The U.S. Economy in 1989 and 1990: Walking a Fine Line

Preston J. Miller
Vice President and Deputy Director of Research
Research Department
Federal Reserve Bank of Minneapolis

David E. Runkle
Economist
Research Department
Federal Reserve Bank of Minneapolis
and Associate Director
Institute for Empirical Macroeconomics

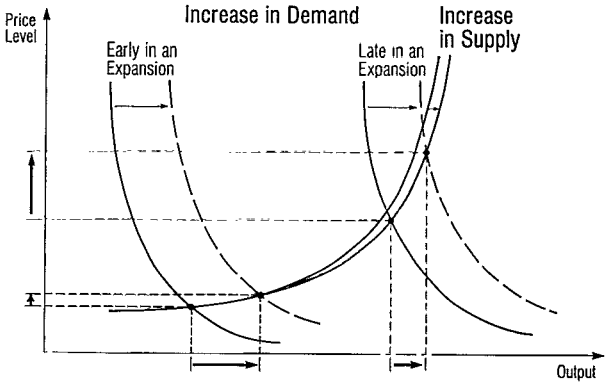
U.S. inflation was surprisingly low in 1988, considering the strength of the demand for goods and services. Nevertheless, the costs of producing goods to meet that demand accelerated as factory operations moved close to capacity and a record proportion of the population became employed. The challenge for the economy in the next two years is to moderate demand enough so that these cost pressures don't burst into rapid price increases, but not so much that output falls—in short, to walk the fine line between high inflation and recession. Although there is a reasonable chance that the economy will be able to do this, it will need good luck and good policies.

Surprisingly Low Inflation

Inflation was lower last year than conventional economic analysis would have predicted.

Conventional analysis suggests that inflation rises as an economic expansion lengthens and rates of resource utilization rise. That follows from a view of how total demand and supply interact. According to this view, output and prices are determined by the intersection of a significantly shifting demand schedule and a slowly shifting supply schedule. (See Chart 1.) Changes in output that occur during a business cycle primarily reflect changes in demand—for example, increases in purchases of durables by consumers and equipment by businesses. Supply expands slowly over time as the work force grows and technology improves.

Chart 1
A Conventional View of Inflation During an Economic Expansion

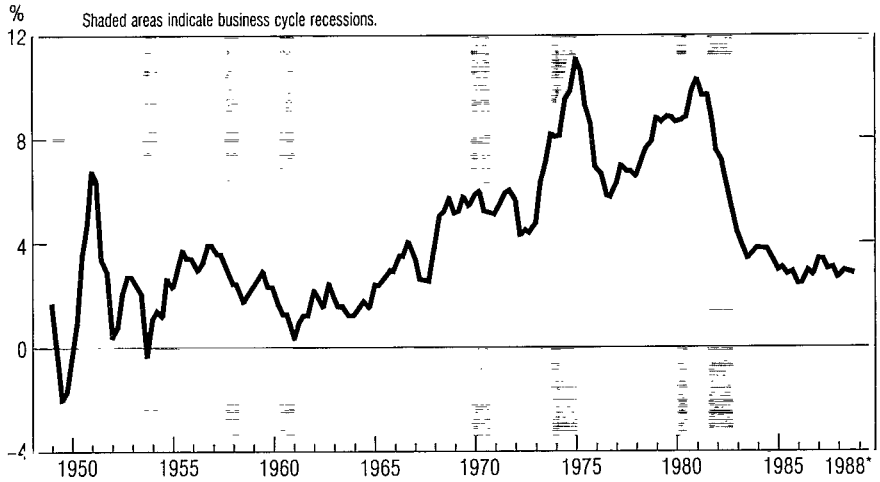


According to conventional analysis, at any point in time, the supply schedule is relatively flat at low levels of resource utilization, but relatively steep at high levels. This is because, at low levels, firms can acquire additional resources, or inputs, without bidding up resource prices, but at high levels, those prices must be bid up to attract the resources away from alternate uses. The resource price increases that firms face at each

Chart 2

40 Years of Inflation

Measured by the U.S. Gross National Product Deflator,
Quarterly Percentage Changes From One Year Earlier



*The 2nd, 3rd, and 4th quarters of 1988 are adjusted for the drought. The 4th quarter of 1988 is preliminary.
Source: U.S. Department of Commerce

point and those that they expect to face in the near future are passed on to consumers. Thus, early in an expansion, when resource utilization levels are low, increases in demand cause corresponding increases in output with only mild increases in prices. But as an expansion lengthens and resource utilization levels become high, increases in demand cause small increases in output and large increases in prices.

