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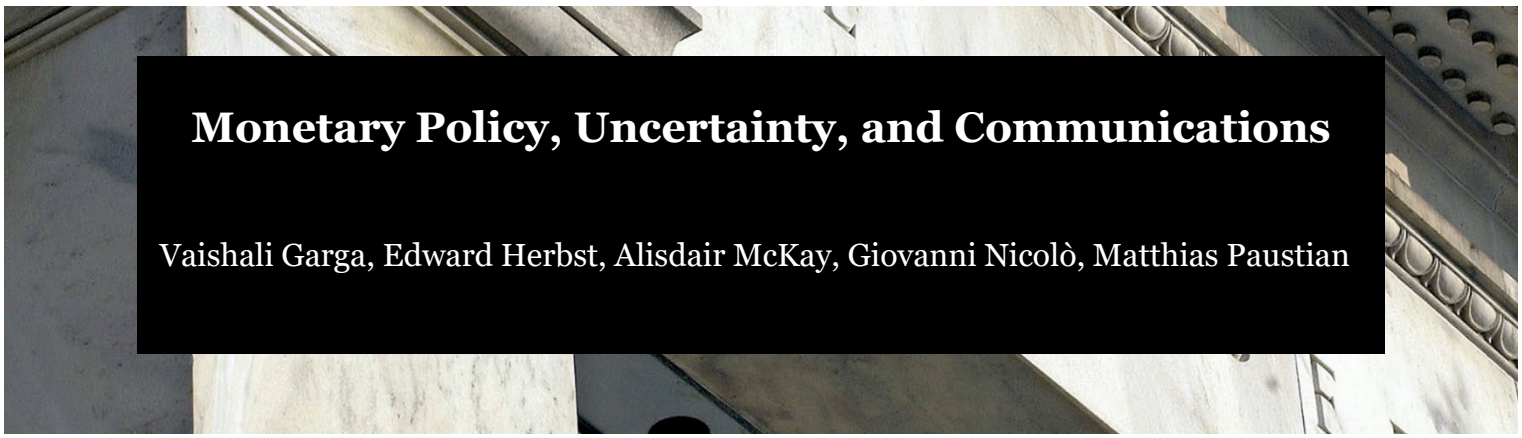

Monetary Policy, Uncertainty, and Communications

Vaishali Garga, Edward Herbst, Alisdair McKay, Giovanni Nicolò, Matthias Paustian

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: We review the design and communication of monetary policy strategies that take into account risks and uncertainty. A key element in a robust monetary strategy is the concept of risk management, which is the weighing of key risks when setting policy. When risks to the outlook are balanced, the baseline outlook may be sufficient to guide policy decisions. However, risk-management considerations become important when risks are asymmetric. We discuss how robust simple interest rate rules and optimal control policy can incorporate risk-management considerations into the design of a monetary policy strategy. Alternative scenarios can illustrate salient risks and how monetary policy might respond if those risks were to materialize. However, using alternative scenarios in policy deliberations and communications requires important implementation choices.

JEL Classification: E31, E32, E52, E58.

Keywords: Uncertainty, risk management, robust monetary policy strategies, scenario analysis, monetary policy communication.

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1. Introduction and overview

This paper analyzes the design and communication of monetary policy strategies, taking into account risks and uncertainty.[1] As outlined in the companion paper "Accounting for Uncertainty and Risks in Monetary Policy" by Bauer and others (2025), policymakers face many types of risks and uncertainty, including regarding the state and structure of the economy and the formation of expectations. This paper identifies key elements of a monetary policy strategy that is robust in the face of these risks and uncertainty. A robust monetary policy strategy shares key elements of any well-designed monetary policy strategy: It is systematic yet flexible, firmly anchors longer-term inflation expectations, and clearly communicates the rationale for the policy decision. In addition, it incorporates risk-management considerations through the weighing of key risks in setting monetary policy.

In the context of model-based analysis, two benchmark approaches, robust simple interest rate rules and optimal control policy, can guide how risk-management considerations are incorporated into the design of a monetary policy strategy. Robust simple rules incorporate risk-management considerations indirectly because they perform well in a broad array of economic environments instead of being narrowly tailored to particular settings. However, robust simple rules often lack the flexibility to appropriately respond to a specific evolution of the economic outlook. By contrast, optimal control policy can explicitly incorporate risk-management considerations: As economic developments reshape the economic outlook and the surrounding risks, the prescription of optimal control adjusts accordingly. However, the prescription is closely tied to modeling assumptions and can be complex, and contemplating the full spectrum of risks is challenging.

Although optimally managing all risks is challenging, alternative scenarios can be a useful tool with which to illustrate salient risks to the baseline outlook and how monetary policy might respond if those risks were to materialize. However, using alternative scenarios in policy deliberations and communications requires important implementation choices. These choices include what forecast to show as the baseline scenario, what risks to highlight, and what monetary policy assumptions to use in constructing the alternative scenarios.

2. Key elements of a robust monetary policy strategy

A robust monetary policy strategy aims to stabilize economic activity and inflation across a wide range of highly uncertain developments. Over the past several decades, the experiences of major central banks and extensive economic research have informed the development of key principles for any well-designed monetary policy strategy.[2] These principles can also help guide

[1] In this paper, we use these terms as defined in the companion paper by Bauer and others (2025).

[2] A series of short notes on "Monetary Principles and Practice" are available on the Board's website at https://www.federalreserve.gov/monetarypolicy/monetary-policy-principles-and-practice.htm. See also Williams (2025) for a related discussion.

policymaking in the face of inherent uncertainty about the economic outlook. They can foster public understanding of monetary policy and help the public to anticipate policy actions. A well-designed policy that takes into account uncertainty should include the following elements.

