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The Federal Funds Rate as an Indicator of Monetary Policy: Evidence from the 1980s

How monetary policy affects economic activity is a perennial question in macroeconomics. One of the main impediments to answering this question is the absence of agreement on what is an accurate gauge of monetary policy. Historically, many economists have used changes in the quantity of money as an indicator of changes in monetary policy. One problem with this approach, however, is that changes in money can result from factors other than changes in monetary policy. For instance, economic conditions can significantly influence money growth over the course of the business cycle.

Several economists have argued that movements in short-term interest rates, particularly movements in the federal funds rate, may be a better indicator of changes in monetary policy than are changes in the quantity of money (McCallum 1983, Laurent 1988, Bernanke and Blinder 1992, and Goodfriend 1992). This view is based on the observation that, with the exception of the 1979–82 period, the Federal Reserve appears to have implemented its monetary policy by targeting the federal funds rate.

In support of the federal funds rate as a gauge of monetary policy, Bernanke and Blinder (1992) present evidence that the federal funds rate is a better predictor of future economic activity than are other interest rates or other monetary aggregates. Additionally, using data before 1979, they show, using a simple vector autoregression (VAR), that changes in the federal funds rate are systematically related to changes in inflation and unemployment. (See the box entitled "Vector Autoregressions.") Specifically, the federal funds rate rises in response to unexpected increases in inflation and falls in response to unexpected increases in unemployment. Thus, their results are consistent with a monetary policy that "leans against the wind," or reacts countercyclically to the business cycle.

In this article, we use simple vector autoregressions to examine whether the relationships found by Bernanke and Blinder for the pre-1979 period persist after 1982, when the Federal Reserve returned to a policy of explicitly targeting the federal funds rate. The results provide more recent evidence on whether sensible monetary policy reaction functions can be derived using the federal funds rate as an indicator of the stance of monetary policy, and whether the funds rate has information about future inflation and unemployment. Also, because the vector autoregression methodology uncovers correlations among macroeconomic variables, the results of this examination may reveal changes in the correlations of macroeconomic variables after 1982 that shed light on several monetary policy issues.[1] For instance, if monetary policy is now less countercyclical, does the federal funds rate now respond less to innovations in unemployment or inflation? Do changes in

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[1] *According to the Lucas Critique, changes in policy regimes or economic institutions will likely change the relationships among macroeconomic variables.*

the federal funds rate now have less information content for economic activity? If so, does this imply that monetary policy became less effective during the 1980s? While answering these types of questions using the vector autoregression methodology is difficult, VARs do provide correlations with which economic models must contend.

In this article, we first review the recent literature on measuring monetary policy. We then present the empirical results, and finally, we outline some interpretations of these findings.

Vector autoregressions and monetary policy

Traditional monetarists (for example, Friedman and Schwartz 1963) view the growth of the money stock as a good indicator of monetary policy. While traditional monetarists argue that the money supply has important effects on the real economy in the short run, they typically stress that policymakers should avoid the temptation to temporarily stimulate real economic activity by rapidly expanding the money supply. Traditional monetarists fear such actions would increase inflation in the long run and exacerbate the business cycle. With the advent of rational expectations in macroeconomics, however, most economists view only unexpected policy actions as having real effects on the economy. Thus, rational expectations monetarists (for example, Sargent and Wallace 1975) take the view that only unexpected changes in the money supply will have temporary real effects, while expected changes in the money supply will be immediately reflected in the price level.

Sims (1980) questions the importance of unexpected changes in money for future changes in economic activity. Using a four-variable VAR, he shows that once the information content of interest rates is taken into account, only a small portion of the unexpected variation in output can be attributed to unexpected changes in the money supply. While some researchers have questioned the robustness of Sims' results, the conclusion that interest rates have substantial information content about future economic activity has held up. For a time, these results were considered damaging to the view that monetary policy is an important factor in explaining business cycles.

However, later research (McCallum 1983 and Laurent 1988) maintains that Sims' results do not imply that monetary policy is unimportant in determining economic activity. These economists argue that because the Federal Reserve conducts policy by targeting the federal funds rate and because changes in the money supply can be caused by factors other than changes in monetary policy, unexpected changes in the federal funds rate may be a better measure of monetary policy than unexpected movements in the money supply.

