Uncertainty and Robust Monetary Policy

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John C. Williams, President and Chief Executive Officer

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Introduction

Good afternoon. I've been waiting for the right opportunity to visit Iceland, and this conference is a wonderful reason to be here. I would like to thank Governor Jónsson for the invitation.

We are experiencing a moment of great uncertainty and change. I'd like to take this time to step back and revisit the lessons of the past several decades of monetary policy under uncertainty, a topic I have devoted most of my career to as a researcher and policymaker. In particular, I'll discuss the key characteristics of monetary policy approaches that are robust to uncertainty.

Before diving deeper into this topic, I must give the standard Fed disclaimer that the views I express today are mine alone and do not necessarily reflect those of the Federal Open Market Committee (FOMC) or others in the Federal Reserve System.

Uncertainty Is Pervasive and Multifaceted

After 30 years in central banking, I can unequivocally say: "Uncertainty is the *only* certainty in monetary policy."[1] Or, in the words of Alan Greenspan, former Chair of the Federal Reserve: "Uncertainty is not just an important feature of the monetary policy landscape; it is the defining characteristic of that landscape."[2]

And there's no doubt that uncertainty will continue to be the defining characteristic of the monetary policy landscape for the foreseeable future. This is a direct result of structural changes in the global economic environment such as those posed by artificial intelligence, deglobalization, and innovations in the financial system—not to mention the perennial challenges of measuring the so-called star variables such as r-star.

Rules vs. Discretion

So, what foundational principles, approaches, and debates have already been established with regard to monetary policy under uncertainty?

I'll begin with the "rules vs. discretion" debate. In both theory and practice, the tradition in monetary economics circles has been to counterpose the value of predictable, rule-like behavior against the need for discretionary actions in the face of uncertainty and rapid change. For example, some say the world is too complicated and uncertain to design a useful policy rule, much less follow one, and discretion is essential. On the other side, discretion can contribute to poor outcomes.

Although the rules-vs.-discretion debate has helped clarify fundamental issues, the right answer, in practice, is a blend of the two. As renowned macroeconomist, monetary theorist, and public policy expert John Taylor pointed out, a simple equation does reasonably well in describing the Fed's interest rate setting during the early Greenspan years, even though Greenspan himself highlighted the risk management nature of policymaking.[3] And policy rules themselves cannot be immutable since they implicitly or explicitly incorporate structural factors that are subject to change over time.

Robust Policy Under Uncertainty

This is where robust policy comes into play. The goal of robust monetary policy is to blend a high degree of predictability and consistency with the ability to perform effectively across a wide range of circumstances. In so doing, it increases the scope for rule-like behavior and reduces the need for discretionary actions. It inherently trades off fine-tuning to a particular view or model of the world with robustness in a world of unknowns. Early advocates of this approach included Bennett McCallum and John Taylor, and it has been studied extensively since then.[4]

A useful analogy is decision-making by a policy committee.[5] Each member of the committee holds a particular view of the behavior of the economy (represented, say, by a particular macroeconomic model). A robust policy is one that yields decisions that may not be the first choice of any individual committee member but is acceptable to most members.

Foundations for Robust Monetary Policy

With robust monetary policy being so important, how can we ensure that we get it right?

It all goes back to foundations. And the features of robust monetary policy are inextricably linked to the core foundations of successful monetary policy identified through decades of theory and evidence.

Today, I will highlight three principles: accountability and independence, transparency, and well-anchored inflation expectations.[6] It's important to note at the outset that these are mutually reinforcing.

I'll start with accountability and independence. History teaches us that central banks can be more successful at delivering price stability when they own the responsibility for that goal and have the independence of action and tools to achieve it. Too often in the past—most notably in the 1970s—some central banks behaved as if they were powerless to control inflation. Today, regardless of economic shocks, changes in government policies, or swings in globalization and deglobalization, central banks recognize that maintaining price stability is their job: they are the protectors of price stability.

