Soft landings on a bumpy runway

Francesca Eugeni and Charles L. Evans

In February 1994, the Federal Open Market Committee (FOMC) began a slow process of increasing the federal funds rate by 300 basis points. The intention was to "head off an incipient increase in inflationary pressures and to forestall the emergence of imbalances that so often in the past have undermined economic expansions."[1] Real gross domestic product (GDP) growth for 1994 was 4.1 percent on the fixed-weight 1987 dollar basis reported at the time, and CPI inflation was under 3 percent for the third year in a row. The final 50 basis point increase in the federal funds rate came on February 1, 1995. By spring 1995, however, initial signs of an economic slowing were beginning to appear. For example, payroll employment was virtually unchanged in April and fell in May; building permits and new home sales fell below 1994 levels; and the purchasing managers' index (PMI) fell below 50 percent in May (a reading below 50 percent indicates that the manufacturing economy is declining).

Chairman Greenspan stated in a speech to the Economic Club of New York in June 1995 that "incoming information on the forces involved does suggest some increased risk of a modest near-term recession." As table 1 shows, the apparent slowing of the economy was reflected in the FOMC's mid-year Humphrey-Hawkins and Blue Chip forecasts for 1995. The central tendency of the FOMC's real GDP growth forecasts had shifted downwards from an initial range of 2 percent to 3 percent to a lower range of 1.5 percent to 2 percent. Similarly, the Blue Chip consensus forecast for 1995 moved down from 2.5 percent in January to 2.2 percent in June. The anticipated soft landing had become a bit bumpy.

We now estimate that 1995 GDP growth came in at 2.4 percent (1987 dollars), making it a year of roughly average growth. However, the individual indicators appeared to weaken uniformly in the spring and early summer of 1995. Should this weakening have been expected, or was it prompted by some unexpected event that occurred in the first half of 1995? These questions take on an added importance when the most recent real GDP growth rate is under 1 percent (as the 1995:Q4 data indicate). This article uses simple statistical forecasting models to investigate the bumpy ride of 1995. Our findings are that the second quarter 1995 slowdown (1) should have been partly expected, but (2) some additional bumpiness suggests that a supply shock hit the economy in the first quarter of 1995. The vector autoregressions (VAR) tools employed in this case study are readily applicable to other historical periods, such as that leading up to the 1990 recession, as well as to a real-time evaluation of several exogenous shocks which tend to affect the U.S. economy.

Francesca Eugeni is an economist and Charles L. Evans is a senior economist and assistant vice president at the Federal Reserve Bank of Chicago.
The authors thank Anil Kashyap and David Marshall for helpful comments.

Competing explanations for the 1995 slowdown

Table 1 displays real GDP growth, the unemployment rate and inflation for 1994, two sets of forecasts for 1995, and the actual data for 1995. The GDP data are reported according to the fixed-weight 1987 dollar national income and product account (NIPA) measures, since the Humphrey-Hawkins forecasts were reported that way. The July forecasts show a clear reassessment of the outlook. An important reason for this was the uniform slowing in the April and May economic releases. Figure 1 displays actual data for eight economic indicators from January1993 through September 1995. Sharp declines are evident in the housing sector, with building permits falling below 1994 levels. A slowdown is also apparent in the employment indicators: Average hours worked in manufacturing and the Conference Board's help-wanted index suffered sharp declines in the second quarter of 1995. In addition, two leading economic indicators, the Conference Board's index of leading indicators and Stock and Watson's experimental nonfinancial leading index (XLI2), declined during this period. Declines in the rate of capacity utilization and the purchasing managers' index in the second quarter of 1995 also reflect a softening in the manufacturing sector.

TABLE 1

Humphrey-Hawkins and Blue Chip 1995 forecasts

	GDP (87$)	CPI	Unemployment rate[1]
	(percent change, Q4/Q4)		*(percent)*
1994 actual	4.1	2.6	5.6
1995 actual	2.4[e]	2.6	5.6
Humphrey-Hawkins 1995 forecasts			
February 22, 1995	2.0-3.0	3.0-3.5	5.5
July 19, 1995	1.5-2.0	3.1-3.4	5.8-6.1
Blue Chip 1995 forecasts[2]			
January 10, 1995	2.5	3.5	5.6
June 10, 1995	2.2	3.5	5.7

