Evaluating the Current Stance of Monetary Policy Using a Taylor Rule

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Summary

Oversight of the Federal Reserve's (Fed's) monetary policy decisions rests with Congress. But oversight is encumbered by the absence of a straightforward relationship between interest rates and economic performance. Further, the Fed's policy decisions are discretionary, meaning there is no objective, transparent "yardstick" for evaluating their decisions. The Fed's conventional policy tool is to target the federal funds rate, the overnight interest rate at which banks lend to each other. A simple rule of thumb guide to monetary policy decisions called a "Taylor rule" is an intuitive way to judge actual policy against some objective, albeit simplistic, ideal. Taylor rules prescribe a federal funds target based on inflation and the output gap (i.e., the difference between actual gross domestic product [GDP] and potential GDP) and can be adjusted to reflect a variety of policy goals.

The Fed eased monetary policy aggressively to counteract the recent recession and financial crisis and has kept a stimulative policy stance in place after the recession ended because of a persistently large output gap. This report compares current policy to a number of Taylor rules. Taylor rules take into account only a limited number of variables, which its proponents consider a strength, but its detractors consider a weakness. Since the Taylor rules considered in this report are based only on inflation and the output gap, they cannot consider other factors that might currently counsel in favor of the Fed's "unconventional," stimulative policy actions, such as the goal of stabilizing the financial system. This fact may explain why actual rates have been a little lower than what many Taylor rules currently prescribe.

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The Goals of Monetary Policy and Congressional Oversight

The government has two main tools for influencing overall economic conditions, fiscal policy and monetary policy. Monetary policy can boost economic activity and inflation by lowering short-term interest rates (the federal funds rate), or depress economic activity and inflation by raising interest rates. Changes in output and employment caused by monetary policy are of a temporary nature: in the long run, there is consensus based on theory and evidence that changes in the money supply affect only inflation and have little effect on the economy's sustainable growth rate. In essence, monetary policy has two attainable goals: to promote economic stability (minimize fluctuations in the business cycle) and price stability (low and stable inflation). Because the Fed has only one tool at its disposal, influence over interest rates, it faces a tradeoff in the pursuit of these two goals—when the two goals conflict, they cannot both be pursued at once.[1]

Congress has delegated responsibility for monetary policy decisions to the Federal Reserve (Fed), but maintains oversight responsibilities. Oversight is made difficult, however, by the absence of a straightforward relationship between interest rates and economic performance. Because of changes in investment demand, any given interest rate may be expansionary when the economy is booming, but contractionary when the economy is in recession. Furthermore, the Fed's policy decisions are discretionary: it justifies policy decisions qualitatively rather than quantitatively. Its decisions to change interest rates need only be consistent with the broad mandate that it maintain full employment, stable prices, and moderate interest rates. When these goals are mutually exclusive, as they frequently are, the mandate can be used to justify virtually any policy decision. In this context, Congress frequently finds itself in a position where it must "take the Fed's word for it" that the policy change will have the effect it is said to have because there is no objective outside "yardstick" against which to evaluate it. This report attempts to offer such a yardstick.

What is a Taylor Rule?

One way to evaluate Fed policy for oversight purposes would be to use complex econometric models to generate predicted results of a monetary policy change, and see if these results conform with the policy change's stated goals. But this requires sophisticated knowledge of econometric modeling that may not be practical for oversight, particularly because different models yield significantly different results. This report uses a simpler, popular alternative called a "Taylor rule" to quantitatively evaluate the current stance of monetary policy. Taylor rules are widely used by researchers to evaluate monetary policy and by central bankers as one tool to help inform their policy decisions.[2] Economist John Taylor, recently a Treasury Under Secretary, proposed the following rule to set interest rates that balances the goals of maintaining economic stability and price stability:[3]

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[1] For more information, see CRS Report RL30354, *Monetary Policy and the Federal Reserve: Current Policy and Conditions*, by Marc Labonte.

[2] For background and analysis of Taylor rules, see CRS Report RL31050, *Formulation of Monetary Policy by the Federal Reserve: Rules vs. Discretion*, by Marc Labonte.

