

**Interest Rate Benchmarks**  
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Thank you for the invitation to speak today, and I hope you are enjoying your visit to the Richmond Fed. The question I would like to discuss this afternoon should be familiar territory for a roomful of economists: How does a central bank know when to raise interest rates?

The backdrop for this discussion, of course, is the continuing speculation about when the Fed's policymaking committee, the Federal Open Market Committee (FOMC), will again raise the target range for the federal funds rate. We last raised rates in December, after having kept the target range near zero for seven years.

One could ask how we knew that was appropriate and not too soon or too late. More generally, how do we assess the appropriate level of interest rates? It might seem like educated guesswork to the casual observer: akin to deciding whether a bowl of porridge is too hot, too cold or just right. But policymakers have more to go on than subjective tastes.

A systematic way to get at an answer to this question is to consider how a central bank moved interest rates in response to changing economic data during a period in which it was generally thought to be conducting policy effectively. Such past behavior for the Fed has been captured by simple algebraic formulas – called “Taylor rules,” after Stanford University professor John Taylor, who first proposed these in 1993 – expressing a benchmark value of the federal funds rate as a function of measures of inflation and real activity.<sup>1</sup> These benchmarks can be thought of as recommendations that a central bank can use to guide its policy choices.

I will argue that central banks should pay close attention to these benchmarks. It's unrealistic, of course, to expect policymakers to follow such formulas slavishly, moving policy rates mechanically in response to the formula. Moreover, several different versions of these rules have been proposed and all depend on unobserved variables, each with a range of alternative estimates. Thus, Taylor rules do not provide a single, unique policy prescription.

Nonetheless, as I will argue, it is important that policymakers regularly compare the setting for their policy rate with a range of benchmarks that appear to capture successful policy conduct. Given the state of the economy, relative to the goals of monetary policy, what prescriptions for interest rates are delivered by a reasonable set of benchmark rules? And what do such rules imply for monetary policy today?

Before I jump in, I should note that my remarks reflect my own views and not those of others in the Fed or on the FOMC.<sup>2</sup>

## Taylor Rules

Many of you are familiar with Taylor rules, but to make sure we are all on the same page, I will begin with a simple generic representation using words rather than algebraic symbols.

On the left-hand side of the equation in my first slide is the policy rate, which in the United States is the federal funds rate.<sup>3</sup>

On the right-hand side are four terms. The first is the short-term expected inflation rate, the idea being that central banks take the expected rate of inflation into account when choosing the nominal policy rate.

I will skip ahead to the last two terms. One depends on the gap between inflation and the central bank's target value for inflation. The other depends on the gap between a measure of real activity – employment, say – and a reference value of that measure corresponding to full resource utilization.<sup>4</sup> Both of these terms are intuitive, in that they match up with most people's understanding of how policy rates ought to vary with business cycle conditions: When inflation is below target, or employment is falling short, interest rates should be lower than they otherwise would be. Conversely, when inflation exceeds target, or labor markets are exceptionally tight, interest rates should be higher than they otherwise would be.

Returning to the second term on the right-hand side, it is usually referred to as the “natural real rate” (or just “natural rate”) because it represents the real federal funds rate that would prevail if the two gap terms were zero. I'll have more to say about this term in a minute.

## The Role of Rules in Monetary Policy

There are two ways of using Taylor rules. One is to fit a version to historical data to see how well it describes central bank behavior. This was John Taylor's original emphasis in 1993, and I alluded to this notion at the outset. It turns out that it can. That is, one can find coefficients  $\alpha_1$  and  $\alpha_2$  such that the formula delivers predicted values for the funds rate that are fairly close to the values that actually occurred.

The other way to think about a Taylor rule is prescriptive, that is, as a normative benchmark indicating how policymakers ought to behave – not for the central bank to follow mechanically down to the last decimal point, but as a general guide to good policy.

