

When Should the Fed Begin Monetary Policy Tightening?

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Abstract: We show that monetary policy in the U.S. may be described by adherence to price-level targeting. When combined with the cyclically adjusted equilibrium real interest rate, the modified Taylor rule tracks the federal funds rate better than the standard Taylor rule. Our analysis suggests that the Federal Reserve should begin an exit from the current close-to-zero interest rate policy in 2014, possibly with the first rate increase taking place in the October FOMC meeting. This is later than suggested by the standard Taylor rule, but somewhat earlier than projected by the Federal Reserve. Normalization of monetary policy is likely to take longer than many anticipate and may not happen until 2018.

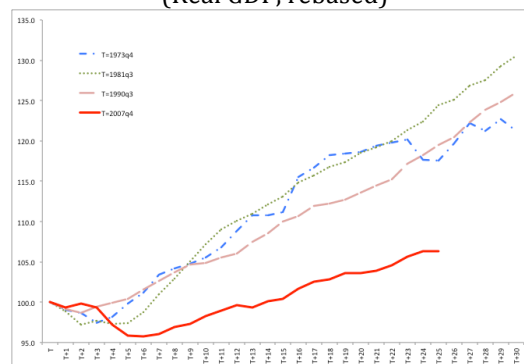
I. The recovery

U.S. economy has made important inroads towards recovery since the depths of the recession. Notwithstanding, minutes of the Federal Open Market Committee's (FOMC) continue to highlight the FOMC members' concerns about the strength of the U.S. recovery and its uneven pace.² Global factors, such as the slow pace of recovery in Europe, have also impacted the recovery in the United States, in addition to a host of domestic factors. Severe winter weather is believed to have contributed to the temporary slowdown in activity during the first quarter of 2014, with activity expected to pick up during the rest of the year. The

FOMC members continue to worry about the weak housing activity. While the labor market had continued to improve, it is not yet clear if unemployment rate properly measures the slack in the labor market and provides an appropriate signal to the tightness of this market.

The depth of the recession and the speed of recovery have been significantly worse than during previous downturns (Figure 1). A weak rebound is frequently associated with financial crises (Reinhart and Rogoff (2014)). It took 14 quarters for the output to return to its pre-crisis level and since the trough (in mid-2009) real GDP has grown only by about 11 percent.

Figure 1. Trends of selected U.S. recessions (Real GDP, rebased)



Sources: Federal Reserve Bank of St. Louis and author's calculations.

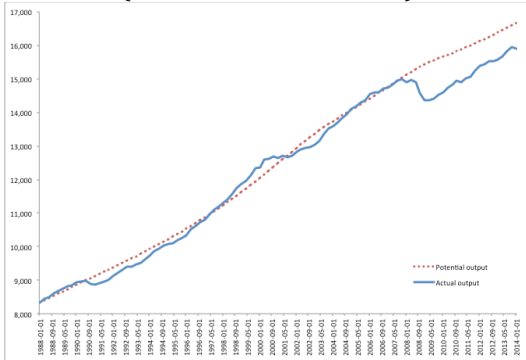
The Great Recession may have reduced the economy's growth potential. Figure 2, based on Congressional Budget Office's estimates of the potential output, shows that the estimated growth rate of potential output has slowed significantly from its pre-crisis level. This has helped narrow the output gap.³ The output gap in the first quarter of 2014 is estimated at about 4½ percent of the potential and has been narrowing.

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² Board of Governors of the Federal Reserve System (2014), FOMC Minutes, June 17-18.

³ For the period 1988Q1 – 2007Q4 the growth rate of potential output averaged 3 percent per year. It slowed down to 2.4 percent immediately before the current recession. The growth rate of the potential is estimated to have fallen to 1.7 percent per year in 2014. Source: Congressional Budget Office.

Figure 2. Actual and potential output, 1988Q1–2014Q1 (In billions of U.S. dollars)



Sources: Federal Reserve Bank of St. Louis and author’s calculations.

Given the sizeable spare capacity in the economy, which has translated into a weak earnings growth due to a weak labor market, it is hardly surprising that inflation has remained well below the FOMC’s inflation target of 2 percent for an extended period. Figure 3 shows that inflation has trended down since peaking in late 2011 (whether measured by the Personal Consumer Expenditure (PCE) price index or the Consumer Price Index (CPI)). Inflation measured by the Core PCE (CPCE), which is the preferred gauge used by the FOMC and excludes food and energy prices, peaked at somewhat lower level in the first quarter of 2012. Inflation expectations have nonetheless remained stable averaging slightly above 3 percent.⁴ According to the minutes of March 29–30, 2014 FOMC meeting, members differed in their views on how fast inflation would return to its long-term target of 2 percent. In part this seems to reflect differences in their perceptions to what extent the fall in short-and long-term unemployment rates are putting pressure on wages and prices.

⁴ Based on twelve-months ahead survey of inflation expectations by the University of Michigan. The 10-year break-even inflation rate has averaged slightly above 2 percent since the Great Recession.

Figure 3. Inflation and inflation expectations, 2003Q1–2014Q1 (In percent of four-quarter change)



Sources: Federal Reserve Bank of St. Louis and author’s calculations.

II. Unconventional monetary policy

The uneven propagation of the recovery has imposed a unique challenge to the FOMC as it attempts to determine the appropriate timing of the exit from the unconventional monetary policy. Even so, the FOMC has begun taking steps to “normalize” the stance of monetary policy. In its December 18, 2013 meeting, the FOMC decided to start scaling down, or taper, its asset purchases:

“In light of the cumulative progress toward maximum employment and improvement in the outlook for labor market conditions, the Committee decided to modestly reduce the pace of its asset purchases. Beginning in January 2014, the Committee will add to its holdings of agency mortgage-backed securities at a pace of \$35 billion per month rather than \$40 billion per month, and will add to its holdings of longer-term Treasury securities at a pace of \$40 billion per month rather than \$45 billion per month.”⁵

⁵ Board of Governors of the Federal Reserve System (2013), FOMC statement, December 18.