From this perspective, the conditions for higher inflation were present in 1988. It was very late in an expansion: By December, real gross national product (GNP, adjusted for inflation) had expanded for over 70 months, making this the longest peacetime expansion in the century. Total demand was clearly strong: Over the four quarters of 1988, real final sales (a measure of demand) grew 4 percent.[1] And by December, utilization of both capital and labor was high: The manufacturing capacity utilization rate was 84.4 percent, the highest it has been since 1979; the civilian unemployment rate was 5.3 percent, the lowest it has been since 1974; and the proportion of the working-age population employed was 61.6 percent, the highest it has ever been.

Despite these conditions, inflation did not rise significantly in 1988, according to some key measures. The broadest measure of inflation—the growth in the GNP deflator—accelerated very little. Adjusted for the effects of last year's severe drought, the deflator rose 3.5 percent in 1988,[2] only slightly more than its 3.1 percent rise in 1987. Chart 2 shows that the annual growth in the deflator has not changed much since 1983. This pattern is matched by that of a narrower inflation measure, the consumer price index with its volatile food and energy components removed. By both measures, inflation in 1988 held fairly steady in the neighborhood of 4 percent.

[1]This measure excludes Commodity Credit Corporation payments because the national income accounts treat them as government purchases, but they really are additions to government inventories.

[2]We subtract the effect of last year's drought on inflation because we expect this effect to be temporary. One way to adjust the GNP deflator for the drought is to use the U.S. Commerce Department's estimate that real output growth fell 0.6 of a percentage point last year due to the drought. We consider this adjustment to be a supply shock and use the empirical approximation that aggregate demand in the United States is unit elastic (Nelson 1988). This approximation implies that the drought raised the GNP deflator just as much as it lowered real GNP. A GNP deflator measure of inflation adjusted for the

This outcome is especially surprising because in the past inflation has tended to rise when these conditions were met, just as the conventional analysis predicts. As Chart 2 also shows, since the end of World War II (until recently), inflation has risen as expansions have lengthened. (For more discussion of this relationship, see U.S. President 1989, p. 268.) Also, inflation has tended to be higher at high rates of resource utilization. This is clear, for example, when the data for 1988 are compared to those for 1979, a year when rates of resource utilization were about as high as they were in 1988. Table 1 shows that, by four very different measures, inflation in 1988 was relatively low.

Inflation last year also surprised a statistical model maintained by researchers at the Minneapolis Fed. This Bayesian vector autoregression (BVAR) model assumes no particular structure for demand and supply, as conventional analysis does. Rather, the model attempts to capture important statistical patterns in the ways different economic variables evolve over time. Since the model includes 47 monthly variables with lagged values of up to 15 months for each variable, it can capture much more complex relationships than those examined above.

Last winter, shortly after the stock market crash, the BVAR model predicted slow growth and low inflation for 1988. It predicted that real growth would be 1.9 percent in 1988 and that inflation, as measured by the GNP deflator, would be 3.2 percent (Runkle 1988). During the four quarters of 1988, real GNP actually grew 2.7 percent and the deflator (unadjusted for the drought), 4.1 percent. Thus, according to these figures, inflation apparently was higher than the model expected.

But it was lower than expected if we take into account the unexpected drought and the surprising strength of the economy last year. If the model had known about these factors, it would have predicted higher inflation. In fact, we estimate that it would then have predicted growth in the GNP deflator over the four quarters of 1988 to be 4.7 percent, about half a percentage point higher than that growth actually was. (For a description of this model experiment, see the Appendix.)