[3] John Taylor, "Discretion vs. Policy Rules in Practice," *Carnegie-Rochester Series on Public Policy*, vol. 39, 1993, p. (continued...)

$$FFR = (R + I) + 0.5 \times (\text{output gap}) + 0.5 \times (I - IT)$$

where:

FFR = federal funds rate
R = equilibrium real interest rate (assumed here to equal 2)
output gap = percent difference between actual GDP and potential GDP
I = inflation rate
IT = inflation target (assumed here to equal 2)

If actual GDP is equal to potential GDP and inflation is equal to its target, the rule calls for an inflation-adjusted federal funds rate of 2%, or an actual federal funds rate equal to 2% plus the current inflation rate. This is often called the "neutral" interest rate, at which monetary policy is neither stimulative nor contractionary.

The goal of maintaining economic stability is represented by the factor *0.5 x (output gap)*, which raises interest rates when actual GDP is greater than potential GDP and lowers rates when it is below potential. The output gap is the difference between actual and potential GDP. Potential GDP is the level of output that would be produced if all of the economy's labor and capital resources were being utilized; in economic downturns, actual GDP falls below potential because some resources are idle. Likewise, because prices adjust slowly, the economy can temporarily be pushed above a level of output that is sustainable. Once prices adjust, output will return to potential. There is no direct way to measure potential GDP, so it must be inferred; different estimating methods yield different results.[4] This Taylor rule states that when actual GDP is, say, 1% above potential GDP, the federal funds rate should be increased by 0.5 percentage points. If policymakers wanted a more (less) aggressive reaction to changes in growth, they would place a larger (smaller) weight on the coefficient than 0.5.

Changes in inflation enter the Taylor rule in two places. First, the nominal neutral rate rises when inflation rises in order to keep the inflation-adjusted neutral rate constant. Second, the goal of maintaining price stability is represented by the factor *0.5 x (I-IT)*, which states that inflation-adjusted interest rates are to be raised when inflation (I) is above its target (IT) and lowered when inflation is below its target. Unlike the output gap, the inflation target can be any rate that policymakers desire. This rule assumes a 2% inflation target, which is the rate specified by the Federal Reserve as its longer-term goal for inflation.[5]

(...continued)

195; Robert Solow and John Taylor, *Inflation, Unemployment, and Monetary Policy* (Cambridge, MA: MIT Press, 1998), p. 45. The specific mathematical form of this rule does not appear to be formally derived from theory or empirical evidence.

[4] This report uses CBO's estimate of potential GDP. See Congressional Budget Office, *CBO's Method for Estimating Potential Output*, August 2001.

[5] Federal Reserve, *press release*, January 25, 2012.

Current Policy Prescriptions According to Different Taylor Rules

In the fourth quarter of 2011, actual GDP was 6.7% below potential GDP (as estimated by the Congressional Budget Office) and the year-over-year change in inflation (using the GDP deflator) equaled 2.5%. Entering these data into the Taylor rule above (and rounding to the nearest quarter point) yields a federal funds rate of (2% + 2.5%) + 0.5 x (-6.7%) + 0.5 x (2.5% - 2%) = 1.5%. That rate is lower than the historical average, but higher than the Fed's current target range of 0% to 0.25%. With inflation at 1.9%, the current neutral rate is 4.5%, according to the rule. Although inflation is above its presumed target, the Taylor rule currently calls for an interest rate below the neutral rate because the economy is far below full potential GDP.

