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Inflation inertia and the optimal hybrid inflation/price-level target

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Inflation Inertia and the Optimal Hybrid Inflation/Price-Level Target*

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Abstract

A hybrid inflation/price-level target combines elements of both inflation and price-level targets. The paper derives a hybrid target within a new Keynesian model with inflation persistence due to price indexation. The result generalizes a result by Vestin (2005) that the optimal policy could be implemented with a price-level targeting regime. We show that the optimal price-level drift in the hybrid target is equal to the degree of price indexation.

1 Introduction

John Maynard Keynes suggested that monetary policy should regulate the supply of money so that "the index number of prices will never move far from a fixed point."[1] Except for Sweden in the thirties,[2] no central banks have followed up Keynes' idea and adopted price-level targeting, although inflation targeting has become a popular monetary regime. The difference between price-level and inflation targeting is that the former implies a stationary price level, while the latter implies complete price-level drift and thus a non-stationary price level.

Price-level targeting has been subject of renewed interest in recent years due to theoretical results characterizing optimal policy under commitment.

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[1]Keynes (1923), cited in King (1998).
[2]See Berg and Jonung (1998).

In the canonical forward-looking new Keynesian model, optimal monetary policy under commitment in the timeless perspective is characterized by a stationary price level, while discretionary policy gives rise to a unit root in the price-level.[3] In order to overcome the inefficiency from discretion, Vestin (forthcoming) showed that if the standard loss function was replaced by an appropriately specified loss function with a price-level target, the monetary policy under discretion would be identical to the optimal policy under commitment. The intuition for the result is that a price-level target requires a period of inflation below target after a positive cost-push shock. When inflation is expected to be low in the future, firms respond to the shock by increasing prices by less, such that the shock has less effect on inflation today. How advantageous price-level targeting is relative to inflation targeting hinges, however, on the degree of forward-lookingness in the Phillips curve.

Batini and Yates (2003) introduced a new perspective on the analysis of price-level and inflation targets by considering a 'hybrid' target, which is a weighted average of an inflation target and a price-level target. They did not, however, use a utility-based welfare loss function as an evaluation criterion, and did not derive an optimal hybrid targeting regime.

Here, we extend the model by Vestin (2005) in two directions. First, we consider the more general new Keynesian model with inflation persistence introduced by Woodford (2003). Second, we adopt Batini and Yates' (2003) hybrid inflation/price-level targeting regime, which embeds both inflation targeting and price-level targeting. By combining these extensions, we reach a simple generalization of Vestin's results that yields some new insights to the debate on price-level versus inflation targeting.

2 The model

We consider the following new Keynesian model:

$$x_t = E_t x_{t+1} - \frac{1}{\sigma}(i_t - E_t \pi_{t+1} - r_t^n) \tag{1}$$

$$\pi_t - \gamma \pi_{t-1} = \beta(E_t \pi_{t+1} - \gamma \pi_t) + \kappa x_t + u_t \tag{2}$$

Equation (1) can be derived from the Euler equation for the representative household's consumption decision, where x_t is the output gap, defined as the deviation of output from the flexible-price level of output, i_t is the nominal interest rate, π_t is the rate of inflation, r_t^n is the flexible-price real interest rate, and u_t is a white noise mark-up ('cost-push') shock. Equation (2) is a 'hybrid' new Keynesian Phillips curve, which is derived by Woodford (2003) assuming that a fixed fraction of randomly chosen firms reset their prices in any given period, while the remaining firms index their prices to

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[3]See Clarida *et al.* (1999) and Woodford (2003).

a fraction γ of lagged inflation. A similar Phillips curve has been derived by Amato and Laubach (2003) and Steinsson (2003), where the existence of the backward-looking term was due to rule-of-thumb behavior among price setters. Woodford showed that under these assumptions, a second-order approximation to consumers' utility gives the following welfare loss function:[4]

$$E_0(1 - \beta) \sum_{t=0}^{\infty} \beta^t [(\pi_t - \gamma \pi_{t-1})^2 + \lambda x_t^2], \tag{3}$$

where the relative weight λ on the output gap depends on the deep parameters of the model.