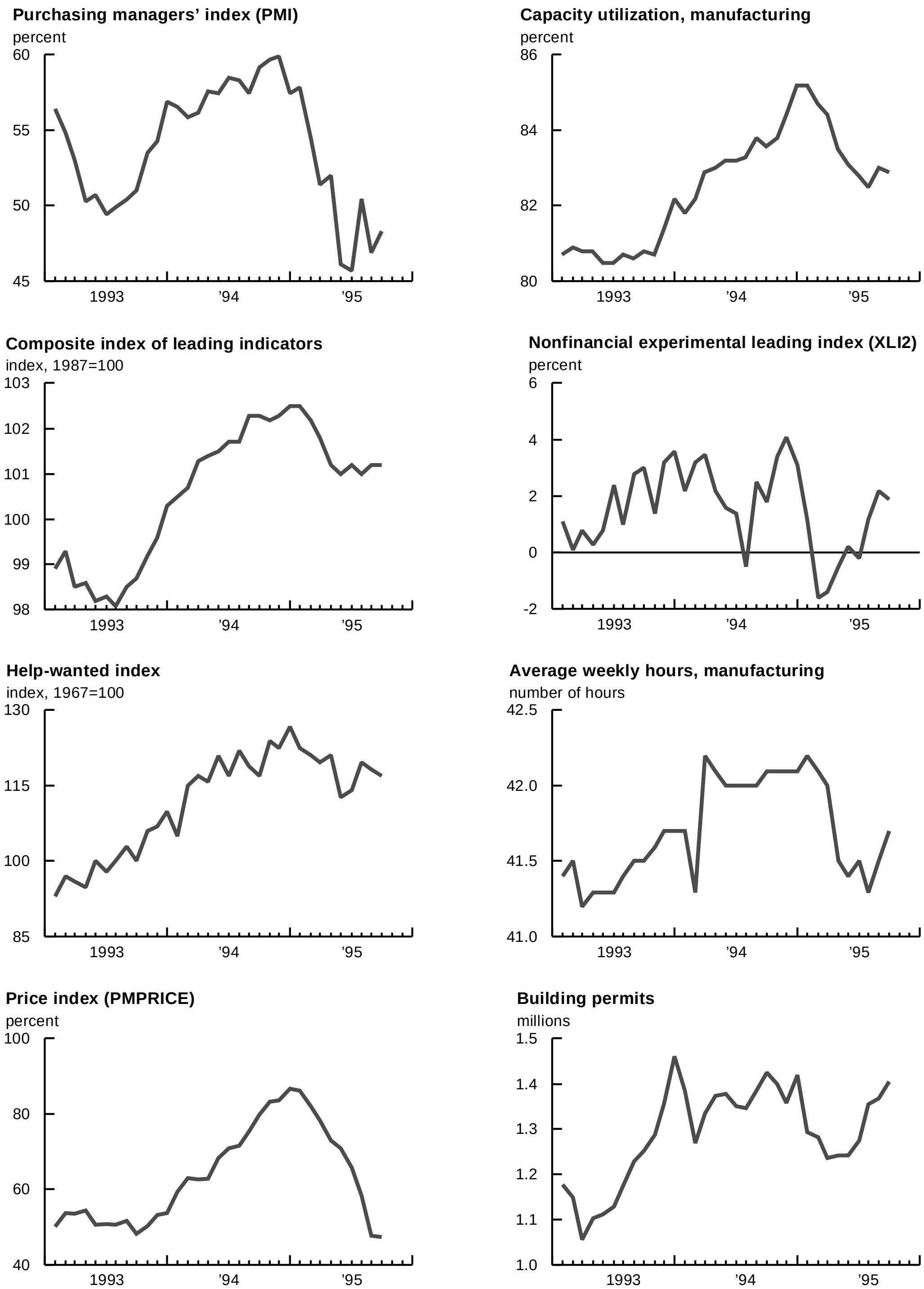
[1]Fourth-quarter average.
[2]Consensus forecast.
[e]Estimate.
Sources: U.S. Department of Labor; U.S. Department of Commerce; Federal Reserve Board of Governors; and Blue Chip Economic Indicators.

What events caused this slowdown? We consider four potential explanations. The first hypothesis is that monetary policy was unusually restrictive during the 12 months in which the federal funds rate rose from 3 percent to 6 percent, and the final two policy moves in November 1994 (75 basis points) and February 1995 (50 basis points) put a significant damper on the economy (monetary policy [MP] shocks). Second, the 300 basis point increase was simply a normal, passive response of monetary policy to underlying fundamentals. In this setting, normal response implies that the policy actions were largely predictable on the basis of historical data (normal response of MP). Third, from the February 1995 forecasts to the July 1995 forecasts, some other fundamental changed which is unrelated to monetary policy. For example, an adverse supply shock or money demand shock could have intervened in the first or second quarter of 1995 (other shocks). Fourth, the spring data could have been uniformly "noisy"—just a fluke—perhaps due to a shifting seasonal pattern which will be corrected in future data revisions (noise).

Although these hypotheses are not mutually exclusive, each has testable implications. First, the *normal response hypothesis* suggests that the spring 1995 slowdown should have been predictable using data through 1994. Specifically, the uniform slowing of the economic indicators by June 1995 should have been implied at the time of the February Humphrey-Hawkins forecasts. A prima facie case against this explanation is that the July Humphrey-Hawkins forecasts were lower than the February forecasts: If the slowdown was expected, why did the forecasts change? A possible counter to this argument is that the outlook for the first half was as expected, but something fundamentally changed to alter the outlook for the second half of 1995. We can address this question by comparing forecasts of the economic indicators against the actual data: If the slowdown is uniformly forecast, this is consistent with the normal response hypothesis.

FIGURE 1

Economic indicators: Actual data, January 1993–September 1995



Sources: The National Association of Purchasing Management; the Conference Board; the Federal Reserve; James Stock and Mark Watson nonfinancial experimental index; the U.S. Department of Labor; and the U.S. Department of Commerce.

Second, the *monetary policy shock hypothesis* may also be consistent with the predictability of the second-quarter slowdown. Given the 75 basis point increase in the federal funds rate in November 1994, it may have been possible to forecast the spring slowdown. One way to distinguish between the normal response hypothesis and the MP shock hypothesis is to measure the size of monetary policy shocks in 1994 and 1995. If the shocks are small and infrequent, the 300 basis point increase in the federal funds rate is consistent with a normal response. If the shocks are large and contractionary, however, that favors the MP shock hypothesis.

TABLE 2

Summary of competing explanations for spring 1995 slowdown

	Implication		
Hypothesis	Predictable	Large MP shocks	Large other shocks
MP shocks	Yes	Yes	No
Normal response of MP	Yes	No	No
Other shocks	No	No	Yes
Noise	No	No	No

Third, if the spring slowdown was unpredictable and not due to monetary policy shocks, then *other shocks* may have been responsible. We attempt to quantify three other shocks which macroeconomists think affect the aggregate economy: permanent supply shocks (like energy and technology shocks), money demand shocks, and temporary expenditure shocks (such as consumer demand or government shifts). Our analysis uses a structural VAR method which is closely related to work by Gali (1992). Finally, if no other shocks are responsible, then the slowdown could conceivably have been *noise*. Table 2 summarizes the four hypotheses and testable restrictions.

Forecasting the economic indicator slowdown

The February 1995 Humphrey-Hawkins forecasts were prepared by the FOMC members' staff in mid-January. This means that the forecasts were initially prepared with data through the third quarter of 1994 and some monthly data from the fourth quarter. In asking whether or not an economic event was evident at the time, it is critical that only the data which was available *at that time* be used.[2] The forecasts presented below use the initial data releases.

We consider separately eight indicators of economic activity to forecast the changes in employment, CPI inflation, and the federal funds rate, as well as the indicator itself. For each indicator we estimate a seven-variable VAR, which includes the indicator, the change in payroll employment, the change in inflation, the smooth change in sensitive materials prices, the change in the federal funds rate, the growth rate of nonborrowed reserves, and the growth rate of total reserves. The equation which determines the indicator includes a constant and six lagged values of all seven variables. The other six equations do not include lagged values of the indicator. This block-recursive structure guarantees that the employment, inflation, and federal funds rate forecasts are the same across each seven-variable VAR system.