If the federal funds rate is a good indicator of monetary policy and monetary policy has real effects on the economy, then the federal funds rate should be a good predictor of economic variables. Bernanke and Blinder (1992) show that the federal funds rate is a good predictor of major macroeconomic variables before 1979 and that the federal funds rate better predicts macroeconomic variables than other interest rates or monetary aggregates.[2] Bernanke and Blinder also discover, using a simple VAR, that the federal funds rate responds to variables the Federal Reserve has been traditionally concerned with—unemployment and inflation. In other words, "reaction functions" can be estimated in which monetary policy (changes in the federal funds rate) reacts countercyclically in response to unexpected movements in unemployment and inflation.

In the next section of this article, we examine whether the relationships found by Bernanke and Blinder for the pre-1980 period held up during the 1980s.

Empirical results

Pre-1980 results. Bernanke and Blinder (1992) specify a series of three-variable VARs consisting of a measure of monetary policy, the prime-age (25–54) male unemployment rate, and the inflation rate as measured by the consumer price index. Each variable is regressed on six lags of itself and six lags of the other two remaining variables. The data are monthly, starting with July 1959 and ending in September 1979, when interest rate

[2] *When post-1979 data are added to their sample, the statistical significance of the federal funds rate in prediction equations generally declines. Their results are consistent with those of Bernanke and Blinder (1990).*

Vector Autoregressions

Vector autoregressions (VARs) are time series models that use only past values of the variables of interest to make forecasts. For instance, a three-variable VAR system of interest rates, unemployment, and inflation can be expressed as

$$R_t = \beta_1 + \Sigma R_{t-i} + \Sigma U_{t-i} + \Sigma \pi_{t-i} + \epsilon_{Rt}$$
$$U_t = \beta_2 + \Sigma R_{t-i} + \Sigma U_{t-i} + \Sigma \pi_{t-i} + \epsilon_{Ut}$$
$$\pi_t = \beta_3 + \Sigma R_{t-i} + \Sigma U_{t-i} + \Sigma \pi_{t-i} + \epsilon_{\pi t},$$

where R, U, and π are the interest rate, unemployment rate, and inflation rate, respectively. β is an intercept term, t is a time subscript, and ϵ is an error term. Thus, each of the three variables is expressed as a linear function of past values of itself and past values of other variables in the system.

In practice, the estimated error terms from each equation are correlated so that it is not correct to assume that, for instance, ϵ_{Ut} represents an independent surprise movement in the unemployment rate. To better interpret the dynamic relationships present in the data, the residuals from the VAR are broken up into linear combinations of independent (orthogonal) shocks. A common orthogonalization is to assume that the VAR system is *recursive* so that there is a chain of causality among surprises in the variables during any given period. For example, a possible recursive system of the VAR above is one in which the interest rate responds to an exogenous shock, and unemployment responds to the contemporaneous interest rate and an exogenous unemployment shock, while the inflation rate responds to the contemporaneous interest rate, contemporaneous unemployment rate, and an exogenous inflation shock. In effect, new surprises, or a shock term for each variable, are created that are now uncorrelated with each other. The transformation of the original shocks into recursive, orthogonal shocks is called the *Choleski decomposition*.

The Choleski decomposition is controversial because if the VAR is used to draw economic inferences, then the recursive restriction imposed on the system should be supported by economic theory. If the identifying assumption of recursivity is not justified, then the estimated parameters will be a mixture of both structural and reduced-form parameters. However, for forecasting purposes, the use of Choleski decompositions in VARs does not pose a problem because no economic inferences are being drawn from the estimated parameters.[1]

[1] For more on VARs, see Todd (1990), Runkle (1987), Sims (1986), Cooley and LeRoy (1985), and Hakkio and Morris (1984).

targeting was de-emphasized. Bernanke and Blinder impose recursivity on the system using the Choleski decomposition, with the ordering from the policy variable to the unemployment rate to the inflation rate.

Bernanke and Blinder use both the federal funds rate and the spread between the federal funds rate and the ten-year U.S. Treasury bond rate, henceforth the *spread*, as indicators of monetary policy. The spread is an alternative indicator of monetary policy because it controls for the general level of market interest rates and therefore provides further information about whether a particular level of the federal funds rate represents a restrictive or loose monetary policy. Figure 1 plots both the federal funds rate and the spread.[3] Note that the spread is nearly a mirror image of the federal

