The inflation-unemployment tradeoff

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Recent estimates of prices, production, and employment show the worst of all possible worlds—high inflation, declining production, and rising unemployment.

- The GNP deflator increased at an annual rate of 9.3 percent in the first half of the year.
- Real GNP declined at an annual rate of 2.3 percent in the second quarter, after an increase of only 1.1 percent in the first.
- The unemployment rate eased up to 6.0 percent in August, after months at or near 5.6 percent, and is expected to rise further.

These figures call into question one of the basic assumptions underlying decades of policy discussion—that there is an exploitable tradeoff between inflation and production (or unemployment).

Policymakers long took for granted that unemployment could be reduced if the country was willing to accept a higher rate of inflation. It was common through the early 1970s to hear policy discussed in terms of this tradeoff.

That some people still talk in these terms while others deny that such a tradeoff exists is not hard to explain. To some extent, this contrast reflects differences in the interpretation of data that are far from conclusive. But to a greater extent, it reflects differences in the time frames the two groups are considering.

Effects of a change in policy (fiscal or monetary) on production are felt quickly—in weeks, months, or quarters. Full effects on the price level, however, take at least two years, and it may take longer for the effects to work through the system. People looking at near horizons, therefore, emphasize the effects on production and employment. Those taking a longer view emphasize the effects on prices.

The neutrality of money

Early in the century, economists still customarily emphasized the long-run price effects of changes in monetary policy. Short-term effects on production were either ignored or simply mentioned in passing. In fact, belief in the neutrality of money—the idea that in the long run money influences only prices and neither the level nor the composition of production—came to be a test of sound economic thinking.

Irving Fisher, who pretty well epitomized this view, wrote 70 years ago that a change in the quantity of money causes a proportional change in the level of prices with no effect on real production over the long run. Similarly, a change in the rate of monetary growth causes an equal change in the rate of inflation, with no permanent effect on real production or employment.

Although Fisher saw that a sudden change in the quantity of money would initially affect the volume of real output or trade, he believed the effect was temporary. In terms of long-run (ultimate) effects, he argued:

> An inflation of the currency cannot increase the product of farms or factories, nor the speed of freight trains or ships. The stream of business depends on natural resources and technical conditions, not on the quantity of money.

Fisher's quantity theory of money focused on only one of the many factors that determine prices, interest rates, and real production. The effects of an increase in the amount of money, he said,

> . . . are blended with the effects of changes in the other factors in the equation of exchange just as the effects of gravity upon a falling body are blended with the effects of the resistance of the atmosphere.

The Keynesian Revolution

In the 30 years after Fisher's publication of *The Rate of Interest* (1907) and *The Pur-*

chasing Power of Money (1911), the world saw the Great War, the Russian Revolution, German hyperinflation, Black Thursday, and worldwide depression. In response to the Great Depression, John Maynard Keynes wrote *The General Theory of Employment, Interest, and Money* in 1935. As the title suggests, Keynes presented a theory he believed was general enough to explain the relationships between money, interest rates, and employment in periods of both "involuntary" unemployment and "full" employment. Keynes and his *General Theory* have had a pervasive influence on economic policy ever since.

He severely criticized classical economists for assuming a world of full employment in which the quantity of money affects only prices and not production or employment. Looking around, he saw many people unable to find work. Seeing a world where normally "labor stipulates (within limits) for a money-wage rather than a real wage," he wrote, "whether logical or illogical, experience shows that this is how labour in fact behaves." Keynes had little patience with the idea that involuntary unemployment was not possible because wages always adjust to maintain full employment.

The drag on prosperity during the Depression, he said, was due to an "insufficiency of effective demand." The government could stimulate aggregate demand through fiscal and monetary policies. By fiscal policy, he meant the deliberate manipulation of tax structures and expenditures.

Although Keynes did not refer explicitly to the tradeoff between inflation and unemployment, the idea is implicit in his discussion at several points, particularly in his analysis of the labor market. He agreed with classical economists that the demand for labor is such that "the wage of an employed person is equal to the value which would be lost if employment were to be reduced by one unit." In the jargon of economics, that means the nominal wage rate is equal to the marginal revenue product of labor.

He disagreed with classical economists, however, on the nature of the supply of labor. The supply, he said, is not solely a function of real wages. "Whilst workers will usually resist a reduction of money-wages, it is not their practice to withdraw their labour whenever there is a rise in the price of wage-goods." In the terminology of today, the price of wage-goods can be interpreted as a consumer price index.