The second principle is transparency, which provides predictability and clarity, and thereby enhances effectiveness. This includes clear communication of a central bank's strategy and policy decisions, and an explicit numerical longer-run inflation target. Transparency reinforces public accountability for price stability and focuses the internal policy debate on how to best achieve that goal. For households and businesses, transparency takes some of the uncertainty off the table so they can better plan. Central banks that adopted inflation targeting led the way on this. For the Federal Reserve, these concepts are described in the FOMC's Statement on Longer-Run Goals and Monetary Policy Strategy, which was introduced in January 2012.[7]

The third key principle, which has become a bedrock of modern central banking, is well-anchored inflation expectations. In the 1960s and 1970s, both short- and longer-term inflation expectations in the U.S. became unmoored, rising as actual inflation rose. This made it more difficult to maintain stable prices amid the shocks of that period. By communicating an explicit inflation target—and then delivering inflation consistent with that target—central banks have earned credibility with the public. This feedback loop between effective policy actions and communications, well-anchored expectations, and price stability short-circuits so-called second-round effects in wage and price setting that exacerbate and prolong the effects of shocks, as was the case in the 1970s.

Risk Management and Fault Tolerance

With these three foundational aspects of successful monetary policy squarely in mind, I will now turn to the design of robust policy. The basic premise is that policymaking under uncertainty is intrinsically an exercise in risk management: guard against risks that have high costs in terms of possible outcomes, and accept risks that don't.

In the remainder of this presentation, I will describe monetary policy in terms of a policy rule that stipulates the setting of interest rates as a function of different variables. The Taylor Rule is one prominent example, whereby the nominal interest rate depends on an estimate of the natural rate of interest, the inflation rate, and the deviation of a measure of economic activity from its natural rate (such as the output or unemployment gap). Although the characteristics of robust policy can be described in different ways, the policy rule formulation helps illustrate some basic concepts.[8]

Fault Tolerance

A useful way to describe the conditions for robust policy is through the lens of "fault tolerance."[9] Fault tolerance is a concept originally used in engineering and is defined as "the ability of a system or component to continue normal operation despite the presence of…faults".[10] Applying this to monetary policy, fault tolerance is related to the sensitivity of macroeconomic outcomes across various models to changes in the parameters of a monetary policy rule.

Figure 1 illustrates two representative cases of fault tolerance. In this example there are two competing models of the economy: A and B in the left panel, and B and C in the right panel. For the purposes of this figure, the monetary policy rule is assumed to be fully described by the parameter β. The two curves trace out the relationship in each model between the parameter β (on the x-axis) and a measure of the resulting macroeconomic outcome, where larger values are worse (for example, the outcome could be the variance of the inflation rate). The optimal choice of the policy parameter is indicated by β*(X) for model X.

The left panel of the figure illustrates the case of a high degree of fault tolerance in both models in that outcomes are not very sensitive to the choice of the policy parameter. The right panel illustrates the case of low fault tolerance in model C for values of the parameter β that diverge significantly from the optimal choice, while model B is the same as in the left panel.

Robust policies are designed to operate in high-fault-tolerance regions and avoid low-fault-tolerance regions. In the case illustrated in the left panel of the figure, a robust policy is characterized by a value of β somewhere between the optimal values in the two models. This policy is not exactly optimal in either model but performs well across the two models.

In the case shown in the right panel of the figure, the robust policy avoids the intolerant region for model C and is therefore biased toward the optimal value in model C. Such a policy provides insurance against the possibility that model C is the true description of the world. The exact choice of the robust policy depends on the precise specification of the central bank's objective function and beliefs about the uncertainty across models.

Three Examples

Fault tolerance provides a conceptual framework for thinking about uncertainty and robust monetary policy. I will now consider three examples of uncertainty—regarding models, the formation of expectations, and the star variables like r-star—where robust policies differ from the optimal policy in a given model and effectively manage the risk of having the wrong model. Each of these cases fits into the examples of fault tolerance illustrated in Figure 1.

