Cardiff Economics Working Papers

Working Paper No. E2008/5

Are Central Bank Preferences Asymmetric? A Comment

Patrick Minford and Naveen Srinivasan

February 2008

Cardiff Business School
Aberconway Building
Colum Drive
Cardiff CF10 3EU
United Kingdom
t: +44 (0)29 2087 4000
f: +44 (0)29 2087 4419
business.cardiff.ac.uk

Are Central Bank preferences asymmetric? A Comment[†]

Patrick Minford

Cardiff Business School and CEPR, UK

Naveen Srinivasan[††]

Indira Gandhi Institute of Development Research, Mumbai, India

Abstract

A recent paper by Ruge-Murcia [European Economic Review 48 (2004), 91-107] on asymmetric central bank objectives provides a new perspective on the policy roots of inflation in developed economies. More precisely, the paper demonstrates that if the distribution of the supply shocks is normal, then the reduced form solution for inflation implies a positive (or negative) relation between average inflation and the variance of shocks. We argue that the evidence offered in support of this hypothesis suffers from lack of identification because Phillips curve nonlinearity combined with quadratic central bank preferences yield the same reduced form solution for inflation. If so, estimating reduced form for inflation will not be able to discriminate between these models. Yet they have quite different implications for policy. Other, structural, evidence is needed.

JEL classifications: E52; E58; E61

Keywords: Preference asymmetry; Phillips curve nonlinearity; Identification

[†] Acknowledgements: We are grateful to two anonymous referees for helpful comments.

[††]Corresponding Author: Indira Gandhi Institute of Development Research, Gen. A.K. Vaidya Marg, Goregaon (E), Mumbai 400065. Tel: +91 22 28416555. Email: naveen@igidr.ac.in

I **Introduction**

The standard explanation of inflation bias is based on two-way interaction between policymakers and the rational public within the context of an expectations-augmented Phillips curve. This conceptual framework relies on the presumption that policymakers use monetary policy to raise output (or employment) above its normal level. This explanation generates a reduced form in which inflation depends on the extent of supply-side distortions or other possible sources of 'temptation to reflate'. It has however been questioned by policymakers as well as by some academics on the grounds of realism (examples include Blinder (1997, 1998)).

Such questioning led to the emergence, since the late nineties, of a new body of literature that incorporates the possible existence of asymmetries in the objective functions of central banks - the new inflation bias hypothesis, exemplified by Ruge-Murcia (2004).[1] More precisely, this literature demonstrates that when the central bank is also expected to engage in stabilization of output (or employment), some uncertainty about the future state of the economy and asymmetric concerns about positive and negative output gaps combine to create an inflation bias. Thus, a bias arises in spite of policymakers targeting the natural rate of output (or unemploy-

[1] Also see Cukierman and Gerlach (2003) and Nobay and Peel (2003). Moreover, the formulations used in these papers are sufficiently flexible to allow for the existence of precautionary demands for both expansions and for price stability.

ment).[2]

Cukierman and Gerlach (2003), among others, provide empirical support for this view. Specifically, they show that if the distribution of the supply shocks is normal, then the reduced form solution for inflation implies a positive (or negative) relation between average inflation and the variance of shocks to output. Thus, the new inflation (or deflation) bias hypothesis implies that the slope parameter in a regression of average inflation on the variance of the supply shock should be significant.

In this paper we show that reduced form evidence offered in support of the new inflation (or deflation) bias hypothesis suffers from a serious lack of identification. This is because Phillips curve nonlinearity combined with quadratic central bank preferences yield the same reduced form solution for inflation. However, the underlying motivation for preference asymmetry is very different: it lies in some way in considerations of political economy and of credibility. By implication estimating a reduced form for inflation will not be able to tell us the true source of any bias. Yet econometric identification is crucial for designing institutions to combat the problem.

