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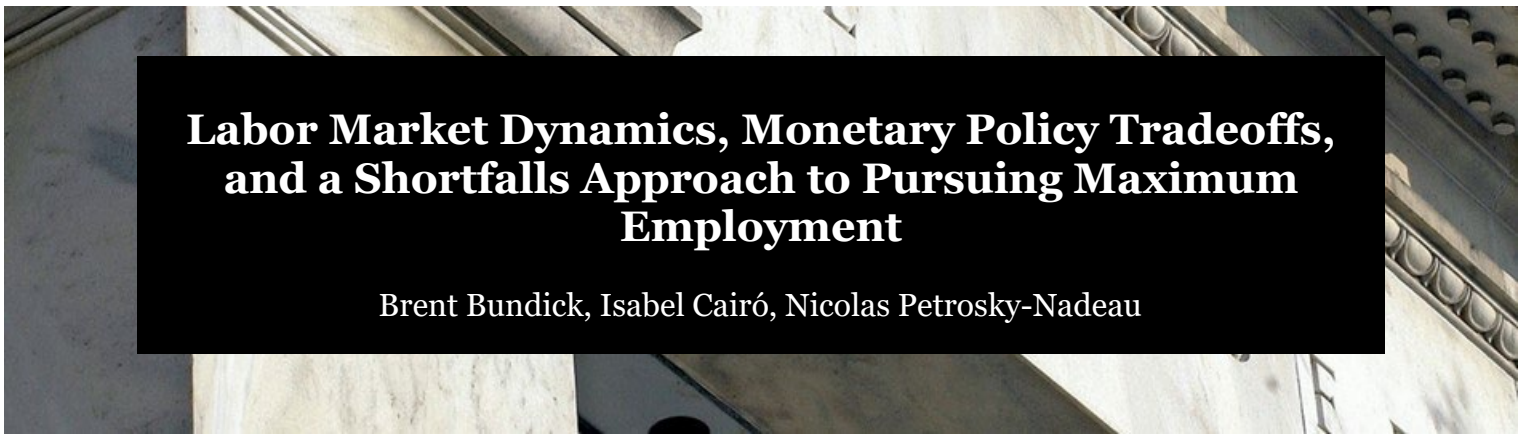

Labor Market Dynamics, Monetary Policy Tradeoffs, and a Shortfalls Approach to Pursuing Maximum Employment

Brent Bundick, Isabel Cairó, Nicolas Petrosky-Nadeau

The analysis in this paper was presented to the Federal Open Market Committee as background for its discussion of the Federal Reserve's 2025 review of its monetary policy strategy, tools, and communications.

Abstract: This paper reviews recent academic studies to assess the implications of adopting a shortfalls, rather than a deviations, approach to pursuing maximum employment. Model-based simulations from these studies suggest three main findings. First, shortfalls rules generate inflationary pressure relative to deviations rules, which offsets downward pressure on inflation stemming from the presence of the effective lower bound. Second, since monetary policy leans against these inflationary pressures, a shortfalls rule implies a limited effect on average outcomes in the labor market. Finally, studies suggest that monetary policy can offset higher-than-desired average inflation under a shortfalls rule by leaning more strongly against deviations of inflation from the 2 percent objective, thereby keeping longer-term inflation expectations well anchored.

JEL Classification: E32, E52, E58.

Keywords: Asymmetric monetary policy strategies, maximum employment, effective lower bound.

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1. Introduction and overview

At the conclusion of the 2019–20 framework review, the Federal Open Market Committee (FOMC) revised its Statement on Longer-Run Goals and Monetary Policy Strategy to indicate that it seeks over time to mitigate shortfalls, rather than deviations, of employment from its maximum level. This paper assesses the implications of adopting a shortfalls approach to pursuing maximum employment by reviewing recent academic studies. Our key takeaways are the following:

- Recent studies using model-based simulations find that shortfalls rules—in which policy rates do not respond to the labor market when the labor market is tight—generate inflationary pressures relative to deviations rules, regardless of the nature of business cycle shocks. Because households and firms are forward looking in these models and experience and expect a more accommodative policy stance in expansions, firms would raise prices by more in anticipation of stronger household demand. This increase in average inflation offsets downward pressures on inflation stemming from the proximity of interest rates to the effective lower bound (ELB), even without the adoption of makeup strategies, and reduces the frequency and severity of ELB episodes.[1]
- The average effect of shortfalls rules on the labor market is limited due to two offsetting forces. On the one hand, the direct effect from less policy tightening during expansions under a shortfalls approach leads to larger declines in the unemployment rate. On the other hand, the indirect effect from expectations of higher average inflation leads to tighter policy, a contractionary force that limits the labor market gains during expansions and leads to larger increases in the unemployment rate during contractions. Both effects are present in these models for any configuration of shocks and regardless of whether the ELB is binding.
- Studies indicate that monetary policy can offset higher-than-desired average inflation under a shortfalls approach by leaning more strongly against deviations of inflation from the 2 percent objective, which can keep longer-term inflation expectations well anchored. Existing work finds that, under benchmark calibrations, ELB episodes are still less frequent under a shortfalls rule if policymakers respond more aggressively to inflation deviations.
- Policymakers may also find it appropriate to lean strongly against high inflation, from a risk-management perspective, when faced with uncertainty regarding potential nonlinearities in the Phillips curve. This is especially true under a shortfalls approach because households and firms expect to be more frequently exposed to the steep portion of the curve during expansions as the labor market becomes tighter relative to a deviations approach.

[1] While this paper reports on the implications of adopting a shortfalls approach for ELB risks, it does not compare the relative merits of that approach to addressing ELB risks with other strategies and tools (for example, makeup strategies, forward guidance, and balance sheet policies).

- Importantly, theoretical work around shortfalls strategies remains somewhat new, and some key considerations have yet to be fully explored. For example, research so far generally abstracts from uncertainty about the measurement of labor market slack, and from hysteresis effects in the labor market—that is, the long-lasting effects on aggregate supply of temporary changes in aggregate demand. Around the time of the 2019–20 framework review, each of these issues was raised by policymakers as possible motivations of a shortfalls approach and can potentially alter the macroeconomic results described in this paper.

2. The 2019–20 framework review and the shortfalls approach

During the recovery period after the Global Financial Crisis, unemployment continued to trend lower as the economic expansion unfolded, while inflation remained below 2 percent. Estimates of the longer-run unemployment rate from the Summary of Economic Projections decreased significantly over this period, with the median falling from 5 percent in January 2010 to 4.1 percent by the end of 2019. Thus, the employment gains of the 2014–19 expansion proved to be sustainable—they did not result in strong inflationary pressures—and widespread across broad demographic groups. In this environment of subdued inflation and low unemployment, there did not appear to be a tradeoff between the Committee's maximum-employment and price-stability goals. Moreover, the proximity of interest rates to the ELB increased downside risks to policymakers' ability to achieve their dual-mandate objectives.