Of the eight indicators, six are in level form: the purchasing managers' index of the National Association of Purchasing Management (NAPM), the NAPM's price index (PMPRICE), the Stock and Watson nonfinancial experimental leading index (XLI2), manufacturing capacity utilization, the Conference Board help-wanted index, and manufacturing average weekly hours. Two of the indicators are in annualized log levels: the Conference Board index of leading indicators and the Department of Commerce building permits.

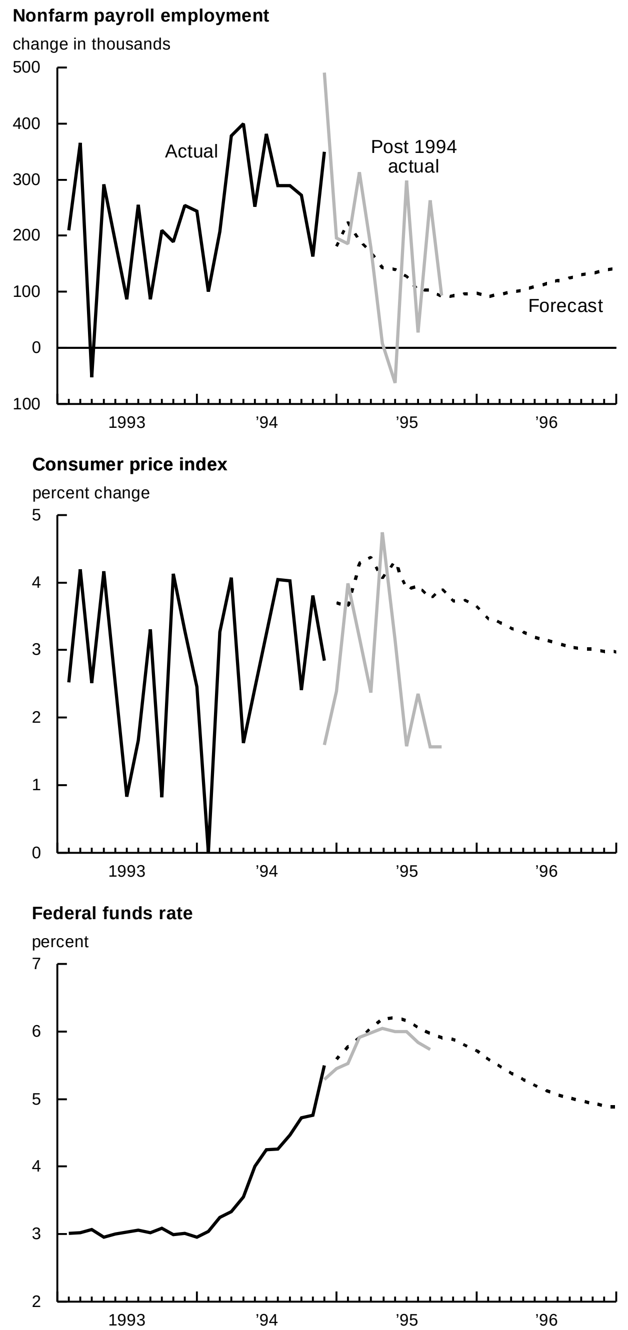
The data are monthly and the sample period for the estimation runs from January 1970 to November 1994. We estimated the system of equations using ordinary least squares (OLS).[3]

We forecast the change in employment, inflation, and the federal funds rate from December 1994 through December 1996 on a monthly basis, assuming no shocks to the system over our forecast horizon. Since our errors are assumed to be mean zero and serially uncorrelated, this is a conditional expectation. Each graph in figure 2 plots three objects: (1) the initial unrevised data from January

1993 through November 1994, (2) forecasts from December 1994 though December 1996, and (3) revised actual data from December 1994 through September 1995, which we did not use in the estimation. Focusing on the forecast paths and the actual data, payroll employment was expected to slow gently from a pace of 200,000 per month to 100,000 by the end of 1995. Instead, the actual data came in quite bumpy—falling abruptly from a gain of over 300,000 in February to a loss of 62,000 in May. Inflation had been forecast to average above 4.1 percent in the first half of 1995, but instead was a much milder 3.2 percent. The statistical forecast called for the federal funds rate to rise until the middle of the year before beginning a slow decline; the actual funds rate held steady from February until midyear when it was lowered slightly. The data in figure 2 indicate a soft landing scenario which encountered a bumpy runway.