Suppose that the central bank is not able to enforce a policy under commitment (in a timeless perspective). A large strand of the monetary policy literature focusses on specifying modified loss functions that gives the central bank incentives to conduct a policy that replicates the optimal policy under commitment.[5] In the pure forward-looking model, i.e., $\gamma = 0$, Vestin (2005) showed that the optimal policy would be implemented if the government assigned the following loss function to the central bank:

$$E_0(1 - \beta) \sum_{t=0}^{\infty} \beta^t [p_t^2 + \tilde{\lambda} x_t^2], \tag{4}$$

where $\tilde{\lambda}$ depends on the parameters in the model (in a non-closed-form way).

We consider the more general hybrid price-level/inflation target suggested by Batini and Yates (2003) and assume that the government assigns the following loss function to the central bank:

$$E_0(1 - \beta) \sum_{t=0}^{\infty} \beta^t [(p_t - \eta p_{t-1})^2 + \hat{\lambda} x_t^2], \tag{5}$$

where p_t is the price level (in logs), and $\hat{\lambda}$ is a choice parameter for the government. The parameter η ($0 \leq \eta \leq 1$) specifies the degree of price-level drift. If $\eta = 1$, there is full drift and the loss function collapses to an inflation target. If $\eta = 0$, there is a (pure) price-level target. Batini and Yates also investigated the intermediate regimes, but did not derive an optimal degree of price-level drift.

As noted by Woodford (2003), by defining $\pi_t^q \equiv \pi_t - \gamma \pi_{t-1}$ and inserting this into equations (2) and (3), and noting the x_t can be treated as the

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[4] The welfare loss function under the rule-of-thumb assumptions of Amato and Laubach (2003) and Steinsson (2003) are similar, albeit not identical, to the welfare loss function under price indexation.

[5] See e.g., Jensen (2002), Walsh (2003), Söderström (forthcoming), and Nessèn and Vestin (forthcoming).

control variable instead of i_t, we see that the policy problem becomes isomorphic to the standard forward-looking model. Based on this insight, we can generalize Vestin's (2005) result. Since Vestin showed that π_t should be replaced by p_t in the loss function, we apply the 'isomorphism result' and replace π_t^q in equation (3) by the level variable $q_t \equiv p_t - \gamma p_{t-1}$. The optimal weight on the output gap term is then equal to the optimal weight in the forward-looking model, i.e., $\lambda = \tilde{\lambda}$. The optimal policy can therefore be implemented by assigning the following loss function to the central bank:

$$E_0(1-\beta)\sum_{t=0}^{\infty}\beta^t[(p_t - \gamma p_{t-1})^2 + \tilde{\lambda}x_t^2]. \tag{6}$$

Thus, it is possible to achieve a policy that is identical to the optimal policy under commitment if the central bank minimizes a modified loss function with a Batini-Yates type of hybrid target, where the degree of price-level drift in the hybrid target is equal to the degree of price indexation, i.e., $\eta = \gamma$.

While Vestin considered the extreme case with no indexation, it is interesting to consider the other extreme with complete indexation. By setting $\gamma = 1$ in (5), we have the interesting result that the optimal monetary regime is (flexible) inflation targeting. There is an ongoing discussion about whether inflation targeting central banks should aim for price stability in the more ambitious sense of price level targeting. The above result shows, however, that if there is full indexation, which Giannoni and Woodford (2003) argue fits US data best and is also assumed by Christiano *et al.* (2005), central banks should keep on targeting inflation and not aim for price-level level targeting.

3 Conclusion

We have derived an optimal hybrid inflation/price level target as proposed by Batini and Yates (2003) in a new Keynesian model with inflation persistence stemming from price indexation. Building on the results by Vestin (forthcoming), we showed that the optimal degree of price-level drift in the hybrid target is equal to the degree of price indexation. In the case of complete indexation, the optimal monetary regime is flexible inflation targeting.

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