- ***Systematic yet flexible.*** A robust policy strategy needs to trade off being systematic with being flexible. The commitment to achieving clear objectives via a strategy that is predictable and well understood by the public fosters credibility, which in turn imparts greater influence on expectations of future policy and outcomes, improving policy transmission. There are consequently major benefits to monetary policy that is systematic. However, flexibility is also important. Uncertain economic developments call for policy to be flexible enough to respond to unusual movements in economic conditions and a broad range of scenarios.
- ***Forward-looking and data dependent.*** As changes in monetary policy affect the economy with a delay, policy is necessarily forward-looking and adjusted with an eye to the expected evolution of the economy. At the same time, policy decisions need to depend on the incoming data and their implications for the outlook and the balance of risks.[3]
- ***Firm nominal anchor.*** A commitment to a well-understood inflation target fosters credibility and anchors longer-term inflation expectations, which helps stabilize inflation without requiring excessive movements in economic activity.
- ***Follows the Taylor principle.*** The nominal policy rate should adjust, over time, more than one-for-one in response to a persistent movement in inflation. Broadly speaking, real interest rates lean against persistent fluctuations in inflation and help stabilize economic activity and anchor longer-term inflation expectations.
- ***Clear communication.*** Clear and transparent communication of policy intentions and of the rationale for policy decisions helps enhance the public's understanding and promotes confidence in the central bank. Transparent communication about risks and uncertainty can also make clear that future policy will be adjusted as needed to achieve longer-run goals. However, care should be exercised so that communication itself does not exacerbate uncertainty or create confusion.
- ***Incorporates risk management.*** A cornerstone of monetary policy under uncertainty is "risk management." Under this approach, policymakers weigh possibilities—for example, that different shocks might hit the economy, or that the structure of the economy could differ from their baseline assessment. The modal outlook is typically a good guide for setting policy if the distribution of risks is symmetric around that mode. However, the mode is not sufficient when risks are asymmetric. The asymmetry of risks can include both the distribution of possible outcomes and the severity of losses associated with those outcomes.

[3] See the companion paper by Bauer and others (2025) for a definition of the concept of balance of risks.

3. Incorporating risk-management considerations into monetary policy analysis

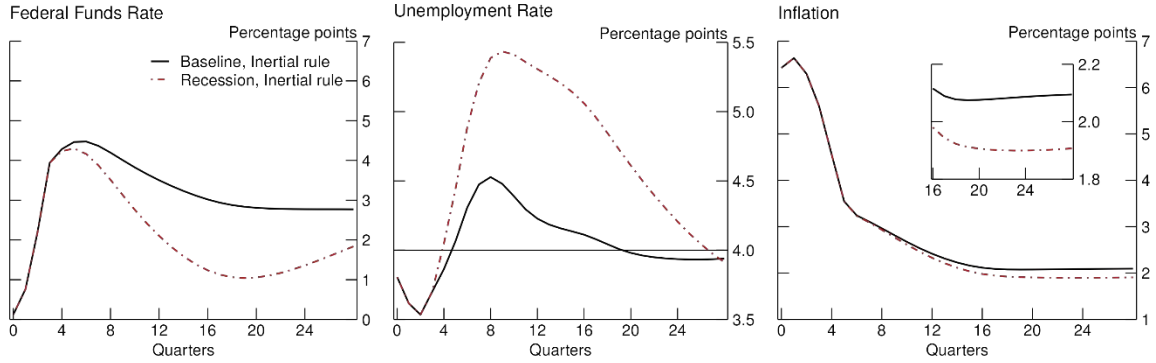
Incorporating risk-management considerations into policymaking can be formalized using the concept of a loss function, which attempts to quantify the welfare costs that arise when the objectives of a monetary policy strategy are not achieved. Typically, loss functions include deviations of inflation from the policymaker's inflation target and the percentage difference in employment from its natural level.[4] Importantly, the loss function includes both current and discounted future costs, because the lags in the transmission of monetary policy imply that the current policy affects the future values of inflation and employment and consequently future losses. In the presence of uncertainty, the dominant framework used to evaluate a policy strategy is *expected loss*, in which costs are weighed according to the assessment of the probability of their realization.[5] A robust policy strategy—one that manages risk well—will result in small expected losses across a range of risks and uncertainty.

[4] Recent work has studied the implications of responding to shortfalls, rather than deviations, of activity from its natural level using simple policy rules (Bundick, Cairó, and Petrosky-Nadeau, 2025) or using a loss function and solving for optimal policy (Kiley, 2024a; Gust, López-Salido, and Meyer, 2017).

In addition, the loss function often also penalizes changes in the policy rate. The inclusion of a desire for interest rate smoothing in an assumed loss function could be motivated in several ways. Such smoothing can improve the predictability of future policy actions, helping to keep the public's inflation expectations well anchored and to influence longer-term interest rates. The desire to smooth variation in the policy rate could also proxy for mitigating financial stability risk stemming from highly volatile interest rates. Moreover, such smoothing implies policy prescriptions that more closely resemble the observed persistence in the actual federal funds rate in the past. Policymakers may put considerable weight on interest rate smoothing as a hedge against model uncertainty or out of concerns for not-perfectly-rational expectations formation (such as learning behavior).

[5] Greenspan (2004) describes such a risk-management approach and how it influenced policy choices in practice. The framework we have described requires the assignment of (potentially subjective) probabilities to events. An alternative approach, known as robust control (or, relatedly, minimax regret), is appropriate for situations in which policymakers are unwilling or unable to assign probabilities to outcomes and seek to achieve the best outcome in the worst-case scenario among those that are considered. The policy prescriptions that emerge from the robust control approach can be sensitive to modeling assumptions about the worst case. In this paper, we focus on the Bayesian approach that evaluates policy strategies based on expected losses, taking as given subjective probabilities of designated events. A related possibility is that policymakers may not even contemplate some possible outcomes (see Kay and King, 2020). Formal analysis of decisionmaking in this setting is challenging. This paper does not specifically engage with "unknown unknowns," but we note that it is important to avoid a false sense of precision that can arise when making decisions assuming only "known unknowns."

Figure 1: Baseline and recession scenario



Source: Authors' calculations.

In order to calculate the expected loss associated with a particular policy strategy, one needs to specify the set of potential outcomes. Many approaches can be used to describe risks, but we focus on the use of alternative scenarios as commonly practiced by central banks and regularly shown in the Tealbook. Figure 1 illustrates a deliberately stylized example of this approach, beginning in a situation of elevated inflation and low unemployment. The figure shows two sets of outcomes: a baseline projection and an alternative scenario, both constructed using the "Inertial rule"—that is, a version of the Taylor (1999) rule that includes a response to the lagged policy rate.[6] The baseline projection (solid black line) represents the modal outlook—that is, the most likely evolution of the economy. Under this projection, the policy rate responds to elevated inflation and the unemployment rate rises modestly above its longer-run level. The recession projection (dash-dotted red line) represents the alternative scenario, in which the economy enters a recession and the policy rate falls more rapidly in response to the higher unemployment rate and somewhat lower inflation. In this example, the recession represents the only risk to the baseline projection, and the risk to unemployment is skewed upwards—that is, the mean unemployment rate is necessarily higher than in the baseline (mode) if there is any chance of the recession occurring.

