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Monetary Policy, Employment Shortfalls, and the Natural Rate Hypothesis

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Abstract

Activity shortfalls are more costly than strong activity. I consider optimal monetary policy under discretion with an asymmetric (activity shortfalls) loss function. The model satisfies the natural rate hypothesis. The asymmetric loss function and resulting optimal monetary policy exacerbates shortfalls in activity. The additional frequency of activity shortfalls arises from the adjustment of expectations implied by the natural rate hypothesis. The shortfalls asymmetry leads to an inflationary bias, similar to results in the time-consistency literature. Mandating a central bank objective with greater symmetry than the social loss function improves outcomes. Greater symmetry lowers the magnitude of activity shortfalls. Greater symmetry also reduces inflation bias. The model also implies that an optimal monetary policy does not accommodate fluctuations from aggregate demand shocks, as is standard in such models. As a result, the analysis implies that monetary accommodation of strength in economic activity likely requires justifications other than asymmetric costs of shortfalls.

Keywords: Monetary Policy, Rules, discretion, symmetric loss function, asymmetric loss function

JEL Codes: E52, E58, E37

[*] Email: michael.t.kiley@frb.gov. The views expressed herein are those of the author and do not reflect those of the Federal Reserve Board or its staff. I would like to thank participants in a workshop on related work at the Federal Reserve Board for comments and suggestions.

1. Introduction

I examine the consequences of monetary policy approaches resulting from asymmetries in the losses associated with employment shortfalls and strength. The model assumes the natural rate hypothesis—monetary policy is neutral in the long run. The analysis demonstrates that asymmetric monetary policy approaches have unintended consequences, including exacerbating activity shortfalls and creating an inflationary bias. Mandating that central banks behave (relatively) symmetrically mitigates these unintended consequences and improves welfare. The analysis suggests that, all else equal, the asymmetry in the costs of labor market weakness and strength does not warrant monetary accommodation of strong labor markets. Other factors, such as permanent effects of strong labor markets on economic potential, may be necessary for optimal monetary policy to accommodate labor market strength.

Recent research and practice at central banks motivates the analysis. The costs of weak labor markets and potential benefits of strong labor markets are sizeable.[2] Some research has suggested that such benefits imply that monetary policy should accommodate labor market strength in the absence of inflation.[3] Research has explored the implications of inequality for monetary policy, with strong labor markets generally viewed as reducing (at least in the short run) inequality.[4] In addition, policy approaches that aim to account for the potential benefits of strong labor markets have entered in central bank deliberations. For example, the Federal Open Market Committee (FOMC) emphasized employment shortfalls in its 2020 framework.[5] In recent years, monetary policy discussions have emphasized asymmetric costs of labor market shortfalls, including in analyses of asymmetric loss functions in research and in central bank policy analyses.[6] Practitioners and central banks have presented policy rules with asymmetric treatment of activity shortfalls in their analyses.[7]

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[2] For example, Aaronson et al, 2019; Hotchkiss and Moore, 2022.

[3] For example, Bernstein and Bentele, 2019. Evans, 2024, discusses the Federal Open Market Committee's 2020 framework and notes that "the strategy highlighted eliminating employment shortfalls only, thus allowing policy to support stronger labour market vibrancy so long as the price stability mandate remains in check."

[4] For example, Feiveson et al, 2020, and Chang, 2022. Kiley and Mishkin, 2024, review the recent discussion.

[5] Altig et al, 2020, and Clarida, 2022, discuss the Federal Reserve's 2020 framework, including the role of activity shortfalls.

[6] Gust, Lopez-Salido, and Meyer, 2017; Penalver and Siena, 2024; and Federal Reserve staff policy simulations prepared for FOMC meetings in Tealbook B from 2016 to the most recently available public versions (The Fed - Transcripts and other historical materials (federalreserve.gov)).

[7] For example, Fuentes-Albero and Roberts, 2021; Papell and Prodhan, 2022; Bundick and Petrosky-Nadeau, 2023; and the Federal Reserve's *Monetary Policy Report* in recent years

Monetary policy conducted on a discretionary basis can lead to an inflationary bias when higher activity is socially desirable (Barro and Gordon, 1983). Central bank design can solve this problem, such as conservative central bankers that dislike inflation (Rogoff, 1985). These insights have had a strong influence on central bank practice and design, including on central bank independence and mandates.[8] Because the classic results on inflation bias under discretionary policy are well understood, the analysis assumes a loss function with no inflation bias in the absence of shocks to the economy. The asymmetry in the loss function is introduced via a specification in which losses are separable in activity shortfalls and strength, with different weights on activity below and above the natural rate.[9] The asymmetric loss function nests as a special case the loss function used by the Federal Reserve staff in its analysis of optimal policy simulations and in the research of, for example, Gust, Lopez-Salido, and Meyer (2017) and Penalver and Siena (2024).