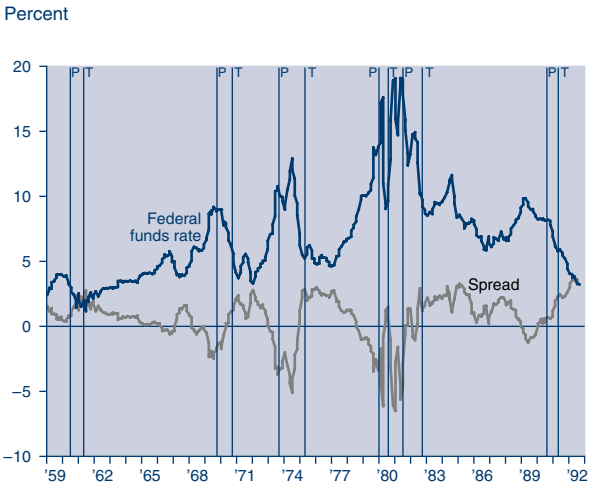
[3] A similar figure appears in Bernanke and Blinder (1992).

funds rate. In general, as Bernanke and Blinder point out, run-ups in the federal funds rate have preceded the onset of all recessions since 1959.

Because the estimation results for the individual equations within a VAR system are of little interest, they are not reported here. Table 1, however, reports the marginal significance level of exclusion tests for lags of the right-hand side variables. As in Bernanke and Blinder, the hypothesis that lags of inflation or unemployment can be excluded from the federal funds rate equation is easily rejected. This result indicates that the recent state of the economy, as measured by lagged inflation and unemployment, contains information about future movements in the federal funds rate. In addition, lags of the federal funds rates are significant in both the inflation and unemployment equations, suggesting, at a minimum, that knowledge of the federal funds rate helps predict these variables. The results for the spread between the ten-year Treasury bond rate and the federal funds rate are qualitatively similar to those of the federal fund rate; for this reason, we do not present them here.

When M2 growth is added to the three-variable system, the federal funds rate still retains its importance (as measured by the significance levels) in explaining the behavior of inflation; the rate is somewhat less important for unemployment. Furthermore, we can reject the hypothesis that the federal funds rate can be dropped from the four-variable system consisting of federal funds rate, M2 growth, unemployment, and inflation.

Figure 1
Federal Funds Rate and Spread



SOURCE: Board of Governors, Federal Reserve System.

Table 2 presents the forecast error variance decompositions for the VAR, including the federal funds rate and M2.[4] A variance decomposition divides the total forecast error variance, at different forecast horizons, into portions attributable to shocks in each of the variables in the system.[5] From Table 2, we find a substantial proportion of the forecast error variance in the federal funds rate is caused by uncertainty about the future values of unemployment and inflation. In other words, knowledge about future states of the economy tells us something about future movements in the federal funds rate. The decompositions for inflation and unemployment indicate that uncertainty about future values of the federal funds rate contributes only modestly to uncertainty about their future values. The contribution of federal funds shocks to the forecast variance of unemployment tends to be greater at longer horizons than that of M2. On the other hand, M2 tends to contribute more to the forecast variance of inflation than does the federal funds rate. Still, the majority of the forecast error variance for inflation and unemployment arises from uncertainty about shocks to those variables themselves.[6]

Overall, the federal funds rate had important predictive content for unemployment and inflation during the period July 1959–September 1979. This

[4] We employ a Choleski decomposition with the ordering of federal funds rate, M2, unemployment, and inflation. The qualitative results are unchanged if M2 and the federal funds rate or unemployment and inflation are switched in the ordering.

[5] The 90-percent confidence bands for the variance decompositions and impulse response functions (reported below) are generated using a Monte Carlo procedure and are available from the authors on request.

[6] Using the spread variable, the forecast error variance decompositions are similar. However, shocks to the spread contribute less to the total inflation forecast error variance, and shocks to inflation contribute less to the total spread forecast error variance.

Table 1
Marginal Significance Levels for Exclusion of Lags, 1959–79

Three-variable system (federal funds rate, unemployment, inflation)

	Marginal Significance Levels		
	Lags of		
	Federal funds	Unemployment	Inflation
Equation			
Federal funds	.0000	.0000	.0002
Unemployment	.0092	.0000	.2300
Inflation	.0000	.0698	.1304

Four-variable system (federal funds rate, M2, unemployment, inflation)

	Marginal Significance Levels			
			Lags of	
	Federal funds	M2	Unemployment	Inflation
Equation				
Federal funds	.0000	.0357	.0003	.0035
M2	.0000	.0000	.0897	.4875
Unemployment	.1140	.1032	.0000	.1032
Inflation	.0000	.0063	.2523	.2376

Tests for dropping variable from four-variable system

M2	$\chi^2(18) = 40.88$	(.0016)
Federal funds	$\chi^2(18) = 85.50$	(.0000)

is the case even after allowing for the effect of money aggregates, as measured by M2. This finding provides indirect evidence that the federal funds rate may be a good indicator of monetary policy.