The concept of expected loss provides a unified framework for evaluating the performance of monetary policy in two benchmark approaches to designing monetary strategies: robust simple interest rate rules and optimal control policy. These two approaches offer complementary risk-management perspectives when designing and communicating monetary policy. We will later use the stylized example in figure 1 to explore the policy prescriptions of

[6] All simulations shown in the paper are constructed using a linearized version of the FRB/US model. In the model, private-sector decisionmakers—such as wage and price setters and financial market participants—form expectations using small-scale statistical (vector autoregressive) models. In the simulations, the "Inertial rule" sets the policy rate according to an inertial Taylor (1999) rule with a coefficient on the lagged policy rate of 0.85 and in which the unemployment rate gap is measured by the deviation of the unemployment rate from an assumed longer-run unemployment rate of 4 percent. For further details about the expectations formation process or the Taylor-type rule, see Hebden and others (2020).

different simple rules and optimal control policies as well as the implications for risk management.

Robust simple interest rate rules

Simple policy rules—which set the short-term policy rate in response to a few key economic variables—provide useful benchmarks for monetary policy deliberations.[7] Several benefits follow from the simplicity of these rules. By design, policy rules are systematic and thus predictable. These rules are relatively easy to communicate and understand, and the relationship of the policy strategy to policy objectives can be made explicit by, for example, directly including the policy objective in the rule. A simple rule also has the advantage that setting policy in accordance with the Taylor principle is typically straightforward.[8] A broad benefit obtains from the principle of parsimony: By focusing on key principles, the rule avoids being narrowly tailored to particular settings or fine-tuned for specific models.

Risk-management considerations can be incorporated into the choice or design of the rule by taking into account its performance in a broad range of situations and environments.[9] A robust policy rule is one that performs well across a broad range of environments. Although economic research has identified some broad features that a robust simple policy rule should possess, such as satisfying the Taylor principle, there is no single simple rule that delivers low expected losses in all settings. Even the design and evaluation of robust simple rules is premised on the set of models and shocks used in the simulations and thus may not be robust to situations or circumstances outside of those explicitly considered.

To illustrate how the performance of simple policy rules can depend on economic circumstances, we build on the alternative simulations used in figure 1. Specifically, we demonstrate how inertial rules—which the literature has found to perform well when private-sector decisionmakers are forward-looking—may lack the flexibility required to respond rapidly to economic downturns. In figure 1, both the baseline scenario and the recession scenario use the Inertial rule. In figure 2, we compare the outcomes (under both projections) when monetary policy instead follows a "Non-inertial rule"—that is, the non-inertial version of the Taylor (1999) rule.

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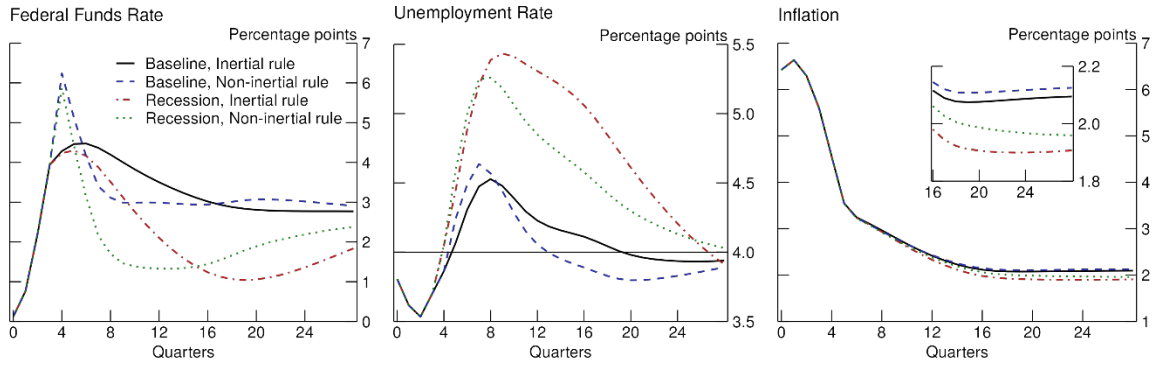
[7] Rules that relate the policy rate to a set of macroeconomic indicators are known as instrument rules. These rules are the focus of this subsection. An alternative approach, targeting rules, instead specify a condition to be fulfilled between the target variables for the central bank. Optimal targeting rules are optimality conditions for the setting of monetary policy that are derived from an objective function and an economic model. Targeting rules are implicit in our discussion of optimal control in the next subsection in this paper. See Svensson (2002) and Giannoni and Woodford (2002).

[8] For background on simple policy rules, see McCallum (2002) and Taylor and Williams (2011). A discussion on "Policy Rules and How Policymakers Use Them" is available on the Board's website at https://www.federalreserve.gov/monetarypolicy/policy-rules-and-how-policymakers-use-them.htm.

[9] In principle, this approach can be used to construct optimal simple rules by choosing the coefficients of a given rule to minimize the expected losses in a given simulation study. See, for example, Levin, Wieland, and Williams (1999, 2003) and Orphanides and Williams (2002).

Figure 2: Outcomes under different simple policy rules



Source: Authors' calculations.

Under the baseline projection, the Inertial rule (solid black line) calls for a more gradual increase of the policy rate than the Non-inertial rule (dashed blue line) in response to the elevated level of inflation at the beginning of the simulation and a more gradual return to its longer-run level thereafter. Although these policy rate prescriptions lead to similar inflation paths, the Inertial rule prescribes more moderate policy rate changes than the Non-inertial rule, resulting in smaller fluctuations of the unemployment rate around its assumed longer-run level of 4 percent. For a hypothetical loss function that places equal weights on deviations of inflation from 2 percent and of unemployment from its longer-run level, the somewhat larger cumulated unemployment deviations associated with the Non-inertial rule amount to an underperformance of that rule relative to its inertial counterpart. In contrast, when the recession materializes, the opposite conclusion applies: After calling for a fast increase in the policy rate at the beginning of the simulation in response to elevated inflation, the Non-inertial rule (dotted green line) prescribes rapid policy rate cuts to stimulate the economy in the face of negative demand shocks. The resulting path of unemployment rate deviations is lower than under the Inertial rule (dash-dotted red line), implying better economic performance under the Non-inertial rule.