Saying that the model would have forecast higher inflation if it had known about the drought and the economy's fast real growth last year may seem like a fancy way of justifying the model's error in forecasting inflation. But it is similar to the discussion of the conventional analysis above. There we said that, given the length of the recovery and the extent of capacity utilization, the conventional analysis would have predicted higher inflation. Here we are saying that, given the occurrence of the drought and the strength of demand, the history-based model would have predicted more inflation. This is more evidence that low inflation last year really was a surprise.

Table 1

A Historical Perspective on Growth, Resource Use, and Inflation

Indicator*	1979	1988
Changes in Output**		
Real Gross National Product (GNP)	2.5%	3.3%
Levels of Resource Use		
Unemployment Rate	5.8%	5.3%
Manufacturing Capacity Utilization Rate	84.6	84.4
Changes in Price Level**		
GNP Deflator	8.9%	3.5%
Consumer Price Index	11.3	4.7
Producer Price Index	9.4	4.3
Average Hourly Earnings Index	8.3	3.4

*The real GNP and GNP deflator changes are 4th quarter changes from one year earlier. The other three inflation measures are December changes from one year earlier. The resource use levels are for December.

**The real GNP and GNP deflator changes in 1988 are adjusted for the drought. The CPI and PPI measures exclude the volatile food and energy components.

Sources: U.S. Departments of Commerce and Labor, Federal Reserve Board of Governors

Accelerating Resource Costs

Although the general inflation rate did not increase much last year, there were signs that it may soon be rising. As factories operated close to full capacity and record numbers of workers were employed, the costs of labor and raw materials accelerated, and they were

drought is, therefore, the reported rate of inflation minus the 0.6 of a percentage point output adjustment. Since the reported growth rate in the deflator is 4.1 percent, the drought-adjusted measure is 3.5 percent. This estimate seems reasonable, for it is very close to another: If, instead, we had adjusted for the drought using the narrower private nonfarm deflator, our measure of inflation would have been 3.7 percent in 1988.

Whenever possible, we analyze price measures with temporary influences removed. Thus, we generally report year-over-year changes, and when we report the consumer and producer price indexes, we exclude the volatile energy and food components.

passed on in higher wholesale prices of finished goods. Though still at historically low growth rates, producer prices and average hourly earnings did rise somewhat faster in 1988 than they had in 1987. Also, at the end of 1988, the Commodity Research Bureau's industrial commodity spot market index, which measures the prices of raw materials, stood 5.9 percent over its level a year earlier.

Cost pressures are most apparent in labor compensation trends. Although wage and salary growth accelerated only a little last year, benefit growth accelerated a lot. According to the employment cost index, in 1988 total compensation per hour increased 4.9 percent, up from 3.3 percent the year before. Although growth in wages and salaries increased from 3.3 to 4.1 percent during this time, growth in benefits increased more, from 3.5 to 6.8 percent. Much of the acceleration in benefits reflects higher payments for health care and Social Security.

Labor cost pressures also are apparent in data on costs per unit of output. In private nonfarm industries, over the four quarters of 1988, compensation per hour increased 4.8 percent while productivity increased only 0.7 percent. In round numbers, a 1 percentage point acceleration in compensation and a 1 percentage point slowing in productivity growth led to a 2 percentage point acceleration in unit labor costs in 1988.

Looking Ahead

Moderate Growth Needed . . .

With historically high resource utilization rates and rising cost pressures, conventional analysis suggests that the economy is near full capacity, that is, where the supply curve has become steep. (Recall Chart 1.) If resource utilization rates continue to climb, cost pressures will continue to build and likely will cause inflation in general to accelerate. Compensation costs and producer prices already have accelerated at the current levels of capacity utilization and unemployment. According to the conventional view, higher rates of resource utilization would lead to further acceleration. That would likely result in higher inflation for final goods and services as merchants pass on resource cost increases to their customers.