An additional source of evidence provided by Bernanke and Blinder is that the response of the federal funds rate to shocks in unemployment and inflation is consistent with a "lean against the wind" policy; that is, the federal funds rate rises in response to a positive inflation shock and falls in response to a positive unemployment shock.

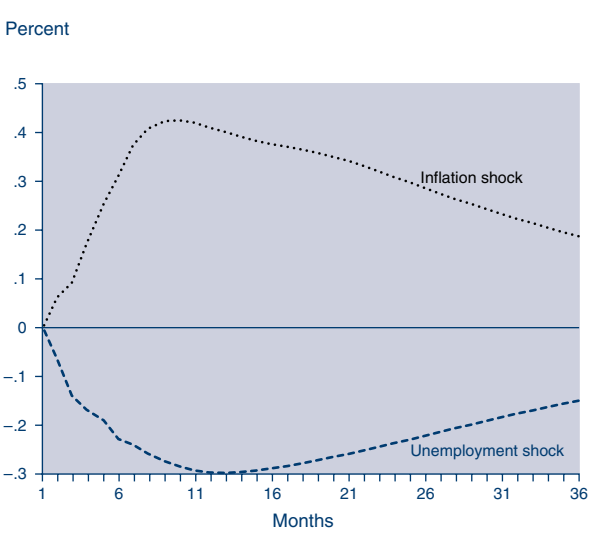
Figures 2 and 3 plot impulse response functions for the three-variable VAR that includes the federal funds rate, unemployment, and inflation and is estimated over the sample period up to September 1979.[7] Figure 2 displays the response of the federal funds rate over time to unexpected movements in inflation and unemployment.[8] As underscored by Bernanke and Blinder, the plots look very much like "lean against the wind" monetary policy reaction functions. The federal funds rate rises in response to an unexpected increase in inflation and falls in response to an unexpected increase in unemployment.

Figure 3 displays the responses of unemployment and inflation to an innovation in the federal funds rate. The qualitative pattern of the impulse response function for unemployment is

[7] *The qualitative behavior of the impulse responses using the spread variable as the monetary policy variable is very similar.*

[8] *The ordering of the unemployment rate and the inflation rate in the VAR does not affect the results that follow. Also, the inclusion of money growth, as measured by M2, in the VAR system does not qualitatively affect the impulse responses of the other three variables.*

Figure 2
Responses of Federal Funds Rate to Inflation and Unemployment Shocks

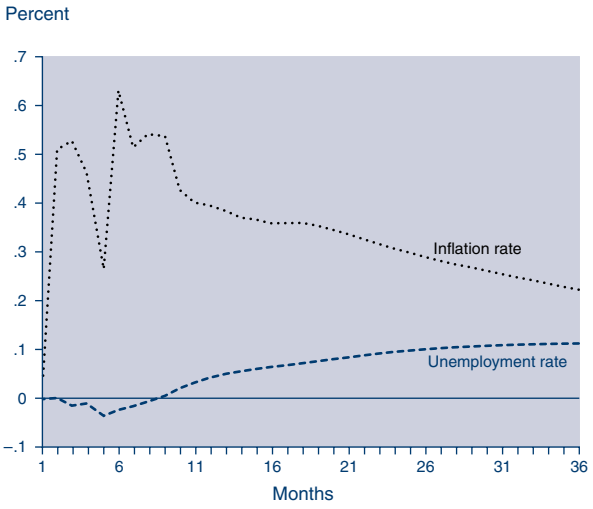


broadly consistent with the view that unexpected changes in the federal funds rate represent changes in monetary policy. Figure 3 shows that after a temporary and short-lived fall, the unemployment rate rises in response to an unexpected increase in the federal funds rate. On the other hand, the inflation rate response moves the wrong way if one interprets a surprise increase in the federal funds rate as a tightening of monetary policy. This "price level" effect, noted by Eichenbaum (1992) in his comment on Sims (1992), raises doubts about interpreting federal funds rate innovations as unexpected monetary policy changes.[9] This price level effect, does not, however, necessarily provide evidence against the effectiveness of a "lean against the wind" policy. The reason is that such a countercyclical policy, to the extent that it is predictable, would be embodied in the coefficients of the VAR and not necessarily be reflected in unexpected movements of the federal funds rate.[10]