Going beyond this illustrative example, the literature has evaluated the performance of a wide set of rules in response to general business cycle fluctuations and to specific risks. This literature has proposed ways to refine simple benchmark rules in a manner that makes them robust in the face of specific risks, but none of these robust rules are applicable in all situations. For example, a drawback of simple benchmark rules is that because they are typically specified to respond to contemporaneous indicators in a fixed manner, they do not explicitly incorporate information about the future course of the economy or about risks to the outlook that are not

captured by those indicators. Forward-looking rules that respond to expected future outcomes represent an attempt to overcome this challenge.[10]

Another strand of the literature has suggested that when the policy rate is near the effective lower bound (ELB), monetary policy behavior should differ—roughly speaking, be looser—from its behavior when the ELB constraint is not a prominent concern. For example, by incorporating a threshold criterion or a makeup variable cumulating past misses of inflation from target when the policy rate is at the ELB, policy rules can implement the well-known lower-for-longer strategy.[11] These kinds of robust rules serve as useful guides when central banks are facing specific risks, though, again, none of them are applicable in all situations.

Another challenge in using simple rules is that the key indicators they focus on may be measured with error. In many cases, simple rules depend on fundamentally unobservable variables like the natural rate of unemployment or the equilibrium level of interest rates. In the presence of measurement error, some studies suggest that robust simple rules should respond relatively less to the mismeasured variables so as to not impart additional volatility to the economy.[12] First-difference rules go a step further and completely omit these unobservable policy "guideposts" like the equilibrium interest rate and are thus robust to the (unavoidable) mismeasurement of these variables.[13] However, these rules are highly inertial and, as a result, tend to underperform when the economic outlook changes rapidly. Overall, although simple rules are unlikely to be robust to all possible circumstances, they can be designed to be robust to some specific risks and measurement challenges.

Optimal control policy

Under optimal control, monetary policy is set to minimize expected losses while accounting for the structure of the economy and the process by which the private sector forms expectations. Depending on the complexity of the model used to calculate the optimal control policy, the policy rate may be a function of many more macroeconomic variables than a simple policy rule and may depend on expected future as well as lagged values of these variables.[14] The

[10] Although well-designed policy should be forward-looking to account for the lagged effects of monetary policy changes, policy that is overly forward-looking may not be responsive enough to incoming information and can result in undesirable fluctuations in economic activity and inflation; see, for example, Levin, Wieland, and Williams (2003). In addition, the performance of forward-looking rules depends on the accuracy of the forecasts used in the rules.

[11] Arias and others (2020) and Hebden and others (2020) discuss makeup strategies—policies that aim to offset, at least in part, past misses of inflation from its objective—and their robustness. Kiley (2024b) argues that ELB risk can be mitigated by incorporating longer-run inflation expectations into a simple policy rule.

[12] See the discussion in Boehm and House (2019).

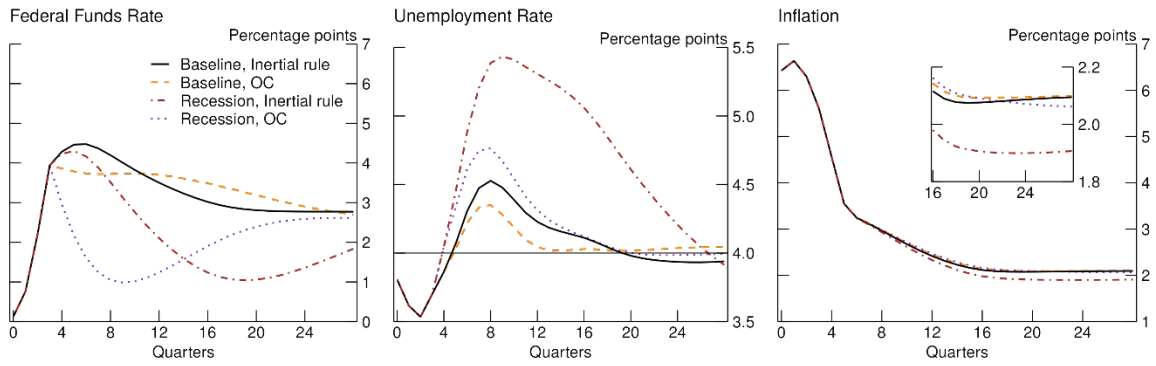
[13] See Orphanides and Williams (2002).

[14] In models in which private-sector decisionmakers are forward-looking, economic outcomes can be improved if current policymakers are able to make credible promises upon which future policymakers follow

typical implementation of optimal control in the Tealbook is one in which the evolution of the economy—according to the baseline outlook or alternative scenario—is taken as known with certainty, precluding formal risk-management considerations. Later in the paper, we discuss how the Tealbook optimal control simulations could be enhanced to explicitly consider the management of specific risks.

By their nature, optimal control policies lead to outcomes that are the best possible under the extensive assumptions—including the specific loss function—with which they are constructed. The forward-looking nature of these policies makes them potentially well suited to design a policy that can explicitly incorporate risk-management considerations. As economic developments reshape the economic outlook and the risks surrounding it, the prescriptions of optimal control adjust accordingly. In this way, the policy prescriptions are both forward-looking and data dependent.

Figure 3: Optimal control simulation under baseline and recession scenario



Source: Authors' calculations.

Figure 3 illustrates the flexibility of optimal control policies using the baseline and alternative scenarios of figure 1.[15] The optimal policies are constructed under the assumption that either the baseline outlook (dashed orange line) or the recession scenario (dotted purple line) materializes with certainty, consistent with the long-standing perfect foresight assumption in the Tealbook. Under the baseline, the optimal policy rate path is close to that of the Inertial rule, leading to similar unemployment and inflation outcomes. Under the recession scenario, the optimal policy path (dotted purple line) falls much more quickly than prescribed by the Inertial

through, even if they believe it is not optimal to do so—that is, the promises are time inconsistent along the lines described by Kydland and Prescott (1977); see also Duarte and others (2020). By contrast, under discretion, policymakers do not keep past promises and therefore lack the commitment required to directly influence private-sector expectations. As a result, policymakers take those expectations as given when setting policy optimally.