Model Uncertainty

The broadest type of uncertainty for monetary policy is related to economic models. This can be due to uncertainty about model parameters within a model or uncertainty about how the economy works across models.

Research on model uncertainty has highlighted two key findings.[11] First, policies that are designed to be optimal in one model can miss the mark in other models. This can be especially problematic when policies are optimized to idiosyncratic features of a particular model that are not common to other models. Second, even when policies optimized for a specific model are not robust to model uncertainty, it is generally possible to find robust policies that perform very well across models. That is, as illustrated by Figure 1, the costs of robustness are relatively small compared to the gains in terms of risk management.

Uncertainty about Expectations Formation

A particularly relevant form of uncertainty for monetary policy concerns the formation of expectations. In many standard models with rational expectations, inflation expectations are *a priori* assumed to be well anchored. In practice, there is a great deal of uncertainty regarding how the public forms expectations.

In models where longer-run expectations can become unmoored, robust policies act more strongly to keep expectations near the target rate than would otherwise be the case.[12] Specifically, the risk of unmooring of inflation expectations tends to increase with the persistence and magnitude of inflation deviations from the target—this is the region of fault intolerance—or low fault tolerance. Therefore, robust policies are biased to avoid such regions by responding more strongly to inflation relative to output or unemployment gaps. Furthermore, to the extent that transparency regarding the central bank's goals and strategy can help anchor longer-run expectations, the trade-offs between optimal and robust policies improve.

Blurry Stars and Difference Rules

The final example is uncertainty over the so-called star variables, such as the natural rates of interest and unemployment. Monetary policy rules often rely on these, but they are measured imprecisely and change over time. Under some assumptions, uncertainty about the values of star variables in isolation should not affect optimal policy; that is, certainty equivalence holds.

However, given the wide range of uncertainties that prevail—including uncertainty about the processes that determine the star variables—the assumptions underlying this theoretical conclusion are unlikely to hold in practice. In this case, acting as if one knows the star variables when making policy can lead to persistent deviations of inflation from the target that risk unmooring inflation expectations.[13]

Fortunately, research has shown that approaches that "follow the data" and don't rely as much on estimates of starred variables perform very well when the uncertainty is very high.[14] A simple and effective approach is represented by "difference rules," where the short-term nominal interest rate is raised or lowered in response to inflation and changes in economic activity. Combining uncertainty about the formation of expectations and the star variables exacerbates the risks of unmooring expectations and reinforces the robustness quality of difference rules.[15]

Conclusion

Many types of uncertainty are associated with relatively high fault tolerance and are therefore manageable by taking a robust policy approach that takes into account a variety of models. In other cases, such as uncertainty about the formation of expectations and the star variables, fault tolerance can be lower and non-robust policies can perform very poorly. In these cases, the risk management implication is to pay the insurance cost in terms of second-best performance to protect against bad outcomes. A critical lesson from this research is the importance of maintaining well-anchored inflation expectations, especially when uncertainty is very high.

The robust policy approach does not pretend to solve the rules-vs.-discretion debate, nor does it tell policymakers what they should do in every circumstance. Instead, it provides insights into the conditions under which different policy approaches are likely to be successful or not. As such, they can be useful guides to navigating a highly uncertain world.

Figure PDF

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[1] John C. Williams, "Certain Uncertainty," remarks at the Macroeconometric Caribbean Conference, Nassau, Bahamas, March 21, 2025.

[2] Alan Greenspan, "Monetary Policy under Uncertainty," at a symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, August 29, 2003.

[3] Taylor, John B., 1993. "Discretion Versus Policy Rules in Practice," *Carnegie-Rochester Series on Public Policy*. 39: 195-214.

[4] McCallum, B. T., 1988. "Robustness Properties of a Rule for Monetary Policy," *Carnegie Rochester Conference Series on Public Policy*, 29: 173–204, and Taylor, John B., 1999. "Introduction to *Monetary Policy Rules*," ed. John B. Taylor, University of Chicago Press, 1–14.