In February 2014 the new Federal Reserve Chair, Janet L. Yellen, updated the Federal Reserve's views regarding the outlook for monetary policy before the Committee on Financial Services of the U.S. House of Representatives in Washington. She confirmed that the FOMC is likely to continue to reduce its asset purchases in further measured steps at future meetings if the incoming data confirms the FOMC expectation on ongoing improvement in labor market conditions and inflation moving towards its longer-run objective.⁶ At its current pace of tapering the FOMC is expected to complete these operations by the end of 2014.

To reduce uncertainty about the future monetary policy and to guide the markets on the possible timing of the exit from unconventional monetary policy and the likely path of the federal funds rate when the Federal Reserve begins to remove policy accommodation, the FOMC introduced in December 2008 forward guidance, which it has modified several times as the circumstances have changed. At first, forward guidance was in the form of qualitative language in the FOMC's communication.⁷ Date-based guidance was introduced in August 2011 when the FOMC included a specific date into its guidance, stating that conditions would likely warrant keeping the federal funds rate target near zero "at least through mid-2013".⁸ This date-based guidance was modified twice in 2012 to extend its end date—first to late 2014 and then again to mid-2015.

⁶ Board of Governors of the Federal Reserve System (2014), Semiannual Monetary Policy Report to the Congress, February 11.

⁷ Specific language was included in the FOMC statements to guide the public about the likely changes in the policy rate target. In its December 2008 meeting, the FOMC included language "for some time". It was changed to "for an extended period" in March 2009.

⁸ Board of Governors of the Federal Reserve System (2011), FOMC statement, August 8.

Bernanke (2013) has noted that the FOMC believed that this left the public unsure about whether and under what circumstances further changes might be introduced to the guidance. To address this issue the FOMC linked the forward guidance about the target interest rate more directly to its economic objectives in December 2013. In this so-called state-contingent guidance the FOMC announced for the first time that no increase in the federal funds rate target should be anticipated so long as the rate of unemployment remained above 6½ percent, provided that inflation remained stable and near its target and inflation expectations were well anchored. The FOMC emphasized in its communication that this condition was to be understood as a threshold, not a trigger for an interest rate increase. According to Bernanke (2013) this allowed the Federal Reserve to remain "on hold" with the rate increase even after unemployment dropped below 6½ percent, and seek "assurances" that the labor market was sufficiently strong before any increase in its target for the federal funds rate would be considered.⁹

Campbell (2013) labeled this type of forward guidance as Odyssean where the monetary authority will be bound by its promise (such as the 6½ percent unemployment and 2½ percent inflation thresholds the FOMC introduced in 2013) while deviations from the past promises were likely to have adverse implications on the central bank's reputation. On the other hand, when the forward guidance is less specific and leaves "discretion" on the part of the monetary authority in setting the policy rate target in response to the incoming data, the guidance can be called Delphic. The Delphic forward guidance is not a specific promise, but could instead

⁹ Bernanke (2013) has pointed out that the FOMC realized the drawbacks in using unemployment rate as the threshold for future monetary policy guidance, but considered unemployment rate as probably "the best single summary indicator of the state of the labor market".

comprise a projection, which provides the monetary authority more leeway to deviate from the guidance in the future.

Another form of forward guidance was introduced by the FOMC with the publication of the FOMC members' assessments for the target path of the federal funds rate, starting with January 2012 FOMC meeting, consistent with the members' economic outlooks (Bernanke 2014). This was preceded by the introduction in October 2007 of the Summary of Economic Projections (SEP), which included the FOMC participants' quarterly projections of macroeconomic variables (i.e., inflation, gross domestic product growth, and the unemployment rate). Furthermore, in January 2012 the FOMC began issuing a statement, which was to be reissued annually, laying out its longer-run goals and policy strategies. In this statement the FOMC for the first time established an explicit longer-run goal for inflation of 2 percent and pointed to the SEP to provide information about the FOMC participants' assessment of the longer-run normal unemployment rate.

These measures were part of the FOMC's process of enhancing the Federal Reserve's commitment to transparency and accountability in implementing monetary policy. By making more information available to the public about policy goals and strategies, as well as on economic forecasts, the Federal Reserve provided a clearer framework to help the public understand and anticipate its policy actions. Bernanke (2014) argued that this has made monetary policy more efficient and also strengthened Federal Reserve's institutional credibility. The FOMC has adopted other measures aimed at clarifying the rationales for its policy decisions, including post-meeting press conferences.¹⁰

¹⁰ The Federal Reserve regularly publishes detailed information about its balance sheet and the specific liquidity facilities.

Bernanke (2013) has emphasized the importance of monetary analysis as a key foundation of FOMC's interest rate decisions. He believes that this was likely to become even more important after the unemployment rate fell below the 6½ percent threshold (the Labor Department reported that the seasonally-adjusted rate of unemployment fell to 6.3 percent in May 2014). That is, indicators other than the unemployment rate will become more important to a comprehensive judgment of the health of the economy and the labor market, such as alternative measures of payroll employment, the labor force participation rate, and the rates of hiring and separation.

With unemployment rate nearing the threshold laid out earlier, the FOMC provided new guidance in 2014, which highlighted the broad range of data used in assessing the economic situation, while stating that the FOMC intended to keep the current target range for the federal funds rate for a considerable time after it completed its asset purchase program, particularly if inflation continued to run below the 2 percent target and inflation expectations remained well anchored (for instance, Yellen 2014). Furthermore, the new language provided information about the likely path of the target rate after the FOMC began removing monetary policy accommodation. In particular, it stated that economic and financial conditions may warrant, for some time, to keep the target federal funds rate below levels that the FOMC views as normal in the longer run, even after employment and inflation are near their mandate-consistent levels. The guidance continued to highlight the data dependency of monetary policy, which took into account a wide range of information, including measures of labor market conditions, indicators of inflation pressures and inflation expectations, and readings on financial developments.¹¹

¹¹ Board of Governors of the Federal Reserve System (2014), FOMC statement, March 30.