[15] The optimal control simulations posit that policymakers choose a path for the federal funds rate to minimize a discounted equally weighted sum of squared inflation gaps (measured as the difference between four-quarter headline personal consumption expenditures price inflation and the 2 percent target), squared unemployment gaps (measured as the difference between the unemployment rate and its longer-run level), and squared changes in the federal funds rate.

rule (dash-dotted red line). Consequently, the rise in the unemployment rate is more muted and inflation remains closer to the 2 percent target. The optimal policy delivers superior outcomes in both cases: It mimics the gradual response of the Inertial rule under the baseline as well as the rapid fall of the policy rate prescribed under the Non-inertial rule in response to the recession (shown in figure 2).

These simulations illustrate the optimal policy response to one specific adverse future outcome that is perfectly anticipated. However, they do not encompass risk management in the form of weighing multiple possible future outcomes, and later we extend the analysis to do so. However, optimal control analysis also has limitations. The prescriptions can hinge crucially on assumptions about the model, the nature of the uncertainty, and the loss function.[16] And though some guidelines emerge—discussed in the next subsection—optimal control policies under uncertainty can also often be complex and difficult to communicate because of the contingent nature of these strategies.

3.1 Optimal monetary policies under uncertainty in specific applications

Two important theoretical benchmarks in the discussion of monetary policy under uncertainty are certainty equivalence and the Brainard attenuation principle. We discuss these concepts in the context of optimal monetary policies.

Under certainty equivalence, which applies only under certain restrictive conditions, the policy that minimizes the expected loss is the same as the optimal policy for the case in which the uncertain outlook is replaced by its expected (mean) value.[17] In this context, it is in the process of computing the mean outlook—weighing outcomes by their probabilities—that policymaking incorporates risk management. In particular, certainty equivalence applies to mean outcomes, but monetary policy analysis often centers around a baseline modal path for the economy with a distribution of risks around this baseline. As discussed in Bauer and others (2025), the modal and mean outlooks will generally not coincide if risks are distributed asymmetrically around the modal projection, as in the case in the stylized example illustrated in figure 1.

A prominent example of deviation from certainty equivalence is the Brainard attenuation principle. Brainard (1967) offers a seminal contribution on how uncertainty about the structure of the economy—and therefore the effectiveness of policy—can affect the choice of an optimal policy. In the simplest case, Brainard (1967) considers a static problem in which a policymaker

[16] Although optimal control policies are more closely tied to a specific model, these limitations also apply to the evaluation of simple policy rules. Additionally, when monetary policy is set by a committee, agreeing on a single loss function (or a set of probabilities) is challenging. We abstract from this issue, though we discuss similar considerations related to alternative scenarios in section 4.

[17] In particular, in the case of quadratic policymaker objectives and a linear economic model, optimal policy is certainty equivalent. The essential feature of linear models is that the tradeoffs between policy objectives are constant. This precludes some salient sources of uncertainty such as those associated with policymaker misspecification of economic relationships.

seeks to optimally use a policy instrument—say, the federal funds rate—to bring an outcome variable—say, the inflation rate—to target. The policymaker is uncertain about the effect of the chosen policy on the target variable but knows the mean and variance of the distribution of possible effects. The policymaker's loss is measured in (squared) deviations of the outcome variable from target. The minimization of the expected loss establishes the Brainard attenuation principle: The more uncertainty there is about the effectiveness of a policy instrument, the less aggressive the policymaker should be in seeking to achieve the policy target. Intuitively, because the effects of policy are uncertain, the actions taken by the policymaker can affect the distribution—and, in this case, the mean and variance—of the target variable. A policymaker who more aggressively seeks to meet the target, on average, creates a higher volatility of the target variable. Therefore, in contrast to the case of certainty equivalence, the policymaker optimally chooses an attenuated policy response that accounts not only for the expected effect of the policy actions, but also for the uncertainty—and particularly the variance—of that effect. The attenuation principle is often referred to in policy discussions as the basis for gradualism in the face of uncertainty.[18]

Although certainty equivalence and the Brainard principle serve as useful reference points, there are limits to the guidance they can provide about the design of policy under uncertainty. Instead, more comprehensive analysis is typically required, and, in some cases, greater uncertainty calls for more aggressive action instead of attenuation. The rest of this section surveys some of this related literature and summarizes its findings on the optimal monetary policy response in the presence of some prominent sources of uncertainty.

Uncertainty about future shocks in the presence of nonlinearities

As discussed before, when certainty equivalence applies, the optimal control approach to risk management involves probability-weighting future outcomes into an expected value—that is, the mean—and basing the policy decision solely on the mean. However, basing policy solely on the assessment of the mean is suboptimal when there are nonlinearities or asymmetries affecting the economic outlook. Specifically, asymmetries can arise when future shocks push the economy, otherwise well approximated by a linear model, into regions of nonlinearities.[19] A linear model is often viewed as a reasonable approximation for normal times, but there are times when the economy displays nonlinear relationships. For example, several studies suggest that the Phillips curve may display nonlinearities at very low unemployment rates.[20] Another particularly salient nonlinearity is the possibility that the nominal interest rate will be constrained

[18] See Blinder (1998) for an example.

[19] A loss function that penalizes shortfalls of employment without penalizing high levels of employment would not be symmetric, and this asymmetry would push the optimal policy toward higher levels of employment than under certainty equivalence, with attendant consequences for the path of inflation; see the discussion in Bundick, Cairó, and Petrosky-Nadeau (2025).

