



## Commentary

Kenneth N. Kuttner

**R**ecent efforts to understand the transmission of monetary policy have spawned a growing literature examining the response of financial markets to monetary policy.<sup>1</sup> Most of these studies assess the likely impact of unanticipated changes in the target federal funds rate, typically in a sample of well-defined policy “events” consisting of Federal Open Market Committee (FOMC) meeting days, plus the days of unscheduled funds rate changes. The problem is that economists do not always know the days on which the policy actions took place, especially in the early 1990s. Before the FOMC began announcing its policy actions in February 1994, there was often some confusion in the financial markets as to whether there had been a change in the funds rate target. This ambiguity has been largely dispelled by the FOMC’s announcements, although, as Hamilton (2008) notes, there has been occasional speculation that the Fed has surreptitiously changed the target rate.<sup>2</sup>

Hamilton’s (2008) paper is primarily an effort to address the issue of unknown event dates. It departs from the usual assumption that the days of policy actions (or possible actions) are known

and uses instead a signal-extraction approach to determine the market’s reaction without conditioning on this information. His elegant approach allows the market’s reaction to be estimated using the entire sample, not just event days. Moreover, the approach allows for the measurement of financial markets’ response to evolving expectations of future Fed actions, a feature that allows him to extract information even when the Fed does not surprise the markets.

The analysis focuses on the response of term interest rates, as in Kuttner (2001), although there is no reason the same approach could not also be applied to stock prices or exchange rates. The paper’s key empirical results largely confirm those reported elsewhere, which is good news for those of us who have used the much simpler event-study approach. The response of term interest rates to changes in the funds rate is uniformly less than one for one, and the effect on longer-term interest rates is generally less than it is for short-term rates. It is interesting to note, however, that this latter tendency is less pronounced than it is in Kuttner’s (2001) results.

My discussion will focus on two issues. The first point is somewhat technical, as it concerns the details of how the “noise” in the federal funds rate is modeled. The second is a more conceptual discussion of how the interpretation of the shocks identified by Hamilton’s procedure might differ from those in conventional event-study analyses.

---

<sup>1</sup> The first paper in this literature was Cook and Hahn (1989). Subsequent work includes Poole and Rasche (2000), Kuttner (2001), Poole, Rasche, and Thornton (2002), Gürkaynak, Sack, and Swanson (2005), and Bernanke and Kuttner (2005).

<sup>2</sup> So far, none of this speculation has proved to be correct.

---

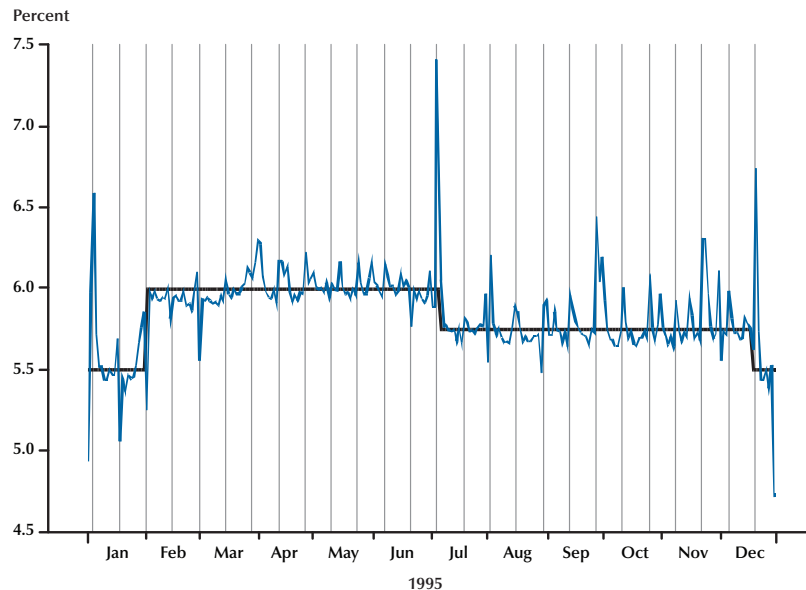
Kenneth N. Kuttner is a professor of economics at Williams College and a research associate at the National Bureau of Economic Research.