The FOMC has stated that when it begins to remove policy accommodation, the FOMC will take a balanced approach consistent with its longer-run policy goals (maximum employment and inflation of 2 percent). While inflation is influenced by monetary conditions, the FOMC believes that maximum level of employment is largely determined by nonmonetary factors that affect the structure and dynamics of the labor market.¹²

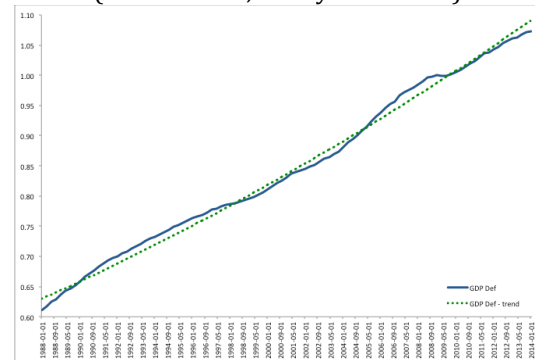
III. The price level gap

Modern central banks around the world, including the Federal Reserve, have adopted price stability as a crucial monetary policy objective. In the interest of limiting volatility in real activity, monetary policy is often assigned other objectives, like full employment in the case of the Federal Reserve, which is mandated by the U.S. Congress.¹³ In practice the price stability mandate is typically defined in terms of low and stable inflation, suggesting that policy-makers and the private sector would care little about the price level per se (which may not be the case). This may be in part because policy-makers' objective function is frequently defined in terms of deviations in inflation and output from their respective longer-term targets (this is consistent with the flexible form of inflation targeting as well). Yet the price level provides a simple way of showing the cumulative effects of sustained high or low inflation rates.

In order to assess the shortfall in the general price level from its trend, we estimate the trend of the GDP deflator (it measures the average price of all goods produced and services provided in the

economy), which is given by $P^* = 0.629 + 0.0035*t + (9*10^{-6})*t^2$. The estimated trend is slightly nonlinear (although the nonlinear term is rather small) and has $R^2 = 98.90$. Figure 4 shows the estimated trend and the actual GDP deflator for 1988Q1–2007Q4¹⁴ and confirms that during periods of sustained higher (lower) inflation the price level tends to exceed (fall short of) its trend and create a positive (negative) gap in the price level from its trend (e.g., during 2005–2006). We estimate that the price level gap in the first quarter of 2014 was about 1 ½ percent and was widening (inflation has been running below the 2 percent trend value).

Figure 4. GDP deflator and its trend, 1988Q1–2014Q1 (Index values, base year = 2009)



Sources: Federal Reserve Bank of St. Louis and author's calculations.

Combined with estimates of the output gap (potential output estimates are provided by the Congressional Budget Office), we estimate the nominal GDP gap in the first quarter of 2014 to be 5½ to 6 percent of its trend (Figure 5). This is significantly smaller than reported by Woodford (2012) and Hatzius and Stehn (2011). The estimation results also suggest that the nominal GDP gap has narrowed since the trough in 2009 by

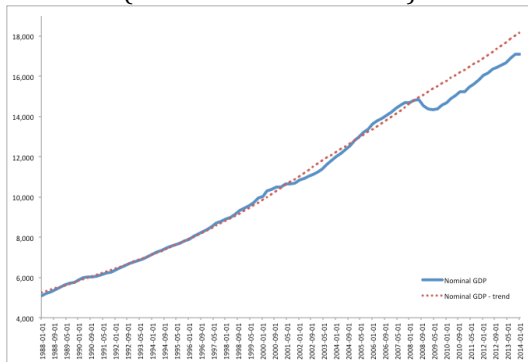
¹² Board of Governors of the Federal Reserve System (2014), Statement on Longer-Run Goals and Monetary Policy Strategy, January 28.

¹³ In the aftermath of the Great Recession, there has been a lot of discussion about financial stability and to what extent monetary policy decisions should be influenced by such considerations.

¹⁴ The end quarter was chosen to coincide with the start of the recession (as estimated by the National Bureau of Economic Research).

about 2 percentage points, rather than widened as reported by Woodford (2012) and Hatzius and Stehn (2011). What has widened is the price level gap, which has been more than offset by the narrowing of the output gap. The key reason for the different results is that we estimated the nominal GDP trend from its components (price level and the potential output) whereas Woodford (2012) and Hatzius and Stehn (2011) estimated the trend from the actual nominal GDP data.¹⁵ Their estimates lead to too high trend growth of nominal GDP, which overstate the trend inflation and/or the potential growth rate of the economy (e.g., Hatzius and Stehn (2011) assumed potential to grow by 2½ percent annually). Estimating the trend for the price level separately provides a more accurate measure of the trend inflation (measured by the GDP deflator).

Figure 5. Actual and trend nominal GDP, 1988Q1–2014Q1 (In billions of U.S. dollars)

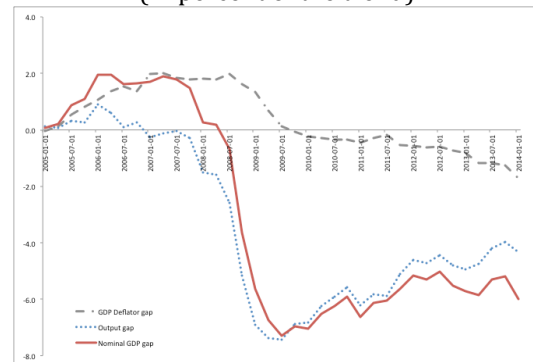


Sources: Federal Reserve Bank of St. Louis and author's calculations.

