# Monetary Tightening Cycles and the Predictability of Economic Activity

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**Abstract**

Ten of thirteen monetary tightening cycles since 1955 were followed by increases in unemployment, three were not. The term spread at the end of these cycles discriminates between subsequent outcomes, but levels of nominal or real interest rates do not.

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## 1 Classifying monetary tightening cycles

The extent to which real activity slows after monetary tightening is difficult to gauge in real time. In this note, we investigate the ability of financial indicators to discriminate between tightening cycles that are followed by declining real activity and those that are not. We investigate the forecasting power of the term spread, levels of nominal and real federal funds rates, the difference between the real federal funds rate and its long-run equilibrium value, and the spread between commercial paper and Treasury bill rates.

We consider tightening cycles since 1955 and assume a cycle ends when either of these criteria is met: (1) the federal funds rate is higher than at any time from 12 months before to 9 months after and is at least 50 basis points higher than at the beginning of this period, or (2) the federal funds rate is higher than at any time from 6 months before to 6 months after and is 150 basis points higher than the average at these endpoints.

The application of these rules leads to reasonable results, as shown in Figure 1. The ends of cycles (thirteen altogether) are indicated by vertical lines and NBER recessions by shading. The first criterion by itself identifies most of the cycles, but misses three (Aug. 1971, Sept. 1973, Apr. 1980) that involve substantial increases in the funds rate. Two of these three were followed by recessions.

Our dating of the ends of monetary cycles generally follows the chronology of the beginnings of tightening cycles from Romer and Romer (1989), although we tend to identify more cycles. Each Romer date within our sample period is followed directly by a cycle end date, with the lone exception corresponding to two consecutive Romer dates (Aug. 1978 and Oct. 1979) between which the federal funds rate essentially did not fall.

## 2 Forecasting real activity at the end of tightening cycles

Is it possible to anticipate the evolution of real activity following the endings of tightening cycles? We investigate the forecasting ability of five financial indicators. The level of the nominal federal funds rate as a measure of monetary policy stance is proposed by Bernanke and Blinder (1992) and Bernanke and Mihov (1998), who examine its usefulness in an identified VAR framework. Laubach and Williams (2003) propose the gap between the current real interest rate and the natural rate of interest as measure of monetary tightness.

We use three alternative measures of the real federal funds rate: adjusted by CPI inflation over the last 12 months, adjusted by expected core PCE inflation, and the gap between the latter and the Laubach-Williams equilibrium real rate. We follow Laubach and Williams (2003) in estimating PCE inflation expectations as the four-quarter ahead percentage change predicted from an AR(3) model that is fitted to the previous 40 quarters. We use the equilibrium real rate from Laubach and William (2003), who estimate it together with the natural rate of output and its trend growth rate in a three-equation macro model.

We also examine the spread between the 10-year constant maturity Treasury rate and the bond-equivalent secondary market rate on 3-month Treasuries, which Estrella and Hardouvelis (1991) and others have shown forecasts recessions well, and the spread between commercial paper and Treasury bill rates, as in Friedman and Kuttner (1998). All interest rates are monthly averages of daily data.

We use two measures of subsequent real activity: conventional NBER turning points and the maximum cumulative increase in the unemployment rate. The unemployment rate measure avoids the implicit discretion in the NBER dating, relying instead on a mechanical rule. Each measure is converted into a dummy by asking whether a recession ensued within 18 months of

the end of the tightening cycle, or whether the unemployment rate increased over the same period.

In Table 1, we list the end dates of tightening cycles and our financial and real indicators.[1] Of the thirteen cycles, only three did not lead to an increase in unemployment: Aug. 1971, Aug. 1984, and Apr. 1995. The other ten were followed by an increase in unemployment and, with one exception, by an NBER-dated recession. The only discrepancy between the unemployment and NBER indicators is after Nov. 1966, a period that has been called a credit crunch or a mini-recession by many and an actual recession by Friedman (1968).

In Figure 2, we plot the (maximal) increase in the unemployment rate after each monetary peak against the term spread in the month of the peak. An intriguing pattern emerges. The three peaks that were not followed by an increase in unemployment were accompanied by a term spread of 125 basis points or more. The remaining ten fed funds peaks were accompanied by a term spread below 35 basis points at the time of the policy reversal.

In Figure 3, we plot the relationships between other interest rates measures at the end of tightening cycles and subsequent changes in unemployment. This figure clearly suggests that none of the other financial indicators is helpful in classifying the response of real activity to monetary policy tightening. To confirm this, however, we apply two formal statistical techniques.

## 3 Statistical analysis

[1] Data availability precludes calculation of the first two observations for indicators based on core PCE inflation.