This special case is a loss function quadratic in activity shortfalls, with no weight in the loss function on activity above potential. Such a loss function could be motivated by a view that activity below its natural rate is costly, while there are no costs (or benefits) from activity above potential. Consider optimal policy for this loss function following an aggregate supply (cost-push) shock which lowers inflation and/or raises output (a "positive" aggregate supply shock, referring to the sign of the effect on output). The monetary policymaker's loss function sees no cost to output above its natural rate but sees costs to inflation deviating from target. As a result, optimal policy will allow all of the cost-push shock to feed through to stronger activity and will stabilize inflation at its objective. Because of this policy, activity can be strong in response to these types of positive aggregate supply shocks. In contrast, negative aggregate supply shocks—those that lower activity and raise inflation—lead policymakers to stabilize both inflation and output somewhat, as both deviations are costly.

All else equal, these policy actions would lead to small activity shortfalls, because monetary policy leans against shortfalls, and strong economic expansions, as strong activity is accommodated. However, the aggregate supply curve—the Phillips curve—satisfies the natural rate hypothesis and activity must equal its natural rate, on average. As part of the equilibrating process that delivers long-run monetary neutrality, expectations shift to alter the nature of

[8] Kiley and Mishkin, 2024, highlight these insights as among the core principles for central banking.

[9] There are many ways to introduce asymmetry. For example, Surico, 2007, introduces asymmetry via a linex function and focuses on an assessment of whether the empirical evidence suggests that policymakers behaved in a manner consistent with asymmetric preferences.

expansionary supply shocks: the degree to which an expansionary supply shock must be expansionary shifts to ensure that the natural rate hypothesis is satisfied. The equilibrium outcome is more mass on activity shortfalls. Moreover, inflation is biased above its objective, as positive aggregate supply shocks lead to inflation at objective while negative aggregate demand shocks lead to inflation above objective.

These results may inform discussions of monetary policy in several ways. First, asymmetric loss functions have been used to inform monetary policy discussions. The motivation for such analyses is the intuitive notion that activity shortfalls are more costly than overshoots. However, such analyses have emphasized deterministic simulations in which the asymmetric responses to shocks—and resulting shifts in expectations—are absent.[10] The simple notion that the natural rate hypothesis may limit the ability of policy to reap the gains of accommodative policy, and can even worsen employment shortfalls, may be a useful consideration for such analyses. Second, the analysis will demonstrate that a different type of Rogoff (1985) conservative central banker can ameliorate unintended consequences of discretionary policy in the face of an asymmetric loss function. Specifically, a central bank that bases policy on a loss function that is more symmetric than the social loss function improves welfare, in a manner similar to how a central bank with a lower weight on activity improves outcomes under discretionary policy in Rogoff (1985). Finally, these results also imply that relatively symmetric policy rules improve outcomes, providing another example of how rules can improve over discretion.

Section 2 presents the model and core results. As the model is simple, section 3 discusses how the model connects with more complex models and presents thoughts on deviations from the natural rate hypothesis that may affect the results. Section 4 concludes.

2. A Model of Optimal (Discretionary) Policy When Activity Shortfalls Are Costly

The model

I use a simple static model. Aggregate supply is represented by a Phillips curve linking inflation to expected inflation, the output gap, and a cost-push (supply) shock, as in

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[10] For example, this channel is absent in the Federal Reserve staff policy simulations prepared for FOMC meetings in Tealbook B from 2016 to the most recently available public versions (The Fed - Transcripts and other historical materials (federalreserve.gov)), reflecting the deterministic, rather than stochastic, simulation and solution method.

Equation 1

$$\pi(t) = E\{\pi(t)\} + \kappa y(t) + u(t).$$

In Equation 1, π denotes inflation, y is the output gap, u is the supply shock with mean zero, and κ is a (positive) parameter. $E\{\quad\}$ is the expectations operator based in period t-1 information—that is, expectations are formed prior to the realization of any shocks to the economy. Note that a coefficient of unity on expected inflation ensures the long-run neutrality of inflation (the natural rate hypothesis). Inflation is positively related to expected inflation. Output above potential raises inflation.

The natural rate hypothesis is a key element of Equation 1. That is, the Phillips curve implies that the unconditional expectation for the output gap is zero—output equals potential in the long run under any monetary policy. (Taking the unconditional expectation of Equation 1, given mean-zero aggregate supply shocks, yields this result.) This issue will be discussed further in section 3.