If on the one hand the true source of bias is asymmetry of preferences then a cure could come simply from instructing the central bank not to act asymmetrically-

[2]Similarly, during periods of inflation stabilization when the buildup of credibility is a major concern, policymakers are likely to be more averse to upward deviations of inflation from its target than to downward deviations. The disinflationary experience of the UK during the second half of the nineties provides some preliminary support to this view (see Srinivasan et al., 2006).

an issue that has come up in the context of the European Central Bank's inflation target 'maximum' of 2%. Clearly on the other hand no such cure is available if the reason for the bias is Phillips curve nonlinearity. Then the bias will persist for as long as the Phillips Curve remains nonlinear. It follows that to distinguish among these alternative hypothesis it is necessary to adduce additional structural evidence either about central bank preferences or about the economy's structure. Previous work on the central bank preference hypothesis has acknowledged (Ruge-Murcia, ibid, p.98) the similar implications of Phillips Curve nonlinearity; but has failed to recognize the seriousness of the identification problem this poses. Thus here we carefully explain the problem and show that it cannot be resolved by reduced form evidence.

In the rest of this paper we briefly set out (section II) Ruge-Murcia's derivation of inflation bias from central bank preference asymmetry and then show (section III) how Phillips curve nonlinearity generates the same reduced form solution for inflation. Since the bias is proportional to the conditional variance of supply shock, the model generates testable cross-section and time-series implications. Section IV provides concluding remarks.

II **Asymmetric Central Bank preferences and inflation (or deflation) bias**

This section briefly recapitulates Ruge-Murcia's derivation of inflation bias from central bank preference asymmetry. The central banker's preferences over inflation and unemployment are represented by the loss function

$$L(\pi_t,\, u_t) = \left(\frac{1}{2}\right)(\pi_t - \pi^\star)^2 + \left(\frac{\phi}{\gamma^2}\right)\left(e^{\gamma(u_t - u_t^\star)} - \gamma\,(u_t - u_t^\star) - 1\right), \qquad (2.1)$$

where π_t is the inflation rate, u_t is the rate of unemployment and $\pi^\star$ and $u_t^\star$ denote the targeted rates of inflation and unemployment, respectively. Here ϕ is a positive coefficient and γ is a nonzero real number. The targeted unemployment rate is the expected natural rate of unemployment (u_t^n):

$$u_t^\star = E_{t-1}u_t^n. \qquad (2.2)$$

The expectations augmented Phillips curve in terms of unemployment is given by

$$u_t - u_t^n = -\lambda\,(\pi_t - \pi_t^e) + \eta_t, \qquad \lambda > 0, \qquad (2.3)$$

where π_t^e is the public's inflation forecast at time t constructed at time $t-1$, and η_t is an aggregate supply disturbance. The public constructs its forecast rationally, $\pi_t^e = E_{t-1}\pi_t$, where E_{t-1} is the expectation conditional on all information available at time $t-1$.

The central bank has imperfect control over the rate of inflation. In particular

$$\pi_t = i_t + \xi_{t,} \qquad (2.4)$$

where i_t is the policy instrument (short-term interest rate) and ξ_t is the disturbance term. Since i_t is chosen at time $t-1$, the specification relaxes the assumption that the central banker has an informational advantage over the public since neither of them observe the shock at time $t-1$. Finally, the structural disturbances of the model (η_t and ξ_t) are assumed to be serially uncorrelated, jointly normally distributed with zero mean, and possibly conditionally heteroskedastic. This assumption allows changes over time in the volatility of the structural shocks.

The central bank chooses the policy instrument so as to minimize the loss function in Eq. (2.1) subject to the economic structure given in Eqs. (2.3) and (2.4). This yields an implicit expression for the instrument i_t. Substitution of this equation into (2.4) yields, after some algebra

$$\pi_t = \pi^\star + \left(\frac{\lambda\phi}{\gamma}\right)\left(e^{\frac{\gamma^2\sigma^2_{u,t}}{2}} - 1\right) + \xi_{t,} \tag{2.5}$$

where $\sigma^2_{u,t}$ represents the conditional variance of unemployment.[3] Finally, linearization of Eq. (2.5) yields the precise form of the regression estimated by Ruge-Murcia (2004) which is,

$$\pi_t = a_0 + a_1\sigma^2_{u,t} + \xi_t, \tag{2.6}$$

where a_0 is a constant intercept and $a_1 = \frac{\lambda\phi\gamma}{2} \lesseqgtr 0$. In general, where the central bank's preferences are asymmetric, the inflation bias is different from zero. The bias is proportional to the conditional variance of unemployment.[4] The sign of the bias

[3] Since shocks are normal, the distribution of unemployment conditional on Ω_{t-1} is normal. Hence, the distribution of $\exp(\gamma\,(u_t))$ is log normal with conditional mean $\exp(\gamma^2\sigma^2_{u,t}/2)$.

