Monetary Tightening Cycles and the Predictability of Economic Activity

by Tobias Adrian and Arturo Estrella*

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Abstract

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

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* Both authors: Capital Markets Research Function, Federal Reserve Bank of New York, 33 Liberty Street, New York, NY 10045. Corresponding Author: Tobias Adrian, tobias.adrian@ny.frb.org, tel. 1-212-720-1717, fax 1-212-720-1582.

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1 Classifying monetary tightening cycles

The conventional objective of monetary policy tightening is to increase the cost of borrowing, which tends to slow down real activity and hence inflationary pressure. The extent to which future real activity is reduced depends on the degree of tightening and is difficult to gauge in real time. In this paper, we investigate the ability of financial indicators to discriminate between tightening cycles that are followed by declining real activity and those that are not. In particular, we investigate the forecasting power of the term spread, levels of nominal and real federal funds rates, and the difference between the real federal funds rate and its long-run equilibrium value.

We investigate monetary tightening cycles since 1955, for which we can obtain consistent monthly data. In general terms, we define the end of a tightening cycle as the month in which the federal funds rate peaks, after steady increases over a period of six months to one year. More precisely, we assume cycles end when either of these two 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 are indicated by vertical lines and NBER recessions by shading. Over the last 50 years, we identify thirteen tightening cycles. The first criterion (longer window) 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.[1] 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 ability of five financial indicators to forecast the response of the real economy to monetary tightening. 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 (together with controls for inflation). 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, as in Laubach and Williams (2003), and the gap between the latter and the Laubach-Williams equilibrium real rate. Finally, we use the spread between the 10-year constant maturity Treasury rate and the bond-equivalent secondary market

[1] Romer and Romer (1989) classify the beginnings of tightening cycles between 1947 and 1988 by investigating the minutes of the Federal Open Market Committee for language that signals a reversal in monetary policy. They identify Oct. 1947, Sep. 1955, Dec. 1968, Apr. 1974, Aug. 1978, Oct. 1979, and Dec. 1988 as beginnings of monetary cycles.

rate on 3-month Treasuries, which Estrella and Hardouvelis (1991) and others have shown forecasts recessions well. All interest rates are monthly averages of daily data.

We use two measures of subsequent real activity: conventional NBER turning point dates and the maximum cumulative increase in the unemployment rate in the 18 months following the end of each tightening cycle. NBER recession dates are widely used and do not require much discussion. The unemployment rate measure avoids the implicit discretion in the NBER dating, relying instead on a mechanical rule. Each measure of activity 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 dates of the tightening cycles together with our financial and real indicators.[2] Among the thirteen monetary tightening cycles over the past 50 years, only three did not lead to an increase in unemployment in the 18 months following the peak: Aug. 1971, Aug. 1984, and Apr. 1995. The other ten tightening cycles were followed by an increase in unemployment and in all but one case by an NBER-dated recession. We see in the last two columns that 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 during the month of the peak for each of the twelve cases since 1955. In the figure, 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

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[2] Note that data availability precludes the calculation of the first two observations for the two indicators based on core PCE inflation.

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

Discriminant analysis seems like a natural method to apply to 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

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

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

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

When x is scalar, the function (1) is monotonic and the discriminant condition may be expressed as an inequality in x.

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

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

where F is the cumulative logistic distribution. Efron (1975) shows that discriminant analysis is typically, though not always, more efficient than logistic regression in classifying samples from two populations. We therefore present in Table 2 results based on both measures.

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 $x < 0.72$. A look at the values of the variables in Table 1 shows that the only observation not classified correctly is Nov. 1966. It is known from the literature that this is the one "false positive" frequently encountered when using the term spread to predict NBER recessions. The spread also does well when gauged by the logit standard, especially in relative terms, with an R-squared of 55%.

The other four financial indicators fare much worse by either statistical technique. 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 nominal and the PCE-adjusted federal funds rates have R-squared slightly above 10%. The real funds rate gap does a bit worse, which may be a consequence of the high level of uncertainty in the estimation of the equilibrium rate, as reported by Laubach and Williams (2003).

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. In contrast, the logit R-squared for the other indicators is somewhat worse than when NBER recessions are used to represent real activity.

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. For instance, recessionary figures for the real funds rate (CPI) have been as low as 0.63% and as high as 9.84%, which encompasses the range of 1.29 to 7.43% for the non-recessionary cases.

