) finds that the robust policy when the structural loss function is used calls for assuming an intermediate degree of inflation persistence. These papers have largely focused on the timeless perspective or optimised interest rate rules. In contrast to this, Leitemo (2007) finds that under discretion and using the structural loss function it is optimal to assume no inflation persistence.

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[3]For a thorough overview, see Levin and Moessner (2005).

2   A Near-Canonical New Keynesian Model

The results of this paper will focus on a standard New Keynesian model with intrinsic inflation persistence, as analysed by Clarida et al. (1999), McCallum and Nelson (2004), Woodford (2003), and Walsh (2005a), among others. Aggregate supply is modelled by the hybrid New Keynesian Phillips curve (NKPC):

$$\pi_t = \theta E_t \pi_{t+1} + (1 - \theta)\pi_{t-1} + \alpha y_t + u_t \qquad 0 \leq \theta \leq 1 \tag{1}$$

where π_t is the rate of inflation, y_t is the output gap and $u_t \sim iid[0, \Omega]$ is an error term. One could think of this error term as representing shocks to firms' desired markups. The degree of inflation persistence is given by $(1-\theta)$, so that the higher the value of θ the more 1 resembles the New Keynesian Phillips curve. It is worth pointing out that several micro-founded modifications to the NKPC (rule of thumb pricing, indexation to past inflation) can result in a Phillips curve of the form (1) above.[4] The rationale behind the inclusion of intrinsic inflation persistence in the Phillips curve is primarily empirical, with Fuhrer (1997) and Roberts (2005) among others finding that inflation is primarily backward looking, in contrast to Gali and Gertler (1999) who argue that the NKPC provides a good description of inflationary dynamics. What these papers highlight is that there is considerable disagreement on how persistent inflation is. That is the reason this paper focuses on uncertainty about θ, a feature that will be of central importance in the results that follow. As this paper only considers shocks to the Phillips curve one can assume without loss of generality that the monetary authority is able to control the inflation rate as an instrument, in which case it is not necessary to include the IS relationship in the analysis.

2.1   Monetary Policy Objectives

In order to close the model an objective function is required. One could use the representative agent's discounted lifetime utility as the policy objective. Doing so would have the benefit of being consistent with the assumptions underlying the hybrid Phillips curve in (1),[5]. However,

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[4]Benigno and Woodford (2005), Amato and Laubach (2003) and Steinsson (2003) among others.

[5]In this case clearer micro-foundations would have been required.

the drawback is that such an objective would be dependent on the assumptions which resulted in (1) being the relevant Phillips curve. Given that (1) is observationally equivalent to different pricing assumptions the conclusions would be highly model-specific. More importantly though, inflation targeting central banks' remits are not to maximise some measure of social welfare. Rather, they are given the task of stabilising inflation and some measure of real activity,[6] with the former being regarded as relatively more important than the latter. Therefore, the policy objective used in this paper will be to minimise a standard loss function:

$$L_t = E_t \sum_{t=0}^{\infty} \beta^t \frac{1}{2} [\pi_t^2 + \omega y_t^2] \tag{2}$$

Where ω represents the relative weight attached to output gap stabilisation. Nevertheless, it is assumed that the monetary authority does not know the true value of θ, so that it aims to minimise its loss (2) subject to its perceived Phillips curve, given by:

$$\pi_t = \hat{\theta} E_t \pi_{t+1} + (1 - \hat{\theta})\pi_{t-1} + \alpha y_t + u_t \tag{3}$$

Where $\hat{\theta}$ represents the central bank's perception of θ. The resulting first order conditions for the optimal commitment solution, in addition to the Phillips curve, are given by:

$$\omega y_t + \alpha \lambda_t = 0 \qquad t \geq 0 \tag{4}$$

$$\pi_t + \beta^{-1}\hat{\theta}\lambda_{t-1} - \lambda_t + \beta(1 - \hat{\theta})\hat{E}_t \lambda_{t+1} = 0 \qquad t > 0 \tag{5}$$

$$\pi_t - \lambda_t + \beta(1 - \hat{\theta})\lambda_{t+1} \qquad t = 0 \tag{6}$$

Where λ is the Lagrange multiplier associated with the Phillips curve constraint. Given that

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[6]See Svensson (2002).

this model explores the role of parameter misperceptions, this is reflected in $\hat{E}$, which represents the central bank's rational expectation conditional on its perceived model ($\hat{\theta}$).