Keynes defined three categories of unemployment—frictional, voluntary, and involuntary. He considered this third category of unemployment inconsistent with classical theory *but* consistent with unemployment in the real world. By involuntary unemployment, he did not mean "the mere existence of an unexhausted capacity to work." He meant that,

> Men are involuntarily unemployed if, in the event of a small rise in the price of wage-goods relatively to the money-wage, both the aggregate supply of labour willing to work for the current money-wage and the aggregate demand for it at that wage would be greater than the existing volume of employment.

Given this definition and assumptions about the labor market, Keynes thought employment would increase when prices increased more than wages.

Regarding monetary policy, Keynes considered the "quantity of money as determined by the action of the central bank" to be one of the "ultimate independent variables" in an economy. Furthermore, the "primary effect of a change in the quantity of money on the quantity of effective demand is through its influence on the rate of interest."

By lowering the rate of interest, the central bank can stimulate investment and raise effective demand. Keynes observed that "the increase in effective demand will, generally speaking, spend itself partly in increasing the quantity of employment and partly in raising the level of prices."

This implicit tradeoff depends, however, on resource utilization. Keynes said that it is probable

> . . . that the general level of prices will not rise very much as output increases, so long as there are available efficient unemployed resources of every type. But as soon as output has increased sufficiently to begin to reach the 'bottlenecks', there is likely to be a sharp rise in the prices of certain commodities.

When the economy reaches full employment, where there is no involuntary unemployment, an increase in the quantity of money causes a fully proportionate increase in prices and wages without any further increase in production. At that point, the economy undergoes what Keynes called true inflation.

A decrease in the quantity of money, however—and thereby a reduction in effective demand—causes a reduction in employment. The reason, Keynes figured, is that,

> . . . the factors of production, and in particular the workers, are disposed to resist a reduction in their money-rewards, and that there is no corresponding motive to resist an increase.

The Phillips curve

Although Keynes' analysis of the relationship between prices and unemployment had a profound influence on economic thinking, the idea of a stable tradeoff was given an enormous boost in 1958 by an article by A. W. Phillips. Using annual data from the United Kingdom from 1861 to 1913, he estimated a nonlinear equation that related the rate of change of money wages to the unemployment rate.

When the data were plotted in a scatter diagram, Phillips obtained a series of counterclockwise loops. The annual rate of increase in money wages tended to be high when the unemployment rate was low. The rate of increase in money wages tended to be low, even negative, when the unemployment rate was high. The equation he estimated was intended to approximate this inverse relationship.

The curve he fitted to 1861-1913 data also fits fairly well data from 1948 to 1957. The Phillips curve, then, seemed to confirm that there was a stable tradeoff between increases in wages and unemployment—a fact with enormous implications for policy.

In 1960, Paul A. Samuelson and Robert M. Solow made their "best guess" of a Phillips curve for the United States. By allowing for some wage increases to reflect gains in productivity, they translated the tradeoff question into a relationship between inflation and unemployment. This modified Phillips curve showed "the menu of choice between different degrees of unemployment and price stability" or "the different levels of unemployment that would be 'needed' for each degree of price level change."

According to Samuelson and Solow's estimates, an unemployment rate of 5 to 6 percent "would appear to be the cost of price stability in the years immediately ahead." For an unemployment rate of 3 percent, they estimated that the price index might have to rise as much as 4 to 5 percent a year. The increase in prices, they said, "would seem to be the necessary cost of high employment and production in the years immediately ahead."

They cautioned that the menu could change since "what we do in a policy way during the next few years might cause it to shift in a definite way." But they could not offer any conclusive or suggestive evidence on the direction or magnitude of the shift that was to be expected.

The natural rate hypothesis

Working independently, Milton Friedman and Edmund S. Phelps developed theories in 1967 predicting a long-run shift in the Phillips curve. According to their theories, there is no long-run tradeoff between inflation and unemployment.

Friedman argued in his presidential address to the American Economic Association that monetary policy "cannot peg the rate of unemployment for more than very limited periods." While "there is always a temporary tradeoff between inflation and unemployment; there is no permanent trade-off."