In view of this experience of subdued inflation and low unemployment, together with the high uncertainty surrounding estimates of the longer-run rate of unemployment, policymakers communicated in their 2020 update to their Statement on Longer-Run Goals and Monetary Policy Strategy a desire to mitigate shortfalls rather than deviations of employment from the Committee's assessment of its maximum level. As discussed in Gourio, Johannsen, and López-Salido (2025), the change from deviations to shortfalls aimed to clarify that employment would be allowed to run at or above its assessed—and highly uncertain—maximum level unless accompanied by expectations for unwelcome inflationary pressures. In this situation, a shortfalls approach to pursuing maximum employment does not try to reduce employment solely because it is above its perceived longer-run maximum level. Nonetheless, this approach does not preclude using labor market indicators to monitor incipient inflationary pressures during a tight labor market that could impede the attainment of the Committee's dual-mandate goals.

3. Monetary policy tradeoffs summarized by the Phillips curve

Monetary policy tradeoffs associated with the Committee's dual-mandate objectives of price stability and maximum employment are summarized by the Phillips curve. The Phillips curve relates current labor market slack to inflation and is determined by structural features of the economy, such as the optimal price-setting decisions of firms, taking as given business cycle shocks and expectations. Changes in aggregate demand move the economy along this structural

Phillips curve, whereas shocks to supply and cost conditions shift this relationship.[2] Monetary policy, through its effects on aggregate demand, can work to achieve the dual-mandate goals along the Phillips curve. However, the precise shape and position of the Phillips curve is not directly observed by policymakers, adding to the uncertainty over the cyclical position of the economy and the nature of the tradeoffs facing policymakers at any given time. The companion paper "Assessing Maximum Employment" by Foote and others (2025) evaluates the performance of selected indicators in assessing the labor market's position relative to the maximum-employment goal.[3]

The economic environment preceding the 2019–20 framework review suggested that the Phillips curve could, in fact, be flatter than previously thought. If the Phillips curve is flat, a tightening in the labor market during an economic expansion may not lead to significant inflationary pressures. That is, policy can support a demand-driven expansion with lower risk of generating inflationary pressures, thereby generating broad-based demand for labor without jeopardizing price stability. However, in periods of high inflation, a flat Phillips curve means that a significant slowing of demand in the labor market needs to occur before price pressures can abate.

Recent post-pandemic experience suggests that the slope of the Phillips curve may become steep following large shocks, possibly due to the presence of supply constraints or because a tight labor market makes it increasingly costly for firms to hire workers to meet the strong demand.[4] A steep Phillips curve implies that a further tightening of the labor market in

[2] The structural Phillips curve is different from the reduced-form Phillips curve, which corresponds to the empirical relationship between inflation and an estimate of economic slack. This empirical relationship is affected not only by the shape of the structural Phillips curve, but also by other factors, including the shocks that buffet the economy, the degree to which inflation expectations are anchored, and the monetary policy strategy pursued by the central bank (McLeay and Tenreyro, 2020). Indeed, policy success (such as better anchoring of inflation expectations) can also change the observed relationship between inflation and labor market slack while leaving the structural Phillips curve unchanged; see Boivin, Kiley, Mishkin (2010) and Bundick and Smith (forthcoming).

[3] There are multiple measures of labor market slack, such as the rate of unemployment, as in the original work of Phillips (1958), or estimates of a gap between unemployment and a benchmark rate of unemployment (see also Crump, Nekarda, and Petrosky-Nadeau, 2020). We discuss uncertainty around the measurement of labor market slack and its implications for monetary policy in section 5.

[4] Very tight labor market conditions make it increasingly costly for firms to fill vacant positions (due to a nonlinear Beveridge curve) and retain existing workers, which can rapidly increase pressure on businesses to raise prices. The link between the difficulty of hiring labor, measured through a ratio of the level of unemployment and job openings, and inflation was first highlighted in the work of Ravenna and Walsh (2008). Bernanke and Blanchard (2025) find that tight labor markets have a relatively persistent effect on inflation. The quantitative importance of the curvature in the Beveridge curve for labor market and aggregate dynamics is studied by, among others, Petrosky-Nadeau, Zhang, and Kuehn (2018) and Petrosky-Nadeau and Zhang (2021). More recently, both Bok and others (2022) and Figura and Waller (2024) examine the possibility of soft landings in the labor market along a steep Beveridge curve. For recent studies on evidence on nonlinearities in the Phillips curve, see Ball, Leigh, and Mishra (2022); Benigno and Eggertsson (2023); Crust, Lansing, and Petrosky-Nadeau (2023); and Gitti (2024). The presence of a nonlinearity in the Phillips curve may have implications for the macroeconomic effects of alternative monetary policy strategies, as discussed in section 5.

response to elevated demand can generate significantly more inflationary pressures. However, when the Phillips curve is steep, a modest reining in of demand due to a tighter policy stance can bring about a substantial reduction in inflation with little cost to the maximum-employment goal, so long as inflation expectations remain well anchored.

4. Interpretation and assessment of the macroeconomic effects of mitigating shortfalls from maximum employment

4.1 Interpretation of shortfalls

Several academic studies have compared the possible implications for the dual-mandate objectives of a deviations versus a shortfalls strategy. In both the academic literature and recurring material in the *Monetary Policy Report,* the conduct of monetary policy is often modeled using simple policy rules.[5] Under a deviations approach to stabilizing the labor market, monetary policy responds symmetrically to inflation and unemployment deviations from their objectives, which can be captured in the following Taylor-type simple rule:

$$R_t = \pi^{LR} + r_t^{LR} + \phi_\pi(\pi_t - \pi^{LR}) + \phi_u(u_t^{LR} - u_t),$$

where R_t denotes the nominal federal funds rate, π_t is inflation, u_t is the unemployment rate, and u_t^{LR} is an estimate of the longer-run rate of unemployment.[6] π^{LR} captures the 2 percent longer-run inflation objective, and r_t^{LR} denotes the equilibrium real federal funds rate in the longer run. The parameters $\phi_\pi \geq 0$ and $\phi_u \geq 0$ denote policymakers' response to deviations of inflation and the unemployment rate from their objectives, respectively. Under a deviations approach to stabilizing the labor market, the parameters ϕ_π and ϕ_u remain unchanged in both tight and slack labor markets.

In contrast, one interpretation of a shortfalls approach is that the policy rate does not respond to the labor market when the labor market is tight. For example, in the following specification, the policy rate does not directly lean against a tight labor market (beyond its effects on inflation) when the unemployment rate is below its assumed longer-run value:[7]

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[5] Such a modeling approach is clearly a simplification; in practice, policymakers consider a wide range of information in setting policy and recognize the uncertainty surrounding economic variables and relationships. For further discussion, see the box "Monetary Policy Rules in the Current Environment" in Board of Governors of the Federal Reserve System (2025), *Monetary Policy Report* (Washington: Board of Governors, February), pp. 46–48, https://www.federalreserve.gov/publications/files/20250207_mprfullreport.pdf.