The time inconsistency of the optimal consistent policy can be seen from the implications of (5) and (6) above. The latter is the first order condition for the startup period and does not contain λ_{t-1}. In other words, there are no previous (expectational) commitments in the first period so that it is optimal for the policymaker to exploit the fact that expectations are initially fixed. Therefore, the first order conditions for inflation in all subsequent periods imply different behaviour from that in the startup period.

Woodford's approach (the timeless perspective) overcomes this type of time inconsistency by assuming that the only first order condition for inflation that applies is (5). By ignoring the first order condition in the startup period the TP policy can can be regarded as the policy that would be currently in place had it first been implemented in the distant past.[7] Therefore, combining (4) and (5) yields the following optimal targeting rule under the TP:

$$\pi_t = -\frac{\omega}{\alpha}[y_t - \beta^{-1}\hat{\theta}y_{t-1} - \beta(1-\hat{\theta})\hat{E}_t y_{t+1}] \tag{7}$$

By contrast, the optimal targeting rule under discretion is given by:

$$\pi_t = -\frac{\omega}{\alpha}[(1-\hat{\theta}\eta_\pi)y_t - \beta(1-\hat{\theta})\hat{E}_t y_{t+1}] \tag{8}$$

where time consistency is ensured by the fact that when the monetary authority re-optimises each period it takes into account the dependence of next period's inflation on current inflation. This implies that $\hat{E}_t\pi_{t+1}$ in the Phillips curve (3) is repaced with its minimum state variable (MSV) solution, as yet unknown, consistent with the monetary authority's beliefs.[8] Thus η_π represents the elasticity of inflation with respect to its previous value in the MSV solution. To see why the discretionary policy does not vary so much with misperceptions a quantitative example

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[7]Because the TP policy does not make use of initial conditions it can be inferior to alternative policies, even of the same form. See Jensen and McCallum (2002) or Blake (2001).

[8]See McCallum and Nelson (2004).

will clarify this. Using the calibrated values discussed below, $\hat{\theta} = 0.1$ yields $\eta_\pi = 0.65$, which falls to 0.09 when $\hat{\theta} = 0.9$. As a result, when inflation changes from being predominantly backward to forward-looking the effect on policy implementation under discretion is much smaller than under commitment and this will be the key to understanding the results that follow.

Studies that have compared the relative performance of the TP and discretionary policies have found that for reasonable parameter values the superiority of TP policies remains a robust result. As McCallum and Nelson (2004) point out 'in all cases examined, the unconditional average performance of timeless perspective policymaking is at least as good as that provides by optimal discretionary behaviour'. Nevertheless, as shown by Sauer (2007) discretion becomes relatively more attractive as the discount factor β decreases or the weight attached to output gap stabilisation (ω) rises. Following McCallum (2005) the former result is rather intuitive; the TP policy performs well in terms of responding to shocks, but it is not as good - on average- with respect to transitional dynamics. A lower β emphasises the latter, shfting the balance in favour of discretion. In addition to this, Dennis (2008) shows how a lower α, that is, a flatter Phillips curve, makes discretion a relatively more attractive policy. However, it is worth pointing out that most of the authors who have considered this issue have focused on the NKPC. Allowing for intrinsic inflation persistence makes the TP policy more attractive, given that the cost of not influencing inflation expectations will be larger.

2.2 Model Solution

Before proceeding to the results it is worth discussing briefly how the model is solved when the policymaker misperceives the degree of intrinsic inflation persistence. Both policies, discretion and the timeless perspective, contain expectations of future output. As these pertain to the central bank they must be solved conditional on its perceived model. Therefore, the solution proceeds in two steps. First, the models are solved for each value of θ in the absence of misperceptions, from which the MSV solution is derived. This is then used to replace $\hat{E}_t y_{t+1}$ with its solution for each policy to ensure consistency. Lastly, having solved for the expectations in each of the optimal targeting rules (7) and (8) these equations are solved jointly with the hybrid NKPC.