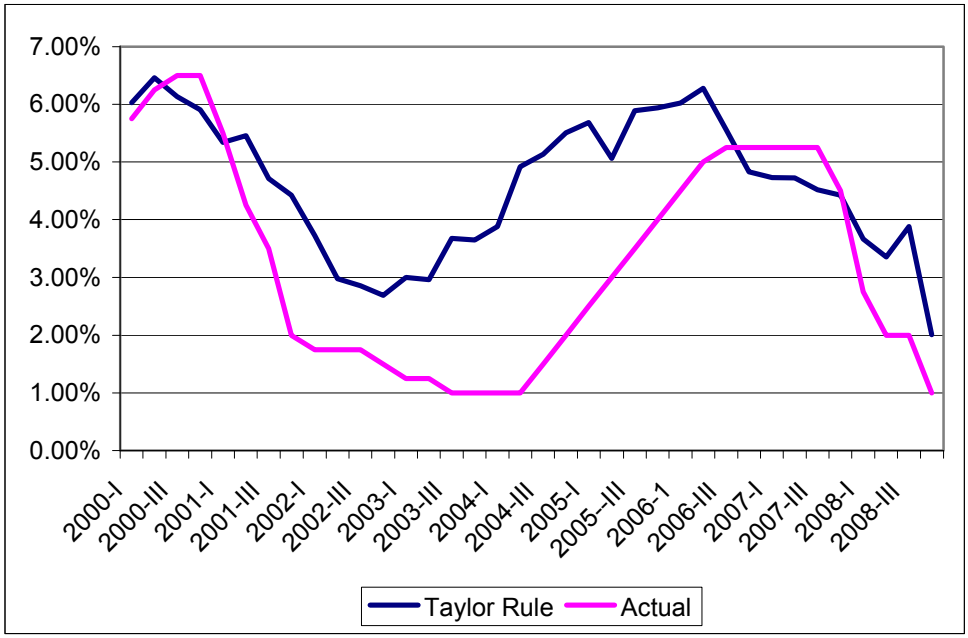
A major drawback to Taylor rules is that they cannot cover all contingencies. Unusual "shocks" not immediately picked up in the output gap or inflation are highly important. For example, in times of financial crisis, the other function of monetary policy, to serve as a lender of last resort to the banking system, could not be adequately incorporated in a rule. Because this rule is based only on current inflation and the output gap, it cannot consider other factors that might currently counsel against tightening policy, such as the goal of stabilizing the financial system. Eventually, the effects of financial turmoil would affect inflation and the output gap and enter into the Taylor rule at that point, but waiting until it did could lead to worse outcomes in the near term. On the other hand, some economists argue that, because of uncertainty over the proper way to model economic activity, simple rules perform more robustly across different models than do complex rules.

Figure 1 plots actual federal funds rates against rates determined by the Taylor rule from 2000 to 2008. This figure should not be used to directly evaluate actual policy, for two reasons. First, because economic data are released with a lag and subject to subsequent revisions, **Figure 1** is based on data unavailable to the Fed when actual policy decisions were made.[6] Second, because subsequent events would have differed had a different monetary path been followed at any given point, the chart cannot be interpreted as a consistent alternative policy option over time.

As can be seen in **Figure 1**, while interest rates under this rule followed the same general pattern as actual rates—monetary easing early in the 2000s and tightening later in the decade—there were some short-term differences. In general, the Taylor rule called for somewhat higher interest rates this decade, and called for rates to begin rising sooner after the 2001 recession was finished. This is evidence supportive of the argument some economists have made that, in hindsight, the Fed left interest rates too low for too long after the 2001 recession.

[6] Athanasios Orphanides, in "Monetary Policy Rules Based on Real-Time Data," Federal Reserve Board of Governors, *Finance and Economics Discussion Series 3*, 1998, points out that subsequent revisions have at times been very large, up to several points in the case of the output gap.

Figure 1. Federal Funds Rate, Actual and Prescribed by Taylor Rule, 2000-2008



Source: CRS calculations based on Federal Reserve, BEA, CBO data.

One drawback to evaluating monetary policy using a Taylor rule is that the policy prescriptions made by the Taylor rule are very sensitive to the choice of data sources and coefficient weights. In particular, because the output gap is a constructed series that can be estimated using a number of different methods, different output gap series produce widely different results. Likewise, there are several equally valid measures of inflation available, and sometimes these series diverge for short periods of time. Kozicki shows that different data sources can change the Taylor rule's recommended interest rate by as many as several percentage points.[7] Discretionary policy is able to weigh conflicting data in a way that a rule cannot. Nevertheless, discretionary policy still must be based on the same conflicting data as rules, so this advantage should not be overestimated. Comparing a series of Taylor rules using many of these different measures can give a more robust benchmark for the stance of monetary policy than using just one set of variables. In practice, some of these measures move relatively closely together, but others move less closely together because they are conceptually distinct.

