The Use of Policy Rules in Monetary Policy Analysis

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1. Introduction

In our analysis of current Federal Reserve policy, the SOMC makes use of some explicit numerical rules, including the justly famous Taylor rule, for the conduct of monetary policy. The purpose of this paper is to discuss the way in which we do this, pointing out several issues concerning crucial details. In addition, the logic of the Taylor rule, as well as a base money rule promoted in my own work (e.g., McCallum, 1988), will be outlined and a different way of using the rules will be briefly mentioned. Finally, I will provide a bit of commentary on current conditions.

Before beginning, it should be said that proponents of explicit numerical rules for monetary policy do not imagine that any actual central bank would ever turn their determination of instrument settings over to some clerk armed with a simple formula and a hand calculator—or even to a team of PhD economists armed with computers and Matlab simulation programs. What they—we—believe is that such formulae can systematically and compactly summarize much of the relevant information in a manner that potentially provides a good starting place or "benchmark" for consideration of policy settings. Rules have in fact been used in this fashion by leading central banks—see, e.g., Stuart (1996).[1]

2. The Taylor Rule

Let us begin by discussing the logic of the Taylor rule. This rule, originally proposed in Taylor (1993), prescribes settings for the Federal Funds rate, which is the variable that the

Fed uses as its operating instrument—i.e., the variable that it controls in order to influence the evolution of macroeconomic conditions.[2] A policy-induced increase in interest rates is generally thought of as representing a move toward more restrictive policy posture, one that tends to reduce aggregate demand. Accordingly, the Taylor rule calls for a higher setting of the Federal Funds (FF) rate when inflation is (or is expected to be) high and/or output is high relative to capacity. It is the real rate of interest that matters, however, so the Taylor rule takes that aspect of economic theory into account.

Specifically, the Taylor Rule can be written as follows:

(1) $R_t = r + \Delta p_t + 0.5(\Delta p_t - \pi^*) + 0.5\, \tilde{y}_t$

The symbols in this equation are as follows:

R_t Federal Funds rate setting, for period t, percent per year

r Average equilibrium real interest rate, percent per year

Δp_t Inflation rate, recent or expected future value, percent per year

π^* Target rate of inflation, percent per year

$\tilde{y}_t$ Deviation of current real GDP from potential or natural-rate value, percent

In his work, Taylor has typically used 2 percent for the average real rate of interest and has also assumed that 2 percent per year is the Fed's target rate of inflation.[3] Different values could be specified for the coefficients on the terms $\Delta p_t - \pi^*$ and $\tilde{y}_t$, but the values of 0.5 were used in Taylor's original work and have been adopted by many analysts since then. Note that the presence of the term Δp_t on the right hand side of (1) implies that a measure of

[1] For a thoughtful practical discussion by ECB economist/policymakers, see Issing et. al. (2001, pp. 41-44).
[2] The Federal Funds rate is the interest rate for overnight loans in the interbank market. The close relationship between this and other short-term rates, plus the influence of these on longer-term rates, make it possible for the Fed to exert an influence on aggregate demand and thus the behavior of macroeconomic conditions.
[3] Some SOMC members believe that a target rate of inflation closer to zero would be preferable.

the real rate of interest, $R_t - \Delta p_t$, is adjusted up or down relative to the average real rate r in response to departures of inflation and output from their target values. Each Δp_t term is being used as a proxy for inflation expected over the near future.

To illustrate use of the Taylor rule, let us apply it to currently-prevailing values. For Δp_t let us first use the 1.5 percent value reported in the SOMC monetary indicator charts, prepared by Charles Plosser, for the rate of increase of the CPI over the past twelve months, and for $\tilde{y}_t$ let us take the value of –1.77 that Plosser reports for the third quarter of 2002. Then the setting for R_t specified by the Taylor rule for present conditions is $2 + 1.5 + 0.5(1.5 - 2) + 0.5(-1.77) = 3.5 - 0.25 - 0.885 = 2.36$. This value is basically the same as that given for 2002.4 by the small-dash line in the SOMC diagram—see Figure 1. The small difference is that the rule plot uses an average of quarterly inflation rates, whereas the inflation plot is a twelve-month figure based on monthly CPI values.