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	Subsequent Change in Unemployment	NBER Recession Indicator
Oct-57	3.50	0.63	NA	NA	0.31	3.0	1
Nov-59	4.00	2.63	NA	NA	0.28	1.3	1
Nov-66	5.76	2.36	2.47	-2.34	-0.31	0.4	0
Aug-69	9.19	3.90	4.63	-0.52	-0.51	2.6	1
Aug-71	5.56	1.29	1.79	-2.16	1.51	-0.1	0
Sep-73	10.78	3.68	4.46	1.39	-1.50	3.8	1
Jul-74	12.92	2.00	2.56	-1.31	0.00	3.5	1
Apr-80	17.61	3.99	8.25	5.70	-2.38	1.0	1
Jun-81	19.10	9.84	13.32	9.49	-2.04	3.3	1
Aug-84	11.64	7.43	7.90	5.36	1.82	-0.1	0
Mar-89	9.85	5.07	5.92	2.34	0.21	0.9	1
Apr-95	6.05	2.97	3.91	2.53	1.25	-0.1	0
Jul-00	6.54	3.00	4.75	1.77	-0.09	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	10/13	0.104	> -5.33	10/13	0.041
Real Fed Funds Rate (CPI)	> -12.33	10/13	0.005	< 47.70	10/13	0.001
Real Fed Funds Rate (Core PCE)	> 2.57	8/11	0.135	> -3.87	8/11	0.032
Real Fed Funds Gap (PCE)	> -2.49	8/11	0.068	> -93.57	8/11	0.000

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)