For example, the Fed has often argued that overall inflation (or "headline inflation") does not give a wholly accurate view of inflation trends because it is highly volatile. A less volatile measure of inflation called "core inflation" can be calculated by stripping out two measures—food and energy prices—that are prone to large changes on a monthly basis.[8] Core inflation in the fourth quarter of 2011 was 2% on a year-over-year basis. Using this measure instead of overall inflation, the same Taylor rule prescribes an interest rate of 0.75%, lower than the "Traditional" Taylor rule because the core inflation rate is slightly lower than the headline rate.

[7] Sharon Kozicki, "How Useful are Taylor Rules for Monetary Policy?," *Federal Reserve Bank of Kansas City Economic Review*, vol. 84, no. 2 (1999:2), p. 5.

[8] Critics have questioned whether core inflation really is a superior measure for determining inflationary trends. See CRS Report RL30344, *Inflation: Causes, Costs, and Current Status*, by Marc Labonte.

The Taylor rule used so far is one out of an unlimited number of possibilities. It is useful to see in **Table 1** how other rules based on different policy goals compare with current policy. For example, economist Lars Svensson argues that since monetary policy affects the economy with a lag, if policy is based on current data it will always be backward looking, and could be seen as "fighting the last war." Because policy decisions made today affect future economic conditions, he argues they should be based on projections of future growth and inflation.[9] Of course, different forecasters have different projections of future growth, but this problem can be mitigated by using the Blue Chip "consensus forecast." Blue Chip is a private company whose monthly consensus forecast is the average forecast of 50 different private sector forecasters. Based on the January 2012 consensus forecast, GDP one year from now is projected to be 6.3% below potential GDP and inflation will fall to 1.8%. Using these data, a rule with the same weights as the Traditional Taylor rule above calls for a current federal funds rate of 0.5%, lower than the Traditional Taylor rule because forecasters believe that inflation will fall below its presumed target in the next year.

Table 1. Current Policy According to Various Taylor Rules

Type of Rule (See text for details)	Federal Funds Rate =	Current Interest Rate Predicted by Rule (Actual=0-0.25%)
Traditional Taylor Rule	(2+i) + 0.5 x (output gap) + 0.5 x (i-2)	1.5%
Taylor Rule using core inflation	(2+core i) + 0.5 x (output gap) + 0.5 x (core i-2)	0.75%
Taylor Rule based on forecast	$(2+ i_{proj.}) + 0.5 \times (\text{output gap}_{proj}) + 0.5 \times (i_{proj.}-2)$	0.5%
"Strict" Inflation Target	(2+i) + 1.0 x (i-2)	5%
"Fine tuning" Taylor Rule	(2+i) + 1.0 x (output gap) + 1.0 x (i-2)	-1.75%[a]
Taylor Rule based on history	(2.2+i) + 0.8 x (output gap) + 0.5 x (i-2)	-0.5%[a]

Source: CRS calculations based on quarterly data from BEA, Federal Reserve, CBO, Blue Chip.

Note: FFR = federal funds rate; output gap = percent difference between actual GDP and potential GDP; i = inflation rate, measured by GDP deflator. Results are rounded to nearest quarter point.

a. Negative rate indicates prescribed policy is constrained by "zero bound." Interest rates cannot be reduced below zero in practice.

Inflation targeting as the anchor for monetary policy has been widely implemented abroad in economies such as Canada, the United Kingdom, and the euro area. Proponents support inflation targets to increase transparency and accountability, as well as three additional reasons related to this report. First, many economists have reservations with "fine tuning" in monetary policy. Because the Fed may not always choose the best policy, in hindsight, and markets can (eventually) adjust on their own, they argue that the best monetary policy is a "hands off" one that does not try to respond to every small change in economic growth, and focuses more on price stability. Second, some economists have argued that monetary policy should focus less on stabilizing output since only the inflationary effects of monetary policy are permanent. Third, in the context of a Taylor Rule, a strict inflation target could be justified on the grounds that measurements of the output gap are too uncertain to be useful (as discussed above).[10]

[9] Lars Svensson, *Inflation Forecast Targeting: Implementing and Monitoring Inflation Targets*, National Bureau of Economic Research, Working Paper no. 5797, October 1996.