In order for inflation not to accelerate, total demand for goods and services cannot grow much faster than 2.5 percent per year. Growth at that rate would reflect continued high utilization of both capital and labor, while faster growth would cause those utilization rates to rise. The 2.5 percent rate is an estimate of how fast total supply can grow based on the U.S. Labor Department's labor force projections and on an analysis of productivity trends. A high-employment rate of growth around 2.5 percent is also suggested by a number of studies (for example, CBO 1988, p. 104; WEFA Group 1988, p. 2.7; Lieberman 1989, p. 1).

If demand and supply—and, thus, output—were to grow at that rate, the number of new jobs would grow less than 200,000 workers per month. To reach that target, job growth must slow from its 1988 rate. Last year, nonfarm output grew 3.4 percent and payroll employment increased 303,000 workers per month. These figures show that if the economy is demand-driven, as conventional analysis suggests, then growth in nonfarm output and employment must be cut roughly a third to reach a growth rate that will not cause additional inflation.

In 1989 nonfarm output growth of 2.5 percent is consistent with faster growth in real GNP. According to the U.S. Commerce Department, last year the drought reduced real GNP growth 0.6 of a percentage point. If the drought ends this year, then real GNP should grow an extra 0.6 of a percentage point as agricultural output returns to normal levels. The ending of the drought can be considered a one-time shift up in total supply. Therefore, real GNP could grow 3.1 percent this year without increasing rates of resource utilization.

Still, this is a moderate rate of growth. Conventional analysis suggests that there is a fine line between growth strong enough to spur inflation and growth slow enough to slip the economy into a recession. If demand grows more than 2.5 percent, inflation is likely to rise. But if demand shrinks, a recession will result. There is not much room between 2.5 percent and zero growth.

. . . And Predicted

Yet the BVAR model and many forecasters seem to think that the economy will be able to walk this fine line in 1989 and 1990. Both demand and prices are expected to grow only moderately.

The BVAR model predicts that over 1989 and 1990 growth in demand will about match growth in supply (Table 2). The model predicts that this year real output will grow 3.1 percent—just what we would expect if nonfarm output grew 2.5 percent and the drought ended.[3] The model also predicts that next year growth

[3]How does a statistical model take into account the ending of a drought? We think that embedded in the model's forecast errors last year is a set of shocks corresponding to the drought which made real GNP lower than it otherwise would have been. As the effects of the drought shocks die out, real GNP will tend to rise back to its former path, resulting in temporarily higher real growth.

Table 2
A BVAR Model's Forecast for the U.S. Economy in 1989-90*

Indicator	Actual 1988	Model Forecast 1989	Model Forecast 1990	1948-88 Average
Annual Growth Rates (4th Qtr. % Changes From Year Earlier)				
Real Gross National Product	2.7%	3.1%	2.3%	3.3%
Consumer Spending	3.6	2.7	2.5	3.4
Durable Goods	6.4	3.2	0.6	5.1
Nondurable Goods and Services	3.0	2.7	2.8	3.2
Investment	-1.0	3.1	1.8	4.3
Business Fixed	5.5	5.7	3.6	3.7
Residential	2.4	-1.8	-2.9	3.8
Government Purchases	0.0	4.3	0.6	3.6
Gross National Product Deflator	4.1	4.0	3.9	4.2
4th Quarter Levels				
Change in Business Inventories (1982 $)	29.2 bil.	27.2 bil.	27.3 bil.	14.4 bil.
Net Exports (1982 $) (Exports less Imports)	-100.7 bil.	-104.1 bil.	-92.5 bil.	-20.7 bil.
Civilian Unemployment Rate (Unemployment as a % of the Civilian Labor Force)	5.3%	5.3%	5.5%	5.7%

*This is the forecast of a Bayesian vector autoregression model using data available on February 10, 1989.
Sources of actual data: U.S. Departments of Commerce and Labor

will slow to 2.3 percent. The slowing in growth seems to be explained by a slowing in demand, as the past increases in interest rates affect the interest-sensitive sectors of the economy (durable goods purchases, business fixed investment, and residential investment). The model also predicts a slowdown in government spending between 1989 and 1990. Altogether, real final sales are predicted to grow 2.8 percent in 1989 and 2.5 percent in 1990. This about matches the conventional estimate of supply growth. It also seems consistent with the model's estimate of supply growth, since the model predicts very little, if any, change in the unemployment rate over the two years.