Post-1982 results

In this section, we examine whether the relationships found by Bernanke and Blinder persist during the 1980s. There are several reasons they may not. First, financial innovation and deregulation during the 1980s may have changed the effectiveness and the transmission mechanism of monetary policy (Bosworth 1989 and Kahn 1989). Second, the high-inflation decade of the 1970s may have changed the way the public reacts to inflation. In particular, the Phillips curve may have steepened, lessening even the short-term trade-off between inflation and unemployment. Furthermore, financial markets may have become more sensitive to inflation fears, and these concerns are more readily reflected in increases in long-term interest rates. Finally, the Federal Reserve may have focused more of its policy on control-

Figure 3
Responses to Federal Funds Rate Shocks



[9] *Similarly, Gordon and Leeper (1993) cite this effect in arguing that innovations in the federal funds rate are an inappropriate indicator of monetary policy. As an alternative, they construct a structural model of the money market to identify monetary policy surprises.*

[10] *Another explanation for this price level effect would be to distinguish between nominal and real federal funds rate innovations. Many analysts would argue that a monetary policy tightening occurs only when the real federal funds rate rises. The price level effect found here may only signal that increases in the nominal federal funds rate are not as large as the contemporaneous increases in inflation and, therefore, do not constitute a tightening of monetary policy. An examination of the viability of the real federal funds rate as an indicator of monetary policy is left for future research.*

Table 2
Forecast Error Variance Decompositions, 1959–79

Federal funds rate

Forecast horizon	Percentage of forecast error variance explained by			
	Federal funds	M2	Unemployment	Inflation
6	77.7	2.9	8.9	10.5
12	51.7	9.3	18.7	20.3
24	30.5	31.9	22.2	15.5
36	23.9	41.6	21.8	12.7

M2

Forecast horizon	Percentage of forecast error variance explained by			
	Federal funds	M2	Unemployment	Inflation
6	22.5	70.3	3.3	4.0
12	21.1	64.0	8.1	6.8
24	23.1	60.0	9.8	7.1
36	24.3	58.0	9.4	8.3

Unemployment rate

Forecast horizon	Percentage of forecast error variance explained by			
	Federal funds	M2	Unemployment	Inflation
6	1.1	2.8	96.2	.3
12	1.7	6.0	90.4	.6
24	13.2	10.2	68.1	3.6
36	23.8	8.7	57.5	8.0

Inflation rate

Forecast horizon	Percentage of forecast error variance explained by			
	Federal funds	M2	Unemployment	Inflation
6	12.9	7.7	2.9	76.5
12	17.2	11.8	4.7	66.2
24	15.5	24.5	6.7	52.3
36	14.2	33.6	8.0	44.2

ling inflation before inflation accelerates. This shift may be the result of a heightened aversion to inflation by the public or increased awareness by the Federal Reserve of the limitations of monetary policy in affecting the real economy.

Is the VAR evidence still consistent with the view that the federal funds rate is a good indicator of monetary policy? The first step in answering this question is to test whether there is any evidence of structural instability in the VAR system after 1982.[11] VARs are estimated over the November 1982–September 1992 period and are compared with VARs estimated over the July 1959–September 1979 period. Using standard likelihood-ratio tests,

[11] *We exclude the October 1979–September 1982 period, when the Federal Reserve de-emphasized the targeting of interest rates in setting monetary policy.*

Table 3
Test for Structural Change Between the 1959–79 and 1982–92 Samples

Three-variable system (federal funds rate, unemployment, inflation)

Entire system	$\chi^2(57) = 137.0$	(.0000)

Significance levels for structural change equation by equation

Federal funds	.0352
Unemployment	.0081
Inflation	.0000

Four-variable system (federal funds, M2, unemployment, inflation)

Entire system	$\chi^2(100) = 219.5$	(.0000)

Significance levels for structural change equation by equation

Federal funds	.0043
M2	.0000
Unemployment	.0442
Inflation	.0000

the hypothesis of stability is easily rejected for the VAR systems using both the federal funds rate and the spread and including and excluding M2 (*Table 3*).[12] Taken equation by equation, there is also evidence that the correlation structure from the 1959–79 period differs from that of the 1982–92 period.

Does the federal funds rate retain its predictive ability in the post-1982 period? Table 4 displays the marginal significance level of exclusion tests for the post-1982 period. The federal funds rate still has predictive content for inflation and unemployment, with significance levels close to or less than 10 percent; therefore, we can strongly reject the hypothesis that the federal funds rate can be dropped from the system. M2, however, loses much of its predictive power in the later sample; therefore, we cannot reject the hypothesis that M2 can be dropped from the system. Furthermore, the significance levels of lags of unemployment and inflation in the federal funds equation indicate that these variables do not explain much of the movement in the federal funds rate in the later period.

