R. W. Hafer
Professor of Economics
Southern Illinois University–Edwardsville

Joseph H. Haslag
Senior Economist
Federal Reserve Bank of Dallas

Scott E. Hein
First National Bank at Lubbock Distinguished Scholar
Texas Tech University

Monetary Policy and Recent Business-Cycle Experience

In recent years, economists have rekindled the debate over whether price stability should be the *sole* objective of monetary policy or if output growth and full employment should be included as additional objectives. In some theories, eliminating inflation is associated with economic dislocation—rising unemployment and slower economic growth—and increased economic volatility, at least temporarily. Those advocating a broad scope for monetary policy objectives argue that making price stability the sole objective is a far too one-sided trade-off. Instead, they contend, the Federal Reserve also should be concerned with promoting output growth and smoothing fluctuations in the economy.

In this vein, critics of recent Federal Reserve policy contend that monetary policy has been too restrictive. In a series of *Wall Street Journal* editorials, Martin Feldstein (1992), Milton Friedman (1992), and James Buchanan and David Fand (1992) asserted that slow M2 growth indicates a Federal Reserve policy that is overly restrictive and cited the failure of the Federal Reserve to keep M2 growth within its target growth range in recent years as evidence of this. Thus, critics reasoned, the Fed must be responsible (at least partly) for weak economic growth. Both Friedman and Buchanan and Fand suggested that letting M2 grow at the midpoint of its target growth range would be an acceptable strategy. Feldstein urged an even more aggressive approach: increase M2 growth to make up for past weakness. In each of these critiques, M2 was the gauge of monetary policy and, more importantly, was identified as the appropriate target for the Fed to hit.

Ironically, other critics claim that progress toward an average inflation rate of zero has been virtually immeasurable. Price stability proponents argue that the gradual elimination of inflation leads to uncertainty, which impedes output growth. Bennett McCallum (1987, 1988) proposes a rule that seeks to eliminate inflation quickly and, on average, would deliver output growth consistent with full employment. In McCallum's setup, the target for monetary policy is nominal gross national product (GNP). McCallum presents evidence from in-sample experiments comparing actual nominal GNP with a simulated GNP generated by his strategy. McCallum's results show that simulated GNP stays fairly close to its desired target path, and he therefore deems his proposal a successful strategy for monetary policy.

In this article, we address both sets of critics. To do so, we examine two alternative monetary policies and gauge their possible impacts on economic activity. Our particular focus is how nominal GNP would have behaved between the fourth quarter of 1986 and the fourth quarter of 1992, which is the period approximately spanning the last half of the business-cycle expansion that ended in 1990 and the early recovery. We describe simulations of nominal GNP in cases in which policymakers chose one of the two policies. Simulating economic activity for this period

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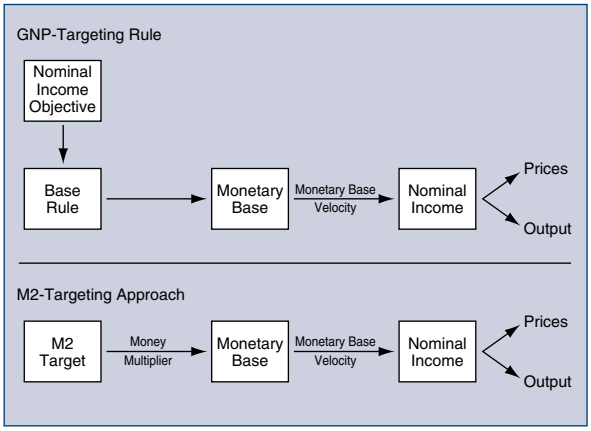
(1986:4–92:4) covers different phases of a business cycle and allows us to assess how nominal GNP might have fared under each monetary policy, especially by comparing the shape and duration of the simulated business cycle with what actually occurred. More importantly, our results address complaints lodged by both sets of monetary policy critics. For those who believe that recent monetary policy has been too restrictive, we provide evidence that a policy focused on maintaining more rapid M2 growth would not have increased economic growth greatly. For those who emphasize price stability, our results provide a glimpse of the path nominal GNP growth would have experienced had a zero-inflation policy been implemented cold turkey.

This article presents two main findings. First, the evidence suggests that the average growth rate of nominal GNP would have been only one-quarter to one-half a percentage point higher had the Federal Reserve implemented a feedback rule designed to maintain M2 growth.[1] In particular, fluctuations in GNP growth would have had approximately the same amplitude as what actually occurred, and the timing of changes in nominal GNP growth would have been roughly identical to what actually happened. Second, our findings indicate that implementing a McCallum-style anti-inflationary policy (hereafter referred to as the GNP-targeting rule) would have been successful in more rapidly slowing nominal GNP growth. This particular simulation exercise, however, shows that nominal GNP growth would have been more volatile compared with what actually occurred. This extra volatility appears to be the price paid for the particular set of nonmonetary shocks that occurred during the simulation period and follows from the fact that the GNP-targeting rule only partially accommodates real shocks to the economy.

Outcomes from two alternative monetary policies

In this section, we simulate the path that nominal GNP growth would have followed under two alternative monetary policies. In particular, we compare simulated nominal GNP growth with what actually occurred during the 1986:4–92:4 period. (See the appendix for a detailed description of each monetary policy and how each simulation was implemented.)

Figure 1
Relationships Between Monetary Base, M2, And Nominal GNP Under Alternative Policies



A general outline of the two alternative policies is presented in Figure 1, which shows that they share many features. The premise in both is that the policies aim at the same ultimate goals, measured in terms of output growth and the inflation rate. Moreover, both policies are implemented through changes in the quantity of monetary base. The two policies differ, however, in their intermediate goals. The GNP-targeting rule, depicted in the top panel of Figure 1, alters the volume of monetary base to achieve a targeted value of nominal GNP growth. The link between the policy instrument and the intermediate target is base velocity growth. Under the M2-targeting approach, depicted in the bottom panel of Figure 1, changes in the volume of monetary base are aimed at

[1] *Over the period in question,* actual *Federal Reserve policy was formulated partly with an eye toward keeping M2 growth within preannounced target growth ranges, but also partly with an eye toward real and financial market conditions. Furthermore, policy was implemented primarily through adjustments in the federal funds rate. In our simulations, consistent with Friedman (1992), we assume that policy is implemented through adjustments in the monetary base and that it focuses on keeping M2 growth at the middle of the target growth range, to the exclusion of all other considerations.*

achieving the midpoint of the M2 target range. With an M2 target, the link between policy instrument and intermediate target is the M2 money multiplier, the ratio of M2 to the monetary base.