[10] Bennett McCallum, *Should Monetary Policy Respond Strongly to Output Gaps?*, National Bureau of Economic Research, Working Paper no. 5952, April 2001.

To see how a "strict" inflation target would operate, the traditional Taylor rule can be adapted by removing the output gap term and increasing the weight on the inflation term to, say, 1.0. Under this rule, the current interest rate would equal 5%—above the neutral rate because inflation is 0.5 percentage points above its presumed target. When inflation does not follow the business cycle closely, a strict inflation target rule causes monetary policy to become less counter-cyclical, and this rule would not have followed actual policy very closely recently.[11] As practiced by inflation targeters abroad, monetary policy has still attempted to stabilize economic growth, usually under the rationale that stable growth helps maintain stable prices.[12] Therefore, the strict inflation target used here does not reflect international experience with inflation targeting.[13]

Alternatively, policymakers may prefer a more aggressive response to changes in economic conditions—more "fine tuning"—than the traditional Taylor Rule provides. More fine tuning can be incorporated by raising both coefficients on the original rule from 0.5 to, say, 1.0. When this change is made, the current interest rate would be -1.75% (see **Table 1**) lower than the "zero bound" that constrains conventional monetary policy (i.e., the Fed's inability to reduce interest rates beyond 0%). This prescription could be seen as supportive of the Fed's recent decision to implement "unconventional" policies. For example, the Fed has provided more liquidity than needed to meet its interest rate target through bond purchases, a practice called "quantitative easing."[14] Because this Taylor rule currently matches actual policy more closely than the previously considered rules, this suggests that the Fed may be acting more aggressively than normal at present.

As has been discussed, an unlimited number of weights can be placed on the inflation and output factors because there are an unlimited variety of policy preferences. Rather than arbitrarily assigning a set of preferences to the Taylor rule, another approach is to determine what weights best parallel actual Federal Reserve policy historically. Taylor does this in a 1999 paper and shows that a Taylor rule has a high goodness of fit (the R-squared is 0.83 and the coefficients are highly statistically significant) in the Greenspan era.[15] In other words, most of the decisions that the Fed made in the Greenspan era through the third quarter of 1997 are the same as if the Fed had been following a Taylor rule; this is reassuring for the use of Taylor rules to aid oversight. The "historical" Taylor rule turns out to have similar weights to the "traditional" one suggested by Taylor: the weight on the output gap would be raised from 0.5 to 0.8 and the weight on inflation would remain 1.5. The equilibrium real interest rate is estimated to be slightly higher in this period (2.2%) than assumed in the original Taylor rule (2%). A comparison of current interest rates and those predicted by this "historical" Taylor rule can be interpreted as showing whether current monetary policy decisions are similar to ones taken by the Fed in the past. If the Fed had continued its historical behavior, interest rates would have tended to be higher than they actually

[11] The phenomenon called "stagflation," when growth is sluggish but inflation is rising, is an example of when inflation does not follow the business cycle in the traditional pattern.

[12] The output gap might not be removed if future (rather than current) inflation were targeted under a strict inflation target. In that case, the rule might still react to changes in the output gap in so far as changes in the output gap affect future inflation. See Laurence Ball, *Efficient Rules for Monetary Policy*, National Bureau of Economic Research, Working Paper no. 5952, March 1997.

[13] See CRS Report RL31702, *Price Stability (Inflation Targeting) as the Sole Goal of Monetary Policy: The International Experience*, by Marc Labonte and Gail E. Makinen.

[14] For more information, see CRS Report R41540, *Quantitative Easing and the Growth in the Federal Reserve's Balance Sheet*, by Marc Labonte.

[15] John Taylor, "A Historical Analysis of Monetary Policy Rules," in John Taylor, ed., *Monetary Policy Rules* (Chicago: University of Chicago Press, 1999), p. 319.

were recently, and interest rates would currently be -0.5%, also below the "zero bound" (see **Table 1**).

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