Some evidence from outside the model seems broadly consistent with its moderate growth forecast (Table 3). The Congressional Budget Office (1989, p. xviii) predicts that real GNP will grow in 1989 and 1990 at about the same rates that the BVAR model predicts. And the Blue Chip consensus forecast (1989, p. 5), the median of the forecasts of 51 prominent private economists, is for growth about half a percentage point slower.

Leading indicators of business investment also suggest continued moderate growth in the economy. While new orders for nondefense capital goods did not grow in the fourth quarter of 1988, order backlogs continued to grow substantially. Together with relative stability in nonresidential building contracts, these data suggest some near-term growth in plant and equipment spending, but not as much as in 1988. This judgement is supported by the Commerce Department's annual plant and equipment survey, which predicts real investment growth in 1989 of nearly 6 percent—a robust rate, but only half of 1988's.

Thus, the consensus appears to be that demand will grow moderately over the next two years. With the capacity constraints facing the economy, this moderate growth suggests that inflation might not speed up during those years. In fact, both the BVAR model and the government and private forecasters expect the in-

Table 3
A Comparison of Growth and Inflation Forecasts

	4th Quarter % Changes From Year Earlier in			
	Real GNP		GNP Deflator	
Forecaster	1989	1990	1989	1990
BVAR Model*	3.1%	2.3%	4.0%	3.9%
Congressional Budget Office	2.9	2.2	3.9	4.4
Blue Chip Consensus of Private Economists	2.4	1.8	4.3	4.3

*This is the forecast of a Bayesian vector autoregression model using data available on February 10, 1989.
Sources: CBO 1989, p. xviii; Blue Chip 1989, p. 5

flation rate, measured by growth in the GNP deflator, to remain close to the low 4.1 percent rate of 1988. (See Table 3.)

Hedging

Moderate real growth and inflation seems possible in 1989–90. But such an outcome will require good luck and good policies.

Good luck is needed, according to the BVAR model. Although this model suggests that the moderate outcome is the most likely one, it also estimates significant probabilities that things could go wrong. It estimates, for instance, that inflation, as measured by the GNP deflator, has a 24 percent probability of accelerating to 5 percent or more in 1989. And it estimates that the chance of a recession (two consecutive quarters of declining real GNP) in 1989 or 1990 is 30 percent.

To avoid such undesirable outcomes, of course, good policy as well as good luck is required. If policy slows total demand too much, a recession could result. Since the connection between policies and the economy is highly uncertain, policymakers must be cautious to avoid slowing demand too abruptly. Past experience shows that gradually slowing the economy is not easy. In the years since 1948 that real GNP growth has slowed from one year to the next, for example, growth was, on average, 2.8 percentage points lower in the second year than in the first. If the economy slowed that much this year, we would have a recession, because growth last year (adjusted for the drought) was only 2.7 percent.

However, even though policymakers must be cautious, they also must be sure to act to restrain inflation in order to maintain public confidence. We argued that inflation was surprisingly low in 1988 and we expect it to remain low in 1989 and 1990. This is a pleasant development, but what explains it? We think part of the answer is that in the last few years policymakers have gained the public's confidence by acting responsibly with regard to inflation. We think this confidence is reflected in the relatively small movements last year in long-term interest rates. And we think it is one reason that merchants have been reluctant to pass on cost increases: they are confident policymakers will not let these cost pressures accelerate further.

Confidence, however, is a fragile thing. It can be shattered if policymakers do not act responsibly—if the Federal Reserve does not stick to its policies described to Congress in February or if progress is not made on the budget deficit. (See paper by Miller in this issue.) Without public confidence in 1989 and 1990, the U.S. economy could easily cross the fine line to much higher inflation.