The IS curve is

Equation 2

$$y(t) = -\sigma[r(t) - E\{\pi(t) - r^*(t)\}.$$

In Equation 2, r represents the short-term interest rate, r^* is an aggregate demand shock, and σ is a parameter. The deviation of output from potential depends negatively on the real interest rate. The IS curve will have no role in the optimal policy problem, as the policymaker chooses the outcomes for inflation and output. Rather, the IS curve will shape the rule for the policy interest rate that implements the optimal policy.

The social loss function is quadratic in deviations from the inflation target, output shortfalls $y(t) < 0$, and strong output $y(t) > 0$

Equation 3

$$L(t) = [\pi(t) - \pi^*]^2 + \alpha^l \cdot [min(y(t), 0)]^2 + \alpha^h \cdot [max(y(t), 0)]^2,$$
$$\alpha^l \geq \alpha^h, \alpha^i \geq 0, i = l, h.$$

With the loss function in Equation 3, deviations of inflation from the socially optimal level π^* are costly and these costs are symmetric in deviations above/below the objective. In contrast, the costs associated with deviations of activity from its natural rate are potentially asymmetric, with the costs of shortfalls of activity relative to potential greater than, or equal to, costs associated with equal-sized positive output gaps ($\alpha^l \geq \alpha^h$). The symmetric case ($\alpha^l = \alpha^h$) is common in textbook treatments of optimal monetary policy under discretion and time-inconsistency (Obstfeld and Rogoff, 1996; Romer, 2012).

Optimal policy under discretion

The policymaker chooses inflation, output, and the nominal interest rate subject to the structure of the economy to minimize the social loss function. The policymaker takes inflation expectations as given—that is, they act under discretion. The optimality conditions reduce to

Equation 4

$$\pi(t) = \pi^* - \frac{\alpha^l}{\kappa} y(t),\ y(t) \leq 0,$$

$$\pi(t) = \pi^* - \frac{\alpha^h}{\kappa} y(t),\ y(t) \geq 0.$$

The following four results characterize optimal policy under discretion.

Result 1: *Aggregate demand shocks do not impact output and inflation.*

This result is standard, does not depend on the degree of asymmetry in the loss function, and follows directly from Equation 4. Along an optimal policy path, the changes in inflation and output relative to its natural rate have opposite signs, reflecting the short-run tradeoff in the Phillips curve, the non-negative costs associated with deviations in objectives, and the fact that aggregate demand shocks move inflation and output in the same direction. These factors imply that optimal policy moves the policy interest rate one-for-one with the aggregate demand shock to neutralize any impact on objectives. Note that Result 1 implies that lower costs of strong output/higher costs of weak output do not justify accommodation of strength in aggregate demand under an optimal policy.

Result 2: *When the loss function is symmetric in activity, inflation equals the inflation objective, on average.*

This result is standard. With a symmetric objective ($\alpha^l = \alpha^h$), Equation 4 implies that the unconditional expectation of inflation equals the objective plus the unconditional expectation of output. The unconditional expectation of output equals zero owing to the natural rate hypothesis. As a result, inflation equals the inflation objective, on average. This implies that there is no inflation bias, which is consistent with the core results in the literature on time-inconsistency. Specifically, the presence of an inflation bias under a symmetric quadratic loss function occurs when the desirable level of activity in the loss function is above activity's natural rate—that is, when the loss function is $[\pi(t) - \pi^*]^2 + \alpha \cdot [y(t) - y^*]^2$ where $y^* > 0$.[11] In our baseline loss function (Equation 3), the bliss point for the desired level of activity is the natural rate, and hence the most commonly modeled source of inflation bias is absent in the model.

Result 3: *When the loss function is asymmetric in activity, activity shortfalls ($y < 0$) become more sizable (formally, $\left|\int_{-\infty}^{0} y \cdot f(y) dy\right|$ is larger) relative to outcomes under a symmetric loss function.*