Our primary focus in both policy experiments is the behavior of nominal GNP growth. Consequently, it is necessary to establish the link between the policy instrument and nominal GNP growth. We follow McCallum in specifying the following model describing how nominal GNP growth is generated:

$$(1) \qquad \Delta Y_t = a_0 + a_1 \Delta Y_{t-1} + a_2 \Delta B_{t-1} + e_t,$$

where Y is the log of nominal GNP, B is the log of the monetary base, e_t represents random shocks, and Δ is the difference operator (that is, $\Delta x_t = x_t - x_{t-1}$). The variables in equation 1 are interpreted as rates of growth indexed by time. The error term in this model is an amalgam of various real shocks, such as aggregate supply shocks, aggregate demand shocks, money demand shocks, and so on, that affect the realized value of nominal GNP growth.

Why focus on nominal GNP growth when the ultimate goals of policy are in terms of output growth and the inflation rate? Nominal GNP growth is the sum of output growth and the inflation rate. Because nominal GNP is a summary measure of the two ultimate policy goals, a substantial literature has developed advocating nominal GNP targeting. By definition, if one knows the average growth rate of full employment output, a nominal GNP growth rate target implies an inflation rate target. Or, alternatively, there is a nominal GNP growth target that corresponds directly to the natural rate of output growth and the target inflation rate. Nominal GNP targeting has some disadvantages relative to monetary targeting, however, the most obvious of which is the fact that the monetary aggregates are available in a more timely manner than are the national income and product accounts.

Estimation. The data for this study are quarterly observations of seasonally adjusted nominal GNP (Y), the St. Louis definition of the monetary base adjusted for reserve requirement changes (B), and seasonally adjusted M2. Equation 1 is estimated using data for the period 1955:1–92:4. The results from the nominal GNP growth equation are as follows (standard errors in parentheses):

$$(2) \quad \Delta Y_t = \underset{}{0.0083} + \underset{(0.084)}{0.2864}\, \Delta Y_{t-1} + \underset{(0.120)}{0.3335}\, \Delta B_{t-1}$$
$$\qquad\qquad (0.002)$$

$$\text{adj } R^2 = 0.17 \quad SEE = 0.010 \quad BG = 1.25.$$

The estimation results, which are quite close to those of McCallum (1988), indicate that both lagged GNP growth and base growth are significantly related to current GNP growth. (Note, however, that a substantial fraction of the variation in GNP growth is left unexplained by this equation.) A Breusch–Godfrey (BG) test for serial correlation yields an F-statistic of only 1.25, indicating that we fail to reject the null hypothesis that no serial correlation is present in the residuals.

GNP-targeting rule simulations. We use the GNP-targeting rule along with equation 2 to generate simulated growth rates for nominal GNP. Two versions of the GNP-targeting rule are used to simulate nominal GNP for the 1986–92 period; one version targets the log level of nominal GNP, whereas the other version targets the growth rate of nominal GNP.

In the first simulation, the GNP-targeting rule presumes that full employment output increases at a 3-percent annual rate each quarter.[2] The target level of nominal GNP is stipulated to increase at the same 3-percent annual rate. The GNP-targeting rule includes a feedback term in which deviations from target log level of nominal GNP affect the quantity of base growth. Accordingly, the GNP-targeting rule dictates that the Federal Reserve undertake open market operations to alter the volume of the monetary base. Figure 2 plots simulated and actual log level nominal GNP, plus the target path under the GNP-targeting rule. The simulation results suggest that adopting the GNP-targeting rule would have been successful in two respects. One is that such a rule effectively slows nominal GNP growth. The other is that variation around the presumed 3-percent target nominal

[2] *The 3-percent target rate follows the work of McCallum, who selected this rate because it is close to the historical average of (trend) output growth.*

GNP path is reduced.[3] The slowing of simulated nominal GNP growth is not smooth, however. In particular, simulated nominal GNP falls sharply relative to actual GNP in the period 1990:2–1991:2. This sharp deceleration in simulated nominal spending growth suggests that adoption of McCallum's GNP-targeting rule would have resulted in a more severe recession.

In a second simulation experiment, we assume that past deviations from the level of nominal GNP are forgiven; that is, the GNP-targeting rule stipulates that base growth responds (with a lag) to deviations from the target growth rate of nominal GNP.[4] The objective each period is not a particular (log) level of nominal GNP but a growth rate. Figure 3 plots actual and simulated nominal GNP growth for the case in which the growth-rate version of the GNP-targeting rule is used to generate the simulated path. Simulated nominal GNP grew at an average 2.5-percent annual rate, while actual GNP increased at an average 5.9-percent annual rate. As Figure 3 shows, the simulated growth rate is always below the actual growth rate of nominal GNP. The plot further suggests that simulated nominal GNP growth would have been more volatile than actual nominal GNP growth. With reference to a 3-percent target growth rate, the RMSD for simulated nominal GNP growth is 0.7 percent, compared with 0.6 percent calculated using actual GNP growth. The implication, therefore, is that applying the GNP-targeting rule would have been somewhat less successful than what actually occurred in terms of average variation around the 3-percent target growth rate. The evidence, therefore, suggests that adopting the growth-rate version of the GNP-targeting rule would have resulted in slower growth and more variability around the 3-percent target path than what the economy actually experienced during the 1986–92 period.

The increased variability of GNP growth under the GNP-targeting rule is largely the result of two factors: a short simulation period and

Figure 2
Nominal GNP Path, 1986:4–92:4, Using the GNP-Targeting Rule With a 3-Percent Target (Level)

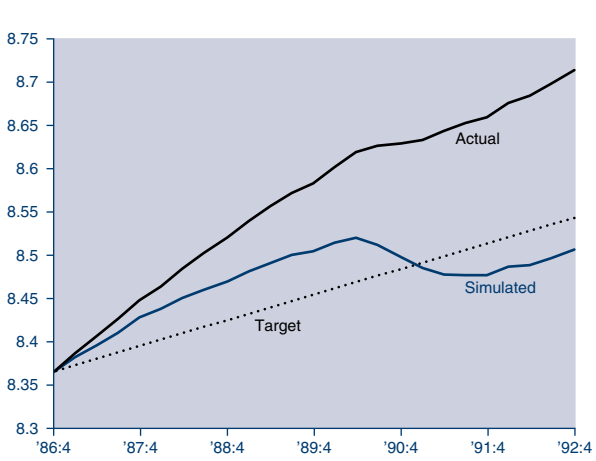
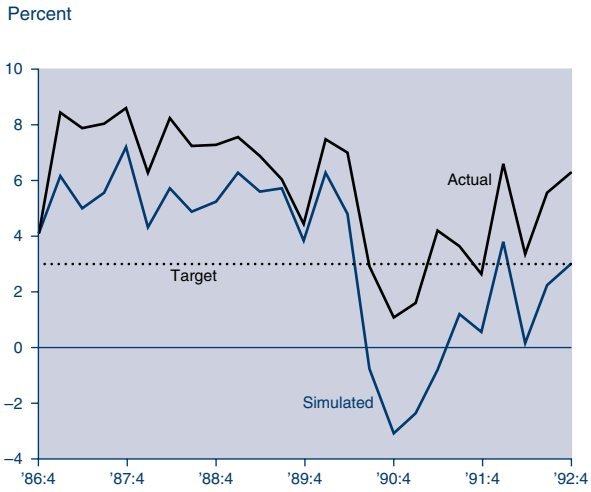