Examining the forecast error variance decompositions for the VAR from the pre-1980 and post-1982 periods (*Table 5*), the federal funds rate still explains a modest percentage of the forecast variance of unemployment and inflation. The contribution of M2, on the other hand, falls substantially in the post-1982 period. Thus, it appears that the federal funds rate has become more important relative to M2 in explaining the behavior of inflation and unemployment in the post-1982 period.

Perhaps the most striking difference in the variance decompositions is the small percentage of the forecast error variance for the federal funds rate that can be attributed to uncertainty about future inflation. In other words, inflation shocks

[12] *Evidence of a unit root in the level of the federal funds rate and the unemployment rate made us cautious about using the data in levels form to make inferences using likelihood-ratio tests. However, instability was also found when the VAR system was estimated in first differences. There was also evidence of instability when the system was estimated in error-correction form using a cointegrating vector found by the methodology developed by Johansen and Juselius (1990).*

Table 4
Marginal Significance Levels for Exclusion of Lags, 1982–92

Three-variable system (federal funds rate, unemployment, inflation)

	Marginal Significance Levels		
		Lags of	
	Federal funds	Unemployment	Inflation
Equation			
Federal funds	.0000	.1700	.8184
Unemployment	.0923	.0000	.6415
Inflation	.0133	.5909	.0003

Four-variable system (federal funds rate, M2, unemployment, inflation)

	Marginal Significance Levels			
			Lags of	
	Federal funds	M2	Unemployment	Inflation
Equation				
Federal funds	.0000	.1060	.3003	.3911
M2	.0000	.0033	.7979	.0322
Unemployment	.1163	.6812	.0000	.6765
Inflation	.0362	.8822	.6827	.0006

Tests for dropping variable from four-variable system

M2	$\chi^2(18) = 18.66$	(.4129)
Federal funds	$\chi^2(18) = 65.04$	(.0000)

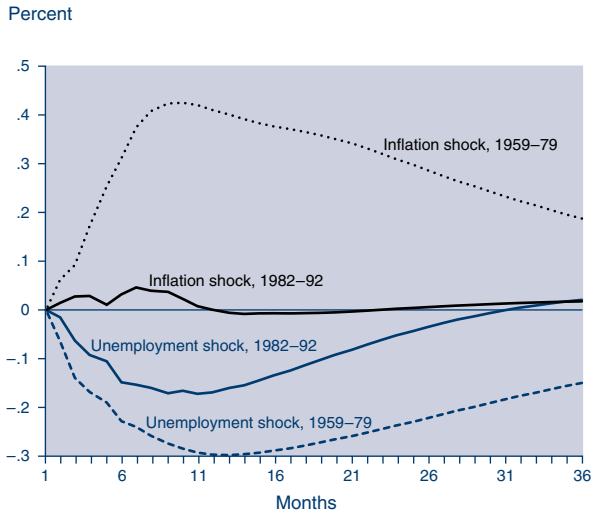
account for little of the variability in the federal funds rate in the later period. This finding raises questions about the traditional monetary policy interpretation of the federal funds rate, since that interest rate does not appear to respond to inflation shocks in the post-1982 period.[13] Additionally, the variance decompositions indicate that a larger percentage of the forecast variance in the federal funds rate can be attributed to uncertainty about innovations to the federal funds rate itself. It seems the federal funds rate has become more independent of the other variables in the VAR during the 1980s.

Figures 4 and 5 present impulse responses for the post-1982 period for the three-variable VAR.[14] Figure 4 displays the reaction of the federal funds rate to unexpected increases in inflation and unemployment. The response of the federal funds rate to an unexpected increase in the unemployment rate in the post-1982 period is less than that in the previous period, although it does indicate a loosening of monetary policy in response to a surprise increase in unemployment. Additionally, the 90-percent confidence bands of the two responses overlap and, hence, are not statistically different from each other. On the other hand, the response of the federal funds rate to an unexpected increase

[13] *Again, the variance decompositions using the spread are similar except that uncertainty about future inflation contributes little to the forecast error variance of the spread (and vice versa) in both the earlier and later periods.*

[14] *The differences in the impulse responses between the two periods result mainly from differences in the estimated coefficients of the VAR equations and not from differences in the sizes of the standard deviation shocks. The size of the shocks for each variable are very close across the two periods.*