Federal Reserve Bank of St. Louis *Review*, July/August 2008, 90(4), pp. 399-403.

© 2008, The Federal Reserve Bank of St. Louis. The views expressed in this article are those of the author(s) and do not necessarily reflect the views of the Federal Reserve System, the Board of Governors, or the regional Federal Reserve Banks. Articles may be reprinted, reproduced, published, distributed, displayed, and transmitted in their entirety if copyright notice, author name(s), and full citation are included. Abstracts, synopses, and other derivative works may be made only with prior written permission of the Federal Reserve Bank of St. Louis.

## Figure 1

### The Target and Effective Funds Rates, 1995



NOTE: Vertical lines denote settlement Wednesdays.

## MODELING FUNDS RATE NOISE

Unlike the more common event-study analysis, Hamilton's signal-extraction method requires statistically modeling the noise process present in the daily effective federal funds rate.<sup>3</sup> Intuitively, the reason for this is that calculating the likely signal present in any given funds rate change requires some estimate as to the amount of noise likely to be present on any given day: The noisier the effective funds rate, the less likely it is that the observed change in the rate (and, by extension, the expected rate implied by the current-month futures contract) represents a policy change.

Observing that the magnitude of these deviations tends to increase over the course of a month, Hamilton models the targeting error as an auto-

regressive process whose innovation variance is a linear function of the day of the month (equations (8) and (9)). To get a sense of the magnitude of these targeting errors, his estimated parameters imply a 45-basis-point standard deviation on the 31st day of the month, 34 basis points on the 30th day, and 17 basis points on the 1st day.

Although this is not an unreasonable first pass, some refinements are possible. First, because there is no reason to think that the end-of-month volatility in 31-day months is greater than it is for 30-day months, it would be desirable to relax the assumption of 31-day months and replace equation (9) with

$$\hat{\epsilon}_d^2 = a + b \times 0.5^{(N_i - t_d)} + \hat{v}_d,$$

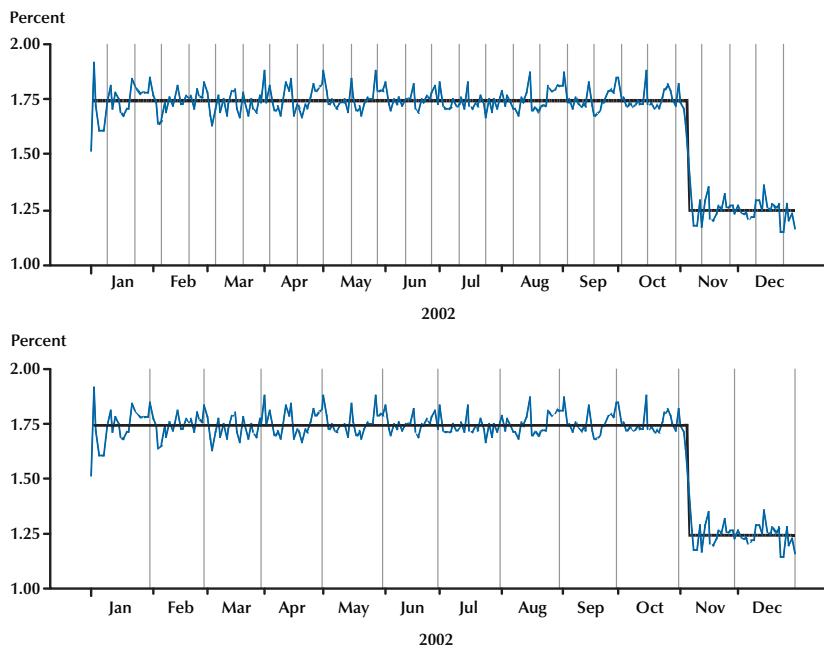
where  $N_i$  is the number of days in month  $i$ .

A second important refinement would be to account for the "settlement Wednesday" effect. Especially in the early part of the sample, the Wednesdays associated with the final day of the reserve maintenance period were often associated

<sup>3</sup> This noise results from the fact that the New York Fed's control over the funds rate is not absolute: Their Trading Desk injects just enough reserves to hit the target funds rate, given its assessment of the factors affecting reserve demand and supply. However, because of unanticipated changes in demand or supply, the actual ("effective") funds rate may differ from the target.