The logic of his conclusion lies beyond the immediate effects of monetary policy in an examination of the "delayed consequences of such a policy." In the employment market at any time, Friedman said,

> . . . there is some level of unemployment which has the property that it is consistent with equilibrium in the structure of *real* wage rates. At that level of unemployment, real wage rates are tending on the average to rise at a 'normal' secular rate, i.e., at a rate that can be indefinitely maintained so long as capital formation, technological improvements, etc., remain on their long-run trends.

This natural rate of unemployment is a function of such real forces as "market imperfections, stochastic variability in demands and supplies, the cost of gathering information about job vacancies and labor availabilities, the cost of mobility, and so on." Among the policy-made determinants that affect its level, Friedman mentioned legal minimum wage rates, the Walsh-Healy and Davis-Bacon Acts, and the strength of labor unions.

He used the word natural, he said, not to suggest that there was something normal or desirable about this rate of unemployment but simply to separate "real" forces from monetary forces.

The actual or reported rate of unemployment Friedman called the market rate. Changes in the quantity of money were assumed to have only a temporary effect on this market rate. Suppose, he said, that the monetary authority increases the rate of monetary growth when prices have been stable.

> This will be expansionary. By making nominal cash balances higher than people desire, it will tend initially to lower interest rates and in this and other ways to stimulate spending. Income and spending will start to rise. To begin with, much or most of the rise in income will take the form of an increase in output and employment rather than in prices. People have been expecting prices to be stable, and prices and wages have been set for some time in the future on that basis. It takes time for people to adjust to a new state of demand. Producers will tend to react to the initial expansion in aggregate demand by increasing output, employees by working longer hours, and the unemployed by taking jobs now offered at former nominal wages.

Friedman considered this part of his scenario pretty standard doctrine, even Keynesian in spirit. But the second part carries the story beyond these initial effects into Fisher's view of the long run.

> Because selling prices of products typically respond to an unanticipated rise in nominal demand faster than prices of factors of production, real wages received have gone down—though real wages anticipated by employees went up, since employees implicitly evaluated the wages offered at the earlier price level.

According to Friedman, this decline in real wages will soon affect expectations.

> Employees will start to reckon on rising prices of the things they buy and to demand higher nominal wages for the future. "Market" unemployment is below the "natural" level. There is an excess demand for labor so real wages will tend to rise toward their initial level. Even though the higher rate of monetary growth continues, the rise in real wages will reverse the decline in unemployment, and then lead to a rise, which will tend to return unemployment to its former level.

The theory predicts that the short-run Phillips curve will systematically shift upward as workers anticipate increases in prices. The fundamental assumption, described by Phelps, is that "the quantities of employment and production are invariant to the rate of in-

flation when that inflation is expected and thus already properly 'discounted.' "

If the government tries through changes in the rate of monetary growth to keep the unemployment rate below the natural rate, the results will be unstable. This is because an increase in the rate of money growth increases aggregate demand and inflation. The unemployment rate is reduced for a while, but as workers learn to anticipate the higher rate of inflation, they will bargain for even greater increases in nominal wages in an effort to regain their previous level of real wages. Employers will begin cutting back on employment, and the unemployment rate will begin returning to its natural level.

To maintain the lower rate of unemployment, the government must step up the rate of growth of money. But this rule for monetary policy leads eventually to continually accelerating rates of monetary growth and inflation.

This long-run instability is called the accelerationist hypothesis. To the extent that it holds in the real world, policies designed to hold unemployment below the natural rate—as opposed to policies, such as retraining programs, designed to shift the natural rate itself—are doomed to failure.

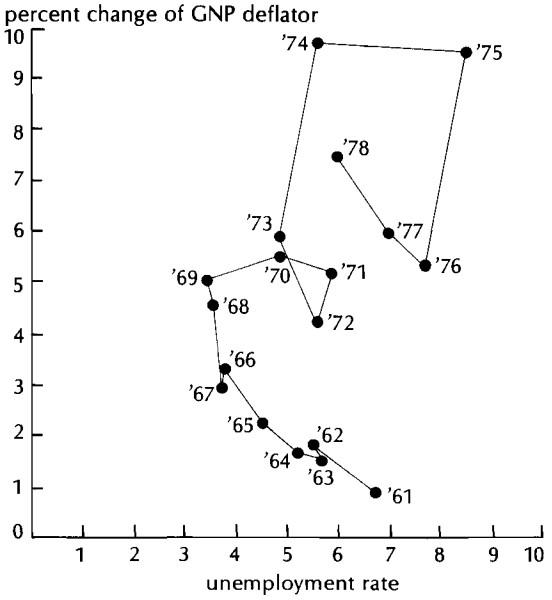
Evidence from the 1960s and 1970s

Review of some of the developments in the United States over the past two decades helps put these theories in perspective. A scatter diagram of the rate of increase in the GNP price deflator and the unemployment rate shows two distinct patterns in the line connecting the data points for successive years.