3. Base Money Rule

At this point let us consider the other rule reported by Plosser, one which has been promoted in several papers of mine, including McCallum (1988, 1993, 2000). This rule specifies the growth rate of the monetary base that the Fed should provide, rather than the value of the FF interest rate. It is accordingly less realistic than Taylor's rule in the sense that the Fed, like most central banks of industrial nations, actually implements policy by control of a short term interest rate. It would be possible for the Fed to control growth of the monetary base, however, if it chose to do so.[4] In any event, we can use this rule as an

[4] The monetary base is the sum of currency held by the non-bank public and bank reserves (i.e., the central-bank money held by the private sector). Since this magnitude appears on its own balance sheet, the Fed can monitor it on a daily basis and make adjustments as needed to keep it at any desired level on average over (say) a week.

indicator of monetary policy ease or restrictiveness, even if the Fed is not operating so as to control the base growth rate.

The base growth rule in question can be expressed as follows:

(2) $\Delta b_t = \Delta x^* - \Delta v_t + 0.5(\Delta x^* - \Delta x_{t-1})$.

Here the symbols are:

Δb_t Rate of growth of the monetary base, percent per year

Δv_t Rate of growth of base velocity, percent per year, averaged over previous four years

Δx_t Rate of growth of nominal GDP, percent per year

Δx^* Target rate of growth of nominal GDP, percent per year

In rule (2) the target value Δx^* is taken to be the sum of π^*, the target inflation rate, and the long-run average rate of growth of real GDP (which is not affected by monetary policy). I take the latter to be 3 percent per year, so with an inflation target of 2 percent, we have Δx^* equal to 5. The term Δv_t is necessary because technological and regulatory changes alter the growth of base velocity from year to year. The rule's measure relating to the past four years is intended as a forecast of the average growth rate of velocity over the foreseeable future; it is not intended to reflect current cyclical conditions. These are represented by the final term, $\Delta x^* - \Delta x_{t-1}$, which is positive when recent growth of output and the price level has been slow. A large resulting value for Δb_t is a signal for monetary ease, represented by a rapid rate of increase in the monetary base—which tends to generate or support a rapid rate of increase in monetary aggregates and thereby stimulate aggregate demand.

Let us now calculate the current value of base growth suggested by rule (2). From Plosser's SOMC worksheets we find that the current value of Δv_t is –2.95, i.e., that base

velocity has been falling at a rate of almost 3 percent per year. Last quarter's rate of nominal GDP growth was 4.2 percent per year, so the formula gives the following: $5 + 2.95 + 0.5(5 - 4.2) = 8.35$. This value agrees with the line in the SOMC plot for the base rule, shown in Figure 2.

If we compare the base-rule value just calculated with the actual base growth rates experienced recently, we see that the base rule calls for a slightly more expansionary monetary policy than that of the past few months. Therefore this rule tends to provide some support for the Fed's recent action of lowering the FF rate target, which represents a policy loosening. By contrast, the Taylor rule prescription mentioned in the previous section calls for a higher FF rate than the 1.75 percent value that prevailed before November 6, so it does not support the recent Fed action. This finding illustrates the obvious point that different rules can give different policy advice, even if they embody the same targets for inflation and output. How does one choose between these conflicting indications? One rather natural approach is to see which rule has given better advice in the past.[5]

4. Historical Analysis

Taylor (1993) showed that the actual behavior of the FF rate matched rather closely the values specified by rule (1) over the period 1987-1992. (See Figures 1 and 3.) That finding was of importance because it was then widely agreed that Fed policy had been quite good over that particular time span. Note that this does not imply that rule-prescribed values should match actual values in the historical record for other periods. Indeed, since most analysts would agree that U.S. monetary policy was badly managed over the 1970s, for

[5] It should be noted that it is entirely possible to formulate rules that combine the Taylor instrument variable, R_t, with the McCallum-rule target variable, Δx_t—or vice versa. Several such variants are explored for the United States, the United Kingdom, and Japan in McCallum (2000).

example, a proponent of the Taylor rule would expect its prescriptions not to match actual FF settings over those years. That such is the case is illustrated in Figure 3. There it can be seen that the actual FF rate was substantially below the rule-prescribed value almost all of the time from 1965 through 1980, suggesting that monetary policy was too loose—relative to an inflation target of 2 percent—over that entire period.[6]

That U.S. monetary policy was too loose over the 1965-1980 period is also indicated by the base-growth rule (2), as is shown in Figure 4. Indeed, this rule suggests that monetary policy was too loose—assuming a 2 percent inflation target—most of the time from 1963 to 1987. (The actual quarterly base growth rates are quite choppy because the Fed tends to smooth interest rates, not base growth. The huge spike at the end of 1999 reflects actions taken to accommodate expected change-of-millennium demand.) Thus the two rules disagree about policy during the period 1982-1986, during which the Taylor rule suggests that policy was too tight and the base rule suggests that it was too loose.