[6] The simple rules considered in this paper use the unemployment rate gap as a measure of resource slack in the economy, as it helps capture the FOMC's statutory goal to promote maximum employment and is highly correlated with business cycle fluctuations. Foote and others (2025) discuss additional measures of labor market slack. See also Crump, Nekarda, and Petrosky-Nadeau (2020).

[7] This paper focuses on the stark case that the policy rule does not respond at all to unemployment fluctuations when the unemployment rate is below its assumed longer-run value. Alternative rules that are

$$R_t = \pi^{LR} + r_t^{LR} + \phi_\pi(\pi_t - \pi^{LR}) + \phi_u \min\{(u_t^{LR} - u_t), 0\}.$$

Given limited practical experience with a shortfalls approach, the academic literature primarily uses model-based simulations to compare outcomes under a deviations approach and a shortfalls approach (often leaving all other features of the economy unchanged). The following subsections review these findings regarding a shortfalls rule's effects on inflation and unemployment on average and in response to both demand and supply shocks. A subset of the effects is illustrated with a simple macroeconomic model that features households that work and consume, firms that employ workers and produce, and a central bank that sets the nominal interest rate following one of the Taylor-type simple rules just described.[8] In this simple model, household and firms are forward looking and fully understand the structure of the economy and the conduct of policy under both a deviations and shortfalls approach to pursuing maximum employment.

4.2 Findings regarding average economic outcomes under a shortfalls approach

Recent academic studies using model-based simulations consistently find that adopting a shortfalls rule generates inflationary pressures when compared with a deviations approach to stabilizing the labor market, regardless of the nature of business cycle shocks.[9] Under a shortfalls approach, because households and firms experience and expect a more accommodative policy stance in expansions, firms raise prices by more in anticipation of stronger household demand when compared with a deviations approach.

When expectations incorporate the inflationary bias associated with the shortfalls approach, the inflationary effect occurs at all points in the business cycle. That is, even when the economy is at its longer-run equilibrium and not experiencing shocks, the possibility of a more accommodative policy if the economy enters an expansion induces firms to set higher prices under a shortfalls rule.[10] As a result of these changes in household and firm behavior both in and outside of expansions, a robust finding across studies is that adopting a shortfalls approach leads to an increase in average inflation relative to a deviations approach. Moreover, this average

asymmetric in unemployment fluctuations, placing less weight on those fluctuations when the unemployment rate is below its assumed longer-run value than when it is above, can also be consistent with a shortfalls approach to pursuing maximum employment.

[8] Additional details on the simple macroeconomic model appear in the appendix.

[9] Studies include Alves and Violante (2025), Bundick and Petrosky-Nadeau (forthcoming), Cairó and Lipton (2023), and Kiley (2024a, 2024b).

[10] This idea is related to the intuition developed in Reifschneider and Williams (2000) and Benhabib, Schmitt-Grohe, and Uribe (2001, 2002), among other works, examining the effects of the ELB on inflation expectations in macroeconomic models. If the monetary authority follows a standard Taylor-type rule without any type of makeup strategy or link to past economic outcomes, households and firms understand that the central bank will be unable to stabilize aggregate demand if the economy hits the ELB. This chance of hitting the ELB in the future induces firms to choose to set lower prices even in the absence of a shock, which can cause inflation expectations to run below target on average. By contrast, a shortfalls rule puts upward pressure on inflation expectations.

inflationary effect does not generally depend on the nature of shocks driving the business cycle. Models in which business cycle fluctuations are driven by shocks to either household demand, productivity, or production costs show an increase in average inflation under a shortfalls approach.[11]

Under their baseline calibrations, all cited studies find that the increase in average inflation under a shortfalls approach can be sufficient to offset downward pressures on inflation stemming from the proximity of interest rates to the ELB. This result is true even without the adoption of a makeup strategy to mitigate ELB risks. Additionally, a shortfalls approach reduces the frequency and severity of ELB episodes relative to a deviations approach.[12]

Turning to the effects on the real economy, the average effect of a shortfalls rule on the labor market is limited due to two offsetting forces in response to either supply or demand shocks, which are present regardless of whether the ELB is binding. On the one hand, a direct effect of less policy tightening during expansions under a shortfalls rule leads to larger declines in the unemployment rate and higher prices. On the other hand, the economy also experiences an offsetting indirect effect stemming from expectations about these future economic outcomes. As forward-looking households and firms anticipate more accommodative policy in expansions under a shortfalls rule, firms choose to set higher prices even outside of expansions. As a result, the central bank leans against this increase in inflation with higher policy rates on average, resulting in a contractionary force that limits the labor market gains during expansions and leads to larger increases in the unemployment rate during contractions. This offsetting indirect effect limits the decline in average unemployment experienced by the economy.[13] As a result of these two forces, studies tend to find quantitatively limited or mixed evidence regarding the effects of a shortfalls approach on average outcomes in the labor market.[14]

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[11] In the cited recent academic studies, the adoption of a shortfalls rule results in a median increase in average inflation of about 0.7 percentage points relative to a deviations rule. The economy experiences higher inflation for all current realizations of aggregate demand or supply shocks—a shift in the Phillips curve—when a central bank switches from a deviations rule to a shortfalls rule without appropriately recalibrating the weight on inflation in its reaction function.

[12] This paper focuses on the implications of adopting a shortfalls approach for ELB risks and does not take a stance on the efficacy of shortfalls relative to other policies aimed at mitigating ELB risks (such as makeup strategies, balance sheet policies, alternative monetary policy strategies, or a combination of such strategies).

[13] This indirect effect is also present in the longer run. A similar point is made in Kiley (2024a). In addition to depending on the forward-looking behavior of households and firms, the slope of the Phillips curve also plays a role in governing the size of the indirect effect. For example, expectations of more accommodative policy in expansions result in higher inflation today under a steeper Phillips curve.

[14] The indirect effect is absent in model simulations that assume perfect foresight in which households and firms do not take into account the possibility of future economic fluctuations. As a result, these papers typically find that the adoption of a shortfalls rule leads to a lower unemployment rate or a positive output gap on average. See, for example, Alves and Violante (2025), Cairó and Lipton (2023), and Kiley (2024b). In addition, Alves and

This paper has focused so far on the use of simple policy rules to implement a shortfalls approach in pursuing maximum employment, as this is the approach followed in most of the recent literature. However, some work implements the shortfalls approach by solving an optimal policy problem under an asymmetric—instead of symmetric—loss function on unemployment deviations, which places weight on unemployment fluctuations when the unemployment rate is above its longer-run value but places no weight on the gap when the unemployment rate is below its longer-run value.[15] The main takeaways from these studies are broadly similar to the ones that we have described for the simple rules.[16]

4.3 Impulse responses to a demand shock: Deviations versus shortfalls approaches

Beyond these effects on the average outcomes for inflation and the unemployment rate, adopting a shortfalls approach may also have implications for the volatility of inflation and unemployment over the business cycle. Using a simple macroeconomic model, figure 1 illustrates the impulse responses of the unemployment rate, inflation, and the real federal funds rate to a demand shock under both deviations and shortfalls simple policy rules (keeping the parameters ϕ_π and ϕ_u constant across rules). The left panels plot the model responses to a positive demand shock, which increases household demand and generates an economic expansion. The right panels instead show the responses to a negative demand shock, which weakens household demand and leads to a contraction.