FIGURE 2

Forecasts of employment, inflation, and the federal funds rate

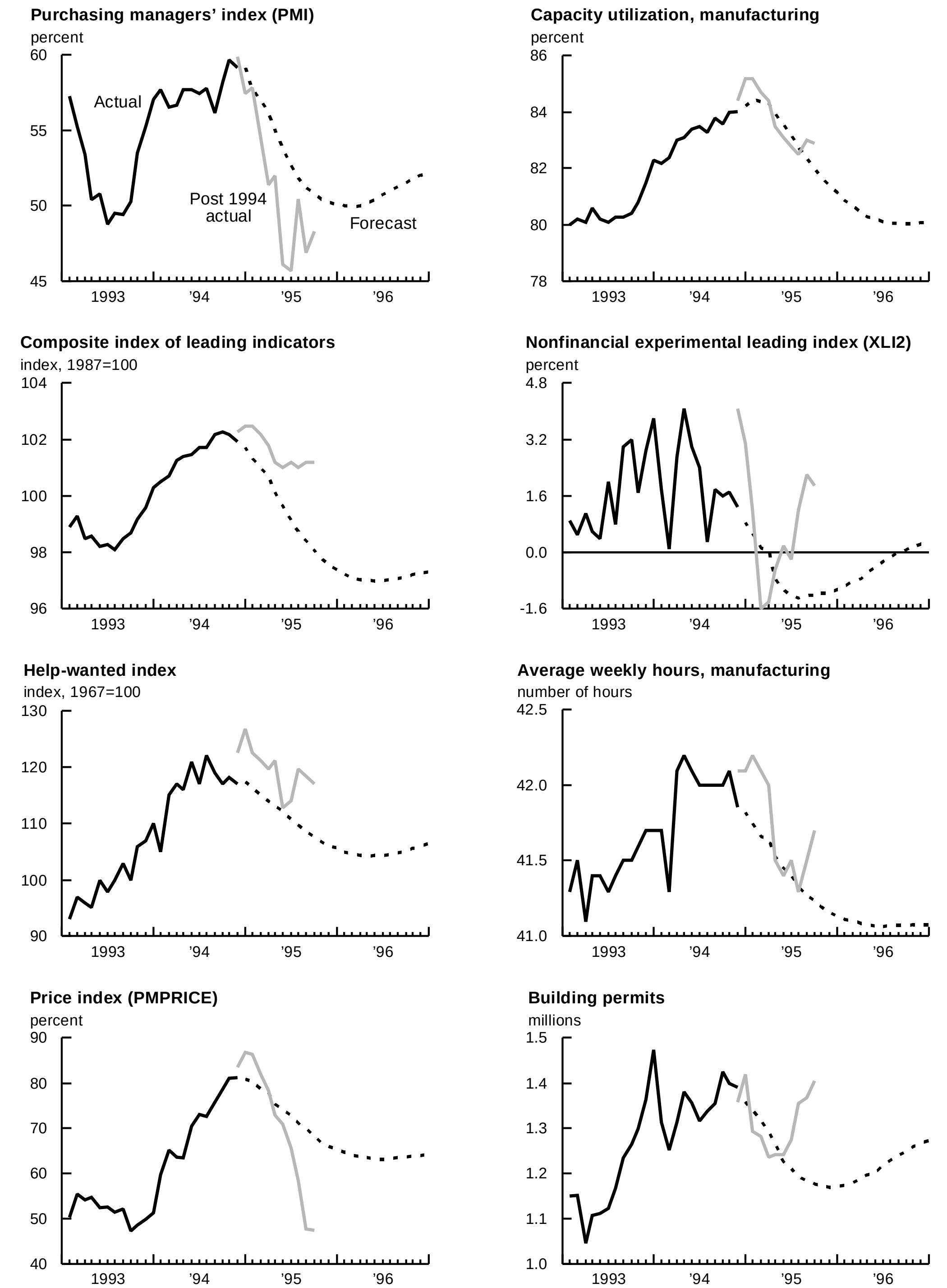


Sources: U.S. Department of Labor and Federal Reserve Board of Governors.

The forecasts of economic indicators (figure 3) begin to shed light on the monetary policy shock and normal response hypotheses: Could the slowdown have been forecast? Overall, the indicators consistently predicted a slowdown over the forecast horizon. For example, the PMI was projected to fall from a level of over 59 percent to under 50 percent by the end of 1995. The XLI2 index was forecast to turn negative by the second half of 1995, indicating below-average growth. However, in most cases, the decline in the actual data for 1995 was sharper than forecast; this is the case for PMI, PMPRICE, XLI2, capacity utilization, and building permits. Two exceptions are the help-wanted index and the index of leading indicators, for which the forecasts were more pessimistic than the actual data. Some portion of the slowdown in early 1995 should have been anticipated according to this analysis; this is consistent with both the monetary policy shock hypothesis (late 1994 monetary policy shocks) and the normal response of monetary policy to underlying economic fundamentals in 1994. However, since the spring slowdown was somewhat sharper than anticipated, some other shocks may also have played a role in the mid-year forecast revisions.

FIGURE 3

Economic indicators: Actual data vs. forecasts



Sources: See figure 1.

Structural identification of monetary policy and other shocks

The discussion above suggests that some new information on economic fundamentals became available between the February and July Humphrey-Hawkins forecasts. What was this new information? Below, we examine four types of shocks which may play a significant role in the evolution of the U.S. economy—a supply shock, a money demand shock, a monetary policy shock, and an expenditure shock.

Identifying exogenous events

The U.S. economy has experienced nine recessions since 1945. One interpretation of these economic ups and downs is that the economy tends toward its average growth rate, but periodically exogenous events intervene—both positive and negative shocks—which lead to persistent deviations of real GDP from its trend. A large negative event, such as the quadrupling of world oil prices in 1973, could account for a recession on its own. Alternatively, a series of smaller, less visible negative shocks could account for a downturn. Many events are observable, but their effects on the economy, in terms of timing and magnitude, are difficult to detect: for example, the 1993 Revenue Reconciliation Act which introduced individual income tax rate brackets of 36 percent and 39.6 percent; the economic transitions due to the NAFTA and GATT free-trade agreements; industrial reshaping due to legislative restrictions or relaxations such as interstate branch banking; and the shift toward managed health care and its accompanying effects on labor costs. Other events are virtually impossible to observe contemporaneously. For example, technological improvements related to computer miniaturization have been taking place over the last 20 years or more, but it is difficult to quantify the timing and extent of the accompanying effects on productivity.

Since casual observers of the economy's ups and downs—both economists and the public—cannot agree on the causes of any particular economic downturn, business cycle researchers have turned to statistical methods to identify exogenous events which lead to economic fluctuations. Structural vector autoregressions (SVARs) are a statistical attempt to identify these shocks by their immediate effects, or perhaps their implied long-run effects, on the economy. For example, Milton Friedman's proposition that inflation is everywhere and always a monetary phenomenon may lead us to identify monetary policy actions with shifts in inflation (perhaps at certain forecast horizons); this is an example of a long-run identifying restriction. A belief that the monetary authority always eases in the face of rising unemployment—a normal response of policy to the state of the economy—might lead us to identify *unusual easing* of monetary policy (a shock) with a decrease in short-term interest rates which was not accompanied by a prior increase in the unemployment rate. This is an example of a contemporaneous identifying restriction.[4]

We consider four aggregate, quarterly data series: the growth rate of real GDP, the change in the federal funds rate, the change in real money balances, and a short-term *ex post* real interest rate. Our data selection is similar to Gali's (1992) empirical implementation. The GDP data are the 1987 dollar fixed-weight data which were available to policymakers in spring 1995. Real money balances are measured as M1 deflated by the consumer price index for urban consumers. We use M1 to capture better the influence of financial innovations on the economy, not based on its usefulness as an indicator of monetary policy. *Ex post* real interest rates are measured as the fed funds rate minus the inflation rate.