[5] This analogy was suggested by Patrick Minford and referenced in: Levin, Andrew T. and John C. Williams, 2003. "Robust Monetary Policy with Competing Reference Models," *Journal of Monetary Economics*, July, 50: 945–75.

[6] John C. Williams, "Connecting Theory and Practice," remarks at the Hoover Institution Policy Conference, Stanford, California, May 3, 2024.

[7] Board of Governors of the Federal Reserve System, Federal Reserve issues FOMC statement of longer-run goals and policy strategy, January 25, 2012.

[8] Alternative characterizations of robust policy include robust control and robust optimal policy; for early references, see Levin, Andrew T. and John C. Williams, 2003. "Robust Monetary Policy with Competing Reference Models," *Journal of Monetary Economics*, July, 50: 945–75.

[9] Levin, Andrew T. and John C. Williams, 2003. "Robust Monetary Policy with Competing Reference Models," *Journal of Monetary Economics*, July, 50: 945–75.

[10] IEEE Computer Society, 1991. IEEE Standard Computer Dictionary: A Compilation of IEEE Standard Computer Glossaries, in *IEEE Std. 610*, 1-217.

[11] See, for example (and references therein), Levin, Andrew T., Wieland, V., and Williams, J. C., 1999. "Robustness of Simple Monetary Policy Rules under Model Uncertainty," in *Monetary Policy Rules*, ed. John B. Taylor, University of Chicago Press, 1–14, 263–99; Levin, Andrew T., Wieland, V., and Williams, J. C., 2003. "The Performance of Forecast-Based Monetary Policy Rules Under Model Uncertainty," *American Economic Review,* June, 93(3): 622-45; Levin, Andrew T., Onatski, A., Williams, J. C., and Williams, N., 2006. "Monetary Policy Under Uncertainty in Micro-Founded Macroeconomic Models," *NBER Macroeconomics Annual 2005*, ed., Mark Gertler and Kenneth Rogoff, University of Chicago Press, 229-87; Taylor, John B. and Williams, J. C., 2011. "Simple and Robust Rules for Monetary Policy," in *Handbook of Monetary Economics, Volume 3B*, eds. Benjamin Friedman and Michael Woodford, 829-60.

[12] Orphanides, Athanasios, and Williams, J. C., 2004. "Imperfect Knowledge, Inflation Expectations, and Monetary Policy," in *The Inflation-Targeting Debate*, eds. Ben S. Bernanke and Michael Woodford, University of Chicago Press, 201-34; Orphanides, Athanasios and Williams, J. C., 2005. "Inflation Scares and Forecast-Based Monetary Policy," *Review of Economic Dynamics*, April, 8(2): 498-527.

[13] "Orphanides, Athanasios and Williams, J. C., 2005. "The Decline of Activist Stabilization Policy: Natural Rate Misperceptions, Learning, and Expectations," *Journal of Economic Dynamics and Control*, November, 29(11): 1927-50.

[14] With a lower degree of uncertainty, a hybrid approach that combines elements of the standard Taylor Rule and a difference rule performs well. See Orphanides, Athanasios and Williams, J. C., 2002. "Robust Monetary Policy Rules with Unknown Natural Rates," *Brookings Papers on Economic Activity*, 2: 63-145; Orphanides, Athanasios and Williams, J. C., 2006. "Monetary Policy with Imperfect Knowledge," *Journal of the European Economic Association*, 4(2/3): 366–75.

[15] Orphanides, Athanasios and Williams, J. C., 2007. "Robust Monetary Policy with Imperfect Knowledge," *Journal of Monetary Economics*, July, 54(5): 1406-35; Orphanides, Athanasios and Williams, J. C., 2013. "Monetary Policy Mistakes and the Evolution of Inflation Expectations," in *The Great Inflation: The Rebirth of Modern Central Banking*, eds. Michael D. Bordo and Athanasios Orphanides, University of Chicago Press, 255-97.