It is unlikely that there would be widespread agreement as to which rule's advice was better in the United States over 1982-1986, but there is a nearly concurrent episode in the United Kingdom that is revealing for present purposes. That is the period of the middle and late 1980s, for which the Taylor rule suggests policy tightness (or appropriateness) while the McCallum rule suggests monetary looseness—see McCallum (2000, Figs. 5-6). Since U.K. inflation rose to near-double-digit levels during the late 1980s, after having been recently brought under control, most observers would agree (I believe) that the latter rule was the more prescient for that period. (As it happens, the inflationary outbreak was ended

[6] In this figure I have used the overall CPI to measure inflation. If the chain-type price index, mentioned by Plosser in one of the SOMC tables, is used instead, the agreement between actual and rule-prescribed rates for 1987-1992 is not nearly so close.

only after the U.K. entered the European Exchange Rate Mechanism in late 1990. The excessive U.K. base growth of the mid 1980s was arguably brought about by a policy of "shadowing the Deutschemark," i.e., stabilizing the pound-DM exchange rate.)

It is important to note that historical exercises of the foregoing type, pioneered by Taylor (1993, 1999) and Stuart (1996), do not claim to yield optimal or even desirable time paths for the policy instrument (R_t or Δb_t). Instead the rule-value lines are intended to indicate desirable instrument settings for each time period (quarter-years in the diagrams) given that inflation and the output gap are at their actual historical levels. Thus for each period individually, the difference between the rule and actual lines indicates whether policy was tight, loose, or about right. But if one of the rules had been followed in previous periods, the prevailing conditions would presumably have been different, possibly very different. For example, if the Taylor rule had been followed during previous years, inflation would have been much lower in 1975-1978 and so the R_t settings specified by the rule would have been much lower. Desirable time paths for the past can be estimated, in principle, but only by means of a different type of analytical exercise—one involving simulations with a rule and a selected quantitative macroeconomic model. Such exercises have some distinct advantages in comparison with ones of the Taylor-Stuart type. First, they are much more difficult to do; second, they require adoption of some particular quantitative macroeconomic model. The latter disadvantage is serious, since there is much disagreement among research economists as to the "correct" specification of a macroeconomic model.

5. Current Situation

Let us conclude by returning briefly to the current U.S. situation, as of November 18, 2002. The McCallum base growth rule currently calls for a base growth rate of 8.35 percent,

as was mentioned above. Actual base growth has been about 6.3 percent for the past six months, i.e., over the second and third quarters. Consequently, it could be said that the base growth rule suggests a slight loosening of monetary policy, which would be consistent with the Fed's FF rate reduction of November 6.

If, however, we look at the Taylor version of an interest rate rule, which the Fed itself would certainly prefer, we see no justification for the November 6 rate cut. As was shown above, use of CPI inflation in the Taylor rule would suggest a FF rate setting of about 2.4 percent. Next, suppose that we consider instead a price index that the Board of Governors reputedly emphasizes in its analysis, the PCE (Personal Consumption Expenditure) price index reported by the Bureau of Economic Analysis. Over the past year this index has risen by about 2.0 percent, or about 2.7 percent if we use the version with food and energy components removed. With the former, the Taylor rule would indicate a FF rate of $2 + 2.0 + 0.5(2.0 - 2.0) + 0.5(-1.77) = 3.1$ percent. If instead we were to use the "core" version (with food and energy removed) the indicated FF rate setting would be even higher.

Alternatively, one could eliminate the output-gap term in the rule, as explained in Plosser's SOMC presentation, or use some other inflation measure. But removal of the output-gap term would increase the rule-specified FF rate, while other inflation measures would still call for a FF rate above 1.7 percent unless they showed inflation at a rate of 0.8 percent or lower (calculations as in Section 2 above). Thus it would be difficult to devise any Taylor-style rule that would justify the FF rate cut of November 6.[7] Does this mean that the Fed has been looking at monetary aggregate indicators? Or has it become very strongly responsive to measures of the output gap? This latter possibility would reflect a type of

behavior that seems quite unwise, in my opinion, for measures of the output gap are known to be highly problematical.[8] Thus the SOMC finds the Fed's rationale for its recent FF rate cut to be rather obscure. We would support the suggestion that the Fed should adopt a more explicit and transparent mode of conducting monetary policy.[9]

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[7] Unless a smaller value was adopted for r, the long run real rate of interest. But academic research on issues other than Taylor rules typically uses a higher value (e.g., 4 percent). Note that belief in a recent increase in trend productivity growth would imply an increased value of r.
[8] For analysis supporting this position, see McCallum (2001) and Orphanides and van Norden (2002). Use of an alternative gap measure, one that indicates a larger negative gap at present, would be one other way of rationalizing the recent rate cut.
[9] For one proposal of this type, see the very recent paper by Goodfriend (2003).