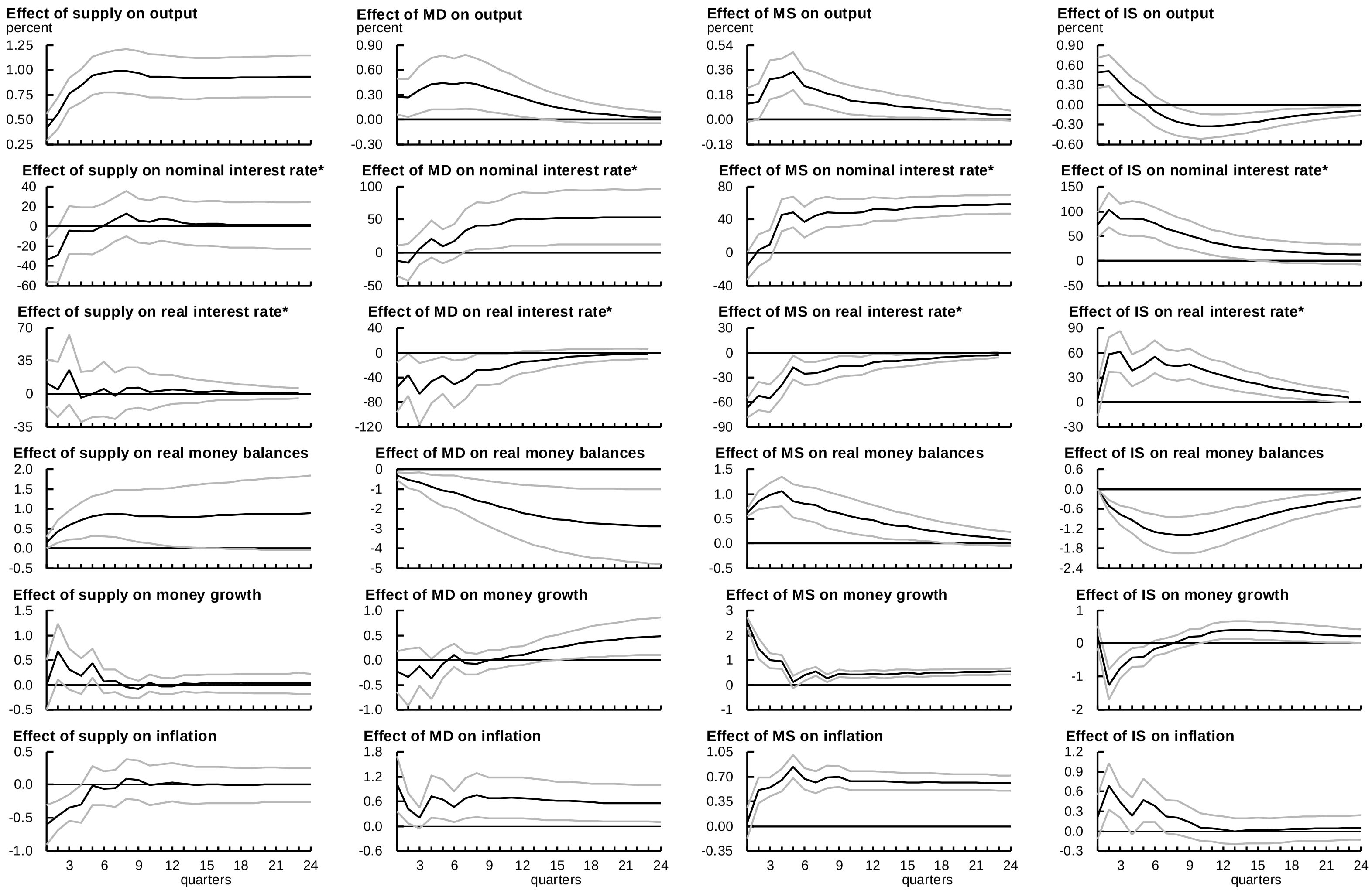
We impose a sufficient set of identifying assumptions on the vector autoregression to just identify four exogenous shocks that influenced the postwar U.S. economy; four loose labels for these shocks are (1) a supply shock, (2) a money demand shock, (3) a monetary policy shock, and (4) an expenditure shock.[5]

The *supply shock* captures exogenous events which permanently affected the level of real GDP. Intuitively, the SVAR statistical analysis investigates fluctuations in real GDP, which did not quickly revert to its unconditional growth path, and labels these events supply shocks. Some candidate observable events are energy shocks, technological improvements or regress, and regulatory restrictions or easings.

The *money demand shock* (MD) captures exogenous events which permanently affected the level of real balances; but did not permanently affect real GDP. Some candidate

FIGURE 4

Impulse response functions: Responses to one-standard-deviation shocks



*In basis points (all others in percent).

Notes: The black lines represent point estimates. The colored lines represent standard error bands.
Real output is measured in 1987 dollars; nominal interest rate is the federal funds rate in basis points; real money balances is M1 deflated by the consumer price index; the real interest rate is ex-ante and is measured as the federal funds rate minus the expected change in the consumer price index.

Source: U.S. Department of Commerce; Federal Reserve Board of Governors; and U.S. Department of Labor.

observable events are: a change in the public's desire to use cash or demand deposit instruments; the effects of regulations on depository institutions and financial intermediaries; and improvements in the financial intermediation process. The insistence that these shocks have not affected real GDP permanently is not a generic economic implication. The practical significance of this restriction is to identify separately the money demand and supply shocks by imposing a long-run Wold causal ordering.

The *monetary policy shock* (MS) captures exogenous shifts in short-term interest rates which have no permanent effect on output; the precise identifying restriction is related to the expenditure shock identification discussed below. The monetary policy shock can be interpreted in the following way. Typically, the Fed's influence on short-term interest rates can be related systematically to the state of the economy. Occasionally, the Fed looks at the current state of the economy and decides to deviate from this systematic rule in an *ex ante* unpredictable way: The deviation is the monetary policy shock. Christiano, Eichenbaum, and Evans (1996) use a related set of assumptions to identify an analogous monetary policy shock. An advantage of the approach taken here, however, is that the monetary policy shock may be correlated with the current state of the economy.[6]

The *expenditure shock* (IS) is intended to capture temporary shifts in aggregate demand expenditures. (Gali [1992] refers to a shock like this as an IS shock, a label that relates to the textbook macroeconomic IS-LM models.) This shock's identifying restrictions are that it has no permanent effects on real GDP or real money balances and no contemporaneous effect on real money balances.[7] Candidate examples of this shock include temporary shifts in investment demand, government purchases or net exports, as well as shifts in consumer confidence. Since temporary supply shifts can also affect aggregate demand, these are also candidate shocks so long as their contemporaneous effect on real balances is nil.