This result is the central new result, and its derivation is slightly more involved. Equation 1 implies that

$$-\int_{-\infty}^{0} y \cdot f(y) dy = \int_{0}^{\infty} y \cdot f(y) dy.$$

Equation 4 and Equation 1 imply that $y(t) = -\frac{\kappa}{\alpha^i + \kappa^2}(u(t) - u^*)$ for $i = l, h$ for some u^* for which $y \lesseqgtr 0$ if $u \gtreqless u^*$. The combination of these observations implies that

$$-\frac{\kappa}{\alpha^h + \kappa^2} \int_{-\infty}^{u^*} (u - u^*) \cdot f(u) du = \frac{\kappa}{\alpha^l + \kappa^2} \int_{u^*}^{\infty} (u - u^*) \cdot f(u) du$$

for some u^* for which $y \lesseqgtr 0$ if $u \gtreqless u^*$. Because $\alpha^l \geq \alpha^h$, u^* is less than or equal to zero. For the symmetric case ($\alpha^l \geq \alpha^h$), u^* is equal to zero—that is, a contractionary aggregate supply shock is any positive value of u. However, an asymmetric loss function results in a lower value of u^* below zero—that is, values of u that would be expansionary under a symmetric loss function are contractionary because inflation expectations adjust to preserve the natural rate hypothesis. As a result, $-\left|\frac{\kappa}{\alpha^l + \kappa^2} \int_{u^*}^{\infty} (u - u^*) \cdot f(u) du\right| = \left|\int_{-\infty}^{0} y \cdot f(y) dy\right|$ is larger.

Result 4: *When the loss function is asymmetric in activity, expected inflation exceeds the inflation objective π^*.*

Result 4 builds on result 3 and generalizes a result in Gust, Lopez-Salido, and Meyer (2017).[12] Equation 4 and Equation 1 imply that $\pi(t) - \pi^* = \frac{\alpha^i}{\alpha^i + \kappa^2}(u(t) - u^*)$ for $i = l, h$ for some u^* for which $y \lesseqgtr 0$ if $u \gtreqless u^*$. As a result,

[11] Textbook examples include Obstfeld and Rogoff (1996) and Romer (1983). The results on inflation bias in the case of a linear-quadratic and symmetric loss function stem from the linear term that arises when $y^* > 0$. Many examples include only the linear term, e.g., Barro and Gordon, 1983.

[12] Gust, Lopez-Salido and Meyer previously derived result 4 for the limiting case in which $\alpha^h = 0$; in this limiting case, result 3 is not needed to demonstrate result 4.

$$E\{\pi(t)\} = \pi^* + \frac{\alpha^h}{\alpha^h + \kappa^2}\int_{-\infty}^{u^*}(u-u^*)\cdot f(u)du + \frac{\alpha^l}{\alpha^l + \kappa^2}\int_{u^*}^{\infty}(u-u^*)\cdot f(u)du.$$

The definition of u^* implies that

$$\frac{1}{\alpha^h+\kappa^2}\int_{-\infty}^{u^*}(u-u^*)\cdot f(u)du + \frac{1}{\alpha^l+\kappa^2}\int_{u^*}^{\infty}(u-u^*)\cdot f(u)du=0,$$

which implies

$$\frac{\alpha^h}{\alpha^h+\kappa^2}\int_{-\infty}^{u^*}(u-u^*)\cdot f(u)du + \frac{\alpha^l}{\alpha^l+\kappa^2}\int_{u^*}^{\infty}(u-u^*)\cdot f(u)du = \ldots$$

$$\frac{\alpha^h}{\alpha^h+\kappa^2}\int_{-\infty}^{u^*}(u-u^*)\cdot f(u)du + \frac{\alpha^h}{\alpha^l+\kappa^2}\int_{u^*}^{\infty}(u-u^*)\cdot f(u)du + \frac{\alpha^l-\alpha^h}{\alpha^l+\kappa^2}\int_{u^*}^{\infty}(u-u^*)\cdot f(u)du > 0$$

as $u^* < 0$ and $\alpha^l > \alpha^h$ for the asymmetric case. As a result, $E\{\pi(t)\} > \pi^*$.

Result 4 echoes the inflation bias result in the literature, albeit for a reason different than that in the most common linear-quadratic model. Specifically, inflation bias arises in the standard model because of the temptation to inflate to raise activity. The loss function herein has no such temptation in the absence of shocks because the bliss point for activity is the natural rate.[13] Rather, the inflation bias stems from the asymmetric approach to the stabilization of shocks. This suggests that the inflation bias herein adds to any inflation bias that occurs owing to the standard assumption of a bliss point for activity above its natural rate. (Indeed, it is trivial to demonstrate this result by replacing $y(t)$ with $y(t) - y^*$ in the loss function Equation 4 and rederiving result 4.)

Implications for central bank mandates and reaction functions

The growing appreciation for the time-inconsistency challenges facing monetary policymakers that followed Barro and Gordon (1983), Rogoff (1985), and others contributed to changes in central bank mandates and practices (Afrouzi et al, 2024).[14] In the nearly half century from the 1980s to the early 2020s, central banks were granted greater independence (Romelli, 2022) and became increasingly transparent (Dincer, Eichengreen, and Geraats, 2022). It is hence natural to consider the implications of the model herein for central bank mandates and practice, especially given the increased focus on the benefits of strong labor markets and the costs of employment shortfalls in monetary policy discussions.