Figure 4
Responses of Federal Funds Rate to Inflation and Unemployment Shocks



in inflation does not correspond to a "lean against the wind" reaction function. The federal funds rate for the most part fails to respond at all to an inflation shock, and the confidence bands of the two responses do not overlap over a horizon of three to twenty months.[15] A "lean against the wind" policy would suggest an increase in the federal funds rate in response to a positive inflation shock. Therefore, whereas in the earlier sample a monetary policy reaction interpretation could be applied, in the 1982–92 period the response of the policy variables do not look like typical reaction functions.[16]

Finally, the response of unemployment and inflation to shocks in the federal funds rate casts further doubt on the interpretation of federal funds rate innovations as monetary policy changes in the post-1982 period (*Figure 5*). The response of unemployment to unexpected increases in the federal funds rate is negative in the post-1982 period rather than positive as in the 1959–79 period (the 90-percent confidence bands of two responses do not overlap after thirteen months). The response of inflation in the post-1982 period to a federal funds rate shock, as in the pre-1980 period, moves in the wrong direction but is much less persistent in the post-1982 period than in the earlier period.

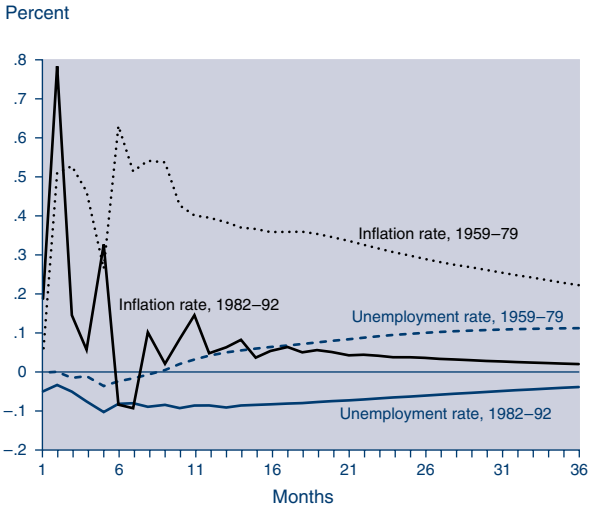
Thus, while the federal funds rate has become more important relative to M2 in explaining inflation and unemployment, it appears that the Federal Reserve no longer "leans against the wind" with respect to inflation shocks in the post-1982 period.

As a final note, the above results are robust to using the core-CPI inflation rate rather than just the CPI inflation rate and to trying to control for the effect of the decline in 1986 oil prices by introducing a dummy variable for this period into the VAR.

Possible interpretations of the results

As noted in the box on vector autoregressions, making economic inferences from estimated VARs is controversial. The fundamental difficulty is that the estimated relationships are derived from reduced-form equations. Thus, VARs provide evidence on correlations in the data, but these correlations may be consistent with a number of

Figure 5
Responses to Federal Funds Rate Shocks



[15] *The spread between the ten-year Treasury bond yield and the federal funds rate actually increases in response to a positive inflation shock.*

[16] *Supporting this point, lagged inflation is no longer statistically significant in the federal funds rate equation.*

Table 5
Forecast Error Variance Decompositions, November 1982–September 1992

Federal funds rate

Forecast horizon	Percentage of forecast error variance explained by			
	Federal funds	M2	Unemployment	Inflation
6	89.4	5.7	4.4	.6
12	75.7	10.6	12.4	1.2
24	72.5	11.6	14.3	1.5
36	73.3	12.7	12.7	1.3

M2

Forecast horizon	Percentage of forecast error variance explained by			
	Federal funds	M2	Unemployment	Inflation
6	18.6	63.1	.3	18.0
12	24.4	56.7	1.4	17.5
24	28.7	52.8	2.2	16.3
36	32.2	50.2	2.5	15.1

Unemployment rate

Forecast horizon	Percentage of forecast error variance explained by			
	Federal funds	M2	Unemployment	Inflation
6	22.6	.6	76.5	0.3
12	21.3	1.3	75.3	2.1
24	23.4	1.8	70.3	4.5
36	26.6	2.6	66.2	4.5

Inflation rate

Forecast horizon	Percentage of forecast error variance explained by			
	Federal funds	M2	Unemployment	Inflation
6	11.0	3.6	1.7	83.7
12	11.5	4.2	3.2	81.0
24	12.3	4.3	3.7	79.8
36	12.6	4.3	3.7	79.3

economic theories.[17] In this section, we discuss several plausible interpretations of the changed relationships found from the VARs above. These interpretations rely on developments in monetary policy issues that arose during the 1980s.