[20] See Blanco and others (2024a, 2024b); Karadi and others (2024).

by the ELB. An implication of the ELB for risk management is that monetary policy should adopt a looser stance than typically implied by the mean outlook.[21]

Uncertainty about the state of the economy

Latent variables like potential output or the natural rate of unemployment, which are key to monetary policymaking, can be inferred from observable data only with considerable uncertainty, and important data on spending or the labor market are typically measured with error. Svensson and Woodford (2003) consider an environment in which there is imperfect information about the state of the economy.[22] They show that optimal policy in such a stylized environment involves two stages. In the first stage, the policymaker estimates the state of the economy from a set of indicators, placing less weight on noisier indicators. In the second stage, the policymaker sets optimal policy taking as given the best estimate of the state of the economy. Under the assumed structure of the economy, the optimal policy determined in the second stage is certainty equivalent and unaffected by the amount of noise. One implication of this framework is that the policymaker's understanding of the state of the economy may evolve only gradually, inducing inertia in policy.

A separate branch of the literature examines whether uncertainty about the natural rate of unemployment or potential output can motivate policies of experimentation or probing when a policymaker is also uncertain about the structure of the economy.[23] Conceptually, this entails setting policy with an eye toward actively learning about these latent variables for better future setting of policy. Broadly speaking, the literature has found that benefits from such an approach are often small. At the same time, active experimentation has costs and could have unintended consequences.

Uncertainty about expectations formation and the structure of the economy

As described in Bauer and others (2025), the transmission of monetary policy depends crucially on the public's expectations about the future course of monetary policy, the policy reaction function, and future inflation. A well-designed monetary policy strategy needs to be robust to uncertainty about the expectations formation process.

In many modern macroeconomic models, economic decisionmakers are assumed to be extremely perceptive: They consider outcomes far into the future and correctly assess the likelihood of these outcomes. In this setting, monetary policy can be very powerful (perhaps implausibly so) by influencing the public's expectations about policy far into the future.[24] In

[21] See Adam and Billi (2007); Nakov (2008); Evans and others (2015); Gust, Johannsen, and López-Salido (2015); and Yellen (2016).

[22] Partial information about the state is assumed to be symmetric—the private sector and the central bank both observe noisy signals of the true state.

[23] See the discussion in Wieland (2006).

[24] See Del Negro, Giannoni, and Patterson (2023) for a detailed description of the so-called forward guidance puzzle. See also McKay, Nakamura, and Steinsson (2016).

reality, the process by which economic decisionmakers form expectations, particularly about the longer run, is uncertain, and the stabilization of longer-term expectations is not necessarily straightforward.

The literature has generally found that monetary policy should give greater weight to the possible states in which longer-term inflation expectations may become unanchored, because although a state with unanchored inflation expectations might not be very likely, losses incurred in that state are high. This is an especially important consideration when there is uncertainty about the inflation expectations formation process. The literature has examined the robustness of different monetary policy strategies and compared their relative performance under different assumptions about expectations formation and found that a robust policy places a larger weight on inflation stabilization over the stabilization of real activity compared to policies that are not robust to this form of uncertainty.[25] Particularly in settings in which inflation may be "intrinsically" persistent through expectations formation—when expectations of future inflation depend on past inflation—and there is uncertainty about this relationship, the literature has found that policy should attempt to act forcefully to avoid inflation at very high or very low levels. This is because uncertainty about the persistence of inflation interacts with the level of inflation. When current inflation is further away from target, the possibility of high inflation persistence implies the risk of sustained future misses in the inflation objective. A similar result emerges when the source of the intrinsic persistence is not the expectations formation process but instead the structure of the economy—for example, if wage and price contracts are indexed to past inflation. In this case, too, the literature finds that optimal policy under uncertainty about inflation persistence does not follow the Brainard attenuation principle and instead reacts forcefully to inflation.

Another case in which the optimal policy under uncertainty may not follow the Brainard attenuation principle is when there is uncertainty about the effectiveness of policy in a dynamic setting. Note that Brainard's original analysis considered uncertainty about the effectiveness of policy within a static setting. However, in a dynamic setting with sufficiently forward-looking economic decisionmakers, an attenuated policy strategy could result in more volatile inflation expectations that destabilize the economy. This channel can work in the opposite direction of the Brainard principle and call for a more aggressive policy rate response.[26]

4. Alternative scenarios in monetary policy deliberations and communications

From a theoretical perspective, risk management would ideally involve accounting for the full spectrum of possible outcomes. In practice, this type of information is not available. Considering the implications of key risks to the outlook in the form of alternative scenarios is a practical route to incorporate risk management into policy deliberations. In addition, as

[25] Orphanides and Williams (2004), Gáti (2023), and Gust and López-Salido (2024) emphasize the importance of inflation stabilization in the context of the management of longer-term inflation expectations.

[26] See Dupraz, Guilloux-Nefussi, and Penalver (2023).

discussed in Bauer and others (2025), some central banks have made use of scenario analysis in public communications. We now discuss these two uses of alternative scenarios.

4.1 Alternative scenarios in monetary policy deliberations

In preparation for the meetings of the Federal Open Market Committee (FOMC), Board staff include alternative scenarios in the Risks and Uncertainty section of the Tealbook. Typically, the scenarios highlight the implications of alternatives to key assumptions in the baseline projection and other salient risks that are particularly important for the outlook. The design of the conditioning assumptions in the scenarios is judgmental, while the implications for the economic outlook are analyzed using a set of macroeconomic models maintained by the staff. In the alternative scenarios, monetary policy is typically governed by the interest rate rule used in the baseline projection.[27]

The use of alternative scenarios in deliberations has several benefits. Alternative scenarios illustrate salient risks to the outlook that can serve as useful points of reference in policy discussions. This may be particularly important under scenarios in which the dual-mandate goals are in conflict and therefore important tradeoffs emerge regarding the speed with which goal variables are returned to target. Policymakers can use the scenarios in conjunction with their own judgment of these risks to engage in risk management. Furthermore, as illustrated in section 3, alternative scenarios can be useful in evaluating macroeconomic outcomes under different monetary policy responses, as is done on occasion in the Monetary Policy Strategies section of the Tealbook.

Alternative scenarios as typically presented in the Tealbook also have some limitations. Scenarios are necessarily a subset of the full range of possible outcomes, and a particular concern is that the scenarios may understate tail risk, as tail events are typically not salient.[28] The emphasis on tail events highlights risks that could be highly consequential for macroeconomic outcomes, but there is a tradeoff: Frequent discussion of tail events could result in overrepresentation of such risks at the expense of other risks that are more likely to occur.