[13] The inflation bias disappears as the distribution of *u* shocks shrinks to the degenerate case in which *u* equals zero with probability equal to 1.

[14] The literature is large, building on Barro and Gordon (1983) and Rogoff (1985), including Cukierman and Meltzer (1986), Waller (1992), and Walsh (1995).

While the source of the inflation bias herein differs from that in Rogoff (1985), the insight that a more conservative central banker—that is, a central bank with a preference or mandate to weigh activity less in the loss function it uses to determine policy—improves the social loss carries over.

Result 5 (Rogoff, 1985): *The social loss is lower if a central bank places a lower weight on activity in its loss function than is present in society's loss function (that is, the social loss is lower in Equation 3 if the central bank acts to minimize a revised Equation 3 in which* α^l *and* α^h *are replaced by* $\gamma\alpha^l$ *and* $\gamma\alpha^h$ *for some* $\gamma < 1$).

Result 5 follows immediately from the fact that the inflation bias introduces a first-order term in the social loss that is reduced if the weight(s) on activity are reduced. The reduction in the weight on activity has a cost as well-it alters the desirable tradeoff between inflation and output implied by Equation 4, but this effect is second order and hence reduced weight on activity is desirable. This result from Rogoff (1985) is a core in lessons from the literature (e.g., Romer, 2012) and remains in the model with asymmetric weights on output even though the source of the inflation bias is different.

Result 6: *The social loss is lower if a central bank has more symmetric preferences over activity in its loss function than is present in society's loss function (that is, the social loss is lower in Equation 3 if the central bank acts to minimize a revised Equation 3 in which* α^h *is replaced by* $\alpha^h + \varepsilon$ *for some* $\varepsilon > 0$).

Result 6 follows from the same logic as result 5: the inflation bias introduces a first-order term in the social loss that is reduced if the central banker views strong economic activity as more costly than implied by the social loss function. This implies a new type of conservative central banker improves welfare—a central banker who behaves as if the costs of strong economic activity are greater than they are and hence sets policy relatively symmetrically.[15]

While the literature often discusses the issues for central bank design in terms of mandated loss functions or conservative central bankers, policy rules are another emphasis since Barro and Gordon (1983). Constrained discretion through reference to rules has been argued to mitigate costs from policy under discretion (e.g., Bernanke and Mishkin, 1997). Result 6 implies a corollary for

[15] While it is difficult to tie theoretical results from simple models to policymaking, this lesson may inform policy discussions, as this general type of analysis is in the mind of (some) central bankers. For example, Evans (2024) notes in his discussion of the FOMC's 2020 framework that "From the perspective of calculating optimal policy responses, it has been convenient to posit quadratic loss functions in employment around a natural level. But positing explicit policy distaste for higher employment doesn't make sense per se. High employment alone should not be a negative. It may be sensible as a proxy for higher inflation risk, but conditions matter, and the inflation specification should contain those downsides."

monetary policy rules, which may be useful for economists who view good central bank practice as a form of constrained discretion through reference to rules.

Corollary: *The social loss is lower if a central bank following an optimal rule of the form* $r(t) = r^{ss} + \pi^{*} + \varphi\{\pi(t) - \pi^{*}\} + \phi^{l}\min[y(t), 0] + \phi^{h}\max[y(t), 0]$ *has more symmetric reactions to activity than implied by society's loss function (that is, the social loss is lower in Equation 3 if the central bank reacts with a response coefficient* ϕ^{h} *that is larger than the* ϕ^{h} *implied by the loss function under optimal discretionary policy).*

This can be seen by noting that the optimal policy under discretion is implemented by an interest rate rule of this form in which ϕ^{l}/φ equals α^{l}/κ, ϕ^{h}/φ equals α^{h}/κ, and $\phi^{l}, \phi^{h}, \varphi$ are large.[16] Since welfare is improved by more symmetric weighting of activity in the central bank's loss function than in society's loss function, a more symmetric optimal reaction function improves welfare. While this result only applies to the optimal reaction function, it may hold more generally (which would require a quantitative evaluation, as in Kiley, 2024).[17]

An illustration of these results for a parameterized version of the model is instructive. Suppose the slope of the Phillips curve is ¼ ($\kappa = 0.25$), the aggregate supply shock follows that standard Normal distribution, and the social loss function only weighs activity shortfalls and this weight equals the Phillips curve slope ($\alpha^{l} = \kappa = 0.25,\ \alpha^{h} = 0$). The equivalence of the Phillips curve slope and the activity weight implies a one-for-one tradeoff between inflation and activity under the optimal symmetric policy, which makes visualization simple without altering the nature of the discussion.