Regarding the nominal GDP gap, it is important for the policy-makers to understand whether the gap arises from below-trend real growth or below-target inflation. This issue is examined below in Figure 6 where the nominal GDP gap has been divided into two components: the output gap and the price level gap. In the immediate aftermath of the recession the

negative nominal GDP gap emerged as a result of the collapse of the real economy, which resulted from a rapidly widening negative output gap (by mid-2009 the negative output gap is estimated to have been about 7½ percent of potential). On the other hand, the price level gap was still positive at the time, due to the relatively rapid inflation in the pre-crisis period (in part because of high food and energy prices).¹⁶ Consequently, the price level remained above its trend for some time after the slowdown in real activity.

Figure 6. Composition of the nominal GDP gap, 2005Q1–2014Q1 (In percent of the trend)



Sources: Federal Reserve Bank of St. Louis and author's calculations.

As the economic crisis advanced, weak domestic demand, including from fiscal restraint, limited price increases and led to lower inflation, thereby causing the price level to undershoot its longer-term trend, which opened up a negative price level gap. Improvements in the economy and the estimated narrowing of the output gap helped offset the widening of the price level gap during the early phase of the recovery, which then led to the narrowing of the nominal GDP gap. In the period since 2012, however, progress in narrowing the nominal GDP gap has stalled, as output growth has slowed and

¹⁵ Estimation periods were also differed, but these were not material to the different results.

¹⁶ Davies et al. (2012) point to the same conclusion about the reason behind the widening nominal GDP gap.

the negative price level gap has continued to widen further.¹⁷

IV. FOMC's projections

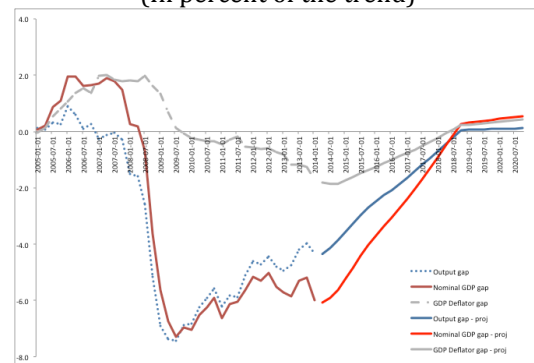
Recent trends in the nominal GDP and its components raise policy issues regarding how to close the gap, which can be achieved either through higher inflation and/or faster output growth (these are not entirely unrelated issues). The FOMC members' projections on the economy, as reported on June 18, 2014, suggest that the nominal GDP gap is not likely to narrow during the projection period (until 2016). This is because the estimated rate of price increase projected by the FOMC (as measured by the PCE price index) will remain below the trend inflation of about 2 percent, reaching the trend rate only in the longer-term.¹⁸ This means that the price level gap is going to widen further in this period.¹⁹ The output gap, on the other hand, would narrow somewhat in the coming years as the FOMC projects output to grow in excess of the (reduced) potential. The growth rate is projected to revert back to the potential in the longer-run.

Given the importance of offsetting past deviations in the nominal GDP gap, the Federal Reserve might need to maintain interest rates low until the nominal GDP reverts back to its longer-term trend. This could imply that inflation may need to be higher than the FOMC's 2 percent target in the interim, which has raised concerns that higher inflation

could lead to the un-anchoring of inflation expectations (this is an achievement the Federal Reserve is unlikely to accept).

But how relevant are the policy-makers' concerns about the un-anchoring of inflation expectations? This depends in part on how much higher inflation has to be. We believe not very much higher. In Figure 7, based on author's calculations, we illustrate one possible scenario where (1) output growth averages 3 1/3 percent per annum during 2015-2018 (higher than the rate of increase projected by the FOMC in June 2014 for 2015-2016), and reverts to the longer-term potential rate in 2019; and (2) inflation, projected by nominal GDP deflator, averages around 2½ percent per year during 2015-18, and reverts back to the FOMC's target in 2019, thus including a period of "above target" inflation.

Figure 7. Nominal GDP gap simulations, 2005Q1-2020Q4 (In percent of the trend)



Sources: Federal Reserve Bank of St. Louis and author's calculations.

A key take-away from this Figure is that trading off slightly higher inflation in the short-run against higher growth rate will be desirable for "normalization" of monetary policy. Furthermore, it is apparent that the road to the "normal" monetary policy stance is likely to take longer than many want to believe. Our illustration suggests that price and output

¹⁷ The slowdown in output growth has coincided with a rapid improvement in the unemployment rate, which is puzzling economists and the policy-makers.

¹⁸ According to the FOMC, longer-run projections refer to the rates of growth, unemployment, and inflation to which the policy-makers expect the economy to converge over time—maybe in five or six years—assuming appropriate monetary policy and no further shocks.

¹⁹ We assume that the CPCE price index and the GDP deflator are projected to grow at the same rate, which is not an unreasonable assumption.

gaps would not be closed until the end of 2018.²⁰

V. Instrument rules

A. Taylor rule

In his 1993 seminal paper, Taylor proposed a simple rule that could be used to assess the FOMC's policy stance. The rule links movements in the federal funds rate to the rate of change in inflation over the previous four quarters and the percentage deviation of real GDP from its target. Taylor assumed that the inflation target was 2 percent. The "equilibrium" real interest rate, or the natural rate, in Taylor (1993) was set at 2 percent (based on his assumption about the steady-state real growth of 2.2 percent). Similar to what policy-makers do, the rule allows the federal funds rate to rise if inflation increases above the target level or if real GDP rises above its trend. According to the "Taylor rule" the normal level of the federal fund rate equaled 4 percent, or 2 percent in real terms, if both inflation and real GDP were on their respective targets.