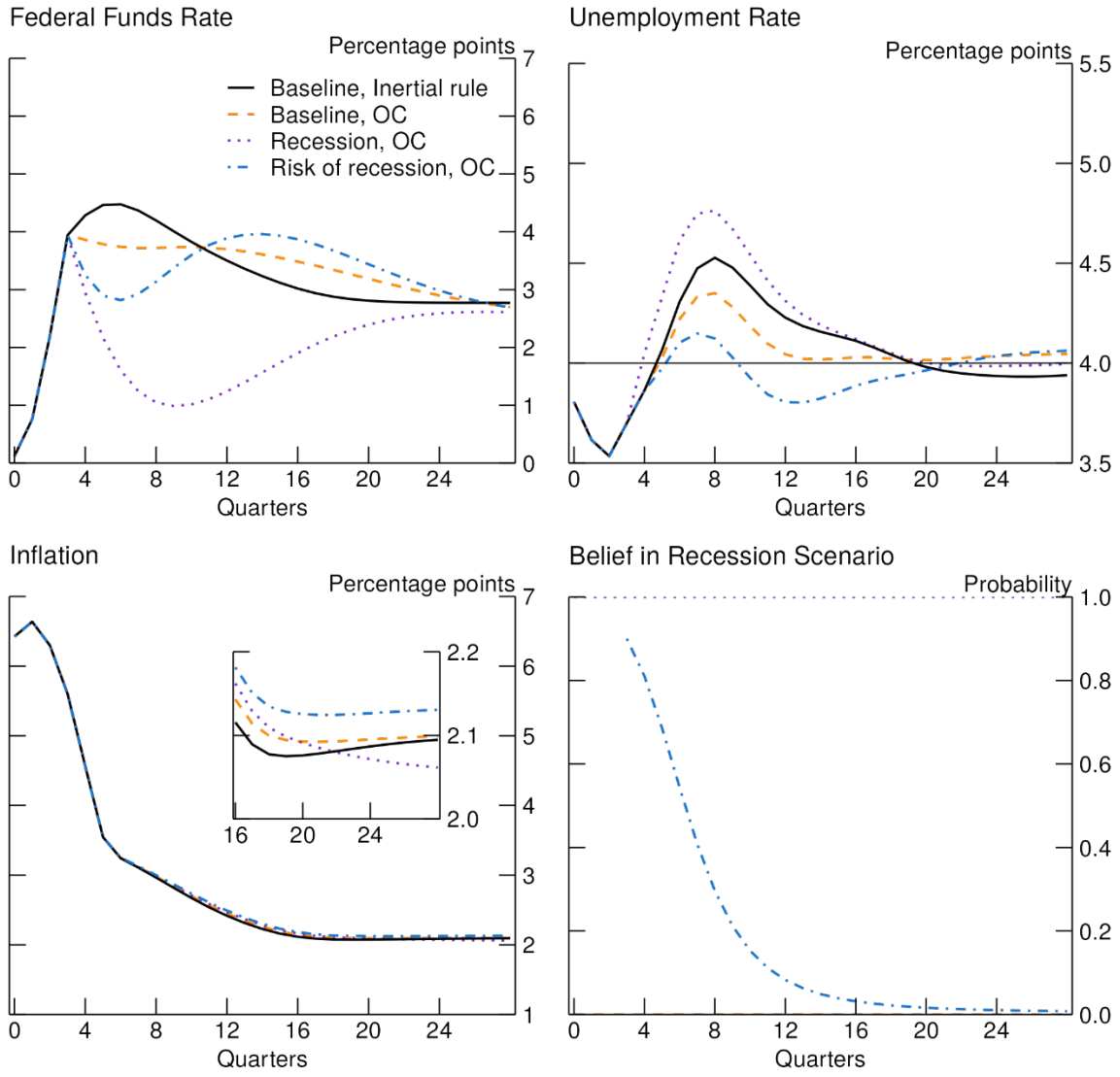
Furthermore, the risk-management approach we described in section 3 involves assigning probabilities to outcomes, but calculating scenario probabilities is challenging. Currently, probabilities are not attached to the alternative scenarios. To use the scenarios for the purpose of risk management, policymakers must then assign their own probabilities. Lastly, the typical assumption that the federal funds rate in the scenarios follows a simple interest rate rule may not give a realistic depiction of how monetary policy is likely to be set under the circumstances presented in the scenarios.

[27] In scenarios in which recessions occur, an adjustment to the baseline rule is usually made to capture the speed with which policymakers typically respond to the recession in the data.

[28] To better capture extreme events, the range of alternative scenarios considered might be informed by extreme outcomes from statistical models, such as those outlined in Bauer and others (2025).

One way in which scenario analysis in deliberations could be enhanced is by formally incorporating risk-management considerations. In that case, the likelihoods of alternative future outcomes play a central role, and uncertainty itself can shape the evolution of monetary policy and hence of the economy, even when a particular scenario materializes. When monetary policy incorporates risk-management considerations, the evolution of the economy in one scenario depends on beliefs about possible alternatives.

Figure 4: Optimal control adjusted for the risk of recession



Source: Authors' calculations.

Figure 4 illustrates how risk-management considerations may be incorporated into scenario analysis by accounting for the policymakers' beliefs and how this can lead to outcomes that are different from the typical Tealbook optimal control simulations (under which a given

scenario is assumed to materialize with certainty). For reference, we show the optimal control policies under the baseline (dashed orange line) and the alternative scenario (dotted purple line) from figure 3. We then superimpose on the figure the results obtained from a risk-adjusted optimal policy simulation, in which the policymaker minimizes expected losses in the face of uncertainty about which scenario will materialize, weighs the probability of each scenario, and updates these probabilities over time as shocks transpire and reveal which scenario is more likely.[29] In the simulation, we assume that the policymaker initially attaches a high likelihood to the recession scenario. However, the baseline scenario in fact materializes, and the policymaker learns this gradually over time. The policy rate path in the risk-adjusted simulation (dash-dotted blue line) is initially more accommodative than when the baseline materializes with certainty (dashed orange line), as the policymaker using a risk-adjusted strategy takes into account the possibility of a recession. However, as policymakers come to realize that the recession is less likely to materialize and that their risk-adjusted policy has been overly accommodative relative to the baseline (which becomes more likely over time), they eventually raise the policy rate above its baseline path.[30] A key aspect of this figure is that it demonstrates that risk-management considerations do not simply lead to a weighted average of the policy paths under the contemplated scenarios. Instead, the risk-adjusted policy path reflects the evolving beliefs of policymakers and the impact of previous policy decisions on current outcomes.[31]

4.2 Alternative scenarios in communications

The Federal Reserve does not currently use scenario analysis in its formal public communications. However, it has been suggested that it would be useful for the FOMC to do so.[32] Below, we describe potential roles that scenario analysis could play in central bank communications as well as some practical considerations in publishing scenarios.