Figure 3
Nominal GNP Growth Rate Path, 1986:4–92:4, Using the GNP-Targeting Rule With a 3-Percent Target (Growth Rate)



[3] *On average, the GNP-targeting rule produces a nominal GNP path that increases at a 2.5-percent annual rate during the period 1986:4–1992:4, compared with actual nominal GNP, which grew at a 5.9-percent annual rate. Relative to the target level of GNP, the root-mean-squared deviation (RMSD) is 0.035 under the GNP-targeting rule but is 0.051 using the actual history of nominal GNP.*

[4] *The term* forgiven *refers to a policy in which past deviations from the target level are not relevant for current policy. In other words, the policymaker is forgiven for these past misses from the target level.*

sizable real shocks hitting the U.S. economy. Note that the largest difference between what actually occurred and what the GNP-targeting rule generates occurs in fourth-quarter 1990. This date corresponds with the run-up in oil prices that occurred between August and October 1990. During this period, actual nominal GNP growth did not fall as sharply as the simulation suggests it would have under the GNP-targeting rule.

Overall, our simulation results suggest that a GNP-targeting rule would have slowed nominal GNP growth compared with what actually occurred. This finding is not surprising in that many people would expect slower nominal GNP growth if the Federal Reserve abruptly switched to a zero-inflation goal when the environment has a positive inflation rate. In addition, our results suggest that compared with what actually occurred, a GNP-targeting rule would have been moderately more successful in reducing variation around a 3-percent nominal GNP level target, but somewhat less successful in reducing variation around a growth-rate target. Under either rule, there is a deceleration in GNP growth in 1990 that is much sharper than what actually occurred, suggesting that these rules, had they been implemented, could well have resulted in a more severe recession.

M2-targeting approach simulations. Next we simulate GNP using the M2-targeting approach. In this setup, we compare nominal GNP growth, M2 growth, and monetary base growth. Our objective is to gain some insight into whether monetary policy aimed (exclusively) at hitting the midpoint of the target M2 growth cones would have been sufficient to avoid the sharp deceleration of nominal GNP growth that occurred in 1990 and to instigate a stronger recovery during the 1991–92 period. This simulation exercise addresses the criticisms that slow M2 growth was a major factor in the recent downturn and slow recovery.

The simulations use the fourth-quarter simulated values of M2 to establish the target growth range for the next year. The Federal Reserve has the option every fourth quarter to establish its target growth ranges using either the realized fourth-quarter value of M2 or the fourth-quarter target value consistent with the midpoint of the previous year's target range. In the former case, in which the target "drifts," the Federal Reserve does not try to make up for missing the previous year's M2 target. The latter case expressly requires the Federal Reserve to stay on a course directly linked to previous targets. Thus, "no target drift" is exhibited in the latter policy course.[5] In the first set of simulations, we examine the case in which target drift is allowed to affect the M2 target growth ranges. Permitting target drift in these simulations is consistent with the Federal Reserve's historical procedure. The target-drift approach also seems to be in line with Friedman's and Buchanan and Fand's prescription for Federal Reserve policy.[6]

The target growth ranges and their midpoints are presented in Table 1. As can be seen, the midpoints have generally been ratcheted down over the 1987–92 period, albeit modestly. This is consistent with the notion that the M2-targeting approach seeks to gradually lower trend money growth and, hence, the inflation rate. Under certain conditions, the longer-run goals of the M2-targeting approach and the GNP-targeting rule would exactly coincide. If average M2 velocity growth is zero, the M2-growth midpoint could be set equal to 3 percent. Under these velocity growth assumptions, the M2-targeting rule examined here presumes that Federal Reserve policy seeks to slow nominal GNP growth at a less dramatic pace than the GNP-targeting rule. For this reason, a direct comparison of simulations from the M2-targeting approach and GNP-targeting rule is not made in this article. Given the short simulation period, the objectives of the two policy approaches are simply too different, making a direct comparison virtually meaningless. Instead, the simulations from the M2-targeting approach will provide some measure of how successful a "soft-landing" strategy might have been.

We begin our examination of the M2-targeting approach by looking at how nominal GNP growth would have evolved under this monetary policy. Figure 4 plots the growth rates of actual

[5] *In the monetary targeting literature, what we call "target drift" is sometimes called "base drift."*

[6] *In this first set of simulations, the forecast for the M2 money multiplier is simply the previous quarter's value. The key assumption is that the money multiplier is not related to the monetary base. This issue is discussed in the box on page 25 entitled "Caveats to Interpreting the Results."*

Table 1
Federal Reserve M2 Target Range

	Upper bound (Percent)	Lower bound (Percent)	Midpoint (Percent)
1987	8.5	5.5	7.0
1988	8.0	4.0	6.0
1989	7.0	3.0	5.0
1990	7.0	3.0	5.0
1991	6.5	2.5	4.5
1992	6.5	2.5	4.5

nominal GNP, together with the growth rate of nominal GNP generated under the M2-targeting approach. In contrast to the evidence from the GNP-targeting rule, simulated nominal GNP growth using the M2-targeting approach looks quite similar to actual nominal GNP growth. Simulated nominal GNP growth follows the same cycle that actual nominal GNP growth followed during the 1986–92 period, with a somewhat more exaggerated downward swing evident in the simulation. The average annual growth rate of simulated nominal GNP growth is 6.1 percent, only slightly higher than the 5.9-percent annual rate actually recorded. From Figure 4, we see that the higher average growth rate comes primarily from higher than actual growth in the 1987–89 period. The plots indicate, however, that after 1990, nominal GNP growth would have been stronger in 1991:3 and 1992:1, but weaker in 1992:2. Overall, the simulations indicate three similar features. Nominal GNP growth would have fallen just as much as actual nominal GNP growth did in 1990, the average growth rate of simulated nominal GNP is nearly identical to what actually occurred in 1991–92, and the stop-and-go pattern present in actual nominal GNP growth in 1991–92 is also present in simulated nominal GNP growth. Hence, there is little evidence in these simulations to support the argument that GNP growth would have been substantially stronger after 1990, the recession and recovery period, had the Federal Reserve followed an M2-targeting approach.