More formally, the Taylor rule can be written as follows:

$$i = \pi + r^* + \theta_{\pi}(\pi - \pi^*) + \theta_y(y - y^*) \quad (1)$$

where i = federal funds rate, π = expected inflation (Taylor (1993) used current inflation rate as a proxy for expected future inflation), r^* = equilibrium real or natural rate of interest, π^* = target inflation rate, y = real output, and y^* = target (or potential) output. Taylor assumed that θ_{π} and θ_y both were equal to one-half.²¹

When the Taylor rule is written as follows, it yields the well-known "Taylor principle" (see, e.g., Asso et al. (2010)):

$$i = i^* + (1 + \theta_{\pi})(\pi - \pi^*) + \theta_y(y - y^*) \quad (2)$$

That is, to stabilize inflation the federal funds rate should rise more than one-to-one in relation to the increase in inflation above the inflation target ($1 + \theta_{\pi} > 1$).

By linking interest rate decisions to inflation and economic activity, Taylor rules offered a convenient way to study monetary policy while abstracting from a detained analysis of money demand and supply (Orphanides, 2007). The Taylor rule has been quite successful in tracking movements in the federal funds rate (see, for instance, Kozicki (1999), Blinder and Reis (2005), Orphanides (2007), Poole (2007), Taylor (1993, 1999, and 2007), Wolters (2007), and Kahn (2010)). It is consistent with the dual mandate of the Federal Reserve, as it places equal weight to price stability and full employment (for instance, using the Okun's Law). The rule also applies to inflation-targeting regimes as it incorporates an explicit inflation target consistent with flexible inflation targeting. By also placing some weight on real activity, it underscores the medium-term orientation of monetary policy to achieve the inflation target while allowing flexibility to support economic activity in the short-run.

Although Taylor underscored the desirability of using rules to implement monetary policy in an environment where the policy-maker is committed to a time-consistent and transparent framework, as well as to central bank independence, he (Taylor (1993)) was aware that operating monetary policy by a mechanical rule was not practical. That is, the FOMC bases its policy decisions on a range of factors, including leading economic indicators, the yields curve, and various forecasts from Federal Reserve's staff models. Poole (2007) analyzed periods when the federal funds rate had deviated from the Taylor

²⁰ The longer-term is consistent with 2 percent PCE inflation and real growth of about 2 -2 ½ percent, consistent with the economy's growth potential.

²¹ Taylor (1993) noted that there was no consensus about the size of the parameters of policy rules and placing some weight on real output worked better than a simple price rule. See Orphanides (2007).

rule and underscored the importance of discretion in actual policy making. He linked deviations from the Taylor rule to factors that were not captured by the rule, for instance the change in FOMC inflation objective from the Consumer Price Index to the Core PCE price index in 2000 that excluded volatile food and energy prices. Furthermore, Poole (2007) noted that on several occasions the FOMC responded to events not captured by the Taylor rule. In 1989 the FOMC increased the target rate more quickly than what was predicted by the Taylor rule, responding to a rising inflation, and during 1990-91 it lowered the rate more quickly as it responded to recession risks. During late 1992 through February 1994 the target rate was held at a lower level than predicted by the Taylor rule and it was during this period that the FOMC expressed concern about “financial headwinds” which were restraining the speed of recovery. In the fall of 1998, the FOMC lowered the funds rate target in response to the Asian financial crisis, the Russian debt default, and the collapse of the Long-Term Capital Management (LTCM); the Taylor rule predicted the rate to remain constant.²² See also discussion in Kahn (2010) and Asso et al. (2010).²³

There are shortcomings with the Taylor-type rule, or its variants, which many authors have pointed out over the years (see, for instance, discussions in Woodford (2003) and Asso et al. (2010)). They include lack of history-dependence and the absence of real-time data that is implicitly assumed in the Taylor rule (e.g., real GDP data is only available with a lag). These types of instrument rules simplify monetary policy decision-making, which

in practice is done in a much broader context. Orphanides (2007) noted that a key element in the design and operational implementation of the Taylor rule is the detailed description of its inputs, such as the output gap and how accurately it can be measured.

Because monetary policy effects are always transmitted with a notable lag (thought to be 4 to 6 quarters in the U.S.), preemptive policy reactions are generally best in response to shocks, which suggests that inference from the Taylor rule should be based on forecasts. But economic forecast could be sensitive to the model’s assumptions and could be subject to considerable uncertainty (for instance, the natural rate of interest is not known and its real-time estimates may be subject to significant misspecifications). Svensson (2003) argued that rules where the instrument reacts to the determinants of the target variables rather than to the target itself are less sensitive to judgment criticism (Taylor argued that rules should not be used mechanically) because the equilibrium forecast already includes the policy-makers’ judgment.²⁴ He advocated against forecast-based instrument rules because they were not optimal and their performance had not been good.

Bernanke (2003) highlighted the importance of “constrained discretion” in monetary policy implementation by referring to “what the central bank does” and “what it says about it”. Inflation targeting, he said, was a good example of a framework that allowed central bank to exercise discretion in the short-run to stabilize output and employment, subject to the longer-term constraint (inflation remaining low and stable). He believed that constrained discretion also described reasonably well the policy approach of the Federal Reserve.²⁵ Taylor (2013 and

²² Nikolsko-Rzhevskyy et al. (2013) used Markov-switching technique to identify periods when the federal funds rate deviated from the Taylor rule projections, labeling such periods as characterizing policy discretion. See also Ilbas et al. (2013).

²³ Yellen (2012) has also cautioned against using a Taylor-type rule during the Great Recession when the economy is subject to an unusual shock to the financial system.

²⁴ Svensson (2003) noted that in the Taylor rule there are no “rules” for discretion or judgment.

²⁵ Bernanke (2003) laid down some principles for constrained discretion in implementing monetary policy.