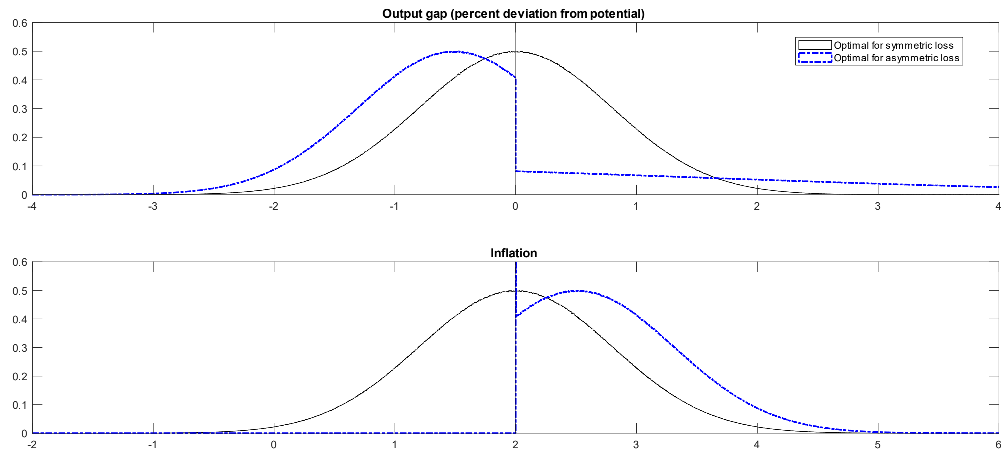
Figure 1 presents the distribution for activity and inflation under optimal policy. The dash-dotted blue lines are the baseline asymmetric case, while the solid black lines are the case where the activity weight is symmetric (and equals 0.25 as in the asymmetric case). Results 3 and 4 are clear. The mass on the activity distribution on shortfalls is higher under asymmetric policy. This occurs because the accommodation implied for positive aggregate supply shocks leads to large booms, which need to be offset by more mass on activity busts owing to long-run monetary neutrality.

[16] This can be seen by inserting these values for the reaction coefficients into the reaction function and taking the limit as ϕ^{l}, ϕ^{h}, φ go to infinity at the same rate, which yields the optimality conditions Equation 4.

[17] Bundick and Petrosky-Nadeau (2023) use stochastic simulations of a dynamic-stochastic-general-equilibrium model to assess a nonlinear policy rule similar to that considered herein. There results show an inflation bias, as herein and in Gust, Lopez, Salido (2017) and Kiley (2024). Their model and global solution technique also implies changes in the reduced-form Phillips curve from nonlinear policy rule. In contrast, the analysis herein takes the Phillips curve parameters as structural. It is likely that the quantitative results in Bundick and Petrosky-Nadeau (2023) depend on their specific (and complex) model, but the general point that reduced-form relationships will change with policy changes is important and merits further research across a range of structural models.

Inflation is biased upward, to a large degree in this case as the extreme form of asymmetry in the assumed loss function implies that inflation never falls below objective. Examination of figure 1 raises questions on the use of shortfall loss functions: it is not clear that the exacerbation of output shortfalls is the type of outcome expected when central banks use such a loss function in policy simulations.[18]

Figure 1: Outcomes under the optimal policy for asymmetric and symmetric loss functions



Source: Author's calculations.