Figure 1: Taylor Rule, SOMC Chart

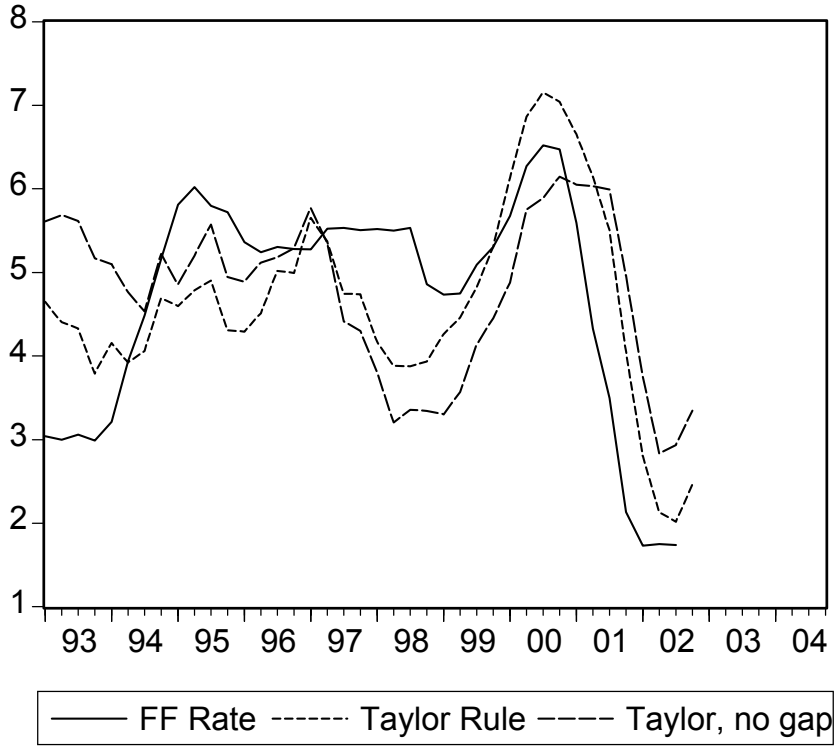


Figure 2: McCallum Rule, SOMC

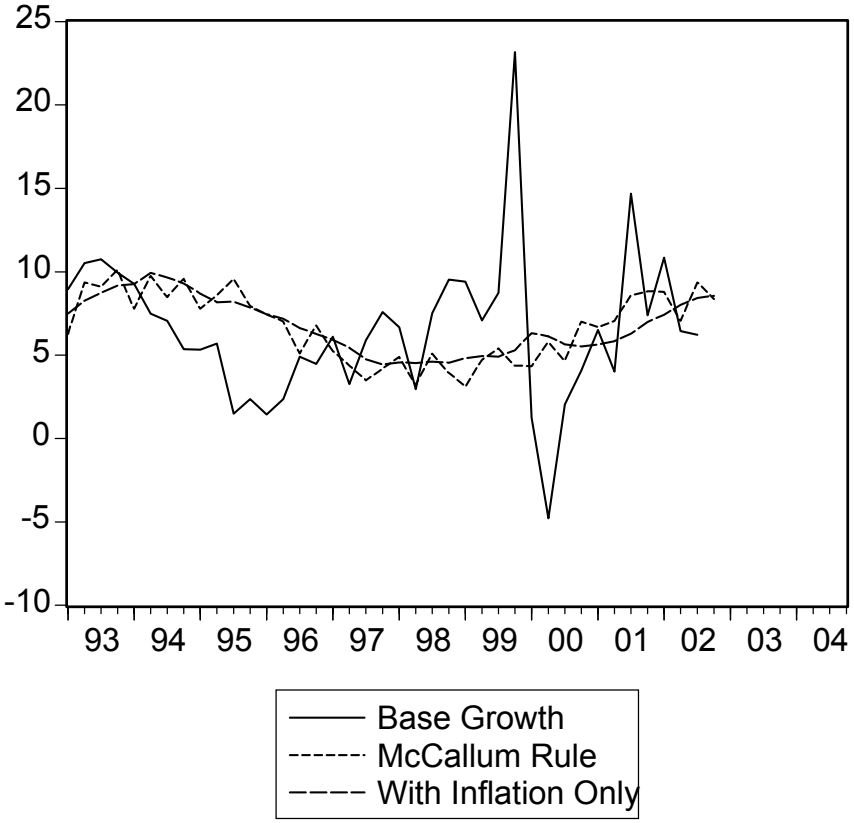


Figure 3: Taylor Rule for U.S. 1960-2002