[4] Also note that the variance of the unemployment rate can be related back to the variances of the

depends on whether $\gamma \lesseqgtr 0$, an inflation or deflation bias according to the sign of 'γ'. Thus, the key implication of this equation is that the average rate of inflation depends positively or negatively on the variance of the unemployment (or variance of supply shocks).

III **Phillips curve nonlinearity and inflation (or deflation) bias**

To make the basic point of the paper without introducing unnecessary complications we modify the expectations augmented Phillips curve by allowing for nonlinearity. Such asymmetry has a long empirical and theoretical history. The point is that with a nonlinear Phillips curve the sacrifice ratio is not independent of the size of an intended change in inflation- it rises as the economy goes further into recession. This suggests that inflation should be reduced more when the economy is in an expansionary mode induced by favourable supply shocks. A nonlinear Phillips curve thus provides a rationale for asymmetry even when the policymaker's preferences are quadratic.

Specifically, we assume that the Phillips curve is linear but the effect of the shock itself on the position of the trade-off is nonlinear. We use this formulation as a tractable representation of nonlinearity in the Phillips curve. A nonlinear Phillips

structural disturbances. As Cukierman and Gerlach (2003) point out, in the absence of anticyclical policy the variability in the rate of growth of output (or unemployment) and the variance of supply shocks are positively and strongly correlated. Hence $\sigma^2_{u,t}$ in Eq. (2.6) can be proxied by $\sigma^2_{\eta,t}$.

curve with quadratic central bank preferences does not yield a closed form solution for inflation and must be evaluated numerically- see Orphanides and Wieland (2000). However it can be shown numerically that the optimal reaction function will be nonlinear (see Minford and Srinivasan, 2006), with the approximate form: $\pi_t = \pi^\star - a\left(e^{\gamma\varepsilon_t} - 1\right)$. This closed form solution is obtained from the assumption we now make on the functional form for the Phillips curve, which places the nonlinearity in the shock mechanism:

$$y_t = \alpha\left(\pi_t - \pi_t^e\right) + \left(e^{b\varepsilon_t} - 1\right), \tag{3.1}$$

where y_t is the output gap in period t, $\alpha > 0$ and $b > 0$ are constants and ε_t the supply shock is assumed to be normally distributed with zero mean and possibly conditionally heteroskedastic. Eq. (3.1) is the short-run Phillips curve which is linear in the unexpected component of inflation but responds asymmetrically to supply disturbances. This tractable representation produces similar effects on policy to the usual (Phillips curve which is nonlinear in the unexpected component of inflation and linear in shocks) set-up.

The central banker's preferences over inflation and output are represented by a quadratic loss function

$$L(\pi_t, y_t) = \frac{1}{2}\left[\left(\pi_t - \pi^\star\right)^2 + \lambda\left(y_t\right)^2\right], \tag{3.2}$$

where $\lambda > 0$ is the relative weight on output-gap stabilization. The private sector has rational expectations; that is,

$$\pi_t^e = E_{t-1}\pi_t. \tag{3.3}$$

Finally, following Ruge-Murcia (2004) we posit a linear relationship between the policy instrument and the inflation rate. Thus, the model shares all the basic features of Ruge-Murcia (2004), and departs instead only in the assumption regarding the central banker's preferences and the functional form of the Phillips curve. In this framework the central bank chooses the policy instrument so as to minimize the loss function in Eq. (3.2) subject to the economic structure given in Eqs. (3.1) and (3.3). This yields the following first-order condition with respect to π_t:

$$\pi_t = \left(\frac{1}{1+\alpha^2\lambda}\right)\left(\pi^\star + \alpha^2\lambda\pi_t^e - \alpha\lambda\left(e^{b\varepsilon_t} - 1\right)\right). \tag{3.4}$$