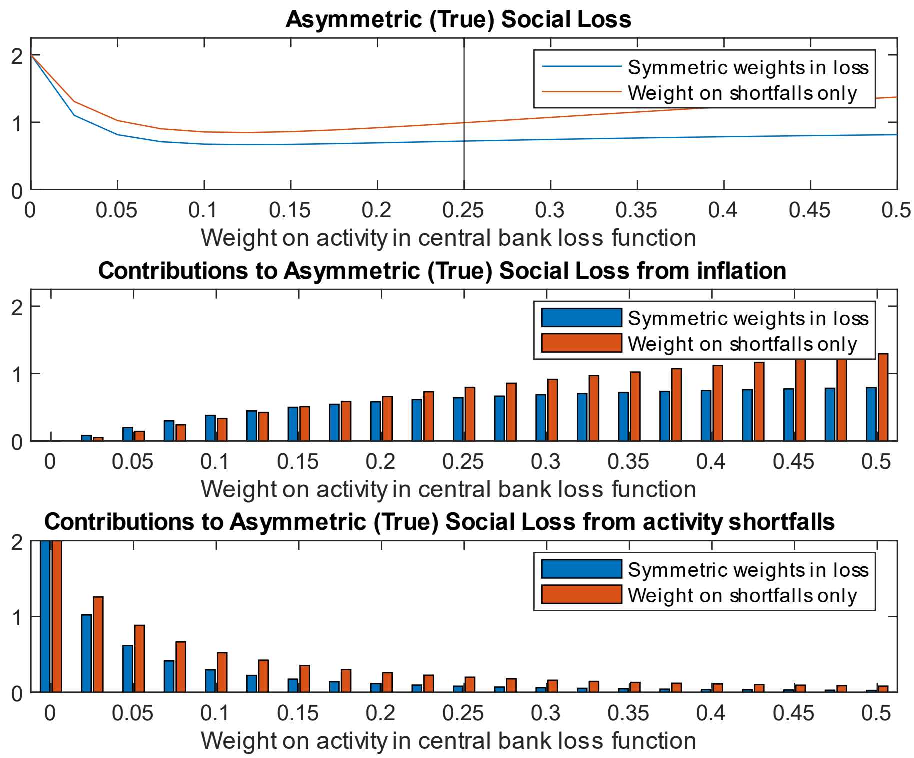
Figure 2 presents information on the social loss in cases where the central bank's loss function may differ from social loss, maintaining the same assumptions as used in Figure 1. The top panel shows the social loss for alternative asymmetric or symmetric weights in the central bank's loss function. The lower social losses from a conservative central banker are clear for the asymmetric weight case. As shown in the bottom panels, asymmetric approaches tend to show larger mean-squared activity shortfalls, as implied by result 3. It is clear from the figure that greater symmetry in central bank practice improves welfare: for example, the mean-squared deviation of inflation from target and activity shortfalls are both lower for a symmetric loss function with activity weight of 0.25 than for the asymmetric loss function with the same weight. It is also the case that welfare is higher when a lower weight is placed on activity, as in Rogoff. For example, the optimal weights when the social loss function is asymmetric with weights $\alpha^l = 0.25,\ \alpha^h = 0$ occurs when the central bank is assigned nearly symmetric weights below α^l of $\alpha^l = 0.15,\ \alpha^h = 0.10$ (not shown),

[18] For example, the Federal Reserve Board's staff optimal policy simulations prepared for FOMC meetings, available at [The Fed - Transcripts and other historical materials (federalreserve.gov)](federalreserve.gov).

providing an example of results 5 and 6. The model is stylized, and such a quantitative example are only illustrative.

Putting results together provides a reminder of the power of the natural rate hypothesis. Changes in expectations can cause policy actions to have unintended effects, such as an exacerbation of shortfalls in activity when policies to accommodate strong activity are pursued.[19]

Figure 2: Losses for alternative central bank weights on activity ($\alpha^l = 0.25,\ \alpha^h = 0$)



Source: Author's calculations.

3. Additional considerations

An asymmetric Phillips curve

I have assumed a linear Phillips curve. Research has suggested that the Phillips curve may be nonlinear, and the combination of high inflation and tight resource utilization in the early 2020s in

[19] The analysis herein analytically characterizes consequences that could be viewed as unintended. Research has alternatively used scenario discussions and judgmental simulations to illustrate unintended consequences, e.g., Erceg et al, 2018..

the United States has reignited focus on this possibility. Benigno and Eggertsson (2023).present evidence that the Phillips curve becomes much steeper when resource utilization is high. Orphanides and Wieland (2000) and Dolado, Marisa-Dolores, and Naveira (2005) find this type of nonlinearity implies that the optimal monetary policy under a symmetric quadratic loss function leans against strong activity more robustly. This consideration would likely carry over to the asymmetric loss function, all else equal.

Macroeconomic dynamics, monetary neutrality, and monetary super-neutrality

The model embeds the natural rate hypothesis—the monetary policy approach has no long-run effects on activity. This assumption is standard in monetary policy analysis since Friedman (1968) and Phelps (1968) and is among the core principles used in monetary policy discussions (e.g., Kiley and Mishkin, 2024). But it is only an approximation to reality. Aa range of factors likely make the average rate of inflation non-neutral in the long run, including costs households and firms face when adjusting their plans to inflation, inefficiencies associated with nominal rigidities and the interaction of these factors with distortions in product and labor markets, taxation of nominal income and imperfect indexation, and potential distortions to saving decisions stemming from misperceptions of nominal and real factors, among others (e.g., Fischer and Modigliani, 1978; Kiley, Mauskopf, and Wilcox, 2007).