In response to an increase in household demand, monetary policy does not actively lean against a tight labor market under the shortfalls rule, resulting in a smaller increase in the real rate than under a deviations rule (dashed blue lines in the left panels). As a result of this more accommodative policy stance, the economy experiences lower unemployment and a larger pickup in inflation, relative to a deviations rule. In response to a decrease in household demand,

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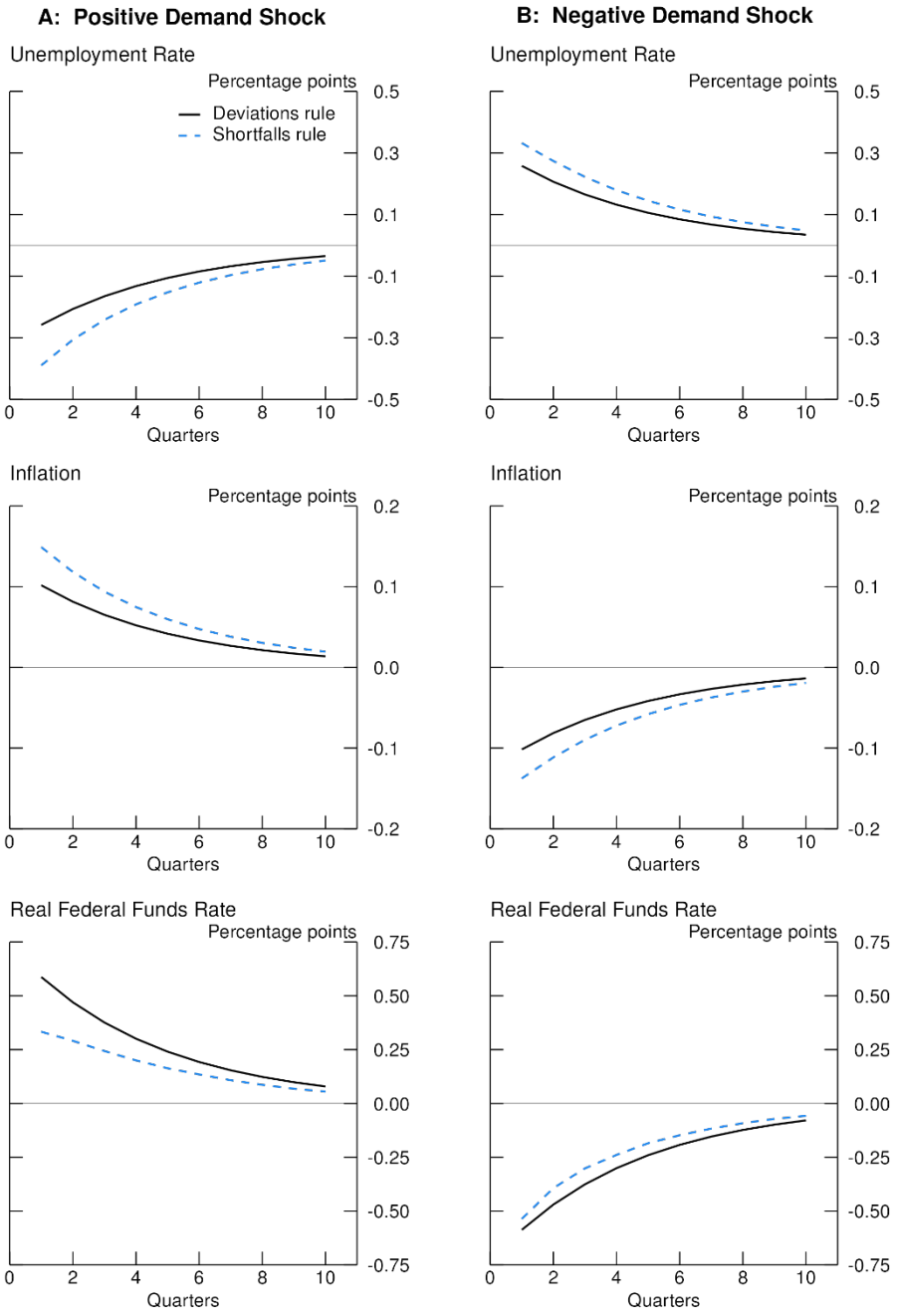
Violante (2025) and Cairó and Lipton (2023) highlight that adopting a shortfalls approach can increase labor force participation, raise earnings for lower-income workers, and reduce the racial unemployment gap. Bundick and Petrosky-Nadeau (forthcoming) find a more muted response of average unemployment under a shortfalls approach, as households and firms in their setting consider that future shocks may hit the economy.

[15] In the years leading up to the 2019–20 review, staff work frequently included optimal-control simulations utilizing a loss function that was asymmetric, penalizing deviations of the unemployment rate from its natural level only when it exceeded the staff's estimate of the natural rate of unemployment. For example, see the exhibit "Optimal Control with Asymmetric Weight on Unemployment Gap and Steeper Phillips Curve" in the April 2016 Tealbook, which is available on the Board's website at https://www.federalreserve.gov/monetarypolicy/files/FOMC20160427tealbookb20160421.pdf.

See also Kiley (2024a) and Gust, López-Salido, and Meyer (2017), who instead study optimal policy using an asymmetric loss function on output losses, which places weight on the output gap when output is below potential but places no weight on the gap when output is above potential.

[16] Of course, the comparison of a shortfalls approach and a deviations approach under optimal policy or simple policy rules depends on policymakers' preferences for optimal policy and on the parameterization of the simple policy rules.

Figure 1: Impulse response functions to a demand shock



Notes: The figure displays the difference in the paths of the unemployment rate, inflation, and the real federal funds rate in response to either a positive or negative demand shock relative to their respective paths under no shock. As a result, these responses do not display the effects to the average levels of the unemployment rate, inflation, and the real federal funds rate of switching from a deviations rule to a shortfalls rule. See Koop, Pesaran, and Potter (1996) for a discussion of impulse responses in nonlinear models. For illustrative purposes, the size of the shock is chosen such that the first-period impulse response for the unemployment rate is negative 0.25 percentage point upon a positive demand shock under the deviations rule. The responses of inflation and the real federal funds rate are annualized.