## Figure 2

### The Target and Effective Funds Rates, 2002



NOTE: The vertical lines in the top panel denote settlement Wednesdays; in the bottom panel they mark the last day of the month.

with extremely large funds rate spikes, as shown in Figure 1. (The vertical lines denote settlement Wednesdays.) To account for this pattern, a reasonable specification for the targeting error might be something like

$$r_d - \xi_d = 0.3(r_{d-1} - \xi_{d-1}) + 14W_d + 19M_d + \hat{e}_d$$

$$\hat{e}_d^2 = 179 + 196W_{d+1} + 1,422W_d - 27M_{d+1} + 1,481M_d + \hat{v}_d,$$

where  $W_d$  is a dummy equal to 1 on settlement Wednesdays and  $M_d$  is a dummy equal to 1 on the last day of the month. The other notation is the same as Hamilton's.<sup>4</sup>

Three features of this alternative specification are particularly interesting. One is that there are

significant *level* effects associated with settlement Wednesdays and with the last day of the month: Errors on these days tend to be positive. The second is that the standard deviation of the targeting error is 27 basis points higher on settlement Wednesdays. Third, unlike in Hamilton's specification, there is no evidence of a month-end effect, except on the very last day of the month.

Other information about changes in the federal funds market can also be brought to bear to further refine the specification. One such change is the shift to lagged reserve accounting as of July 30, 1998. Partly as a result of this change, the month-end and settlement-Wednesday volatility of the funds rate, as well as the overall variance, has fallen sharply in recent years. Post 1998, the standard deviation of the last-day-of-month targeting error is only 22 basis points (compared with Hamilton's last-day estimate of 45 basis points), and there is no longer any evidence of a settlement-Wednesday spike. That the Federal Reserve

<sup>4</sup> The parameter estimates are estimated using ordinary least squares from May 17, 1989, through October 12, 2007, excluding September 2001 and December 1999.

Bank of New York's Trading Desk has improved control over the funds rate is readily apparent in Figure 2. (The vertical lines in the top panel denote settlement Wednesdays; in the bottom panel they mark the last day of the month.)

Finally, in refining the estimates of the targeting error process, one would want to make allowances for special circumstances affecting the federal funds market. Hamilton already makes one such allowance, omitting September 2001 from the sample used for estimating the model. December 1999 should be dropped for similar reasons: With the Y2K changeover approaching, the Fed flooded the market with reserves in an effort to assuage liquidity concerns. Consequently, the funds rate traded as much as 150 basis points below its target as the end of the month approached. Including atypical episodes, such as this one, could overestimate the amount of noise normally present in the effective funds rate.

It is important to emphasize that none of these observations undercuts in any way the soundness of Hamilton's basic approach. In particular, I can think of no reason to suspect that any misspecification in equations (8) or (9) would necessarily bias the parameter estimates reported in Hamilton's Table 2. Instead, it is more akin to the problem of choosing inappropriate weights in a weighted-least-squares procedure: In that case, while the parameter estimates may not be biased, the procedure is not making optimal use of the information contained in the data.

## ON INTERPRETING THE "HAMILTON SHOCKS"

The second part of my remarks concerns the interpretation of the funds rate shocks underlying Hamilton's procedure. By way of background, it may be useful to distinguish between two different regimes. In the first regime, changes in the funds rate target are equally likely on any day—but changes in the target are not announced by the FOMC. This regime plausibly corresponds to the pre-1994 world, in which policy actions were generally not disclosed and a significant fraction of rate changes took place between meetings. In

this regime, day-to-day changes in the futures-implied rate on any particular day would plausibly represent the market's inference as to whether the Fed had changed its target on that day.

In the second regime, which is more relevant post 1994, the days of the rate changes are largely known; and even when policy actions are taken between FOMC meetings, the changes are announced, and not in response to any specific news that might have arrived on that day. In this case, the day-to-day change in the futures rate on days *other than* "event" days (i.e., days of rate changes or FOMC meetings) would reflect changes in the market's expectation of the target funds rate on some *future* date.