Discriminant analysis is a natural method for our problem. We would like to use a financial indicator $x_i$ (where $i$ runs over the $n$ = 13 ends of tightening cycles) to classify the cases into one of two "populations," one in which real activity slows down and one in which it does not. Let $y_i \in \{0,1\}$ be an indicator of an economic slowdown, based on either NBER dates or the rise in unemployment. Discriminant analysis provides a rule of the form: classify an observation as $y_i = 1$ if $f(x_i) > 0$ and otherwise as $y_i = 0$.

When $x$ is a vector of indicators, the sample discriminant function is

$$f(x) = \log(\hat{\pi}_1/\hat{\pi}_0) - 1/2\left(\hat{\mu}_1'\hat{\Sigma}^{-1}\hat{\mu}_1 - \hat{\mu}_0'\hat{\Sigma}^{-1}\hat{\mu}_0\right) + (\hat{\mu}_1 - \hat{\mu}_0)'\hat{\Sigma}^{-1}x, \qquad (1)$$

where $\hat{\pi}_j$ is the sample frequency of $y_i = j$, $\hat{\mu}_j$ is the sample mean of $x_i$ conditional on $y_i = j$, and

$$\hat{\Sigma} = \frac{1}{n-2}\left[\sum_{y_i=1}(x_i - \hat{\mu}_1)(x_i - \hat{\mu}_1)' + \sum_{y_i=0}(x_i - \hat{\mu}_0)(x_i - \hat{\mu}_0)'\right].$$

Our second measure is based on a logistic regression of the form

$$P(y_i = 1) = F\left(\hat{\beta}_0 + \hat{\beta}_1 x_i\right), \qquad (2)$$

where $F$ is the cumulative logistic distribution. See Efron (1975) for a comparison of the two approaches.

Consider first the case of the term spread, with real activity defined in terms of NBER recessions. The discriminant condition for classifying an end of tightening as a slowdown is $x < 0.72$. Table 1 shows that the only observation not classified correctly is Nov. 1966. The spread also does well when gauged by the logit standard, especially in relative terms, with an R-squared of 55%.

The other five financial indicators fare much worse with discriminant analysis. In each case, the discriminant condition cannot sort out the differences, classifying all the observations as slowdowns. The logit results lead to a similar conclusion, although the paper-bill spread performs much better than the others.

Results using the unemployment rate as a measure of real activity are qualitatively similar. The one salient difference is that the term spread has a perfect record using either discriminant or logit analysis.

The statistical reason for the relative success of the term spread is simple. Its range of values when unemployment subsequently rises is -2.38 to 0.31%, as compared with 1.25 to 1.82% when unemployment declines. Not only is there no overlap, but there is a substantial gap between the two ranges. In contrast, the non-recessionary observations for each of the other variables are interspersed among the recessionary cases, as Figure 3 shows.

Note finally that classification rules other than $f(x_i) > 0$ are possible, such as rules that cap the probability of one type of classification error. For instance, when the unemployment indicator is used, the rule that classifies $y = 1$ when the term spread is less than 2 basis points limits the probability of misclassifying an expansion as a recession to 5%. Similarly, the rule that $y = 1$ when the term spread is less than 90 basis points limits the probability of misclassifying a recession as an expansion to 5%.

More generally, there is no guarantee that the future performance of the term spread will match the historical record since 1955. It seems clear from the evidence, however, that its potential usefulness as a leading indicator in periods of monetary tightening should not be overlooked.

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**Table 1: End of Monetary Tightening Dates and Financial and Real Indicators**

| End of Tightening Date | Fed Funds Rate | Real Fed Funds Rate (Lagged CPI) | Real Fed Funds Rate (Expected PCE) | Real Fed Funds Gap (Expected PCE) | 10-Year / 3-Month Spread | Commercial Paper - Bill Spread | Subsequent Change in Unemployment | NBER Recession Indicator |
|---|---|---|---|---|---|---|---|---|
| Oct-57 | 3.50 | 0.60 | NA | NA | 0.31 | NA | 3.0 | 1 |
| Nov-59 | 4.00 | 2.63 | 1.83 | NA | 0.28 | -0.04 | 1.3 | 1 |
| Nov-66 | 5.76 | 2.26 | 2.47 | -2.34 | -0.31 | 0.22 | 0.4 | 0 |
| Aug-69 | 9.19 | 3.90 | 4.63 | -0.52 | -0.51 | 0.77 | 2.6 | 1 |
| Aug-71 | 5.56 | 1.29 | 1.79 | -2.16 | 1.51 | 0.29 | -0.1 | 0 |
| Sep-73 | 10.78 | 3.68 | 4.46 | 1.39 | -1.50 | 1.28 | 3.8 | 1 |
| Jul-74 | 12.92 | 2.00 | 2.56 | -1.31 | 0.00 | 3.33 | 3.5 | 1 |
| Apr-80 | 17.61 | 3.99 | 8.25 | 5.70 | -2.38 | 0.96 | 1.0 | 1 |
| Jun-81 | 19.10 | 9.84 | 13.32 | 9.49 | -2.04 | -0.16 | 3.3 | 1 |
| Aug-84 | 11.64 | 7.43 | 7.90 | 5.36 | 1.82 | -0.21 | -0.1 | 0 |
| Mar-89 | 9.85 | 5.07 | 5.92 | 2.34 | 0.21 | 0.58 | 0.9 | 1 |
| Apr-95 | 6.05 | 2.97 | 3.91 | 2.53 | 1.25 | 0.16 | -0.1 | 0 |
| Jul-00 | 6.54 | 3.00 | 4.75 | 1.77 | -0.09 | 0.38 | 1.7 | 1 |