There are two complementary reasons that such rules make sense as prescriptive guides. First, it turns out that simple Taylor rules can characterize U.S. monetary policy fairly well during periods when the FOMC was relatively successful. For example, this is true for the period known as the Great Moderation -- the period from the early 1980s to 2007 -- particularly during the period since 1993, when inflation has averaged very close to 2 percent. Simple rules fit also, but with different coefficients, during times in which the FOMC did relatively poorly – the period from the late 1960s through the end of the 1970s, for example. The difference is that during less successful periods, the Fed did not respond strongly enough to inflation.<sup>5</sup> That is, the Fed's policy did not satisfy the so-called Taylor principle, which says the central bank ought to respond more than one-for-one to increases in the inflation gap. Additional support for a prescriptive role

for Taylor rules is provided by experiments performed in artificial theoretical economies, in which such rules tend to provide superior policy outcomes over time.<sup>6</sup>

There is another important reason for policymakers to consult benchmark rules. Because inflation is a monetary phenomenon – that is, solely up to the central bank in the long run – a wide range of intertemporal economic decisions are affected by how the Fed is expected to respond to inflation and employment gaps in the future. Indeed, a major lesson (perhaps *the* major lesson) that emerged from the macroeconomic experience of the 1970s is that expectations can become unhinged when the public loses confidence in the willingness of the central bank to take the actions necessary to keep inflation under control.

To anchor expectations, a central bank can communicate its intentions. For example, the FOMC has stated that its goal is 2 percent average inflation, as measured by the annual change in the personal consumption expenditures price index.<sup>7</sup> But this wouldn't work for long if the central bank's actions did not consistently follow suit. Market participants watch carefully how a central bank reacts to incoming measures of inflation and activity, and they will try to divine how the central bank is likely to react to incoming data in the future. Aligning current policy closely with the way in which policy reacted in times when expectations were relatively anchored is one way to minimize the risk that market participants begin forecasting a departure from the central bank's objective.

### **What Do These Benchmarks Look Like?**

In order to see what these benchmarks are telling us, we need estimates of the unobserved latent variables that appear on the right-hand side. For example, the employment gap is the difference between the actual current unemployment rate and an unobserved “natural rate of unemployment.” This natural rate can be thought of as full employment, or the rate to which unemployment would converge in the absence of unanticipated economic disturbances. FOMC members' latest projections for this figure range from 4.7 percent to 5.0 percent.<sup>8</sup> I will use the historical figures published by the Congressional Budget Office. Its latest estimate, for the second quarter, is 4.8 percent, similar to many others. The actual unemployment rate was 4.9 percent in August, so the employment gap is essentially zero right now.

Expected inflation is also an unobserved variable, representing the rate of change in the overall price level that market participants expect in the near term. A conventional proxy for inflation expectations is the lagged four-quarter change in a core price index for personal consumption expenditures (that is, excluding food and energy). This currently stands at 1.6 percent on a year-over-year basis, indicating a small negative inflation gap of  $-0.4$  percent.

What is labelled the “natural real rate” in the chart is the intercept term in the Taylor rule, representing the appropriate value of the real funds rate when the gap terms are zero. This can be interpreted as the longer-run average real interest rate, or the rate to which the real federal funds rate ought to gravitate in the absence of further disturbances. Think of it as a relative price – in particular, the price of consumption today relative to consumption in the future. This price depends on factors affecting overall demand, today and in the future, such as current and

expected income and retirement prospects, as well as factors affecting overall supply, such as the availability of workers, technology, immigration and the regulatory environment.<sup>9</sup>

Globally, we've seen a decline in realized real rates over the last two to three decades. One hypothesis for why this has happened is the possibility of secular decline in growth, particularly since the end of the Great Recession. Some economists have suggested that, for a variety of reasons, this is a norm we should expect going forward. Persistently slower growth would imply lower real rates of interest.

The natural real interest rate is not observable; it has to be estimated from observed data. Taylor's early implementations assumed a constant natural real rate. Because actual real rates have been trending down over the last couple of decades, however, it now looks as if the natural rate ought to be viewed as time varying. My next chart shows two estimates of the natural rate over time. One is a well-known measure constructed by Thomas Laubach, director of the Division of Monetary Affairs at the Board, and John Williams, president of the San Francisco Fed. An alternative, which uses more agnostic methodology that involves fewer restrictive assumptions, comes from two Richmond Fed economists, Christian Matthes and Thomas Lubik. Both of these estimates show a downward trend, with estimates of the natural real rate that are currently close to zero.<sup>10</sup>

The final chart shows a representative version of the Taylor rule from Taylor's 1999 work using two different assumptions about the natural real rate. One uses Taylor's classic assumption of a constant 2 percent natural real rate. The other uses the Laubach-Williams estimate.