2014) believed that too much discretion has contributed to the adverse economic outcomes (e.g., in the period leading to the current recession characterized by increased risk-taking and rising housing prices).

B. Price level rule

An alternative framework to inflation targeting is price-level targeting where the central bank targets a particular path of a price level (measures in practice by a price index). The path may involve an upward trend implying a positive target for inflation rate (since $P^* = P^*_{-1} + \pi^*$, where variables with “*” refer to targets).²⁶ An obvious difference between inflation targeting and price-level targeting is that while the former targets the rate of growth of the price level, the latter targets the price level itself.

Over a century ago, Knut Wicksell, a Swedish economist, suggested that the central bank should adjust the policy rate target when the price level deviated from its target path (see Woodford (2003) for a discussion). Then the following form of the Taylor rule will determine the interest rate:

$$i = \pi + r^* + \theta_p(P - P^*) + \theta_y(y - y^*) \quad (3)$$

This type of “Wicksellian” Taylor rule introduces history-dependence into the policy-making, a key property of optimal policy in a forward-looking model. In Eq. (3) the price level, P , depends not only on current inflation rate, which is defined as $P = P_{-1} + \pi$, but also on past rates of inflation. History-dependence forces the central bank to compensate for any shocks that may have affected inflation in the past by adjusting interest rates

accordingly. For comparison, as pointed out by Ruge-Murcia (2012) for instance, an inflation-targeting central bank has no formal obligation to offset past misses in the inflation rate, up or down, from the inflation target. Giannoni (2012) showed that committed to a rule, such as shown in Eq. (3), helps reduce output and inflation variability and is more robust to shocks than the standard Taylor rule.²⁷

An important variable in Eq. (3) is r^* , the equilibrium real interest rate. In the standard Taylor rule this variable is assumed to remain constant (Taylor set it at 2 percent). There is evidence, however, that the equilibrium real interest rate, or the natural interest rate, has not stayed constant but has varied over time (see for instance, Laubach and Williams (2001) and Summers (2014)). Recently, Barsky et al. (2014) showed that the natural interest rate has been pro-cyclical in the U.S. and has tended to fall during recessions (during the Great Recession they argue that it has become negative).

To capture pro-cyclicality of the equilibrium real rate, we assume that this rate responds to the output gap in the following way:

$$r^* = \acute{r} + \theta_{r^*}(y - y^*) \quad (4)$$

where \acute{r} denotes a constant and refers to the steady-state value of the equilibrium real interest rate (which, for simplicity, we assume equals the value in Taylor’s paper of 2 percent).²⁸ Substituting Eq. (4) into Eq. (3), using definitions for P and P^* , discussed earlier, and taking a difference of Eq. (3) leads to the following result:

$$i = i_{-1} + (\pi - \pi_{-1}) + \theta_p(\pi - \pi^*) + (\theta_y + \theta_{r^*})(y - y^*) - (\theta_y + \theta_{r^*})(y_{-1} - y^*_{-1}) \quad (5)$$

²⁶ Woodford (2003) noted that by allowing for a time-varying price level target, the central bank stabilizes the price level around a growing trend (e.g., consistent with an annual inflation target).

²⁷ Gorodnichenko and Shapiro (2007) used a price-level targeting model to explain Federal Reserve’s monetary policy during the 1990s.

²⁸ See Woodford (2001).

In Eq. (5) the third and fourth terms are similar to the standard Taylor rule, except for the parameter of the output gap term, which is augmented by $\theta_{r^*} > 0$ from Eq. (4), the cyclical adjustment in the real interest rate.²⁹ The second and third terms relate to inflation adjustment in the price-level targeting arrangement. Even if inflation remains below its target, that is $\pi < \pi^*$, rising inflation ($\pi > \pi_{-1}$) could offset the inflation gap term and explain why the federal funds rate target may need to be increased. Similarly, the last two terms are related to the adjustment related to the output gaps in the current and previous periods, in part reflecting changes in the equilibrium real interest rate. According to Eq. (5), the federal funds rate would rise even if both output gaps remain negative but the sum of the last two terms is positive.

During the Great Recession, given the negative equilibrium real interest rate and the negative price level gap, one may expect the federal funds rate target to be lower than suggested by the standard Taylor rule and remain below the “longer-term” normal level even after inflation and the output have returned to their respective steady-state levels. This may be what the FOMC had in mind in its June 18, 2014 statement:

“The Committee currently anticipates that, even after employment and inflation are near mandate-consistent levels, economic conditions may, for some time, warrant keeping the target federal funds rate below levels the Committee views as normal in the longer run.”

The modified Taylor rule, where the federal funds target is adjusted for the

price-level gap and permits adjustment in the natural real interest rate based on the economic cycle, is consistent with this. However, it does not prevent the policy rate target from rising if the output and inflation gaps are narrowing (even if both current and lagged output gaps remain negative).

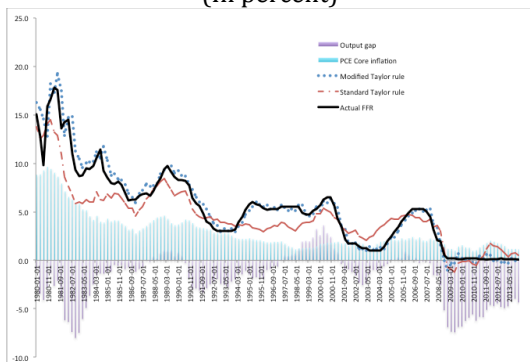
The modified Taylor rule does much better than the standard Taylor rule in the historical data. In Figure 8 we assume that $\theta_p = 0.25$ and $\theta_y + \theta_{r^*} = 0.5$, which fit well with the data. While we do not intend to do a systematic error analysis on these parameters, it is apparent that the outcome is sensitive to the choice of values of these parameters. A large value of θ_p (> 0.5) will mainly lead to an overshoot in the federal funds rate target during the 1980s and early 1990s when high inflation was a serious concern to the policy makers. Regarding $\theta_y + \theta_{r^*}$, any value above unity would lead to a sharply higher volatility of the federal funds rate projection, and to a sizeable negative rate target during the Great Recession when the output gap became significantly wider (Kozicki (1999) has analyzed the stability of the parameters of the standard Taylor rule for U.S. data).³⁰

It can help explain, for instance, the events during the 1980s when the inflation was brought down from double-digit levels to a low single digit. The standard Taylor rule implies a more rapid easing of monetary policy than was the case in practice while the modified Taylor rule projects the actual federal funds rate remarkably well. Nominal GDP at the time was running well above its long-term trend, reflecting high inflation, and hence continued tight policy remained appropriate throughout the period even though output was below its trend.