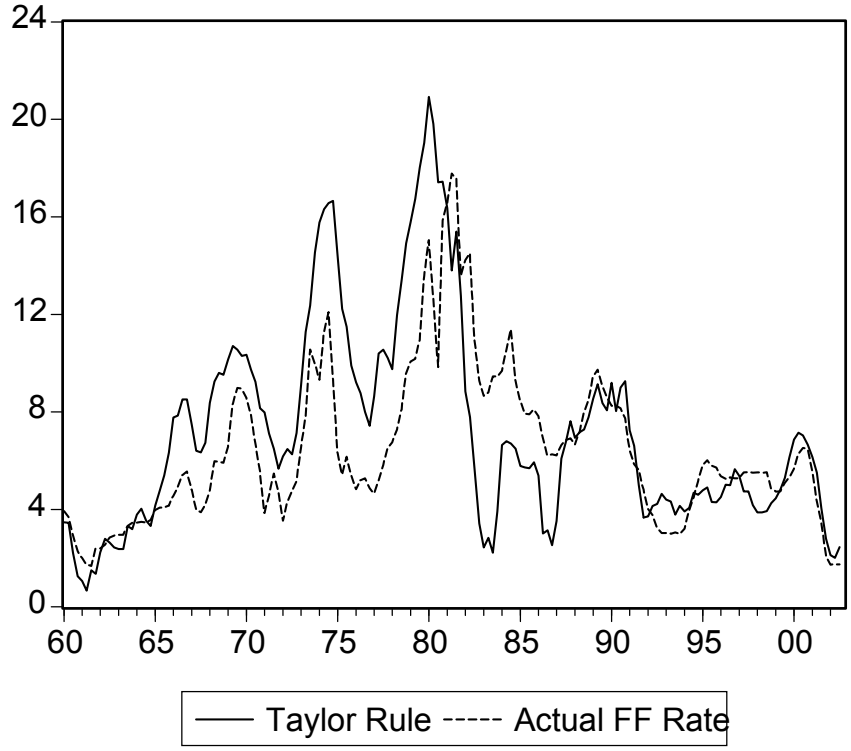
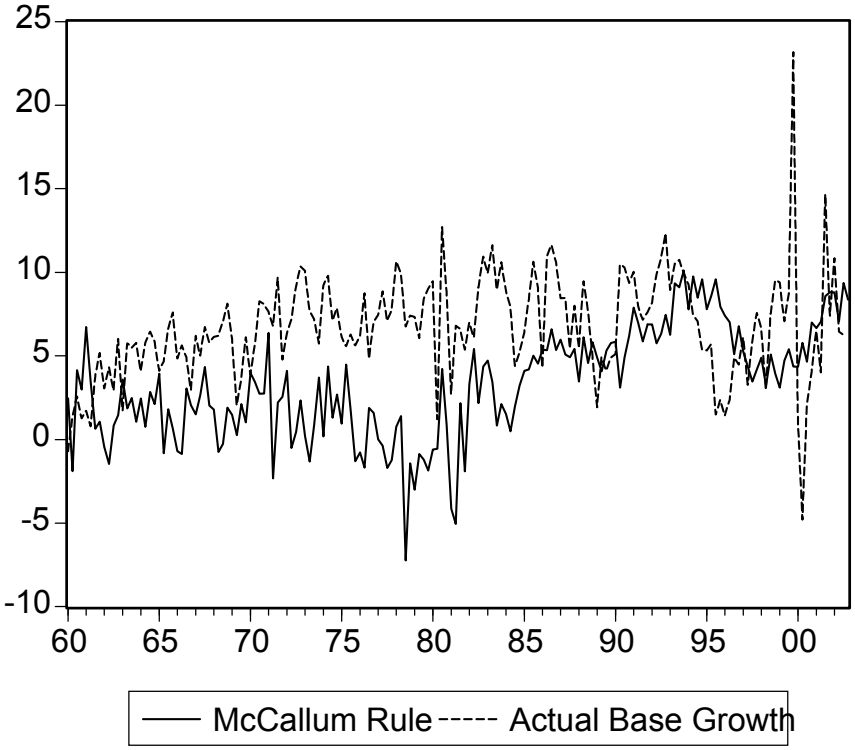


Figure 4: McCallum Rule for U.S. 1960-2002



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