Estimates of the impulse response functions

The system of equations is estimated over the period from January 1970 to November 1995. Although the central objects of interest in the investigation are the shocks themselves, we must inspect the implications of the shocks first in order to assess the plausibility of the estimates. Figure 4 displays the responses of output, nominal and real interest rates, real balances, money growth, and inflation to one-standard-deviation shocks.[8] The identifying restrictions are evident from the impulse responses. Notice that only the supply shock affects the level of output at horizons longer than 24 quarters, and only the money demand and supply shocks affect real balances in the long-run. The final identifying restriction is that the expenditure shock does not affect real balances contemporaneously, as is evident from figure 4.

Although the identifying restrictions here differ from Gali's (1992) slightly and our sample period extends to 1995 instead of 1987 as in Gali's paper, the estimated impulse response functions are quite similar to his estimates.

Supply shock—A positive one-standard-deviation supply shock stimulates output growth before leveling off after six quarters. Inflation falls immediately but temporarily. This finding of a conditionally countercyclical inflation rate accords well with the predictions of business cycle models in which technology and supply shocks lead to economic fluctuations. (See, for example, King and Watson [1994].) The rise in real balances is a plausible response to individuals'desire to facilitate a greater number of transactions.

Money demand shock—A negative one-standard-deviation money demand shock stimulates output growth temporarily, but the standard error bands are large enough that the entire pattern of responses may be insignificantly different from zero. According to the point estimates, however, real balances fall permanently: The long-run response of money growth and inflation is to increase. This leads to a permanent increase in nominal interest rates and a permanent decline in the quantity of money demanded.

Monetary policy shock—A positive one-standard-deviation money supply shock stimulates output and leads to an increase in inflation. Many small-scale VAR models, similar to ours, find that an expansionary monetary policy shock leads to an anomalous decrease in the price level, and Gali's estimates also display a hint of this "price puzzle" (see Christiano, Eichenbaum, and Evans [1996] for a discussion of the price puzzle phenomenon). However, our estimates do not display a price puzzle, which may be due to the structural identification. Although the contemporaneous fall in nominal interest rates is insignificant, real interest rates fall significantly.

Expenditure shock—A positive one-standard-deviation expenditure shock leads to a temporary increase in output and a rise in real interest rates. This response pattern seems consistent with a shift outward in an aggregate-demand relationship when aggregate supply is roughly fixed: Scarce resources today suggest that future consumption is cheaper than today's consumption (that is, real interest rates are currently high).[9] The fall in real balances seems to be consistent with a fall in money demand, as is evident from the sharp increase in nominal interest rates and falling output level after the second quarter.

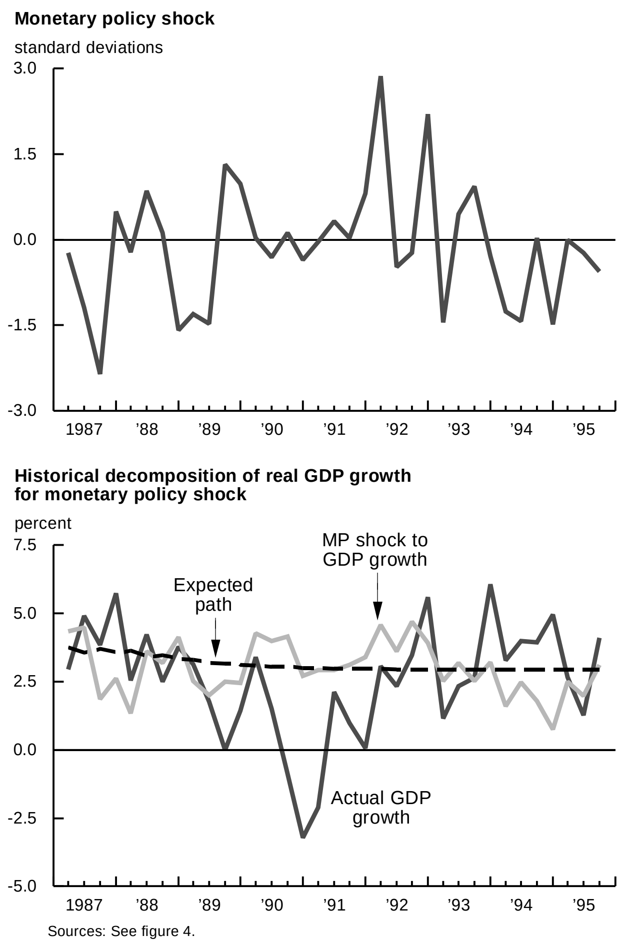
Below, we examine the results within the context of the monetary policy shock and other shocks hypotheses.

The monetary policy shock hypothesis

The top panel of figure 5 displays the estimated monetary policy shocks from the structural VAR estimation discussed above. The shocks have been normalized to have a variance of one. The bottom panel displays a historical decomposition of real GDP growth based upon the monetary policy shocks only: Specifically, this decomposition records how output growth would have evolved since 1987 if there had only been the estimated monetary policy shocks. According to figure 5, monetary policy was unexpectedly tight at the end of 1988 and in early 1989—the decomposition reveals that real GDP growth was reduced by about 1.25 percent in 1989. These estimated shocks accord well with the Fed's stated intention of fighting inflation during that period. The historical decomposition of inflation (not reported here) reveals that inflation was about 1.25 percent lower as a result of these shocks. According to these estimates, a series of expenditure shocks in 1987-88 would have caused inflation to rise above 6 percent during the mid-1988 to mid-1990 period if the monetary shocks had not intervened. After the 1990-91 recession, monetary policy was unexpectedly easy at year-end 1991 and year-end 1992. This accords well with the Fed's 100 basis point cut in the discount rate in December 1991 and the lack of a monetary policy tightening in the second half of 1992 when real GDP grew by 4.5 percent. The decomposition of output growth reveals that

FIGURE 5

The monetary policy shock hypothesis



Sources: See figure 4.