That the Federal Reserve no longer "leans against the wind" with respect to inflation in the post-1982 period is somewhat surprising given the supposedly higher premium the Federal Reserve put on price stability during this period. Economic models of monetary policy indicate that a monetary authority's increased desire to fight inflation results in policy's being tightened more severely in the case of an unexpected increase in the inflation rate (Ball 1990 and Alogoskoufis and Smith

[17] *In other words, the economic theories have "observationally equivalent" reduced forms.*

1991). If the federal funds rate is a good indicator of monetary policy, these results indicate just the opposite: the policy response to an increase in the inflation rate became muted during the 1980s.

One plausible explanation of the results that reconciles the muted response of the federal funds rate with an increase in the Federal Reserve's resolve to fight inflation is evidence that the behavior of inflation changed during the 1980s. Inflation since the early 1980s exhibits substantially less persistence than in the previous period, so that increases in inflation one month are temporary and, in fact, tend to be followed by a decrease in the next month (Emery, forthcoming). This change in the persistence of inflation is reflected in the difference between the response of inflation to federal funds shocks in the two periods noted in Figure 5. The behavior of inflation during the 1980s implies that lagged values of inflation provide little information about inflation in the future. As a result, unexpected movements in inflation, as measured by the VAR, no longer require a monetary policy response.

An additional explanation is that the Federal Reserve has abandoned a "lean against the wind" policy and instead conducts monetary policy in a more forward-looking manner. That is, the Federal Reserve increases the federal funds rate in anticipation of inflation so as to not get behind the curve with respect to fighting inflation. Since low-dimension VARs, such as the ones examined in this article, probably do not reflect all the information available to the monetary authorities at the time policy decisions are made, the estimated impulse response function for the federal funds rate may not adequately capture the forward-looking nature of monetary policy.

Sims (1992) uses a similar argument in explaining the perverse inflation response to a federal funds rate innovation. Because the VAR does not reflect all the information available to the monetary authority when it conducts policy, the federal funds innovations in these VARs still reflect systematic policy responses. Therefore, the positive response of inflation to a positive federal funds innovation is really capturing the increase in the federal funds rate in anticipation (correctly) of inflation. The resultant tightening is not sufficient to completely eliminate the subsequent inflationary pressures. If, indeed, this price puzzle does reflect a forward-looking Federal Reserve, then because this price puzzle is present in both periods (even more so in the earlier period, as indicated in Figure 5), it appears that the Federal Reserve is not substantially more forward-looking in the 1982–92 period than in the 1959–79 period.

Figure 6
U.S. Inflation
(Six-month moving average)

SOURCE OF PRIMARY DATA: Bureau of Labor Statistics.

Of course, it is very possible that the two explanations offered here are related. A more forward-looking Federal Reserve could conceivably be better able to diminish the persistence of inflation by effectively offsetting fluctuations in the underlying trend inflation rate, so that the price level effect is diminished. Many analysts have maintained that the Federal Reserve stabilized the inflation rate around 4 percent during most of the 1980s (Goodfriend 1992) and that as a result of this policy, deviations of inflation away from 4 percent were temporary. By contrast, movements in inflation before 1980 tended to be more indicative of rising or ebbing inflationary pressures because the Federal Reserve did not respond quickly enough to changing price pressures (*Figure 6*).

Conclusions

The vector autoregression evidence on the federal funds rate as an indicator of monetary

policy weakens when the period since 1982 is examined. Specifically, in contrast to the pre-1980 period, the federal funds rate no long displays a "lean against the wind" response to inflation—that is, it does not increase in response to unexpected increases in inflation. However, this change does not necessarily imply that the federal funds rate is no longer an indicator of monetary policy. The vector autoregression results indicate that after 1982, the federal funds rate responds to unexpected changes in the unemployment rate in a manner similar to that before 1980 and consistent with a traditional monetary policy interpretation. Furthermore, there exist several possible explanations that are consistent with a monetary policy interpretation of the federal funds rate.[18]

Nonetheless, the main message of this article is to highlight how correlations between important macroeconomic variables can change when institutions or policy regimes change. While the federal funds rate may still be a good indicator of monetary policy, its relationship with unemployment and inflation is now clearly different from what it was before 1980.

[18] *See Goodfriend (1992) for a narrative approach that supports the use of the federal funds rate, in addition to other long-term rates, as a good indicator of monetary policy during the 1980s.*

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