Source: Authors' calculations.

monetary policy eases less under a shortfalls rule than under a deviations rule, resulting in a smaller decline in the real rate (dashed blue lines in the right panels). As previously discussed, this reflects the fact that expectations of higher inflation outcomes in the future are associated with expectations of tighter monetary policy and higher real interest rates. As a result, the right panels show that, in equilibrium, the economy experiences slightly larger increases in unemployment and a larger decline in inflation under a shortfalls rule in a contraction when compared with the outcomes under a deviations rule.

Taken together, these responses suggest that the economy may experience higher volatility of both inflation and labor market outcomes conditional on demand shocks.[17]

5. Discussion

5.1 Stronger lean against inflation deviations

Studies suggest that monetary policy can offset higher-than-desired average inflation under a shortfalls approach by leaning more strongly against deviations of inflation from the 2 percent objective, keeping longer-term inflation expectations well anchored.[18] If households and firms are forward-looking and fully understand the central bank's reaction function, the increase in average inflation under a shortfalls rule without a strong lean against inflation deviations could coincide with an increase in longer-term inflation expectations.[19] Existing work finds that, under benchmark calibrations, ELB episodes are still less frequent under a shortfalls rule if policymakers respond more aggressively to inflation deviations.[20]

[17] Additional results from the simple model suggest that this increase in volatility of both inflation and unemployment conditional on demand shocks occurs both with and without a potentially binding ELB. The exact quantitative increase in the volatility of inflation and unemployment crucially depends on model assumptions regarding the economy's structural features. For example, the economy experiences a larger increase in the volatility of unemployment and a smaller increase in the volatility of inflation under a shortfalls rule if the Phillips curve is flatter.

[18] A policy rule that seeks to more aggressively stabilize inflation does entail potential costs. For instance, while it lowers the volatility of inflation and the unemployment rate in response to demand shocks, a more aggressive response to inflation deviations can elevate the volatility of unemployment in response to cost-push shocks. As noted in Kiley (2024b), the inflationary bias of a shortfalls approach would be mitigated by rules reacting to weak and strong labor markets asymmetrically but, nonetheless, lean somewhat against employment above its sustainable level.

[19] Further research is needed to study whether the adoption of a state-dependent reaction to inflation—the possibility that the response to inflation deviations depends on the state of the economy—may provide additional benefits in the context of a shortfalls approach to stabilizing the labor market.

[20] For example, see table 3 of Bundick and Petrosky-Nadeau (forthcoming). Recent empirical work by Bundick, Smith, and Van der Meer (2024) argues that market participants have perceived the FOMC's reaction function as being more responsive to inflation over the past few years.

5.2 Uncertainty over nonlinearities

Even absent a change to a central bank's reaction function, a given sequence of supply shocks may change the underlying dynamics of the labor market and inflation, shifting the Phillips curve. If the Phillips curve is nonlinear, such shifts present the additional risk of pushing the economy toward a steeper tradeoff between price stability and maximum employment.[21] Therefore, when faced with uncertainty regarding potential nonlinearities in the Phillips curve, policymakers may find it appropriate to lean strongly against inflation deviations from a risk-management perspective. This may be further warranted under a shortfalls approach, because research shows that higher inflation outcomes are more likely with a higher degree of curvature of the structural Phillips curve. In such an environment, households and firms anticipate more periods of elevated economic activity that result in high levels of inflation because of the steep portion of the Phillips curve. These high levels of economic activity and inflation under a shortfalls approach could make the empirical relationship between inflation and labor market slack steeper.[22]

5.3 Open questions

The theoretical academic work around shortfalls strategies remains somewhat new, and some key considerations have yet to be fully explored. First, research so far has generally abstracted from uncertainty about the measurement of labor market slack, which was an important motivation for the adoption of a shortfalls approach in 2020.[23] One could argue that a shortfalls approach implemented as described in section 4 might have some benefits relative to a deviations approach when policymakers might face uncertainty regarding the labor market. For example, suppose that the true longer-run unemployment rate is u^{LR}, but policymakers do not observe it and estimate a value that is higher than u^{LR}. When the unemployment rate falls below its estimated longer-run value, policy would tighten unnecessarily under a deviations rule, while a shortfalls rule would not directly respond to the unemployment rate gap. Alternatively, if policymakers believe that the longer-run unemployment rate is lower than its true value u^{LR}, then policy would tighten insufficiently as the unemployment rate falls below u^{LR}, a similar

[21] For example, the disruptions to supply chains and negative labor supply factors seen during the COVID-19 pandemic may have temporarily shifted the structural Phillips curve outward. This experience seems to have taken place in several countries, regardless of the monetary policy framework in place. Bundick, Smith, and Van der Meer (2024) examine the COVID-19 inflation experiences across several advanced economies. They argue that despite differences in the implementation of their policy frameworks, inflation expectations were just as well anchored—or, in some countries, better anchored—after the pandemic.

[22] See Bundick and Petrosky-Nadeau (forthcoming), Cairó and Lipton (2023), and Kiley (2024b). In Bundick and Petrosky-Nadeau (forthcoming), the unconditional correlation between inflation and unemployment—a measure of the slope of the relationship between inflation and economic slack—shifts from negative 0.24 to negative 0.30 when the central bank moves from following a deviations rule to a shortfalls rule. In Cairó and Lipton (2023), this correlation shifts from negative 0.32 to negative 0.51.

[23] See Kiley (2024b) for an example of work that considers how exogenous measurement error in estimates of economic slack has implications for monetary policy strategies.

outcome under both a deviations rule and a shortfalls rule. While this asymmetry of the shortfalls approach may have benefits in this setting, it also causes inflationary pressure relative to a deviations approach. As a result, forward-looking policymakers might find it appropriate to closely monitor incoming data in tight labor markets because of heightened inflation risks.[24]

Second, another key consideration that existing research about shortfalls strategies has not fully studied is the possibility of either positive or negative hysteresis effects—that is, the long-lasting effects on aggregate supply of temporary changes in aggregate demand—in the labor market. In particular, given that expansions would bring tighter labor market conditions under a shortfalls approach, they have the possibility to boost the economy's potential via a lower average unemployment rate or a higher trend labor force participation rate, for example, which can add to the expansionary effects of a shortfalls approach.[25] These benefits would have to be compared with the potential negative scarring effects that could result from larger increases in the unemployment rate during contractions under a shortfalls approach.[26]

Third, some work highlights that the exact assumptions about the structure of the labor market, such as the persistence of unemployment, may be important for determining the quantitative impact of a shortfalls approach. Intuitively, the expectation of more durable expansions implies that marginal cost will be elevated for longer periods, prompting forward-looking firms to raise prices more, amplifying the indirect contractionary effect highlighted in section 3.[27] Also, the model-based research conducted thus far commonly assumes households and firms fully understand the entire structure of the economy and the monetary policy reaction function. Relaxing some of these assumptions could have implications on the strength of the indirect effect from adopting a shortfalls approach because the indirect effect relies on household and firm expectations about future policy.[28]

Fourth, there is limited work on the potential interactions between a shortfalls approach to the labor market and the Committee's full set of tools and strategies underlying the 2020 update of the Statement on Longer-Run Goals and Monetary Policy Strategy. For example, only

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[24] See Meyer, Swanson, and Wieland (2001), Orphanides and Williams (2002), and Yellen (2002) for discussions on the performance of simple interest rate policy rules in the presence of uncertainty regarding the longer-run unemployment rate.