In order to make Eq. (3.4) consistent with Eq. (2.6), we linearize the exponential term above by means of a second-order Taylor expansion around $\varepsilon_t = 0$. That is, $e^{b\varepsilon_t} \approxeq 1 + b\left(\varepsilon_t\right) + \frac{b^2(\varepsilon_t)^2}{2}$. Substituting this approximation in Eq. (3.4) and taking expectations conditional upon information available in period $t-1$ yields:

$$\pi_t^e = \pi^\star - \left(\frac{\alpha\lambda b^2}{2}\right)\sigma_{\varepsilon,t}^2, \tag{3.5}$$

where $\sigma_{\varepsilon,t}^2$ denotes the conditional variance of supply shock. Finally, substituting Eq. (3.5) for π_t^e in Eq. (2.4) yields the reduced form solution for inflation:

$$\pi_t = a_2 + a_3\sigma_{\varepsilon,t}^2 + \xi_t, \tag{3.6}$$

where $a_2 = \pi^\star$ and $a_3 = -\left(\frac{\alpha\lambda b^2}{2}\right) < 0$. Eq. (3.6) is the optimal feedback rule for inflation when the Phillips curve is nonlinear. Moreover, this particular functional form for the Phillips curve implies a deflation bias.[5] The intuition for this deflation bias stems from the asymmetric interest rate-setting behaviour under a convex Phillips curve whereby policymakers (with a given inflation target) have a greater incentive to avoid periods of excess demand, as these require larger and more protracted recession to undo the inflation generated when output is above target.

Thus, both nonlinearity of the Phillips curve and asymmetric preferences imply the same reduced form solution for inflation. Hence, estimating Eq. (2.6) or Eq. (3.6) will not be able to tell us what the 'true' source of the bias is. Yet this information is crucial for designing institutions to combat the problem. In order to distinguish these two theories other, structural, evidence is required. This could be direct evidence on the structure of central bank preferenses or the Phillips Curve; or it could be indirect evidence through estimating a full structural model with all cross-equation restrictions imposed from each theory, then testing between the two structures.

IV **Conclusion**

[5] We note that we can get both inflation or deflation bias with a nonlinear Phillips curve. In our Phillips curve formulation the response of output to shocks is convex. The model in this case predicts a deflation bias. In contrast, if we had modelled the response of output to shocks to be concave, the model predicts an inflation bias. Thus, both models (asymmetric preference and nonlinear Phillips curve) predict an inflation or deflation bias.

Recent literature on asymmetric central bank objectives provides a new perspective on the policy roots of inflation in developed economies. Rather than being due to a systematic attempt to maintain output above potential (or unemployment below its natural level) this literature raises the possibility that much of the inflationary bursts experienced by developed countries during the last thirty years were due to the existence of a precautionary demand for expansions. It also suggests that, during periods in which the central bank's resolve to stabilize inflation is strong, like the second half of the nineties in the UK, the precautionary demand for price stability may dominate.

In this paper we have argued that the reduced form evidence offered in support of asymmetric central bank preferences suffers from a serious lack of identification. Specifically, it is argued that Phillips curve nonlinearity combined with quadratic central bank preferences yield exactly the same reduced form solution for inflation as asymmetric preferences. A resolution requires structural evidence.

References

Blinder, A. (1997), "Distinguished Lecture on Economics in Government: What Central Bankers Could Learn from Academics and Vice Versa", Journal of Economic Perspectives, 11, 3-19.

Blinder, A. (1998), Central Banking in Theory and Practice, (London: MIT Press).

Cukierman, A., and S. Gerlach, (2003), "The Inflation Bias Revisited: Theory and Some International Evidence", The Manchester School, 71, 541-565.

Minford, P., and N. Srinivasan, (2006) "Opportunistic monetary policy: An alternative rationalization," Journal of Economics and Business, vol. 58(5-6), pages 366-372.

Nobay, A.R, and D. A. Peel (2003), Optimal Discretionary Monetary Policy in a Model of Asymmetric Central Bank Preferences," Economic Journal, 113, 657-65.

Orphanides, A., and V. Wieland, (2000) "Inflation Zone Targeting," European Economic Review, 44 (7), 1351-87.

Ruge-Murcia, F. (2004), "The Inflation Bias When the Central Bank Targets the Natural Rate of Unemployment," European Economic Review, 48, 91-107.

Srinivasan, N, V. Mahambare and M. Ramachandran (2006) "UK monetary policy under inflation forecast targeting: is behaviour consistent with symmetric preferences?" Oxford Economic Papers, vol. 58, issue 4, 706-721.