Figure 5 plots the actual and simulated path for M2 growth during the simulation period. From Figure 5 we see that, with a couple of exceptions, the M2-targeting approach results in M2 growth that is roughly similar to what actually occurred. There is one episode during 1991 in which M2 growth experienced a dramatic swing under the M2-targeting approach. From Figure 5, one could infer that the M2-targeting approach may not have resulted in M2 growth that would have been substantially different from its actual behavior. Summary statistics largely support this inference. The standard deviation is 4 percent under the M2-targeting approach, while the historical standard deviation is much lower, 2.3 percent. On average, M2 would have grown at a 4.4-percent annual rate if the Federal Reserve had adopted this version of the M2-targeting approach, slightly higher than the 4.1-percent rate actually recorded.

Critics of the Federal Reserve argue that deficiencies in M2 growth relative to its target were policy mistakes. One can judge whether a policy aimed at hitting the midpoint of the target ranges would have been superior to what actually occurred by plotting the outcome and the midpoint target line. This is done in Figure 5a. Note that the target drift in the simulated path of M2 (measured in log levels) differs from the target drift actually experienced. Consequently, the plot uses one target line for the actual path of M2 and

Figure 4
Nominal GNP Growth Rate Path, 1986:4–92:4, Using the M2-Targeting Rule

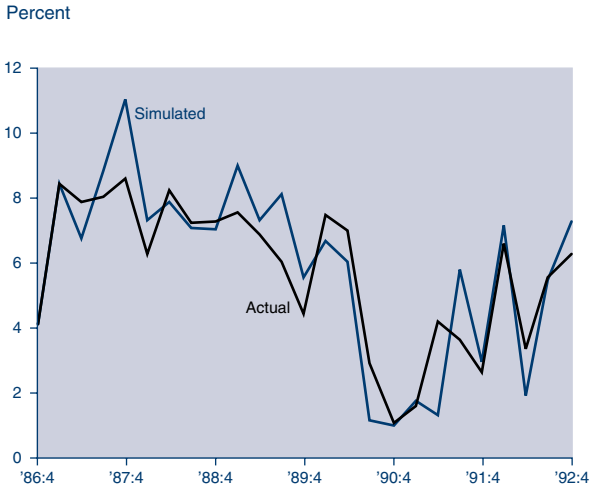


Figure 5
M2 Growth Rate Path, 1986:4–92:4, Using the M2-Targeting Approach

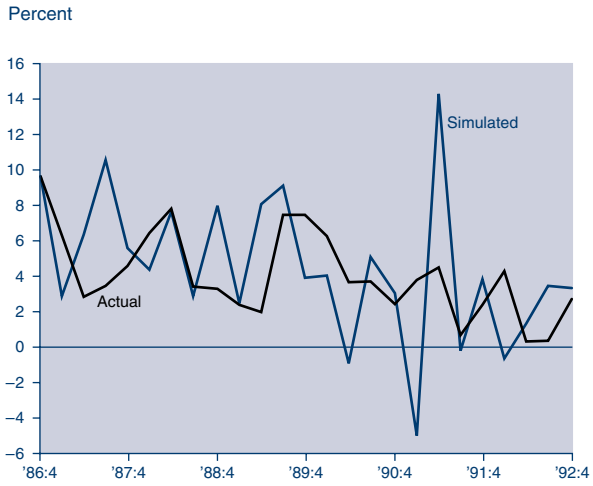
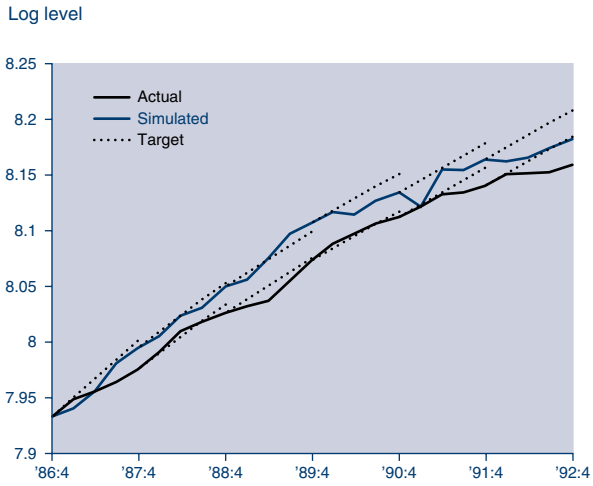


Figure 5a
M2 Path, 1986:4–92:4, Using the M2-Targeting Approach (Target Lines with Target Drift)



another for the simulated path. All comparisons are based on the difference between actual or simulated M2 and the corresponding target value. The plots do not strongly indicate that one path is substantially better than the other in terms of being closer to the target value. The RMSD is 0.95 percent for simulated M2 growth and 0.90 percent for actual M2 growth. The evidence suggests that the Federal Reserve would have done slightly worse in minimizing variation around its M2 target path had the Fed adopted the M2-targeting approach.[7]

In summary, the M2-targeting approach would have resulted in slightly higher growth rates for nominal GNP growth and M2 growth. However, the evidence does not support the claim that nominal GNP growth would have been substantially stronger during the 1990–92 period had the Federal Reserve simply focused exclusively on hitting its M2 target growth rate. In addition, because of forecasting errors permitted in this simulation, it is not clear that the Federal Reserve would have been substantially more successful in hitting its M2 target growth rates than it actually was.

Some extensions

We now present some extensions to the basic simulations considered above. In particular, we reconsider the GNP-targeting rule when the target growth path is allowed to more closely mimic the soft landing sought by the Federal Reserve. We also consider two extensions to the M2-targeting approach. First, we consider a case in which the Federal Reserve eliminates target drift. This extension is motivated by Feldstein's (1992) call for the Fed to "make up" for past deficiencies in M2 growth. Second, we examine the case in which the Federal Reserve perfectly hits its M2 target growth path, thus abstracting from M2-control problems.

The GNP-targeting rule with a softer landing. One might view the GNP-targeting rule as being too harsh, in the sense that the changeover to the

[7] *One potential criticism of the M2-targeting approach as implemented here is the method used to forecast the M2 money multiplier. Recall, we use last quarter's actual value of the M2 money multiplier as the forecast of this quarter's value. Since* $M2_t = mm2_t + B_t$ *(where* mm2 *denotes the log value of the M2 money multiplier), the variability in the M2 money multiplier is solely responsible for our finding that the M2-targeting approach would have been less accurate in hitting the M2 target than what actually occurred. We address forecasting concerns and discuss their impacts on nominal GNP growth in the next section.*

3-percent nominal GNP growth target is too abrupt. Suppose the Federal Reserve seeks a softer landing to its zero-percent inflation goal. How would the simulations differ if the target growth rate for nominal GNP were gradually lowered? This alternative is motivated largely by a reading of the FOMC minutes during the simulation period: the Federal Reserve was seeking a gradual approach toward its long-run goals, rather than the abrupt move toward zero inflation.