From 1961 to 1969, the country had generally declining unemployment and increasing inflation. The GNP implicit price deflator, for example, was increasing at an annual rate of 0.9 percent in 1961 and 5.0 percent in1969. The unemployment rate averaged 6.7 percent in 1961 and only 3.5 percent in 1969.

This period was the heyday of Phillips curve fitters. With nearly any inflation series and unemployment variable, it was easy to estimate a seemingly stable Phillips curve. Models fitted the data well and did a reasonably good job in predicting in the near term.

The shifting Phillips Curve



In the 1970s, however, "stagflation" has been the rule. Plots of inflation and unemployment rates for 1970 to 1978 show two clockwise loops corresponding to the two recessions. In the first, unemployment reached an annual average rate of 6.1 percent in 1971. In the second, it reached a high of 8.7 percent in 1975.

In terms of Phillips curves, the lesson of the past decade has been that changing conditions can shift the short-run tradeoff between inflation and unemployment. The logic of Friedman and Phelps explains part of this shift—that as workers begin anticipating higher rates of inflation, the short-run Phillips curve systematically shifts upwards.

This explanation, however, will not account for some of the shifts. From 1973 to 1975, for example, both inflation and the level of unemployment rose sharply, largely as a result of the removal of wage and price controls and the quadrupling of prices of crude oil. There were also other special factors at work—crop failures, change in the composi-

tion of the labor force, adverse weather, the financial woes of New York City. But, it is hard to disentangle the effects of these influences without more sophisticated statistical techniques.

Modeling the effects of policy

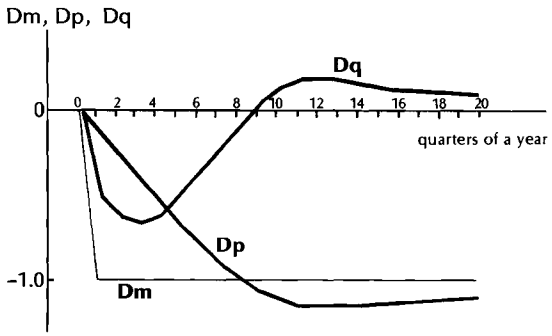
Econometric models—sets of statistically estimated equations describing the workings of the economy—are used to estimate the expected effects of monetary policy. These dynamic models, ranging in size from one or two equations up to hundreds or even thousands of equations, provide estimates of both the short-run and long-run effects of policy changes, allowing examination of both the "honeymoon" period when there is probably a tradeoff between inflation and unemployment and later when the tradeoff largely disappears.

A small model developed by the author imposes the long-run assumptions of Irving Fisher on a set of linear equations. Weighted averages of lagged values of the rates of growth of the money supply (Dm) and federal government purchases of goods and services are used to predict the rates of change of real GNP (Dq) and the GNP price deflator (Dp). Dummy variables are included to provide estimates of the effects of wage and price controls in the early 1970s and the later boosts in prices of imported oil.

This model predicts, other things being equal, a one percentage point decrease in the rate of growth of money will cause an equal reduction in the rate of inflation within two years. During that time, there will be a temporary reduction in the rate of growth of real production. After two years, real output will gradually return to its natural level and the rate of inflation will be permanently reduced one percentage point.

A graph of these expected results provides a visual summary of the model's dynamic impact multipliers. Time is plotted along the horizontal axis. Rates of change of money, real GNP, and the GNP implicit deflator (a price index) are plotted along the vertical axis.

Effects of a decrease in the rate of growth of M-1



The model is Keynesian in the short run. In the first year after a change in monetary policy, there is more of an effect on real production than on the price level. Beyond this initial period, however, the effect on prices begins to take shape as the major response.

Responses of this model to a tightening of monetary policy are substantially different from those of large-scale models, which typically predict that effects of changes in the rate of monetary growth are spread over long periods, years or even decades. But when these large-scale models are presented to policymakers, they are usually simulated for only two or three years. In a sense only the initial honeymoon period is considered. No consideration is given to what lies beyond this first period of bliss.