Table 1: Calibrated Values

α	β	ω	σ_u
0.1	0.99	1/16	1

In both cases the solution of the models can be written as

$$z_t = m z_{t-1} + n u_t \tag{9}$$

where $z'_t = [y'_t \ \pi'_t]$, so that the loss function can also be represented as

$$L_t = E_t \sum_{j=0}^{\infty} \beta_j z'_{t+j} W z_{t+j} \qquad W = \begin{bmatrix} \omega & 0 \\ 0 & 1 \end{bmatrix}$$

Given the above and following Dennis (2007), the value of the loss function is calculated by the following

$$L_t = \left[z'_{t-1} H' \hat{P} H z_{t-1} + v'_t G' \hat{P} G v_t + \frac{\beta}{1-\beta} tr \left(G' \hat{P} G \Omega \right) \right]$$

This is the method to calculate the results that follow. Comparing the two policies, it is worth noting that as perceptions of θ vary, it is the TP policy that will be altered the most. The reason for this is that although in both cases it is optimal to focus on stabilising inflation - relative to output- the more persistent it is, but as $\hat{\theta}$ decreases η_π also decreases in (8), partly offsetting the policy change under the discretionary equilibrium.

3   Calibration and Model Results

The model's parameter values are the same as those used by McCallum and Nelson (2004) and are chosen to be consistent with empirical estimates (Gali and Gertler (1999)). These are shown in 1. A value of $\omega = 0.0625$ indicates that both output and inflation stabilisation carry equal weights in the loss function and will be used as a benchmark.[9] However, the effects of alterating the value of this parameter will be discussed below.

[9]For inflation targeting central banks this value should therefore provide a realistic ceiling.
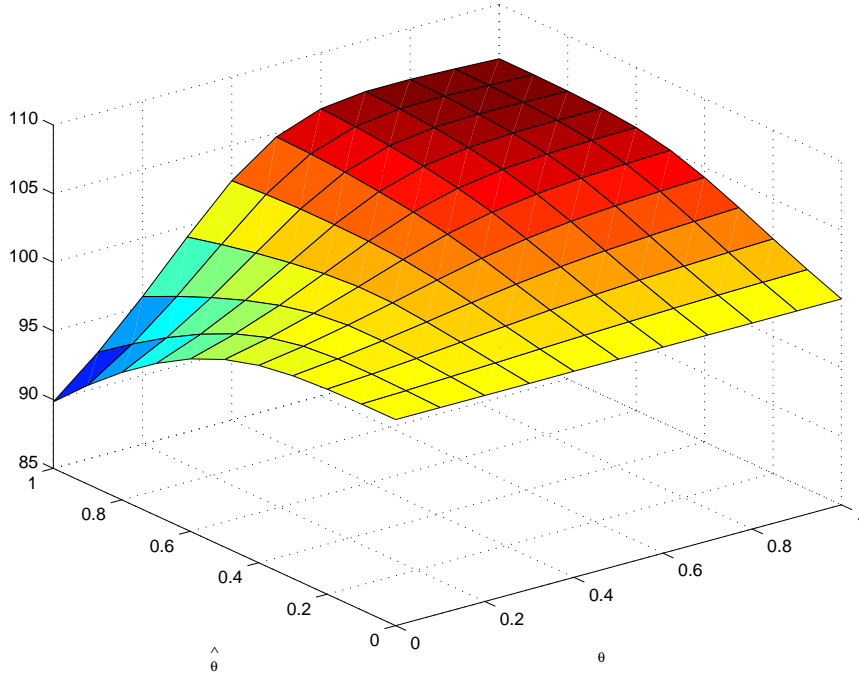
Figure 1: Losses under the timeless perspective relative to discretionary policy.