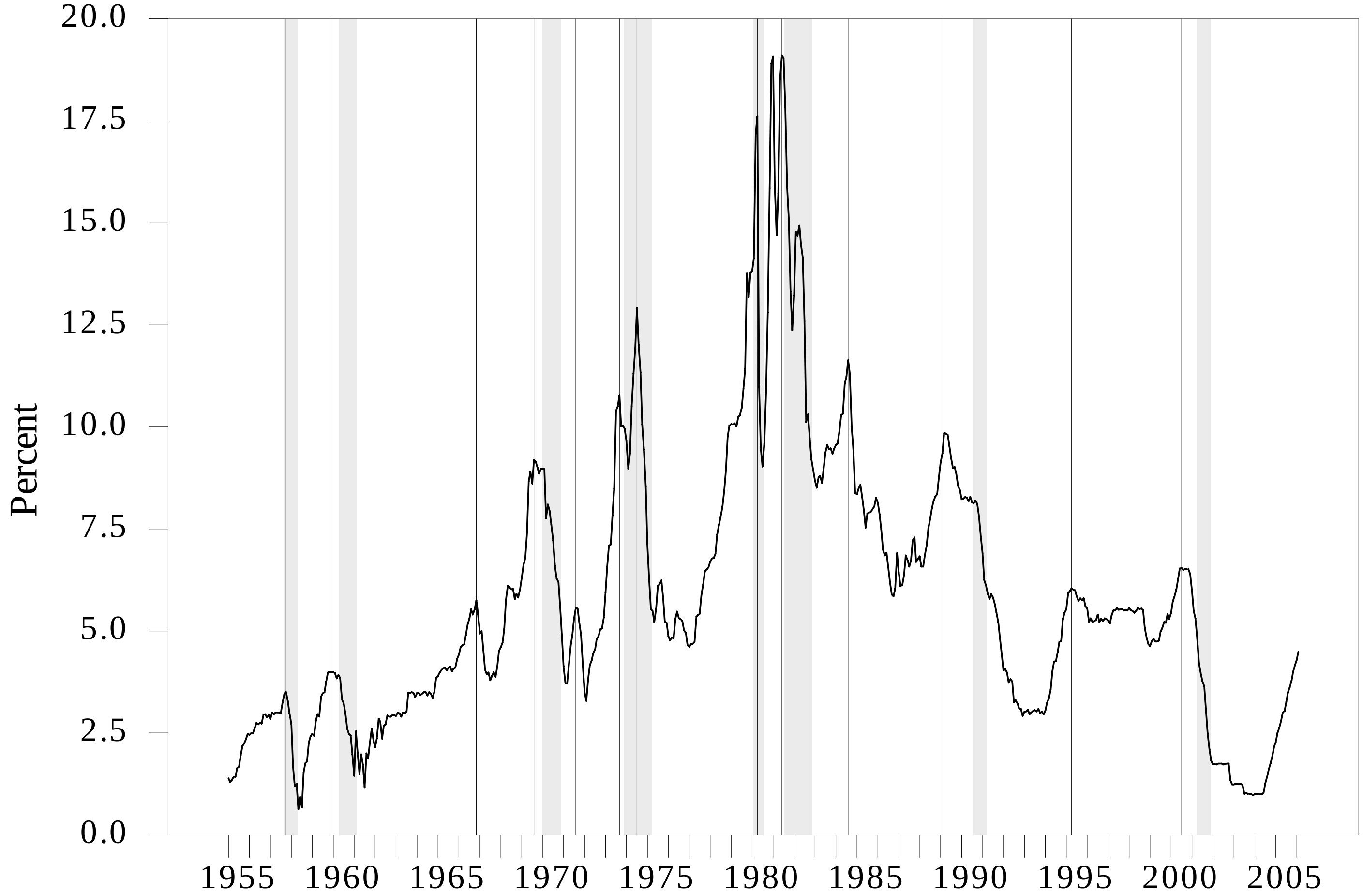

Figure 2: The 10-year minus 3-month spread and subsequent unemployment increases

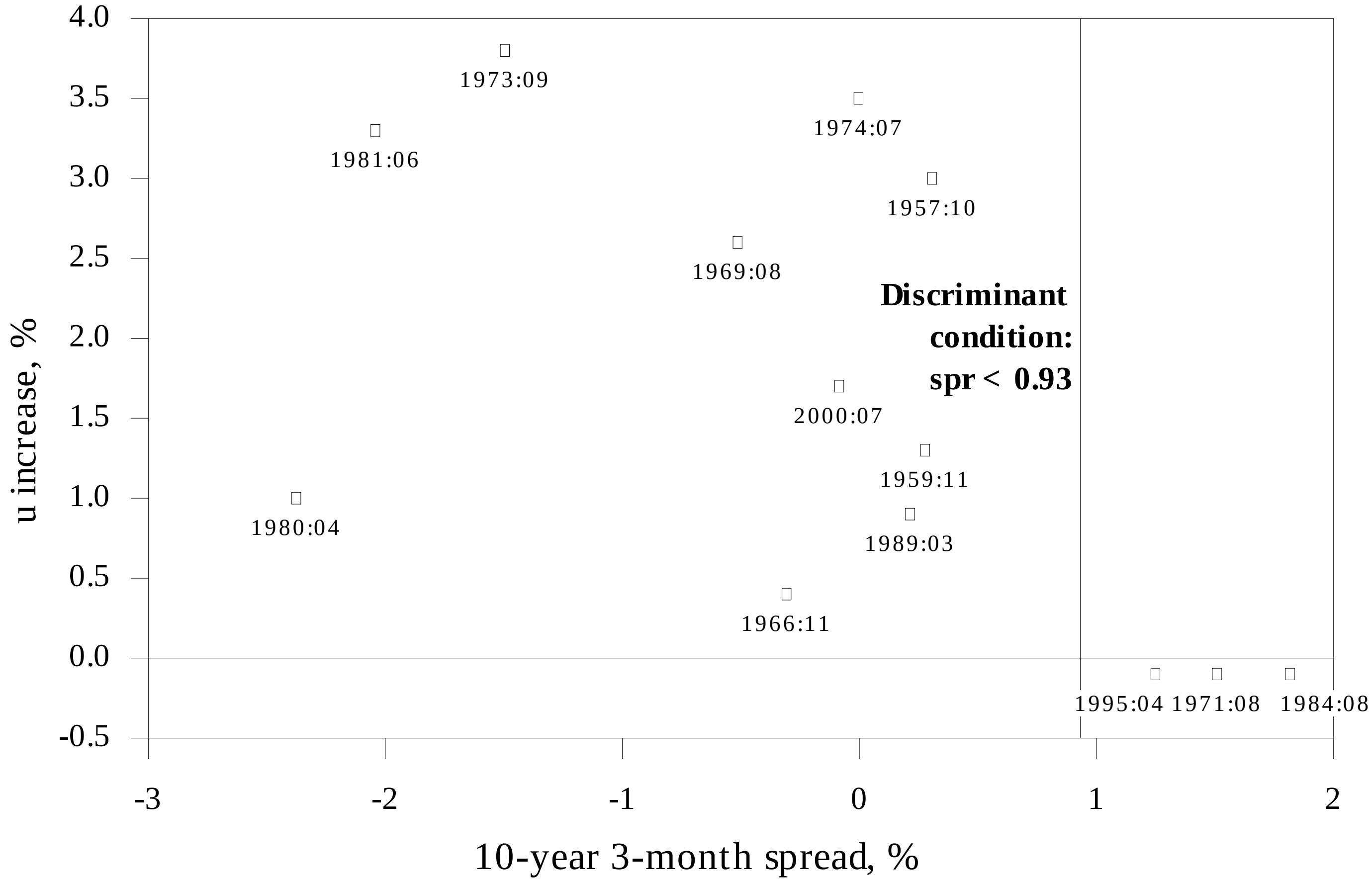

Figure 3: The Fed Funds Rate and Subsequent Unemployment Changes