Now consider the sources of news that could affect policy expectations. One source is new macroeconomic information: higher-than-expected employment, for example, or lower-than-expected inflation. The other source would be changes in the Fed's perceived preferences regarding inflation vis à vis output—the presumed source of monetary policy "shocks," as the term is commonly used in the literature.

These distinctions bear on how we should interpret the information contained in alternative measures of monetary policy shocks or surprises. In the second regime, policy surprises (i.e., changes in the futures rate) occurring on event days are more likely to be driven by the second category of news: changes in the Fed's perceived preferences.<sup>5</sup> Changes occurring on days *other than* event days would, for the most part, be associated with the arrival of economic news. In the first regime, however, day-to-day changes in the futures rate could result from *either* source: changes in policy preferences *or* macro news.

Thus, conditioning on known event days allows the econometrician to distinguish between the endogenous response of policy expectations to new economic information and otherwise inexplicable policy shocks. This distinction can be critically important in assessing the financial market response to monetary policy. As shown in

<sup>5</sup> It is also possible that the change would be interpreted as the Fed reacting to private information, although the evidence for this view is weak; see Faust, Swanson, and Wright (2004).

Bernanke and Kuttner (2005), the stock market's reaction to unanticipated funds rate changes is effectively zero when those changes occurred on the same day as an employment report, a pattern that was common in the early 1990s. Any analysis that failed to make this distinction could provide a misleading answer to the primary question of interest to policymakers: how the market will react to an unexpected change in the fund rate target.

Within Hamilton's framework, it would be easy to make this distinction. In fact, it suggests an interesting test of the null hypothesis that the response to (calendar-adjusted) changes in the futures rate is the same on event days as it is on non-event days. The alternative, of course, would be that the reaction differs in a systematic way. Given the richness of the dataset, it would be possible to go further and distinguish between event days and the days of specific economic news releases (e.g., inflation, employment, gross domestic product). This assumes that the relevant days are known, of course—but after 1994, this is not such a bad assumption. Econometrically, the only modification to Hamilton's procedure would be to allow the relevant dummy variables to interact with the slope coefficient in equation (26).

## CONCLUSION

None of these points takes away from the bottom line: The paper is a classic Hamilton time-series *tour de force*. It addresses an important question using elegant econometrics, and it incorporates a detailed knowledge of the market for federal funds. Using more of that knowledge to refine the targeting-error specification would enhance an already fine paper, as would further efforts to understand what the shocks in the model really represent.

## REFERENCES

- Bernanke, Ben S. and Kuttner, Kenneth N. "What Explains the Stock Market's Reaction to Federal Reserve Policy?" *Journal of Finance*, June 2005, 60(3), pp. 1221-57.
- Cook, Timothy and Hahn, Thomas. "The Effect of Changes in the Federal Funds Rate Target on Market Interest Rates in the 1970s." *Journal of Monetary Economics*, November 1989, 24(3), pp. 331-51.
- Faust, Jon; Swanson, Eric T. and Wright, Jonathan H. "Do Federal Reserve Policy Surprises Reveal Private Information About the Economy?" *Contributions to Macroeconomics*, 2004, 4(1), pp. 1-29.
- Gürkaynak, Rafet S.; Sack, Brian P. and Swanson, Eric T. "Do Actions Speak Louder Than Words? The Response of Asset Prices to Monetary Policy Actions and Statements." *International Journal of Central Banking*, June 2005, 1(1), pp. 55-93.
- Hamilton, James D. "[Assessing Monetary Policy Effects Using Daily Federal Funds Futures Contracts.](#)" Federal Reserve Bank of St. Louis *Review*, July/August 2008, 90(4), pp. 377-93.
- Kuttner, Kenneth N. "Monetary Policy Surprises and Interest Rates: Evidence from the Fed Funds Futures Market." *Journal of Monetary Economics*, June 2001, 47(3), pp. 523-44.
- Poole, William and Rasche, Robert H. "Perfecting the Market's Knowledge of Monetary Policy." *Journal of Financial Services Research*, December 2000, 18(2/3), pp. 255-98.
- Poole, William; Rasche, Robert H. and Thornton, Daniel L. "[Market Anticipations of Monetary Policy Actions.](#)" Federal Reserve Bank of St. Louis *Review*, July/August 2002, 84(4), pp. 65-93.