Appendix
Measuring Demand Effects in a BVAR Model

In the preceding paper, we said that a Bayesian vector autoregression (BVAR) model of the U.S. economy would have predicted inflation of 4.7 percent last year if, when the prediction was made, it had known about the drought and the strength of demand last year. We explained there (in note 2) how we estimated that the drought would have added 0.6 of a percentage point to the 1988 inflation rate (the same amount it reduced the 1988 output growth). Here we explain how we measured the unexpected strength in demand last year and determined that it would have added the other 4.1 percent to the model's inflation forecast.

Identifying a Unit Shock

We determined the effect of the demand strength by first identifying a particular set of shocks to the model's core sector as a demand shock and then computing what the model's inflation forecast would have been if the unexpected strength in the economy last year had been caused solely by demand shocks.[1]

The most difficult part of our experiment was determining how we should define a *demand shock.* There is no unique way to define any kind of shock to a BVAR model because the model's forecast errors are correlated across equations.

Researchers have adopted three main methods to *orthogonalize* the shocks, that is, to get rid of the correlation among them. The most commonly used method, developed by Sims (1980), is to assume that a correct Wold causal chain for the model is known. An order for the equations in the model must be assumed, and this method assumes that the innovations in any equation are orthogonal to the innovations in the equations that follow it. Thus, the order of the equations is important for this method. Unfortunately, that order is arbitrary and affects the model's impulse response functions.

Another method of orthogonalization is to use standard simultaneous-equation techniques and impose identifying assumptions that exclude different variables in each equation (Blanchard and Watson 1984, Bernanke 1986, Sims 1986). However, Sims (1980) has criticized this method as arbitrary.

For our model experiment, we adopted yet another method of orthogonalization: we used an eigenvector decomposition of the covariance matrix of the one-step-ahead forecast errors from the core sector of the model (Miller and Roberds 1987).[2] Since the eigenvectors are orthogonal by construction, we checked whether any of them displayed the properties usually associated with a demand shock, namely, that the shock to real output is positively correlated with the shocks to the price level and the interest rate and negatively correlated with the shock to inventory accumulation. One of our eigenvectors had those properties. With that eigenvector, we defined a *unit demand shock* as a set of one-month changes that go along with a real gross national product (GNP) increase of 1 percent:

Real GNP	+1.0%
Stock Price Index	+16.2%
Foreign Exchange Value of the Dollar	+2.5%
GNP Deflator	+0.1%
Monetary Base	−0.1%
Treasury Bill Rate	+65.7 basis points
Change in Business Inventories	−$8.9 billion.

Scaling the Shocks

Having defined a unit demand shock as this set of changes, we estimated what our model would have predicted for inflation in 1988 if, because of demand shocks alone, real GNP had grown 3.3 percent (its actual growth, if there had been no drought). We allocated the additional growth across the quarters of 1988 in proportion to the actual growth rate in each quarter.

We first generated a baseline forecast using data through January 1988 and assuming all future shocks were zero. Then, for each quarter, we computed the size of the demand shock that would be necessary to bring real GNP from the baseline forecast level to the level necessary to reach the 3.3 percent growth target. We then computed the effect that this shock would have on future levels of real GNP and the GNP deflator. By scaling the shocks in each period, we determined what the model would have predicted about the GNP deflator if the deviation between real GNP's baseline forecast and its assumed path was caused by this demand shock.

Using this method, the model predicted that, without a drought but with demand as strong as it was, inflation in 1988 would have been 4.1 percent.

[1] The structure of the national forecasting model maintained by researchers at the Minneapolis Fed is discussed by Litterman (1984), Todd (1984), and Roberds and Todd (1987).

[2] The innovations in the model's core are partially orthogonalized automatically because contemporaneous values of stock prices, the Treasury bill interest rate, and the foreign exchange value of the dollar are included in the equations for the price level, real gross national product, the monetary base, and the change in business inventories. Since we wanted to create our own orthogonalization of the core's innovations, before we computed an eigenvector decompositon we transformed the core into an equivalent system that included only lagged variables in each equation.

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