In order to consider the relative merits of discretionary over TP policymaking a metric is needed. For this paper the metric is

$$V = 100 \frac{L^d}{L^{tp}} \tag{12}$$

Where L^d and L^{tp} denote (unconditional) losses under discretion and the timeless perspective policies, respectively. Therefore, the two policies yield the same welfare measure when V equals 100, with rises in V representing relatively larger losses arising from discretionary policy. In addition to this, one can also consider, from a robustness point of view, what the worst scenario implies for each policy. Given how V is measured this can be observed by comparing the highest and lowest values in V as deviations from 100.

Figure (1) shows the effects of misperceptions about θ with ω and α taking their benchmark values. In the absence of misperceptions (along the main diagonal) the TP policy is superior to discretion, except when $\theta = 0$, since with a fully backward Phillips curve both policies yield identical results. Moreover, the TP is relatively more beneficial as inflation becomes a more forward-looking process due to the greater stabilisation bias under discretion. However, once misperceptions are taken into account, the appeal of the TP policy vanishes when the monetary
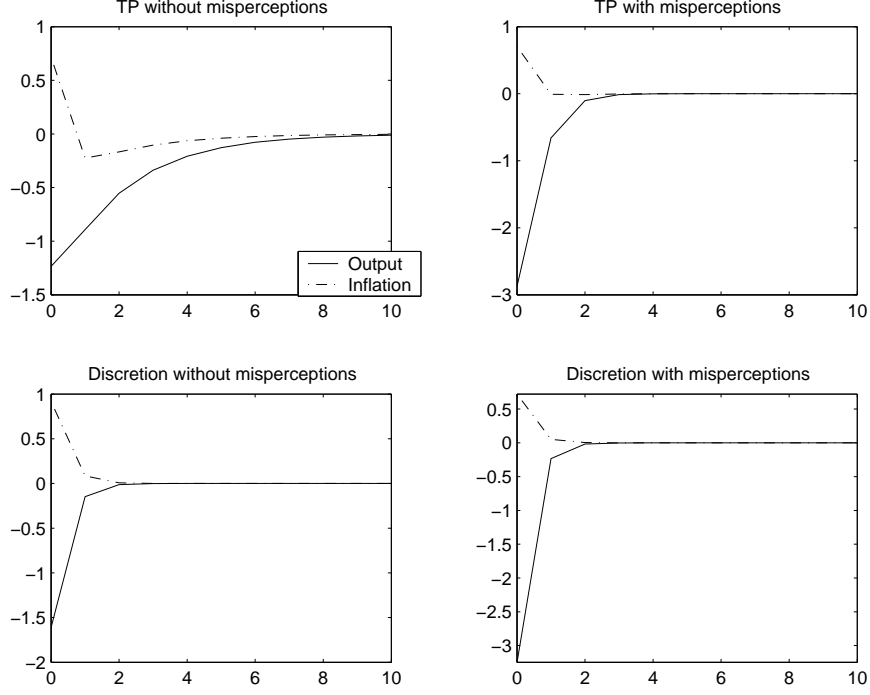
Figure 2: Impulse respones to a unit shock to the Phillips curve. $\theta = 0.9$, and with misperceptions $\hat{\theta} = 0.1$