[25] Aaronson and others (2019) present evidence that when the labor market is already strong, further improvements offer additional benefits to disadvantaged groups. They also present some evidence suggesting that labor force participation gains are somewhat persistent over time for certain disadvantaged groups, though their analysis does not distinguish between strong and weak labor market conditions.

[26] See, for example, Fallick and Krolikowski (2022), and Hotchkiss and Moore (2022). Cerra, Fatás, and Saxena (2023) provide a review of recent empirical and theoretical literature about hysteresis effects of business cycles.

[27] Bundick and Petrosky-Nadeau (forthcoming) show that the magnitude of the inflationary bias of the shortfalls approach increases with the amount of persistence in the dynamics of the labor market. The described effect is present under both demand and supply shocks.

[28] Bundick and Petrosky-Nadeau (forthcoming) show that the effects on average inflation are smaller under the assumption of boundedly rational households and firms.

a couple of studies explore the interactions of a shortfalls approach within the context of a flexible average inflation-targeting framework. These limited results highlight that interactions between these two policy strategies could be important in practice, but further work may be needed to fully understand the policy implications.[29]

Finally, it is worth noting that the existing theoretical literature studying the macroeconomic effects of the adoption of a shortfalls approach uses models that are disciplined using pre-COVID data. The five years since the adoption of the shortfalls approach have been marked by unusual events, potentially complicating the empirical evaluation of a shortfalls approach.

[29] Alves and Violante (2025) suggest that flexible average inflation targeting and a shortfalls approach to stabilizing the labor market could have similar effects, on average, but operate at different points in the business cycle. The benefits of average inflation targeting occur during downturns, while the benefits of a shortfalls approach accrue during expansions. Conversely, Bundick and Petrosky-Nadeau (forthcoming) and Kiley (2024b) combine shortfalls approaches with makeup strategies and suggest that the interaction of these two alternative ways to address the disinflationary bias emanating from the ELB exacerbates the inflationary effects of a shortfalls approach.

References

Aaronson, Stephanie R., Mary C. Daly, William L. Wascher, and David W. Wilcox (2019). "Okun Revisited: Who Benefits Most from a Strong Economy?," Brookings Papers on Economic Activity, Spring, pp. 333–404, https://www.brookings.edu/wp-content/uploads/2019/03/Aaronson_web.pdf.

Alves, Felipe, and Giovanni L. Violante (2025). "Monetary Policy under Okun's Hypothesis," NBER Working Paper Series 33488. Cambridge, Mass.: National Bureau of Economic Research, February, https://doi.org/10.3386/w33488.

Ball, Laurence, Daniel Leigh, and Prachi Mishra (2022). "Understanding US Inflation during the COVID-19 Era," Brookings Papers on Economic Activity, Fall, pp. 1–80, https://www.brookings.edu/wp-content/uploads/2022/09/BPEA-FA22_WEB_Ball_Leigh_Mishra_updated.pdf.

Benhabib, Jess, Stephanie Schmitt-Grohé, and Martín Uribe (2001). "The Perils of Taylor Rules," *Journal of Economic Theory,* vol. 96 (January), pp. 40–69, https://www.doi.org/10.1006/jeth.1999.2585.

——— (2002). "Avoiding Liquidity Traps," *Journal of Political Economy,* vol. 110 (June), pp. 535–63, https://doi.org/10.1086/339713.

Benigno, Pierpaolo, and Gauti B. Eggertsson (2023). "It's Baaack: The Surge in Inflation in the 2020s and the Return of the Non-Linear Phillips Curve," NBER Working Paper Series 31197. Cambridge, Mass.: National Bureau of Economic Research, April, https://www.doi.org/10.3386/w31197.

Bernanke, Ben, and Olivier Blanchard (2025). "What Caused the U.S. Pandemic-Era Inflation?," *American Economic Journal: Macroeconomics*, vol. 17 (3), pp. 1-35, https://doi.org/10.1257/mac.20230195.

Boivin, Jean, Michael T. Kiley, and Frederic S. Mishkin (2010). "How Has the Monetary Transmission Mechanism Evolved over Time?" in Benjamin M. Friedman and Michael Woodford, eds., *Handbook of Monetary Economics,* vol. 3, pp. 369–422, https://doi.org/10.1016/B978-0-444-53238-1.00008-9.

Bok, Brandyn, Nicolas Petrosky-Nadeau, Robert G. Valletta, and Mary Yilma (2022). "Finding a Soft Landing along the Beveridge Curve," FRBSF Economic Letter 2022-24. San Francisco: Federal Reserve Bank of San Francisco, August 29, https://www.frbsf.org/wp-content/uploads/el2022-24.pdf.

Bundick, Brent, and Nicolas Petrosky-Nadeau (forthcoming). "From Deviations to Shortfalls: The Effects of the FOMC's New Employment Objective," *American Economic Journal: Macroeconomics*.

Bundick, Brent, and A. Lee Smith (forthcoming). "Did the Federal Reserve Break the Phillips Curve? Theory and Evidence of Anchoring Inflation Expectations," *The Review of Economics and Statistics*.

Bundick, Brent, A. Lee Smith, and Luca Van der Meer (2024). "Maintaining the Anchor: An Evaluation of Inflation Targeting in the Face of COVID-19," Research Working Paper 24-15. Kansas City: Federal Reserve Bank of Kansas City, December, http://doi.org/10.18651/RWP2024-15.

Cairó, Isabel, and Avi Lipton (2023). "Labor Market Discrimination and the Racial Unemployment Gap: Can Monetary Policy Make a Difference?" Finance and Economics Discussion Series 2023-065. Washington: Board of Governors of the Federal Reserve System, May, https://doi.org/10.17016/FEDS.2023.065.

Cerra, Valerie, Antonio Fatás, and Sweta C. Saxena (2023). "Hysteresis and Business Cycles," *Journal of Economic Literature,* vol. 61 (March), pp. 181–225, https://doi.org/10.1257/jel.20211584.

Crump, Richard K., Christopher J. Nekarda, and Nicolas Petrosky-Nadeau (2020). "Unemployment Rate Benchmarks," Finance and Economics Discussion Series 2020-072. Washington: Board of Governors of the Federal Reserve System, August, https://doi.org/10.17016/FEDS.2020.072.

Crust, Erin E., Kevin J. Lansing, and Nicolas Petrosky-Nadeau (2023). "Reducing Inflation along a Nonlinear Phillips Curve," FRBSF Economic Letter 2023-17. San Francisco: Federal Reserve Bank of San Francisco, July 10, https://www.frbsf.org/wp-content/uploads/el2023-17.pdf.