We assume that the nominal GNP growth target is equal to the midpoint of the M2 target growth range.[8] As we did in the GNP-targeting simulations, we examine cases in which the level and growth rate of nominal GNP serve as alternative targets. Figure 6 plots the simulated and actual values of nominal GNP for the soft-landing approach to the GNP-targeting rule. The target level of nominal GNP is included in the plot for reference. Figure 6 shows that simulated nominal GNP would have been virtually identical to actual nominal GNP until 1990. Beginning in 1990, simulated nominal GNP declines sharply toward the target level until second-quarter 1991, when simulated and actual nominal GNP begin once again to increase at about the same rate. Under the soft-landing approach to the GNP-targeting rule, simulated nominal GNP would have increased, on average, at a 4.8-percent annual rate from 1986 through 1992. (Recall that actual nominal GNP increased at a 5.9-percent average annual rate.) The RMSDs are 2.6 percent and 1.5 percent for simulated and actual nominal GNP, respectively. Thus, the evidence suggests that actual nominal GNP was closer to the target path than nominal GNP would have been under a GNP-targeting rule aimed at a soft landing.

Figure 6
Nominal GNP Path, 1986:4–92:4, Using the GNP-Targeting Rule with a Soft-Landing Target (Level)

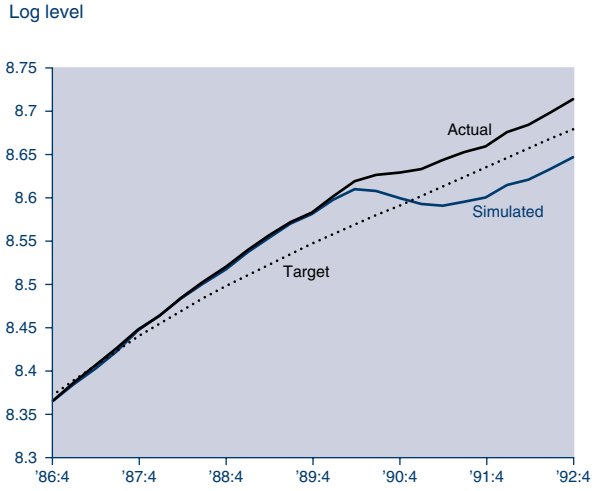


Figure 7
Nominal GNP Growth Rate Path, 1986:4–92:4, Using the GNP-Targeting Rule with a Soft-Landing Target (Growth Rate Target)

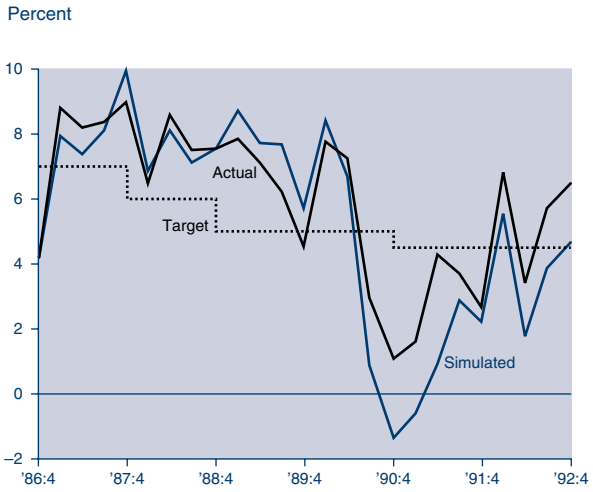


Figure 7 plots simulated nominal GNP growth when the target is the soft-landing nominal GNP growth rate. In addition, actual nominal GNP growth and the target line are plotted in Figure 7. Figure 7 reveals that simulated nominal GNP growth falls more sharply in the third and fourth

[8] *Simulated paths for monetary base and M2 are available from the authors upon request. There are any number of ways to identify the target growth rate for nominal GNP. The target growth rate is assumed to gradually approach the long-run rate. This means that the constant term and the target value in the feedback expression must be changed from the case in which nominal GNP was assumed to grow at a 3-percent annual rate each quarter. This identification is simple to implement. However, it presumes that the Federal Reserve believed that M2 velocity growth would be zero over the simulation period.*

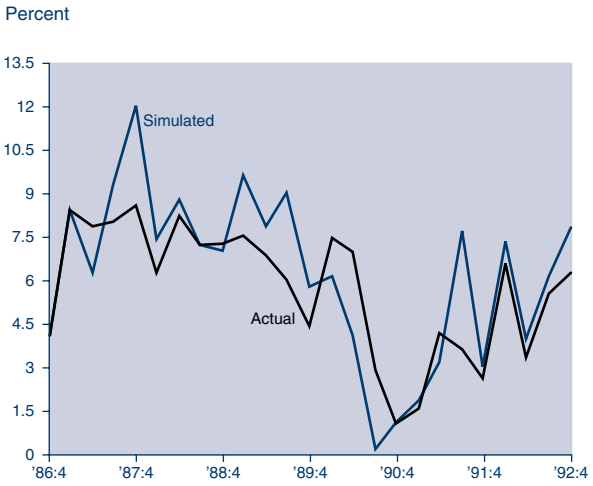
quarters of 1990 than does actual GNP growth. The average growth rate of simulated nominal GNP is 5.3 percent, about one-half a percentage point below the average growth rate of actual nominal GNP. The RMSD for simulated nominal GNP growth is 0.7 percentage points, higher than the RMSD of 0.5 percentage points using actual nominal GNP growth. This evidence again suggests that actual nominal GNP growth would have been closer, on average, to the soft-landing target than simulated nominal GNP growth would have been using the GNP-targeting rule.

In short, the extensions result in a much sharper decline in simulated nominal GNP in 1990 compared with what actually occurred. In addition, the evidence indicates that the average deviation from target nominal GNP is smaller if calculated using actual nominal GNP rather than simulated GNP. This finding is robust whether one chooses a level or growth rate target for nominal GNP. As with the 3-percent version of the GNP-targeting rule, the evidence suggests that a much sharper recession would have occurred. The evidence further indicates that the GNP-targeting rule with the soft-landing target would have been less successful in terms of hitting the targets paths than what actually occurred.