One use of alternative scenarios in communications is in highlighting the message that a range of outcomes for the economy is possible, thereby putting less emphasis on the baseline outlook. This would underline the data-dependent nature of monetary policy, which may not be

[29] The policymaker updates beliefs about the scenarios as new information is acquired using Bayes rule: The posterior belief at the end of each period reflects the (prior) belief at the beginning of the period and the likelihood that a given scenario is true in light of the data received over the period. For more details, see Cairó and others (2025).

[30] Under a loss function that does not penalize interest rate changes, the initial accommodation and the subsequent reversal in the risk-adjusted policy are more accentuated, and the unemployment rate returns to its longer-run level earlier in the simulation. Conversely, the longer it takes for the policymaker to learn that the risk of recession does not materialize, the more inertial the risk-adjusted policy is, potentially leading to larger expected losses.

[31] Because households and firms use VAR-based expectations, they do not take uncertainty into account in their own spending and pricing decisions, isolating the role of uncertainty in risk management for policy.

[32] Bernanke (2025) offers proposals for changes to FOMC communications, including the use of alternative scenarios. See also Bordo, Levin, and Levy (2020) and Bernanke (2024). We note that scenarios are sometimes discussed by policymakers in the context of speeches and other communications.

easily conveyed through a single baseline forecast. De-emphasizing a baseline scenario could be particularly valuable at times of heightened uncertainty when there are one or more alternatives that are nearly as likely as the baseline.

Another use of alternative scenarios could be to explain the rationale for policy decisions that are influenced by risk-management considerations. More generally, alternative scenarios would provide the public with additional information about how the monetary policy strategy might respond to particular future events, thereby supplying more information about the reaction function. This might be particularly useful for communicating how policymakers would respond in situations in which the policy objectives are in tension.

Publishing alternative scenarios would require making a series of implementation choices. We list some of the key choices below.

- **What to show as the baseline?** Publishing alternative scenarios could require a decision about what to show as the baseline. A baseline forecast could represent the views of the FOMC or be a staff product.
- **What scenarios to show and when to show them?** The choice of a particular scenario is as much a part of the communication as the details of what the analysis shows. There may not always be salient risks that policymakers wish to highlight, raising the question of whether scenarios are used on a routine basis or only in special circumstances. Another practical consideration is the timing of the release relative to the FOMC meeting or other monetary policy communications and when to stop highlighting particular scenarios.
- **Is the policy rate path shown? What other variables are published?** If the intent is to clarify the monetary policy reaction function, then publishing the policy rate path would be essential.
- **How is monetary policy determined in the scenario analysis?** What is most useful to the public is to understand how monetary policy would respond if these scenarios were to materialize. However, it seems unlikely that policymakers, even when following a common strategy, would necessarily have a clear consensus on the appropriate policy rate path under all proposed hypothetical scenarios. Hence, monetary policy would likely have to be specified using an assumed monetary policy rule. Internationally, the Riksbank analyzes alternative scenarios using a macroeconomic model that includes a simple interest rate rule. In contrast, the Reserve Bank of Australia and the European Central Bank present scenarios under the assumption that the policy rate is not adjusted.
- **Whose views are represented?** The scenarios could be presented as the views of the staff or the policymakers. The Federal Reserve's internal scenario analysis is currently conducted using Board staff views of salient risks (partly informed by interactions with policymakers) and macroeconomic models, highlighting the important role that the staff might play in implementing scenario analysis. Alternatively, policymakers could be surveyed on how they

would likely respond to different scenarios or conditioning assumptions in a manner similar to the SEP process for the modal outlook.

- **How would the analysis be conducted?** If models are used in constructing the scenarios, how much information about those models would be made public? Other central banks have typically used their staff models for conducting alternative scenario analysis. The public communication often highlights the main model assumptions and mechanisms driving the results without revealing quantitative details of the model.

Implementation issues aside, the publication of alternative scenarios could have some unintended consequences. First, publishing a path of the policy rate under a scenario designed by Board staff may be misunderstood as communicating the reaction function of the FOMC and additionally misperceived as a commitment of the FOMC to follow that path if the risk materializes. Second, publishing a set of scenarios may not fully convey the uncertainty and all salient risks. At times of heightened focus on a specific risk, publishing or not publishing a relevant scenario may send an undesired signal about the FOMC's view on the scenario itself. Third, scenario analysis could result in the Federal Reserve implicitly commenting on the economic consequences of events and policies that are outside the purview of the central bank. Finally, if alternative scenarios are presented without reference to their likelihood, the public may misperceive the policymakers' judgement of risks and uncertainty. For example, an extreme scenario could be interpreted as likely, with unintended implications for private-sector expectations. As we have noted, there is some experience with publishing alternative scenarios by foreign central banks, but this is a relatively recent phenomenon, and it is too early to assess their utility and performance. Moreover, assessing the effectiveness of alternative scenarios as a communications tool is challenging, because there does not exist a well-established framework for evaluating the performance of most communication tools.

5. Conclusion

Setting policy under uncertainty requires flexibility to adapt to changing circumstances, but also a systematic approach so that policy is predictable and longer-term inflation expectations remain anchored. The implications for monetary policy of uncertainty depend crucially on the specific source of uncertainty and the modeling framework chosen for the analysis. Greater uncertainty does not generically tilt optimal monetary policy decisions to become more gradual, nor is a more aggressive approach universally preferable. At times of heightened risk, central bank communications play an important role by connecting current and future policy actions to risk-management considerations in the context of an evolving outlook. Alternative scenarios can be used to communicate how policy is responding or will respond to developments in a way that best achieves policy goals; however, using alternative scenarios in this way requires making several important implementation choices and weighing the associated benefits and costs.

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