Fallick, Bruce, and Pawel Krolikowski (2022). "Excess Persistence in Employment of Disadvantaged Workers," *International Journal of Central Banking*, vol. 75, pp.165–215, https://www.ijcb.org/journal/ijcb22q4a5.htm.

Figura, Andrew, and Chris Waller (2024). "What Does the Beveridge Curve Tell Us about the Likelihood of Soft Landings?" *Journal of Economic Dynamics and Control,* vol. 169 (December), 104957, https://www.sciencedirect.com/science/article/pii/S0165188924001490.

Foote, Chris, Shigeru Fujita, Amanda Michaud, and Joshua Montes (2025). "Assessing Maximum Employment," Finance and Economics Discussion Series 2025-067. Washington: Board of Governors of the Federal Reserve System, August, https://doi.org/10.17016/FEDS.2025.067.

Gitti, Giulia (2024). "Nonlinearities in the Regional Phillips Curve with Labor Market Tightness," working paper, University of Turin, Collegio Carlo Alberto, January.

Gourio, François, Benjamin K. Johannsen, and David López-Salido (2025). "The Origins, Structure, and Results of the Federal Reserve's 2019–20 Review of Its Monetary Policy Framework," Finance and Economics Discussion Series 2025-065. Washington: Board

of Governors of the Federal Reserve System, August, https://doi.org/10.17016/FEDS.2025.065.

Gust, Christopher, David López-Salido, and Steve Meyer (2017). "Asymmetric Monetary Policy and the Effective Lower Bound," *Research in Economics,* vol. 71 (September), pp. 441–51, https://www.sciencedirect.com/science/article/pii/S1090944317301503.

Hotchkiss, Julie L., and Robert R. Moore (2022). "Some Like It Hot: Assessing Longer-Term Labor Market Benefits from a High-Pressure Economy," *International Journal of Central Banking,* vol. 73, pp. 193–243, https://www.ijcb.org/journal/ijcb22q2a5.htm.

Kiley, Michael T. (2024a). "Monetary Policy, Employment Shortfalls, and the Natural Rate Hypothesis," Finance and Economics Discussion Series 2024-032. Washington: Board of Governors of the Federal Reserve System, May, https://doi.org/10.17016/FEDS.2024.032.

——— (2024b). "Monetary Policy Strategies to Foster Price Stability and a Strong Labor Market," Finance and Economics Discussion Series 2024-033. Washington: Board of Governors of the Federal Reserve System, May, https://doi.org/10.17016/FEDS.2024.033.

Koop, Gary, M. Hashem Pesaran, and Simon M. Potter (1996). "Impulse Response Analysis in Nonlinear Multivariate Models," *Journal of Econometrics*, vol. 74 (September), pp. 119–47, https://doi.org/10.1016/0304-4076(95)01753-4.

McLeay, Michael, and Silvana Tenreyro (2020). "Optimal Inflation and the Identification of the Phillips Curve," *NBER Macroeconomics Annual,* vol. 34, pp. 199–255, https://doi.org/10.1086/707181.

Meyer, Laurence H., Eric T. Swanson, and Volker W. Wieland (2001). "NAIRU Uncertainty and Nonlinear Policy Rules," *American Economic Review*, vol. 91 (May), pp. 226–31, https://www.doi.org/10.1257/aer.91.2.226.

Orphanides, Athanasios, and John C. Williams (2002). "Robust Monetary Policy Rules with Unknown Natural Rates," Brookings Papers on Economic Activity, pp. 64–118, https://www.brookings.edu/wp-content/uploads/2002/06/2002b_bpea_orphanides.pdf.

Petrosky-Nadeau, Nicolas, and Lu Zhang (2021). "Unemployment Crises," *Journal of Monetary Economics,* vol. 117 (January), pp. 335–53, https://www.sciencedirect.com/science/article/pii/S0304393220300064.

Petrosky-Nadeau, Nicolas, Lu Zhang, and Lars-Alexander Kuehn (2018). "Endogenous Disasters," *American Economic Review,* vol. 108 (August), pp. 2212–45, https://www.aeaweb.org/articles?id=10.1257/aer.20130025.

Phillips, A. W. (1958). "The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861–1957," *Economica,* vol. 25 (November), pp. 283–99, https://doi.org/10.1111/j.1468-0335.1958.tb00003.x.

Ravenna, Federico, and Carl E. Walsh (2008). "Vacancies, Unemployment, and the Phillips Curve," *European Economic Review,* vol. 52 (November), pp. 1494–521, https://www.sciencedirect.com/science/article/pii/S0014292108000664.

Reifschneider, David L., and John C. Williams (2000). "Three Lessons for Monetary Policy in a Low-Inflation Era," *Journal of Money, Credit and Banking,* vol. 32 (November), pp. 936–66, https://doi.org/10.2307/2601151.

Yellen, Janet (2002). Comments on Athanasios Orphanides and John C. Williams, "Robust Monetary Policy Rules with Unknown Natural Rates," Brookings Papers on Economic Activity, pp. 126–35, https://www.brookings.edu/wp-content/uploads/2002/06/2002b_bpea_orphanides.pdf.

Appendix

A.1 Simple macroeconomic model used in section 4

This section provides further details on the three-equation New Keynesian model the paper uses to examine the effects of a shortfalls approach to pursuing maximum employment in section 4. This simple economic environment features households that work and consume, firms that employ workers and produce, and a central bank that sets the nominal interest rate following a simple interest rate rule. The economic environment can be summarized by an IS equation that links the output gap $x_t$to the gap in the central bank's nominal policy rate R_t relative to its longer-run value, equation (1), and a Phillips curve that links economic activity and inflation expectations to current inflation π_t (expressed as a gap relative to the central bank's objective) in equation (2):

$$x_t = E_t x_{t+1} - (R_t - E_t \pi_{t+1} - r_t^n), \tag{1}$$

$$\pi_t = \beta E_t \pi_{t+1} + \kappa x_t + s_t. \tag{2}$$

Fluctuations in the economy are driven by either a demand shock (fluctuations in the natural rate of interest, r_t^n) or an inefficient supply or, alternatively, a cost-push shock (fluctuations in s_t). The stochastic processes for r_t^n and s_t are given by

$$r_t^n = \rho_r r_{t-1}^n + \epsilon_t^r,$$

$$s_t = \rho_s s_{t-1} + \epsilon_t^s,$$

where $0 < \rho_r < 1$, $\epsilon_t^r \sim \mathrm{N}(0, \sigma_r^2)$, $0 < \rho_s < 1$, and $\epsilon_t^s \sim \mathrm{N}(0, \sigma_s^2)$.

Because the model lacks a concept of unemployment, this paper uses a simple Okun's law–type relationship that links fluctuations in the unemployment rate gap to the output gap:

$$u_t = -\frac{1}{c} x_t, \tag{3}$$

where u_t is the unemployment rate gap defined as the difference between the unemployment rate and its natural rate.