The standard rebuttal to this criticism of ignoring long-run effects appears in Keynes' famous quip, "In the long run, we are all dead." Robert Solow offered a variation on this theme in a comment on the tradeoff between inflation and unemployment. The tradeoff, he said, "may not be permanent; but it lasts long enough for me." This approach is equivalent to assuming away the stability problems of the long-run effects of monetary policy.

Equally important, it is simply not true that all of us, even most of us, will be dead in the time that is appropriate for judging the effects of monetary policy. According to the author's small model, the full price effects of a change in policy are expected in about two

years. Even if these effects take longer to develop, they are not far enough in the future for policymakers to ignore.

Summary and conclusion

The country is in a state of stagflation—inflation high and GNP declining. In this situation, despite the temptation to act quickly to cushion the effects of the recession that is apparently under way, the Federal Reserve must also consider the long-run consequences of policy—especially the consequences for prices, interest rates, and the international position of the dollar.

To provide some perspective on these effects, this article has reviewed some of the most prominent theories of this century on the effects of changes in monetary policy and the kind of tradeoff that can be made between inflation and unemployment. Care has been taken to distinguish between short-run and long-run effects of a change in the rate of monetary growth.

These theories, in turn, have been put into perspective by reviewing the basic trends in unemployment and prices over the past two decades. These trends have brought a growing consensus that there is no permanent tradeoff between unemployment and inflation and that the short-run tradeoff can be shifted by such special factors as wage-price controls or a sharp rise in oil prices.

Although a change in the rate of monetary growth can affect production and employment, these effects appear to be only transitory. The model indicates that after only a couple of years, the effects of monetary policy are reflected primarily in the rate of inflation. This suggests that monetary policy should be directed at what can be controlled—the long-run inflation rate—instead of being dissipated in a quixotic effort to keep unemployment below its natural rate.

The Gittings Model

This model consists of two linear difference equations that are estimated after the imposition of assumptions about the long-run neutrality of money. One equation is for the rate of growth of nominal GNP (Dy); the other is for the rate of inflation (Dp) as measured by the GNP deflator. At any time, the growth rate of real GNP (Dq) is equal to the growth rate of nominal GNP minus the rate of inflation.

The two equations have the same basic structure. They include the same number (N) of lagged dependent variables and the same number (M) of lagged values of the rate of monetary growth (Dm). Each equation includes an intercept term, a weighted average of the rates of growth of federal government purchases of goods and services (Dg), and dummy variables for periods following the imposition of wage and price controls in the third quarter of 1971 and the quadrupling of crude oil prices in the fourth quarter of 1973. The sample period for estimation is from the first quarter of 1959 through the fourth quarter of 1976.

The specific functional form for the inflation equation is the following:

$$Dp(t) = a_o + \sum_{i=1}^{N} a(i)Dp(t-i) + \sum_{j=o}^{M} b(j)Dm(t-j) + \sum_{j=o}^{M} c(j)Dg(t-j) + dumwp(t) + dumoil(t)$$

This equation is an ordinary difference equation. The current rate of inflation (Dp(t)) is assumed to be a function of the rates of inflation in previous periods (Dp(t-i)). The lag weights (b(j) and c(j)) for the rates of growth of money and federal government purchases are generated by third-degree polynomials with an end-point constraint.

Assumptions about the long-run neutrality of money correspond to the following constraints on the coefficients of the inflation equation:

$$\sum_{i=1}^{N} a(i) + \sum_{j=o}^{M} b(j) = 1\,, \qquad \sum_{i=1}^{N} ia(i) + \sum_{j=o}^{M} jb(j) = 0$$

These constraints and the polynomial generating functions are also used in estimating the equation for the rate of growth of nominal GNP.

In estimating this model the author tried a large number of alternative lag structures. The model used to generate the reported impact multipliers consists of third-order difference equations with 14-quarter weighted averages of the growth rate of the money supply and federal government purchases. The dummy variables are applied for 10 quarters. Within the sample period, this model explains 52 percent of the variance of the rate of change of nominal GNP and 84 percent of the variance of the rate of inflation.

For a technical description of the model, see "A Linear Model of the Long-Run Neutrality of Money." *Staff Memoranda* 79-6, Federal Reserve Bank of Chicago. Copies are available from the bank's Public Information Center.