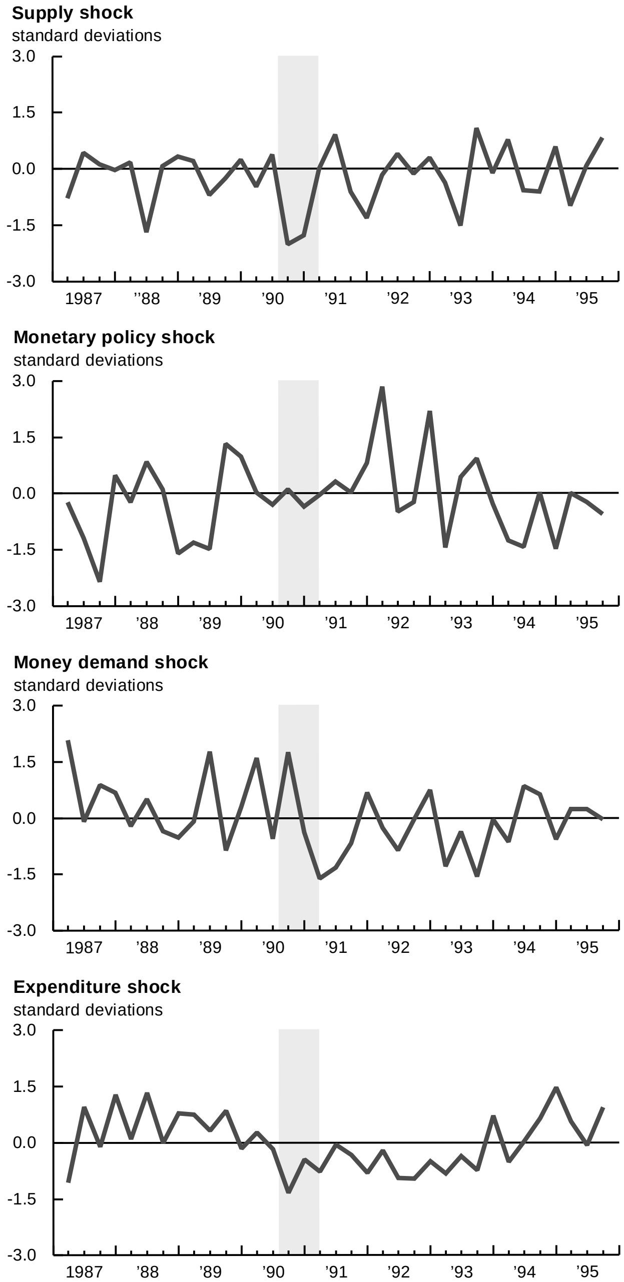
Note: All the shocks are normalized to have unit variance and a positive shock results in a rise in output.

1992 output growth was about 1.5 percent higher due to these shocks. Consequently, these measures of unanticipated monetary policy actions seem to capture the flavor of this period.

According to the *monetary policy shock hypothesis*, the 1995 second-quarter slowdown was due to an unanticipated policy tightening at the end of 1994 or in the first quarter of 1995. There is some validity to this hypothesis. The 75 basis point increase in the federal funds rate in November 1994 seems to be consistent with a large unexpected monetary policy shock in the fourth quarter of 1994; indeed three of the four quarters of 1994 point to tight monetary policy. Furthermore, the impulse response functions displayed in figure 4 indicate that a 1.5-standard-deviation shock in the fourth quarter of 1994 would lead to about a 0.5 percent reduction in real GDP by the second quarter of 1995. So this hypothesis may account for a portion of the slowdown.[10] The decomposition of output growth indicates that monetary policy shocks reduced second-quarter 1995 real GDP growth by 1 percent, but this estimate includes the lagged effects of policy shocks earlier in 1994. Nevertheless, the Fed's action in the fourth quarter of 1994 should have been taken into account in the February 1995 Humphrey-Hawkins forecasts. Consequently, while the statistical analysis indicates that monetary policy actions may have slowed the economy in the first half of 1995, it can't explain the midyear projection of slower economic growth in 1995.

FIGURE 6

Monetary policy shock and other shocks



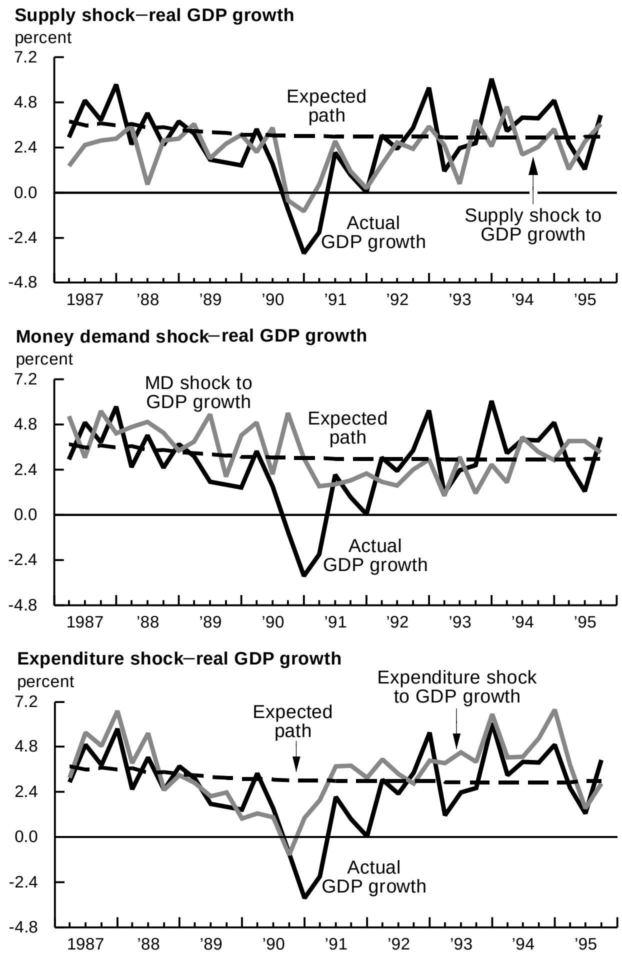
Notes: All the shocks are normalized to have unit variance and a positive shock results in a rise in output.
Shaded area indicates recession.
Sources: See figure 4.