As a result, it is natural to consider whether the natural rate hypothesis provides a good guide for policy discussions. In the model, the exacerbation of activity shortfalls and the inflation bias arise from the response of monetary policy to shocks under an asymmetric approach. That is, the focus is on short-run effects of monetary policy. These short-run effects are separate from long-run effects, and the literature labels these categories as monetary neutrality and monetary super-neutrality (e.g., Afrouzi et al, 2024). Monetary neutrality is a reasonable, albeit debatable, assumption, as the ability of the short-run adjustments in monetary policy to permanently raise activity is at least questionable. (See discussion below of hysteresis.) And the analysis herein relies on monetary neutrality. In contrast, the range of factors that may lead to long-run effects on activity from the level of inflation are factors that affect the super-neutrality of monetary policy. This type of neutrality—which is not the focus herein—is unlikely to hold (Afrouzi et al, 2024).[20]

A related point is that the analysis herein relies on a highly stylized model. More formal models, derived from first principles, would include aspects that affect super-neutrality and introduce dynamics, such as a New-Keynesian model of the type used in Afrouzi et al (2024). In general, a New-Keynesian dynamic-stochastic-general-equilibrium model will introduce complications that make the analytical results derived herein either complicated or impossible to derive, although comparable results likely hold. For example, Kiley (2024) considers a standard New-Keynesian model and conducts quantitative simulations of a large-scale policy model and finds comparable results regarding activity fluctuations and inflation biases.[21]

Hysteresis: Scarring or expanding activity?

While monetary neutrality is a reasonable approximation, the literature has accumulated evidence suggesting that cyclical fluctuations have persistent or permanent effects. Cerra, Fatás, and Saxena (2023) review the literature and reach two conclusions. First, cyclical fluctuations appear to have permanent effects on activity, but the channels through which this occurs—i.e., effects on productivity through innovation or capital accumulation, effects on labor market attachment and participation, or others—are not clear. Second, the evidence for scarring effects—adverse effects on activity over the longer-run from weak activity—is much stronger than evidence for positive effects from strong labor markets. For example, Reifschneider, Wascher, and Wilcox (2015) emphasize the asymmetric view that weak labor markets result in permanent scarring. This view is consistent with the idea in Hotchkiss and Moore (2022) that the significant asymmetries in the welfare effects of activity fluctuations stem from the adverse effects of labor market weakness.

To the extent that hysteresis effects primarily operate through scarring, the results herein have a counterintuitive implication: An asymmetric policy driven by a shortfalls-focused loss function exacerbates employment shortfalls under the natural rate hypothesis. If scarring is present, this

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[20] Note that the separation between neutrality and super-neutrality is artificial. For example, the steady-state level of inflation affects the properties of shock transmission, e.g., Kiley, 2007.

[21] Kiley (2024) uses a simple New-Keynesian model (e.g., Woodford, 2003; Gali, 2008; Kiley, 2016) and develops connections to results from the Federal Reserve's FRB/US model. A dynamic model also introduces issues associated stabilization bias that add to the issues herein, e.g., Svensson, 1997, and Dennis and Soderstrom, 2006.

would imply that the asymmetric approach worsens scarring and is even more adverse for activity shortfalls than in the baseline natural-rate model considered herein.

In contrast, hysteresis effects that primarily work through positive effects of strong labor markets would have the opposite implication. Putting these thoughts together, the natural rate hypothesis suggests that a shortfalls approach is costly to society in the absence of positive hysteresis, pointing to the value of additional analyses of potential positive long-run effects of strong economic activity on potential activity.

4. Conclusions

Activity shortfalls are more costly than strong activity. Discussions of monetary policy have emphasized this asymmetry in recent years. I considered optimal monetary policy under discretion with an asymmetric (activity shortfalls) loss function. The model satisfies the natural rate hypothesis. A shortfalls-driven optimal monetary policy exacerbates shortfalls in activity and creates an inflationary bias. The additional frequency of activity shortfalls arises from the adjustment of expectations implied by the natural rate hypothesis. Mandating a central bank objective with greater symmetry than the social loss function improves outcomes. Greater symmetry counterintuitively lowers the magnitude of activity shortfalls. Greater symmetry also reduces inflation bias. Moreover, greater costs from activity shortfalls do not justify accommodating demand-driven strength in activity. It remains optimal to stabilize activity and inflation in response to demand shocks. As a result, monetary accommodation of strength in economic activity likely requires justifications other than asymmetric costs of shortfalls. For example, positive hysteresis from strong labor markets may provide such a justification—a subject for future research.

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