²⁹ Summer (2014) argued that the real equilibrium interest rate in the U.S. has been declining for years due to in part structural factors and could be even negative in the post-Great Recession period.

³⁰ It suggests that θ_y is less than 0.5, a value that is commonly used in the standard Taylor rule.

Figure 8. Modified and standard Taylor rule projections, 1980Q1–2014Q1
(In percent)



Sources: Federal Reserve Bank of St. Louis and author's calculations

Regarding the period of “policy discretion” during the early 2000s, which has been analyzed by economists (Poole (2007), for instance), the standard Taylor rule suggests an earlier increase in the federal funds rate target than what actually happened. Some economists have pointed out that this was a “failure” of the standard Taylor rule and that the Federal Reserve was late in tightening monetary policy. However, examining this period using our modified Taylor rule, we see that the actual federal funds rate was consistent with the target rate implied by the rule. The reason is that the Federal Reserve did tighten monetary policy once the output gap was closing and inflation started to accelerate. Based on this assessment, had policy been tightened earlier, as was suggested by the standard Taylor rule, it would have led to a premature increase in the federal funds rate target, with adverse implications for the economy’s growth prospects.³¹

Applying the Taylor rule to the Great Recession, both the standard and modified Taylor rule point to an easing of monetary policy as the crisis takes hold,

³¹ Recently, Carlstrom and Zaman (2014), among others, have proposed modifications to the Taylor rule to better track movements in the federal funds rate. Many of these modifications, however, assume that the FOMC targets inflation rate rather than the price level.

but not to a highly negative policy rate in the aftermath of the recession. Based on the modified Taylor rule, monetary policy should be easier for longer than with the original Taylor rule.

VI. Timing the exit

Timing the exit from the extraordinary accommodation remains a key challenge for the Federal Reserve. As we already noted, the FOMC has indicated (see, for instance, the FOMC statement of June 18, 2014) that it will take a balanced approach consistent with its longer-run goals of maximum employment and inflation of 2 percent when it decides to begin to remove policy accommodation, and that conditions may warrant keeping the federal funds rate below levels the FOMC views as normal in the longer run.

The FOMC is mindful of the effects of a premature increase in the policy rate (for instance, see Bernanke et al., 2004). Although there are costs and risks in having a long period of low interest rates, such as for financial stability, higher interest rates will also carry the risk of slowing the economy, or even ending a fragile recovery if done prematurely, and cause inflation to fall rather than rise. Bernanke further noted that these types of outcomes tend to be associated with extended periods of lower, not higher, interest rates.

Economic weakness also poses its own risks to financial stability, the very thing higher interest rates may be meant to guard against.³² Because only a healthy economy can deliver sustainable high real rates of return to savers and investors, Bernanke (2004) argued that the best way to achieve higher returns in the medium term is for the Federal Reserve to provide policy accommodation as long as it is necessary to foster maximum employment and price stability. Janet

³² The discussion of financial stability and its links to monetary policy is beyond the current study.

Yellen has also echoed these concerns and the virtues of cautiousness in monetary policy conduct (Yellen, 2014).³³

In order to time the “lift-off”, that is when the FOMC begins to raise the federal funds rate target from its current 0–0.25 percent range, Woodford (2012) proposed for the FOMC to use an “output gap”-adjusted price level. According to this suggestion the policy rate should remain at the floor until the output-gap-adjusted price level target has been reached.³⁴ An important implication arising from this proposal is that it might be necessary to keep the policy rate below its longer-run, “normalized” level for some time even after inflation has reached its longer-run target level and the output gap has closed.

Woodford (2012) also mentioned nominal GDP targeting as an alternative to the output gap-adjusted price level target, which he argued would preserve many of the advantages of the output gap-adjusted price level target.³⁵ If the Federal Reserve adopted nominal GDP targeting, it would keep the policy rate target at the floor as long as the nominal GDP remained below the predetermined target path.

Frankel has advocated nominal GDP (growth) targeting, which he thinks helps stabilize real output and inflation.³⁶ In the post-Great Recession environment, the advantage of nominal GDP targeting is that it provides a better basis for policy to

anchor the public’s inflation expectations than an inflation-targeting framework.³⁷ By allowing policy discretion in response to inflation and output, the nominal GDP target would encourage economic growth in a downturn although inflation would be higher in the short run. This is also in the spirit of Woodford (2013) who has advocated that the central banks should not “scrap inflation targeting, but fix it”. It would be consistent with the longer-term nominal GDP target and not compromise the longer-term inflation anchor (i.e., inflation targeting does not specify the near-term policy decisions, given the medium-term orientation of monetary policy in inflation targeting while a nominal GDP target path would help guide these decisions).

The modified Taylor rule, which we introduced earlier, assumes that the Federal Reserve targets the price level and also takes into account the cyclical adjustment in the real equilibrium interest rate. Although the real interest rate, according to Eq. (4), will remain below its long-run level, it will be rising as the negative output gap narrows. This, together with the projected increase in inflation during the forecast period, points to the need to tighten monetary policy, albeit later than with the standard Taylor rule but earlier than projected by the Federal Reserve.