Notes: All variables are expressed in percent, except for the dichotomous NBER indicator. The real fed funds gap is computed by subtracting from the real PCE-adjusted rate the Laubach-Williams (2003) one-sided estimate of the equilibrium real rate for the quarter in which the monthly observation falls.

**Table 2: Statistical Analysis of the Relation between Interest Rates and Real Activity**

| Measure of Real Activity: | NBER Recessions | | | Increase in Unemployment Rate | | |
|---|---|---|---|---|---|---|
| Indicator | Discriminant condition | Correctly classified | Logit R-Squared | Discriminant condition | Correctly classified | Logit R-Squared |
| Term Spread | < 0.72 | 12/13 | 0.550 | < 0.93 | 13/13 | 1.000 |
| Fed Funds Rate | > 2.58 | 9/13 | 0.104 | > -5.33 | 10/13 | 0.041 |
| Real Fed Funds Rate (CPI) | > -11.57 | 9/13 | 0.005 | < 45.06 | 10/13 | 0.001 |
| Real Fed Funds Rate (Core PCE) | > 0.35 | 8/12 | 0.068 | > -11.63 | 9/12 | 0.011 |
| Real Fed Funds Gap (PCE) | > -2.49 | 7/11 | 0.068 | > -93.57 | 8/11 | 0.000 |
| Commercial Paper-Bill Spread | > -0.27 | 8/12 | 0.280 | > -0.90 | 9/12 | 0.236 |

Note: Discriminant conditions are expressed in percent. Logit R-squared is the Estrella (1998) measure of fit.