You can see that during the Great Moderation both benchmarks tracked the actual federal funds rate pretty well. Monetary policy arguably performed reasonably well during this period: Inflation was low and relatively stable, and the U.S. economy suffered just two, relatively mild recessions.

In contrast, the figure also shows that the federal funds rate was significantly below the levels of the benchmark during the late 1960s and 1970s, a period of very poor monetary policy, when inflation rates were high and quite variable. This was a period in which the Fed succumbed to political pressure to keep policy too accommodative. When inflation surged as a result, the Fed raised rates precipitously enough to send the economy into recession. This period of "go-stop" monetary policy, as it was called, was brought to an end by the strong anti-inflation policy stance of the Volcker FOMC.

So these look like useful policy benchmarks, in the sense that good economic outcomes were realized when we tracked the rules pretty closely, and significant deviations were associated with adverse results. The stability of inflation during the Great Moderation was undoubtedly aided by confidence in how the FOMC was going to react to incoming data.

The final chart also shows that when the Great Recession hit, it drove rule recommendations sharply negative. But now the economy has been expanding for some time. Labor markets have been steadily improving, reducing the size of the employment gap, and inflation has remained relatively close to target.

As a result, the prescriptions of these benchmark interest rate rules have been driven up above zero. In the traditional Taylor rule with a 2 percent natural real rate, the federal funds rate recommendation was 3.3 percent in the second quarter. In the version using the Laubach-Williams estimate of the natural real rate, the federal funds rate recommendation was 1.5 percent in the second quarter – lower than the fixed rate rule but still well above the current funds rate value of about 40 basis points. Thus, even taking into account our estimates of the potential decline in the natural real interest rate, it appears that the funds rate should be significantly higher than it is now.

## **Monetary Policy Outlook**

That brings us up to the present. So what's on the horizon?

The current economic outlook suggests our benchmark rates are likely to continue to rise. As I noted a moment ago, steady employment growth over the last several years has driven down the employment gap. The economy added an average of 229 jobs per month last year. Growth was somewhat lower, at 182 jobs per month, over the first eight months of this year. But this is still approximately double the rate needed to keep pace with growth in the working-age population. Unless employment growth slows significantly in the months ahead, it will continue to push our benchmark interest rates up.

Inflation appears likely to lift benchmark interest rates as well. As noted, core PCE currently stands at 1.6 percent on a year-over-year basis, but it is running at 1.8 percent on average so far this year. Some have suggested the higher inflation we've seen in the first half of 2016 will not be sustained – that it represents a statistical artifact having to do with imperfections in the way the data is adjusted for seasonal effects. As always, we will need to watch the incoming data carefully to see if recent trends continue or abate. Still, the data so far this year have been consistent with inflation moving back toward our 2 percent objective.

With a steadily strengthening labor market and rising inflation, the gap between the policy rate and our benchmarks could continue to grow, and in any event, seems unlikely to shrink.

As I've noted, a Taylor rule is best thought of as a policy guide, not a dictate, and so it must be used with care. Alternative approaches to implementing a Taylor rule produce alternative policy recommendations, and some are significantly different from the ones I have shown. Still, the range of plausible Taylor rule recommendations lies almost entirely above zero now and is centered between the two that I have shown you.

It's also true that there can be factors that cause monetary policy to – appropriately – deviate from a simple rule. Indeed, even in periods when the Taylor rule I showed you fits the data pretty well, it is rarely an exact fit. Concerns about risks emanating from global developments, for instance, might legitimately cause policymakers to hold rates temporarily below levels prescribed by a rule. But the success of these benchmarks as good descriptions of effective policy over time means that deviations should be neither too frequent nor too persistent. Departing from established benchmarks risks muddling the public's understanding of monetary policy.

In the last couple of years, U.S. monetary policy has frequently been described as “data dependent.” By itself, however, that phrase conveys little beyond the premise that the current stance of monetary policy has not been irrevocably locked in. The question is *how* does monetary policy depend on the data? Benchmarks like the Taylor rule provide a concrete and quantitative answer to that question by linking policy to inflation and employment, the Fed’s two mandate goals.<sup>11</sup> Responding to additional developments that are not clearly related to inflation and employment has the potential to confuse the public, increasing uncertainty about our future conduct and raising doubts about our commitment to our two goals.