M2 targeting revisited. We now consider two modifications to the M2-targeting approach developed above. First, we eliminate drift in the M2 target path. In this case, we assume that the Federal Reserve uses its fourth-quarter target value as the starting point for the next year's target path. The no-drift approach was suggested by Feldstein in his prescription for monetary policy.[9] By eliminating target drift, past deficiencies in monetary policy are not forgiven.

Second, we examine the situation in which

Figure 8
Nominal GNP Growth Rate Path, 1986:4–92:4, Using the M2-Targeting Approach (No Target Drift)



the Federal Reserve has perfect foresight with respect to forecasts of the M2 money multiplier. This assumption removes the forecast error present in our earlier simulations. Moreover, it is straightforward to show that the perfect-foresight assumption is a strong version of the no-drift case.[10]

How much does nominal GNP growth change when the M2-targeting approach is implemented without target drift? Under the no-drift case with random-walk forecasts of the M2 money multiplier, the average growth of nominal GNP over the 1986–92 period is 6.3 percent, with a standard deviation of 2.7 percent. Simulated nominal GNP growth is 0.2 percentage points higher, on average, when drift in the M2 target is eliminated. Figure 8, which plots actual and simulated nominal GNP growth under the M2-targeting approach without target drift, shows that the simulated path is nearly identical to that generated with target drift. In particular, the slowdown in 1990 and the moderate, uneven growth during 1991–92 is present even when target drift is eliminated. One subtle difference occurs in second-quarter 1991. With target drift present, nominal GNP growth would have been substantially below what actually occurred (see Figure 4). In Figure 8, however, simulated nominal GNP growth in second-quarter 1991 would have been almost

[9] *The issue of target drift versus no target drift has a long history in the debate over monetary policy.*

[10] *Under the perfect-foresight assumption, target drift is implicitly eliminated. Because the Federal Reserve hits its target every fourth quarter under perfect foresight, the starting point for next year's target path is, by construction, the fourth-quarter target value. Thus, the perfect-foresight case is identical to jointly assuming no drift and no forecast error.*

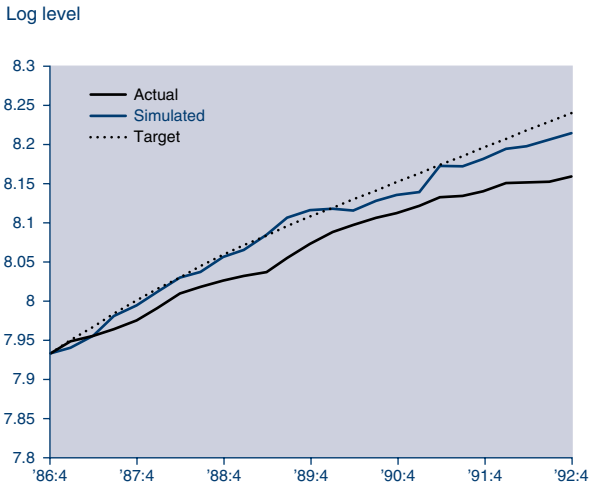
equal to what actually occurred. Thus, the evidence shows that eliminating target drift does generate somewhat stronger nominal GNP growth after 1990 than is generated when target drift is present. Any substantive gain, however, appears limited to second-quarter 1991.

Figure 9 plots the log level of M2 under the M2-targeting approach with target drift eliminated, along with the target path and actual M2. The vertical distance between the target line and the outcome from the M2-targeting approach in Figure 9 is due solely to forecast error of the M2 money multiplier. Figure 9 shows that the M2-targeting approach yields an M2 path consistently below the target path since 1990. The implication is that the random-walk forecasts of the M2 money multiplier consistently overpredict the multiplier value.[11]

In almost every quarter, simulated M2 is closer to the target value than actual M2. Despite the run of underpredicting the M2 money multiplier, simulated M2 would have been closer, on average, to a no-drift target than what actually occurred. To get an idea of the extent of the difference between the no-drift target value and the actual quantity of M2, by fourth-quarter 1992, M2 was $3,495.4 billion, whereas the no-drift target value would have been $3,789.9 billion. Hence, the actual value of M2 was roughly $294.5 billion, or 8.4 percent, below what the target would have been in the absence of target drift.[12]

Finally, how would nominal GNP have grown if one could perfectly forecast the M2 money multiplier? Here we use the actual value of the M2 money multiplier, implicitly assuming that this path is independent of the path for monetary base. Under the M2-targeting approach with perfect foresight, the average growth rate of nominal GNP is 6.5 percent, 0.6 percentage points higher than what actually occurred. Figure 10 plots nominal GNP growth generated under the perfect-foresight assumption, along with actual nominal GNP growth. In general, the path of simulated nominal GNP growth is roughly the same as what actually occurred. Even under the perfect-foresight assumption, simulated nominal GNP growth has the erratic stop-and-go pattern that characterizes actual GNP growth. In sum, nominal GNP growth with the perfect-foresight assumption does only modestly better than what actually occurred. Contradicting the critics, the evidence provided here does not support the notion that the M2-targeting approach would have resulted in a smaller decline in nominal GNP in 1990 than what actually occurred or that simulated nominal GNP growth would have experienced a smoother, stronger recovery compared with what actually occurred.

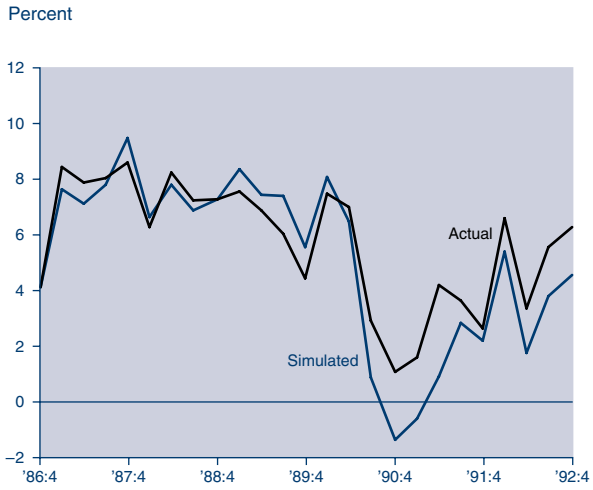
Figure 9
M2 Path, 1986:4–92:4, Using the M2-Targeting Approach (No Target Drift)



[11] *In a related article, John Duca (1993) suggests that standard M2 money demand functions systematically overpredicted M2 during the 1990–92 period. One interpretation is that some real shock was influencing M2. In our setup, such a shock would be picked up as changes in the M2 money multiplier.*