The other shocks hypothesis

Figure 6 displays each of the four estimated shocks over the period 1987 to 1995, while figure 7 displays the historical decompositions of real GDP growth for the supply, money demand, and expenditure shocks. As mentioned above, between mid-1988 and mid-1989 the Fed raised the federal funds rate by about 300 basis points; according to our estimates, this was a period of unexpectedly tight monetary policy aimed at fighting inflationary expenditure shocks in 1988, which were growing 1987 real GDP phenomenally (and above capacity rates). Typical accounts of this period refer to attempts to engineer a soft landing for the economy, but by fall 1990, the U.S. was slipping into a recession.[11] According to our estimates, two large negative supply shocks hit the economy in the second half of 1990. The decompositions in figure 7 reveal that these shocks were large enough to induce two quarters of negative growth by themselves. This seems like a plausible account given the Iraqi invasion of Kuwait in August 1990 and the accompanying military buildup in the Persian Gulf during the remainder of 1990. Compounding these problems were slightly negative expenditure shocks in 1990 and two large negative money demand shocks in the first half of 1991. The latter shocks correspond to a period of turbulent financial intermediation, as evidenced by the closure of insolvent thrift institutions and bank capital replenishment. Monetary policy during this period was extraordinarily neutral according to these measures. Consequently, this statistical analysis suggests that events other than monetary policy played a significant role in the 1990-91 recession.

FIGURE 7

Historical decomposition of real GDP growth



Sources: See figure 4.

Turning to the 1995 period, notice first that the money demand and monetary policy shocks are relatively small and neutral. For example, although the fourth-quarter expenditure shock (a relatively high 1.5 standard deviations) leads to an immediate increase in fourth-quarter output (according to the impulse response functions in figure 4), the effects begin to reverse within two quarters. Thus, the fourth-quarter expenditure shock does imply a slight slowing for 1995, although it should have been known at the time of the February Humphrey-Hawkins forecasts. The second culprit is an estimated first-quarter negative supply shock. According to figure 4, this shock alone, if not reversed, would have led to an almost 0.75 percent reduction in output before the end of the year. For economic forecasters, this shock represents news that became available in late April 1995. The decomposition in figure 7 indicates that the supply shock cumulatively (beyond just the first-quarter shock) reduced output growth by almost 2 percent, but these effects were neutralized by mid-1995. The latter fact couldn't have been deduced until late July, given the data release dates for the second quarter. Therefore, a first-quarter supply shock appears to be the most likely culprit for the slower growth forecasts by midyear 1995.

Conclusion

Our case study of the 1995 economic slowdown reveals that part of the widespread deterioration in economic indicators was predictable in light of 1994 monetary policy actions—in terms of the statistically unusual actions that the Fed took, as well as its typical response to the state of the economy in 1994. This was not clearly evident *ex ante* from the February 1995 Humphrey-Hawkins forecast range of 2 percent to 3 percent growth; but it is consistent with the lower end of this range. Second, the midyear slowdown appears to have been partially unpredictable. This is evident from the July 1995 Humphrey-Hawkins forecast revision of 1.5 percent to 2 percent growth, and our statistical analysis identifies that an adverse supply shock of modest proportions hit the economy in the first quarter of 1995.

NOTES

[1]Greenspan (1996).

[2]For an example of how important this distinction can be in another context, see Diebold and Rudebusch (1991).

[3]Since six of the equations do not contain the seventh variable (the economic indicator), estimation using the method of seemingly unrelated regression (SUR) is more efficient than OLS. However, we found that the results were relatively insensitive to the estimation method, so we report below the results from the OLS estimation.

[4]Alternatively, a large decrease in short-term interest rates which was not commensurate with the (small) increase in unemployment could signal an *unusual easing*.

[5]For technical details related to analyses like this one, see Gali (1992) or Watson (1993).

[6]Both approaches to measuring monetary policy shocks require the assumption that the Fed has implemented a single, stable reaction function for monetary policy over the estimation period under study. In the current study, this is 1970 to the present. An additional requirement is that the four variables in the present VAR must span the space of exogenous events affecting the U.S. economy.

[7]One interpretation of this latter restriction is to take the IS-LM apparatus at face value: A positive expenditure shock increases output and interest rates contemporaneously without real money balances changing initially. Note that if money demand is stable, then the increase in output leads to a higher quantity of money demanded, but the increase in interest rates has an opposing effect. Our identifying restriction assumes that these two effects cancel. A test of this restriction is the plausibility of its implications for other variables.

[8]The colored lines refer to one-standard-error "bootstrap" standard errors. The bootstrap standard errors were generated using 500 Monte Carlo draws. The original VAR estimates were taken to be the data-generating process, Monte Carlo errors were selected by sampling from the original VAR innovations with replacement, and the identifying restrictions were imposed and re-estimated for each draw.

[9]See Barro's macroeconomic textbook (1987) for an analytical framework like the one described above.

[10]Our discussion refers to our estimates of the shocks. Economists can disagree over whether a 1.5-standard-deviation shock should be labeled "statistically different from zero."

[11]For a reference to a "soft landing," see the Transcript of the Federal Open Market Committee meeting, March 28,1989.

REFERENCES

Barro, Robert, *Macroeconomics*, 2nd ed., New York: John Wiley, 1987.

Christiano, Lawrence, Martin Eichenbaum, and Charles Evans, "The effects of monetary policy shocks: Some evidence from the flow of funds," *Review of Economics and Statistics*, 1996, forthcoming.

Diebold, Francis, and Glenn Rudebusch, "Forecasting output with the composite leading index: A real-time analysis," *Journal of the American Statistical Association*, Vol 86, No. 415, September 1991, pp. 603–610.

Gali, Jordan, "How well does the IS-LM model fit postwar U.S. data?" *Quarterly Journal of Economics*, Vol. 107, No. 2, May 1992, pp. 709–738.

Greenspan, Alan, "Remarks," Speech to the Economic Club, New York, NY, June 1995.

________________, "Statement on Humphrey-Hawkins," Testimony before the U.S. House, Committee on Banking and Financial Services, Subcommittee on Domestic and International Monetary Policy, February 20, 1996.

King, Robert, and Mark Watson, "The post-war Philips curve: A revisionist econometric history," *Carnegie-Rochester Conference Series*, Vol. 41, December 1994, pp. 157–219.

Watson, Mark, "Vector autoregressions and cointegrations," Federal Reserve Bank of Chicago, working paper, 1993.