Firm public understanding of how the Fed conducts monetary policy is essential to achieving our goals. The historical record suggests that uncertainty about future policy can destabilize inflation expectations. As inflationary pressures built in the late 1960s and the Fed did not fully respond, the public’s expectations about future policy became unanchored, giving rise to a spiral of inflationary instability that was costly to tame.

One could argue that things are different now, such as the diminished influence of labor unions and the reduced prevalence of commodity supply shocks. And central banks around the world have learned much in the intervening years about the conduct of monetary policy. But that only underscores the fact that if the Fed were to begin losing credibility, that erosion would likely play out differently than it did in the 1970s; shifting expectations are difficult to model with any confidence. Moreover, there are disturbing similarities between then and now that could undermine expectations, including recent challenges to the Fed’s independence in the form of proposed changes to our governance structure.<sup>12</sup> We should not be complacent about the effects such actions might have on inflation expectations.

In principle, we know the remedy for unraveling inflation expectations: raise rates rapidly. But in such a scenario, it would be hard to calibrate policy settings carefully enough to avoid precipitating a contraction in real activity.

So while inflation risks might not be fashionable, I think we should pay close attention when our policy benchmarks move far away from our current policy rate.

With that, I’ll be happy to take your questions.

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<sup>1</sup> John B. Taylor, “[Discretion Versus Policy Rules in Practice](#),” *Carnegie-Rochester Series on Public Policy*, December 1993, vol. 39, pp. 195-214; and John B. Taylor, “[A Historical Analysis of Monetary Policy Rules](#),” in *Monetary Policy Rules*, edited by John B. Taylor, Chicago: University of Chicago Press, 1999, pp. 319-341.

<sup>2</sup> I am grateful to Renee Haltom, Andreas Hornstein, Joseph Johnson and John Weinberg for assistance in preparing these remarks.

<sup>3</sup> Actually, the FOMC sets a target range for the federal funds rate. For example, the target range is now 25 to 50 basis points, and the actual federal funds rate has been close to 40 basis points. For simplicity, I will treat the target value as a single number.

<sup>4</sup> Taylor’s original analysis used output gaps rather than employment gaps, but one can translate one into another using Okun’s Law. For simplicity, I will work with employment gaps.

<sup>5</sup> Richard Clarida, Jordi Gali, and Mark Gertler, “[The Science of Monetary Policy: A New Keynesian Perspective](#),” *Journal of Economic Literature*, December 1999, vol. 37, no. 4, pp. 1661-1707.

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<sup>6</sup> Ibid; and John B. Taylor and John C. Williams, "[Simple and Robust Rules for Monetary Policy](#)," in Handbook of Monetary Economics, Vol. 3, edited by Benjamin M. Friedman and Michael Woodford, Netherlands: Elsevier, 2010, pp. 829-859.

<sup>7</sup> Board of Governors of the Federal Reserve System, "[Statement on Longer-Run Goals and Monetary Policy Strategy](#)," adopted January 24, 2012, amended January 26, 2016.

<sup>8</sup> Economic projections of FOMC members, June 15, 2016:

<http://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20160615.pdf>.

<sup>9</sup> See Marvin Goodfriend, "[The Case for Unencumbering Interest Rate Policy at the Zero Bound](#)," Paper presented at the Federal Reserve Bank of Kansas City Economic Symposium, Jackson Hole, Wyo., August 26-27, 2016.

<sup>10</sup> Thomas Laubach and John C. Williams, "[Measuring the Natural Rate of Interest](#)," Review of Economics and Statistics, November 2003, vol. 85, no. 4, pp. 1063-1070; and Thomas A. Lubik and Christian Matthes, "[Calculating the Natural Rate of Interest: A Comparison of Two Alternative Approaches](#)," Federal Reserve Bank of Richmond Economic Brief no. 15-10, October 2015.

<sup>11</sup> Aaron Steelman, "[The Federal Reserve's 'Dual Mandate': The Evolution of an Idea](#)," Federal Reserve Bank of Richmond Economic Brief no. 11-12, December 2011.

<sup>12</sup> For more on the political pressures that jeopardized the Fed's independence in the 1960s and 1970s, see Robert Hetzel, *The Monetary Policy of the Federal Reserve: A History*, Cambridge: Cambridge University Press, 2008, Chapter 12; and Allan Meltzer, *A History of the Federal Reserve*, Vol. 2, Book 1, Chicago: University of Chicago Press, 2009, Chapter 4.