[12] *The astute reader may wonder why the sizable difference between actual and simulated M2 does not translate into a greater distinction between actual and simulated nominal GNP growth in Figure 8. The relationship between M2 growth and nominal GNP growth is M2 velocity growth. Note that M2 velocity growth is the difference between monetary base velocity growth and M2 money multiplier growth. With monetary base growth present explicitly in the nominal GNP growth equation, deviations from trend in monetary base velocity growth are present in the simulation. To the extent that deviations from trend in both M2 velocity growth and M2 money multiplier growth are negatively correlated, movements in M2 growth may not translate into movements in nominal GNP growth.*

Figure 10
Nominal GNP Growth Rate Path, 1986:4–92:4, Using the M2-Targeting Approach (Perfect-Foresight Assumption)



Summary and conclusions

We present simulations in this article that correspond to two alternative monetary policies proposed by critics of the Federal Reserve. We focus on how nominal GNP under each of these two policies would have behaved compared with what actually occurred. As such, the simulated paths for nominal GNP provide us with a measure of the costs and benefits of each strategy compared with what the U.S. economy actually experienced during the 1986–92 period.

We offer two main conclusions. First, our results suggest that a GNP-targeting rule of the type advocated by Bennett McCallum would have been effective in slowing nominal GNP growth relative to what was experienced between 1986 and 1992. The evidence also suggests, however, that such a GNP-targeting rule would have been less successful in terms of minimizing variability around the target value of nominal GNP. Indeed, except for the case in which the Federal Reserve targets the level of nominal GNP increasing at a fixed 3-percent annual rate, deviations from the target path are smaller for actual nominal GNP than what would have been generated under the GNP-targeting rule. The apparent cause behind nominal GNP's bumpy path is a series of real shocks influencing the economy. We interpret these findings as a first-pass attempt to measure the economic costs, in terms of business-cycle fluctuations, that a policymaker faces by adopting the GNP-targeting rule. The benefit of the rule is that the economy more quickly achieves its long-run goal of zero inflation. The costs, at least over the 1986–92 period, include slower growth and moderately greater volatility around nominal GNP target values and, possibly, a much steeper recession than that which actually occurred.

Our second conclusion is that using a monetary policy in which the Federal Reserve seeks only to hit the midpoint of its annual M2 target ranges, nominal GNP growth would have been roughly the same as that which actually occurred. Our simulations reveal that the average growth rate of GNP would have been only between 0.1 and 0.6 percentage points higher (depending on the assumptions underlying the simulations) than what actually occurred. Critics of recent monetary policy fault the Federal Reserve's failure to achieve its M2 targets for the evolution of economic activity in the 1991–92 period. Our results show that hitting the midpoints of the M2 target might well have not materially altered either the reduction in nominal GNP in 1990 or the moderate, stop-and-go pattern of nominal GNP growth experienced in 1991–92. Indeed, this outcome suggests that the culprit was not Fed actions, but real shocks affecting nominal GNP growth that the M2-targeting approach would largely have been unable to offset. In this sense, our simulations suggest that the slow growth of M2 is not the sole reason for the slow nominal GNP growth since 1986.

Our results explore issues raised by critics of Federal Reserve policy. Those who advocate a policy more oriented toward achieving zero inflation get a glimpse of what the implied costs are—slower nominal GNP growth but also greater volatility in nominal GNP growth for periods as long as twenty-five quarters. For those who want more robust monetary growth, specifically aimed at hitting the M2 target midpoints, the results show that very little would have been achieved in terms of promoting faster nominal GNP growth. A question for future research is whether this episode represents the typical monetary policy contribution to nominal GNP growth or whether the 1986–92 period was an aberrant one in some sense.

Caveats to Interpreting the Results

For the purposes of our research, we assume that the Federal Reserve uses the monetary base as the instrument of monetary policy beginning in the fourth quarter of 1986. Indeed, the equations in this article treat history as if the monetary base were the exogenous policy variable in determining nominal GNP growth between 1954 and 1992. Policy history, however, suggests that the Federal Reserve did not use the monetary base as its primary instrument during the postwar period. While the simulations follow the methodological approach adopted by McCallum (1987, 1988), important caveats could affect the results presented in this article.

The Lucas critique

In his criticism of econometric policy evaluation, Robert Lucas (1972) demonstrated how changing monetary policy rules would probably change the parameter estimates in reduced-form equations. The Lucas critique applies to both our nominal GNP growth equation and, implicitly, to our M2 money multiplier forecasts.

We assume that equation 2 is not affected when monetary policy switches from its (average) postwar behavior to the base rule or the M2-targeting approach. The fact that the equation is statistically stable over the 1986–92 period is not sufficient to rule out the possibility that the parameter estimates in equation 2 would change due to a change in the policy rule. The Lucas critique casts doubt over the simulated paths for nominal GNP growth. In partial defense of our approach, it should be noted that McCallum estimates several atheoretical models and some structural models to consider the robustness of the rule. Overall, the outcome of the rules-based policy is consistent across a variety of models. He (appropriately) recognizes the parameter estimates would not be the same under alternative policy rules but that such simulations provide a useful starting point.

The money multiplier forecasting equation

We assume that the path of the money multiplier is independent of the monetary base. Not only do we assume that changes in monetary policy do not affect the reduced-form model of the M2 money multiplier, we further assume that movements in the monetary base do not affect the multiplier. Work by Daniel Thornton and Michele Garfinkel (1991) suggests that the money multiplier may be sensitive to changes in the monetary base. If true, our simulations may have been affected by changes in the monetary base. Even so, our conclusions would be changed only if the M2 money multiplier would have been much lower as a result of adopting these policies. Under the M2-targeting approach, monetary base would grow at a faster rate to offset the decline in the money multiplier. Accordingly, the faster monetary base growth in equation 2 implies that nominal GNP growth would be higher. Interestingly, Thornton and Garfinkel's results suggest a positive association between changes in the monetary base and changes in the M2 money multiplier. Since the M2-targeting approach results in faster monetary base growth in our simulations, Thornton and Garfinkel's results suggest that the speedup in base growth would be moderated by faster growth in the M2 money multiplier.

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Appendix

In this appendix, we describe the two alternative monetary policies examined in this article. In particular, the approaches used to simulate the GNP-targeting rule and the M2-targeting approach are discussed in detail.