authority assumes that inflation is predominantly forward looking but is in fact highly persistent. The reason for this result can be gleaned from an analysis of the impulse response functions under each policy. An example of this is shown in Figure (2), which displays the impulse responses to a unit shock to the Phillips curve. To understand the effects of misperceptions the figure shows the results with and without misperceptions. For the latter $\hat{\theta} = \theta = 0.9$, and the results can be seen from the two figures on the left. The two figures on the right show the effects of misperceptions ($\hat{\theta} = 0.1$), so that the monetary authority perceives inflation to be much more persistent than it actually is. Under the timeless perspective the effect of overestimating the degree of inflation persistence is a greater attempt stabilise inflation, the result of which is that although the initial response to the shocks is almost identical, with misperceptions inflation rapidly returns to steady state. It then follows that the contraction in output is larger, but more importantly, the effect of misperceptions under the timeless perspective is to alter the variables' dynamics. Using incorrect parameter values prevents the monetary authority from making best use of private sector expectations and hence results in lower welfare. By contrast, under discretion the model's dynamics remain largely unchanged; overestimating the degree of inflation persistence in this case is akin to attaching a lower weight on the output gap in th eloss function. Whilst this again results in inflation being over-stabilised, the consequences for the
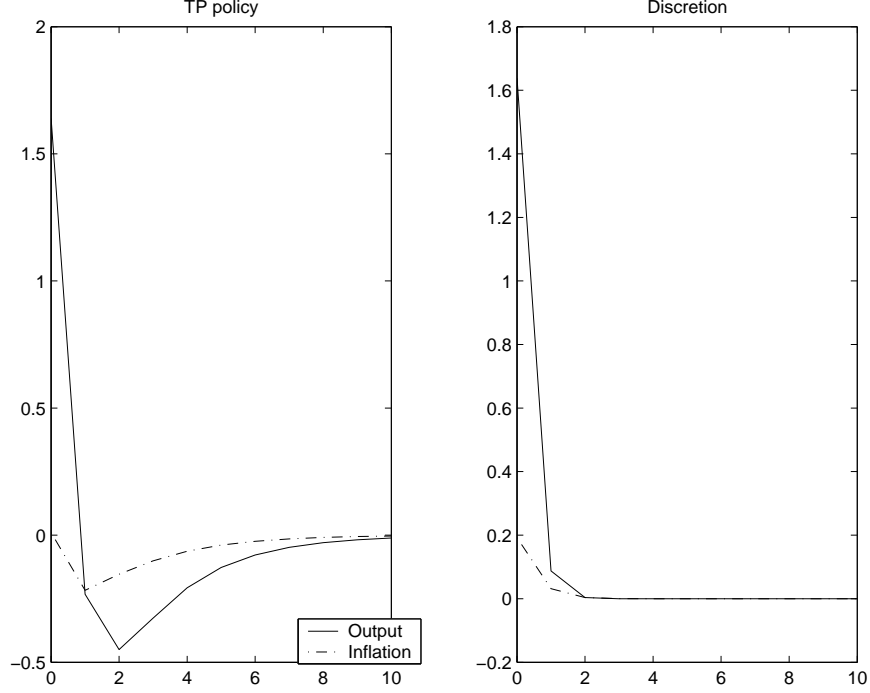
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Figure 3: Difference in impulse responses with and without misperceptions, derived from Figure (2) above.

both inflation and output are not altered to the same extent as under the timeless perspective.

The consequences of misperceptions can be seen more clearly in Figure (3), which shows the differences in the impulse responses with and without misperceptions for each policy perspective. Whilst the initial response of inflation to the shock is similar under both policies it is under the TP that misperceptions have a longer lasting effect, and this is therefore reflected in the behaviour of output. This confirms the statement above that under the timeless perspective misperceptions cause larger policy changes than under discretion, the reason being that $\hat{\theta}$ and $\eta_{y\pi}$ move in opposite directions under the latter policy. The result of this is that discretion can be the more robust policy when the actual degree of intrinsic inflation persistence is unknown.

4   Conclusion

This paper has analysed the implications of misperceptions about the degree of intrinsic inflation persistence for optimal monetary policy in a forward looking rational expectations model. It has used an ad hoc loss function for two main reasons: it better reflects the behaviour of central

banks and alternative theoretical underpinnings can equally give rise to a hybrid New Keynesian Phillips curve, so that it is not clear which structural loss function should be used. The paper finds that misperceptions about structural inflation persistence cause larger policy changes under the timeless perspective than under discretionary policymaking. It is generally agreed that comparing these two policy perspectives using the uncondtional loss function the timeless perspective generates lower losses under all reasonable parameter values. This paper has shown that even under such a welfare criterion discretion can be the superior policy when the degree of inflation persistence is unknown. This calls into question the desirability of implementing timeless perspective policymaking in policy analysis, as is currently being done by Norges Bank.

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