Shocks to the natural rate of interest, r_t^n, act as demand shocks that tend to move the unemployment rate and inflation in opposite directions. In contrast, cost-push shocks tend to move the unemployment rate and inflation in the same direction.

Finally, this paper uses two alternative specifications for the conduct of monetary policy. Specifically, we first assume that the central bank responds symmetrically to inflation and unemployment gaps under a deviations rule:

$$R_t = \phi_\pi \pi_t + \phi_u u_t. \tag{4}$$

To illustrate the economic implications under a shortfalls approach to pursuing maximum employment, we next assume that the central bank follows a shortfalls rule:

$$R_t = \begin{cases} \phi_\pi \pi_t + \phi_u u_t & if\ u_t \geq 0 \\ \phi_\pi \pi_t & if\ u_t < 0. \end{cases} \quad (5)$$

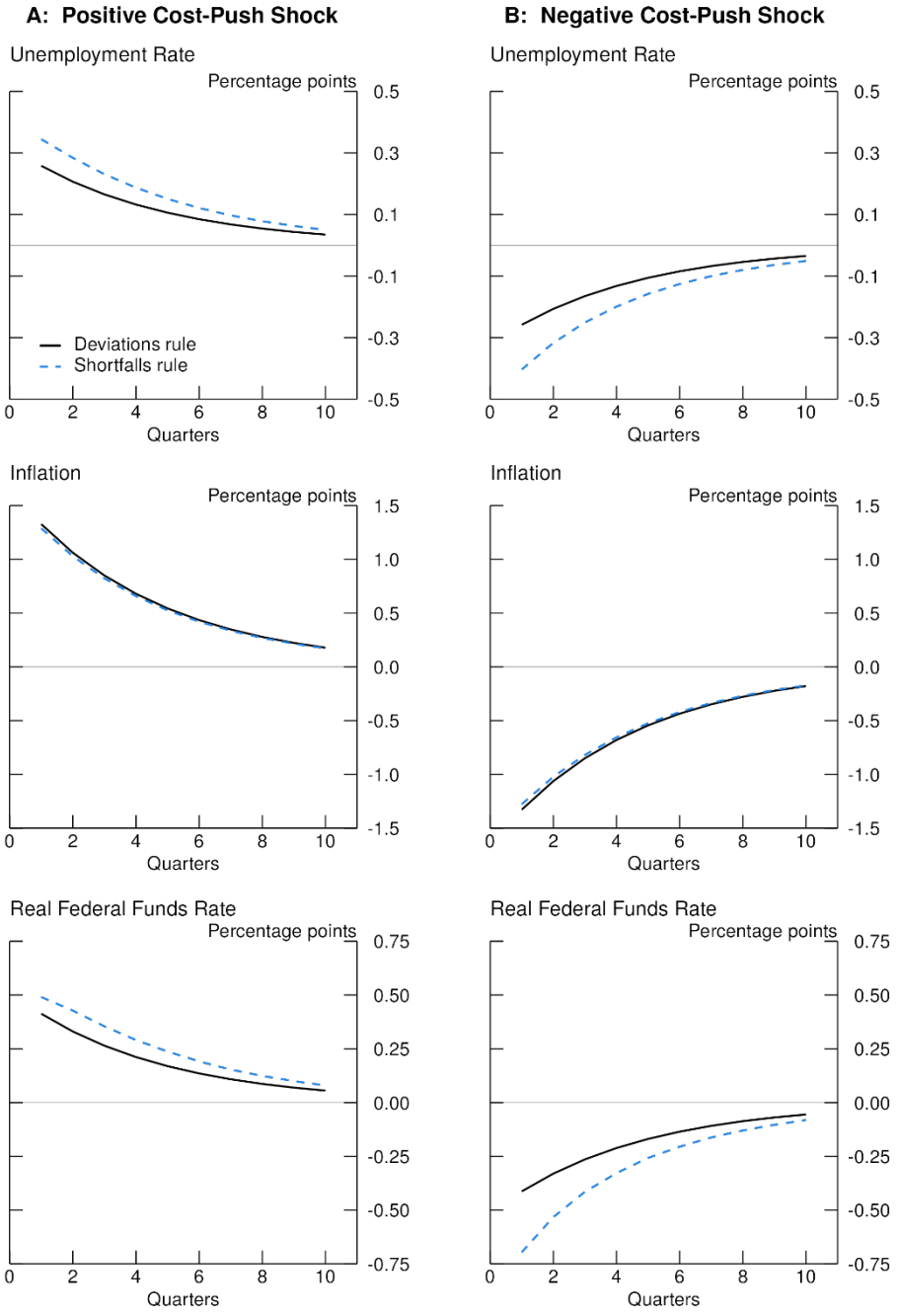
The model is solved using a global solution method in which households and firms understand the full structure of the economy and the possibility that future shocks may occur. The following parameters are used to solve the model:

$$\beta = 0.99,\ \kappa = 0.01,\ c = 2,\ \phi_\pi = 1.5\ \ \phi_u = -0.5,$$
$$\rho_r = 0.8,\ \sigma_r^2 = 0.0025, \rho_s = 0.8, \sigma_s^2 = 0.0007.$$

A.2 Impulse responses to a cost-push shock: Deviations versus shortfalls approaches

Figure 2 illustrates the responses of the unemployment rate, inflation, and the real federal funds rate to an inefficient supply or, alternatively, a cost-push shock. While the responses to inflation are broadly similar under both the deviations and shortfalls rules, the economy experiences additional volatility in the unemployment rate under a shortfalls approach. In response to a negative cost-push shock that lowers inflation (right panels in figure 2), the unemployment rate falls more under the shortfalls rule than under a deviations rule, as the policy rate under a shortfalls rule does not actively lean against the tightening in the labor market. These effects correspond to the "direct effect" of a shortfalls rule, as described in section 4. However, there is an "indirect effect" from expectations of this more expansionary policy that raises inflation at all times, compared to when a central bank follows a deviation rule. Because policy leans against this increase in inflation, a shortfalls rule is more restrictive than a deviations rule in response to a positive cost-push shock and unemployment rises more (left panels in figure 2).

Figure 2: Impulse response functions to a cost-push shock



Notes: The figure displays the difference in the paths of the unemployment rate, inflation, and the real federal funds rate in response to either a positive or negative cost-push shock relative to their respective paths under no shock. As a result, these responses do not display the effects to the average levels of the unemployment rate, inflation, and the real federal funds rate of switching from a deviations rule to a shortfalls rule. See Koop, Pesaran, and Potter (1996) for a discussion of impulse responses in nonlinear models. For illustrative purposes, the size of the shock is chosen such that the first-period impulse response for the unemployment rate is negative 0.25 percentage point upon a negative cost-push shock under the deviations rule. The responses of inflation and the real federal funds rate are annualized.

Source: Authors' calculations.