**Figure 1: The Fed Funds Rate, Ends of Tightening Cycles (grid), and NBER Recessions (shading)**

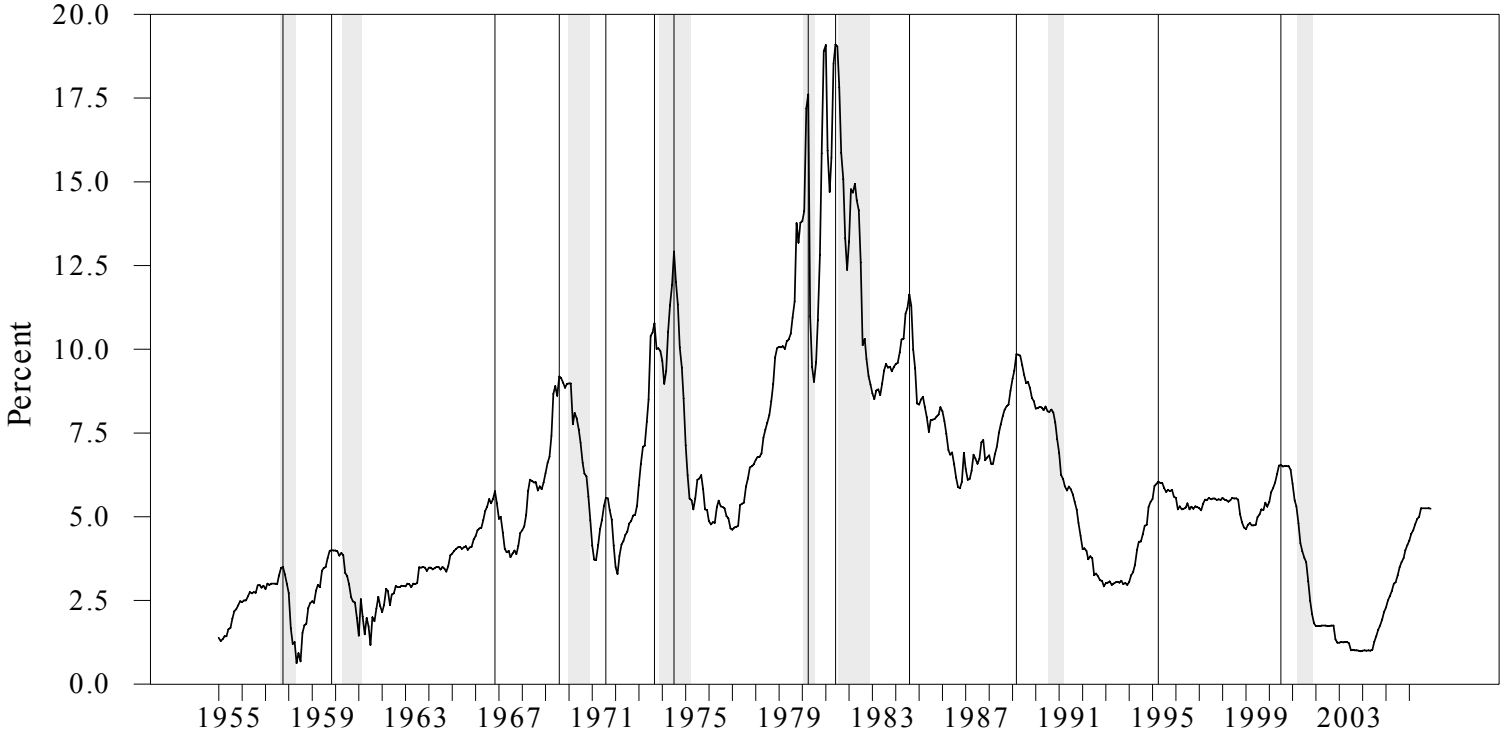
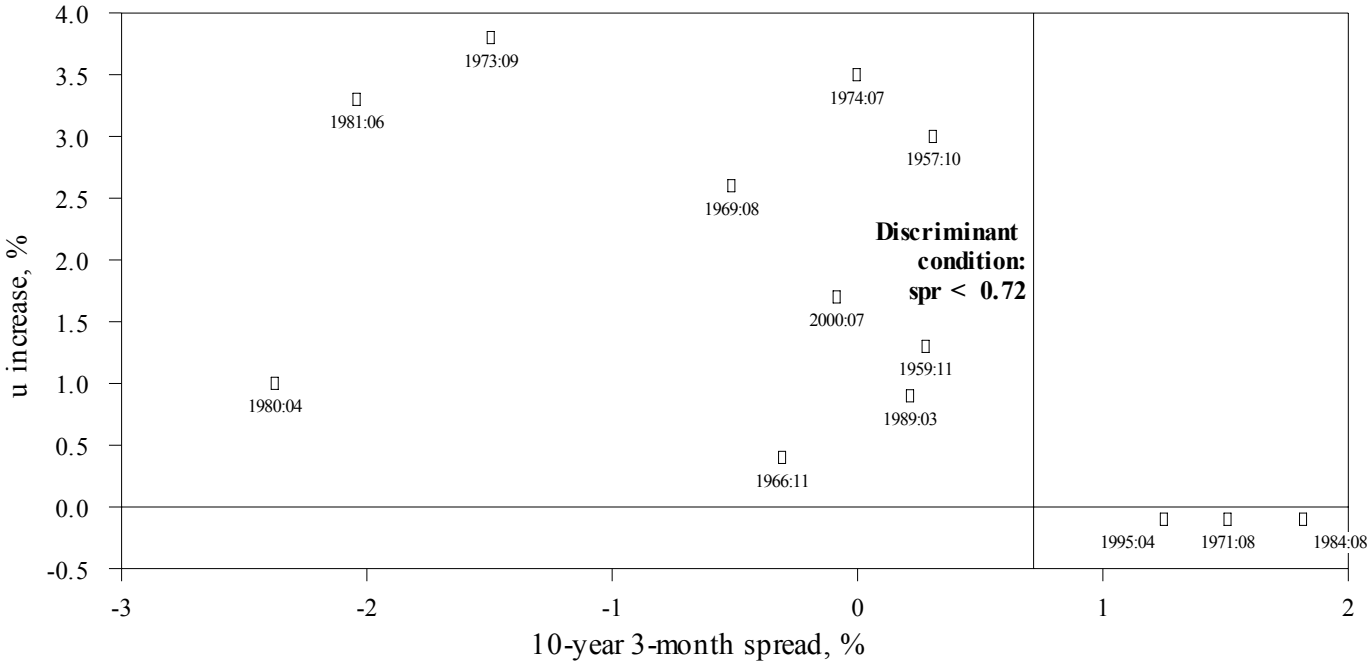


**Figure 2: The 10-year minus 3-month spread and subsequent unemployment increases**



## Figure 3: The Fed Funds Rate and Subsequent Unemployment Changes