The GNP-targeting rule

The GNP-targeting rule used in our simulations is similar to the one proposed by Bennett McCallum (1987, 1988). The GNP-targeting rule is written as

$$\text{(A.1)} \qquad \Delta B_t = 0.00739 - 1/16\,[(Y_{t-1} - Y_{t-17}) - (B_{t-1} - B_{t-17})] + \lambda(Y^*_{t-1} - Y_{t-1}),$$

where ΔB is the growth rate of the monetary base (B is the log of the monetary base), Y is the log of nominal GNP, Y^* is the target value for (the log of) GNP, and λ ($0 \leq \lambda \leq 1$) is a parameter relating the current period's base growth to past deviations from the target growth rate of nominal GNP. Following McCallum, we assume that potential output increases at a constant 3-percent annual rate, or roughly the historical trend rate of real GNP growth. In a noninflationary environment, Y^* increases at the same 3-percent annual rate.

Equation A.1 has three components. The constant term — 0.00739 — stipulates that the base should increase at a quarterly value equal to a 3-percent annual rate. The second component is that base growth responds to changes in velocity growth. This aspect of the GNP-targeting rule has also been advocated by Allan Meltzer (1984). More specifically, each percentage point increase in the sixteen-quarter moving average of velocity growth, for example, is matched by a percentage point decrease in base growth. Lastly, the base responds to differences between realized nominal GNP and its target. In other words, there is a λ-percentage point increase in base growth for each percentage point that nominal GNP is below the previous quarter's target of GNP, all else being equal. In our simulations, the nominal GNP target is defined in both levels and growth rates. In the growth rate version, $\Delta Y^*_{t-1} - \Delta Y_{t-1}$ replaces the terms inside the parentheses in the feedback component.

The GNP-targeting rule with a growth rate target differs from McCallum, who specifies that deviations from last quarter's target level affects the current quarter's base growth. By specifying a GNP-targeting rule in which base growth responds to deviations from nominal GNP's target growth rate, an economy in which the average rate of inflation is zero is the appropriate notion of price stability for monetary policy's goal. In McCallum's level specification of the GNP-targeting rule, a stronger version — a constant long-run price level — is the price-stability notion adopted.

With equation A.1, one more equation is needed to implement the GNP-targeting rule; that is, the (stochastic) law of motion for nominal GNP. We assume that movements in nominal GNP are driven by equation 2 in the text.

The M2-targeting procedure. Following Friedman's (1992) suggestion, the monetary base is used as the instrument to hit the midpoint of the Federal Reserve's stated target ranges for the M2 aggregate. The M2 targeting approach is implemented by using a link between monetary base and M2. In the simple money multiplier model (Brunner 1968), M2 is represented as

$$\text{(A.2)} \qquad M2_t = B_t + mm2_t,$$

where $M2$ is the log of the M2 aggregate, B is the log of the monetary base, and $mm2$ is the log of the M2 money multiplier ($M2$/B). Equation A.2 indicates that a desired M2 level objective can be achieved by simply supplying the quantity of monetary base consistent with the M2 target, given the M2 money multiplier. In practice, however, the Federal Reserve may miss the M2 target value because the value of the money multiplier is not known with certainty at the time it determines the quantity of monetary base.

The M2 target value and the practical aspect of forecasting the money multiplier suggests rewriting equation A.2 as

$$\text{(A.2}') \qquad B_t = M2^T_t - mm2^f_t,$$

where $M2^T_t$ is the target (log) level for M2 this quarter, and $mm2^f_t$ is a forecast of this quarter's money multiplier. How closely the policymaker hits the M2 target depends in large part on how accurately the multiplier can be predicted.

To implement the M2-targeting policy, it is necessary to identify two values: the M2 target value and the forecast of the M2 money multiplier. The target value of M2 is derived using the midpoint of the Federal Reserve's announced target range. The starting point is the value of

(Continued on the next page)

Appendix—*Continued*

M2 in the fourth quarter of 1986. Because the target range is updated each year in the fourth quarter, there also arises an issue regarding the treatment of starting points in the fourth quarter of each successive year. Two approaches specify the first-quarter target value of M2 for each year. These two approaches are characterized as follows:

(A.3) $$M2_t^T = M2_{t-1} + g_t,$$

or

(A.4) $$M2_t^T = M2_{t-1}^T + g_t,$$

where g is the quarterly value of the midpoint of the target growth range. Equation A.3 specifies that the first-quarter target uses the actual value of M2 in the fourth quarter of the previous year. Since actual M2 can differ from its target value, A.3 permits deviations from fourth-quarter target to persist, thus introducing target drift into the policy. In contrast, equation A.4 specifies the first-quarter target value of M2 using the target value from the preceding fourth quarter. This approach requires that deviations from the target path are not permanent. Because fourth-quarter deviations from the target value are not passed on to the first-quarter target in A.4, this latter specification is referred to as the no target drift case. Both A.3 and A.4 are used in this article to identify the target path for M2 in the simulations.

Once the path for M2 is identified, the money multiplier is left to forecast. In general, the path for the money multiplier can be described by the equation

(A.5) $$mm2_t = A(L)X_{t-1} + \epsilon_t,$$

where X is a $1 \times K$ vector of exogenous (including predetermined) variables, $A(L)$ is the qth degree matrix polynomial in the lag operator L, and ϵ is a random-error term with mean zero and finite variance, σ_ϵ. Suppose the conditions are satisfied such that optimal multiplier forecast is given as

(A.5′) $$mm2_t^f = A(L)X_{t-1}.$$

We use two alternative methods to forecast the money multiplier. First, we assume that the M2 money multiplier follows a random walk.[1] Second, we consider a perfect-foresight model where $mm2_t^f = mm2_t$.

After identifying the path for the M2 target and obtaining the M2 money multiplier forecast, the path for monetary base is constructed using equation A.2′. Assuming equation 2 is the data-generating function for nominal GNP growth, the values of base money generated by both the base rule and M2-targeting approach are used to simulate a path for nominal GNP.

The path for nominal GNP growth also includes a nonmonetary-policy shock term. To measure the nonmonetary-policy shock, we estimate the nominal GNP growth equation (equation 1) over the period 1954:2–92:4, interpreting the residuals from this regression as the nonmonetary-policy shocks. The nonmonetary-policy shocks are denoted e_t. Let $\Delta Y_t = 0.0083 + 0.2864\ \Delta Y_{t-1} + 0.3335\ \Delta B_{t-1}$ be the value of nominal GNP growth consistent with the path for monetary base growth generated by the monetary policy. For the period 1986:4–92:4, the simulated value of nominal GNP growth is $\Delta Y_t^s = \Delta Y_t + e_t$. By the properties of regression analysis, the nonmonetary-policy shock is orthogonal to movements in the monetary base. The idea here is to measure those parts of nominal GNP growth that are not explained by movements in monetary base.

[1] We also used Box–Jenkins methods to forecast the M2 money multiplier, following work by Bomhoff (1977), Hafer and Hein (1984), and Johannes and Rasche (1987). The simulations with the time-series approach are negligibly different from those reported here.