Figure 9 shows the current federal funds rate range (0–0.25 percent) as well as the central tendencies of the FOMC members’ projections of the federal funds rate target path (June 2014). The FOMC projections indicate that the authorities would begin raising the federal funds rate target in 2015, gradually, with the federal funds rate target to reach 2½ percent by the end of 2016. The federal funds rate target is projected to approach 4 percent

³³ See also the FOMC Minutes and statement, April 2014.

³⁴ The theoretical foundation for the output gap-adjusted price level target is found in Eggertsson and Woodford (2003). The target is defined as the log of general price index plus a positive multiple of the output gap (where the multiplier depends on the relative importance of output gap stabilization in the policy-makers objective function).

³⁵ Woodford (2012) noted, however, that nominal GDP target would not achieve full welfare gains associated with the credible commitment to the output gap-adjusted price level target.

³⁶ Frankel and Chinn (1993) have analyzed the stabilization properties of nominal GDP targeting.

³⁷ See, Frankel ‘s (2012) article titled as “Nominal GDP Targeting Could Take the Place of Inflation Targeting” on his Blog (www.jeffrey-frankel.com), dated June 16, 2012.

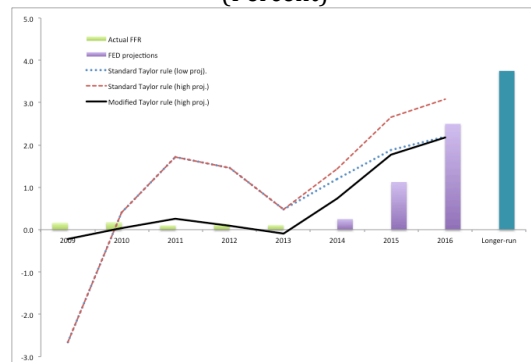
in the longer-run, which by many would be considered the normal level of the federal funds rate target and consistent with the longer-run real interest rate of 2 percent (assuming inflation target of 2 percent). The projected path of the target federal funds rate is consistent with the gradual approach to raising rates the FOMC has adopted in the past (see, for instance, Blinder, 2006, and Stella, 2013, on this issue).³⁸

Our analysis using the modified Taylor rule points to a more gradual adjustment in the federal funds rate target than the standard Taylor rule (we used the “higher values of the FOMC’s central tendency” for economic activity and inflation in our projections (June 2014)). It suggests that an exit from the low interest rate policy should begin in late 2014, with the rate target reaching 75 basis points by the end of the year (this would be 50 basis points higher than the Federal Reserve’s projection). This would mean, given the past experiences of the FOMC, that the first 25 basis points increase in the target rate should take place in October 2014 and the second one in December 2014. The modified Taylor rule suggests that the federal funds rate target would reach 2¼ percent by the end of 2016. This is slightly below the median value of the FOMC’s projection of 2½ percent. It suggests that the FOMC might pause during this period to monitor the effects of the higher target rate on the economy (increasing the rate target by 150 basis points only requires 6 meetings if each rate increase comprises 25 basis points).

We believe that the projected path of the modified Taylor rule interest rate is within a reasonable margin of the FOMC’s interest rate for the period 2014–2016. Judging from the projected trend and

extending the trend is to what the FOMC defines as the “longer term” seems to suggest that the policy rate may well stay below its normal level for an extended period, consistent with FOMC’s views.³⁹ It should be kept in mind, however, that the outcome of any projection is subject to uncertainty and sensitive to assumptions about the parameters of the model (that is, parameters θ_p , θ_y and θ_{r^*}), which we have already discussed. The projections therefore need to be viewed with caution. The chosen parameter values provide the best fit for the period 1988–2007 (using mean square errors) that was used in the estimation of the price level gap.

Figure 9. Policy interest rate projections and the Taylor rule, 2009–2016 (Percent)



Sources: Federal Reserve Bank of St. Louis and author’s calculations.

VII. Concluding remarks

The purpose of this paper was to see if a simple Taylor-type instrument rule could be useful in analyzing monetary policy during the Great Recession and to determine the timing of exit from the ultra low interest rates. Our research therefore contributes to a large literature that is already available in this area. A particular point of departure in our study is to assume that the FOMC’s objective is to minimize deviations in the price level

³⁸ Blinder (2006) showed that most central banks adjust their policy rates by exactly 25 points at the time. There is significant positive serial correlation in the data, suggesting that each subsequent rate adjustment goes to the same direction.

³⁹ Christensen (2014) estimated the exit timing by using the Treasury yield curve data and concludes that the start of the rate increase is most probably in mid-2015.

from the long-run trend rather than use a standard inflation targeting argument. We believe that the price-level targeting is validated by the historical data. We also incorporated into the modified Taylor rule a cyclically adjusted equilibrium real interest rate, compared to the common assumption of a constant equilibrium real interest rate. These modifications result in a Taylor rule that is superior to the standard Taylor rule in explaining past trends of the federal funds rate.

It also gives us confidence to project the future path of the federal funds rate target. Using the modified Taylor rule to project the path of the federal funds rate target for 2014–2016, we conclude that the current path of the federal funds rate projected by the FOMC (mean value) is rather well explained by our modified Taylor rule. Even though the FOMC may decide to hold the policy rate target at its current range (0–0.25 percent) for longer, our analysis suggests that the rate target should be raised already in 2014, with the first increase possibly taking place in the October 2014 FOMC meeting. However, normalization of the policy rate target is likely to take an extended period of time, in line with the FOMC “longer-term” view.

We believe that concerns about the un-anchoring of inflation expectations may well be overstated. Therefore, the authorities may have to accept inflation rates slightly above the target level during transition to the new steady state. Our projections further indicate that the “normalization” of monetary policy is likely to take longer than many wish to believe and may not happen before 2018.

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