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# INFLATION AND UNEMPLOYMENT: ARE THEY COMPLEMENTS OR SUBSTITUTES?

By Clark Edwards\*

Unemployment and inflation used to be seen as bipolar events. They were considered to be at opposite ends of a continuum and, therefore, could not both happen at the same time. Since 1970, events have taught many of us to see them as possibly correlated or independent rather than as substitutes.

The older belief was well grounded empirically. During the last 31 years (1948-78), the United States experienced 12 years of relatively high unemployment (over 4 percent) and low inflation (less than 2.5 percent) (table 1 and fig. 1). Economists following Keynes identified insufficient aggregate demand as the cause of the unemployment and recommended expansionary monetary and fiscal policies. During years of high unemployment and low inflation, expanding money supplies and increased government deficits were expected to deal with the problem.

During 6 of the years since 1948, the United States experienced relatively high inflation (over 2.5 percent) and low unemployment (less than 4 percent) (table 1 and fig. 1). These were characterized as years of excess aggregate demand. Tight monetary and fiscal policies were expected to cope with inflation without exacerbating unemployment.

Only 2 of these 31 years—1952 and 1953—were characterized by both low price rises (less than 2.5 percent) and low unemployment (less than 4 percent) (table 1 and

Inflation and unemployment plagued the U.S. economy during the decade of the seventies. Some economic models suggest that inflation and unemployment are bipolar events—they cannot occur at the same time. This article reviews two models that have been in the economics literature since the thirties and that explain inflation and unemployment as complements, not substitutes. One is the well-known IS/LM framework, the other is sometimes called the structural unemployment framework. A third model which helps to explain the complementarity between inflation and unemployment—one which focuses on the international balances of payments and trade—is not discussed.

## Keywords

*Inflation Unemployment  
Monetary policy  
Fiscal policy  
Economic theory*

fig. 1) The national goals adopted by the Congress in 1946 of stable prices and full employment have yet to be realized.

The recent experience of simultaneous inflation and unemployment initially came as a surprise to many. But by now this phenomenon has occurred in 11 of the past 31 years. The first time it happened, in 1956 and 1957, the phrase "structural unemployment" was introduced. The concept was that one had to examine the detailed structure of the economy, not just the aggregate, to locate which

sectors had unemployment and which had inflation. Persistent inflation and relatively high unemployment have occurred in each year since 1970.

Broad monetary and fiscal policies worked reasonably well during the 12 years of relatively high unemployment and low inflation and during the 6 years of inflation and relatively low unemployment. This gave the public a sense of confidence in the economics profession. But the policies seemed to fail during the 11 years of simultaneous inflation and high unemployment. This failure, and the apparent inability of economists to explain to the public and to policymakers what was happening, has understandably weakened public confidence in the advice of economists.

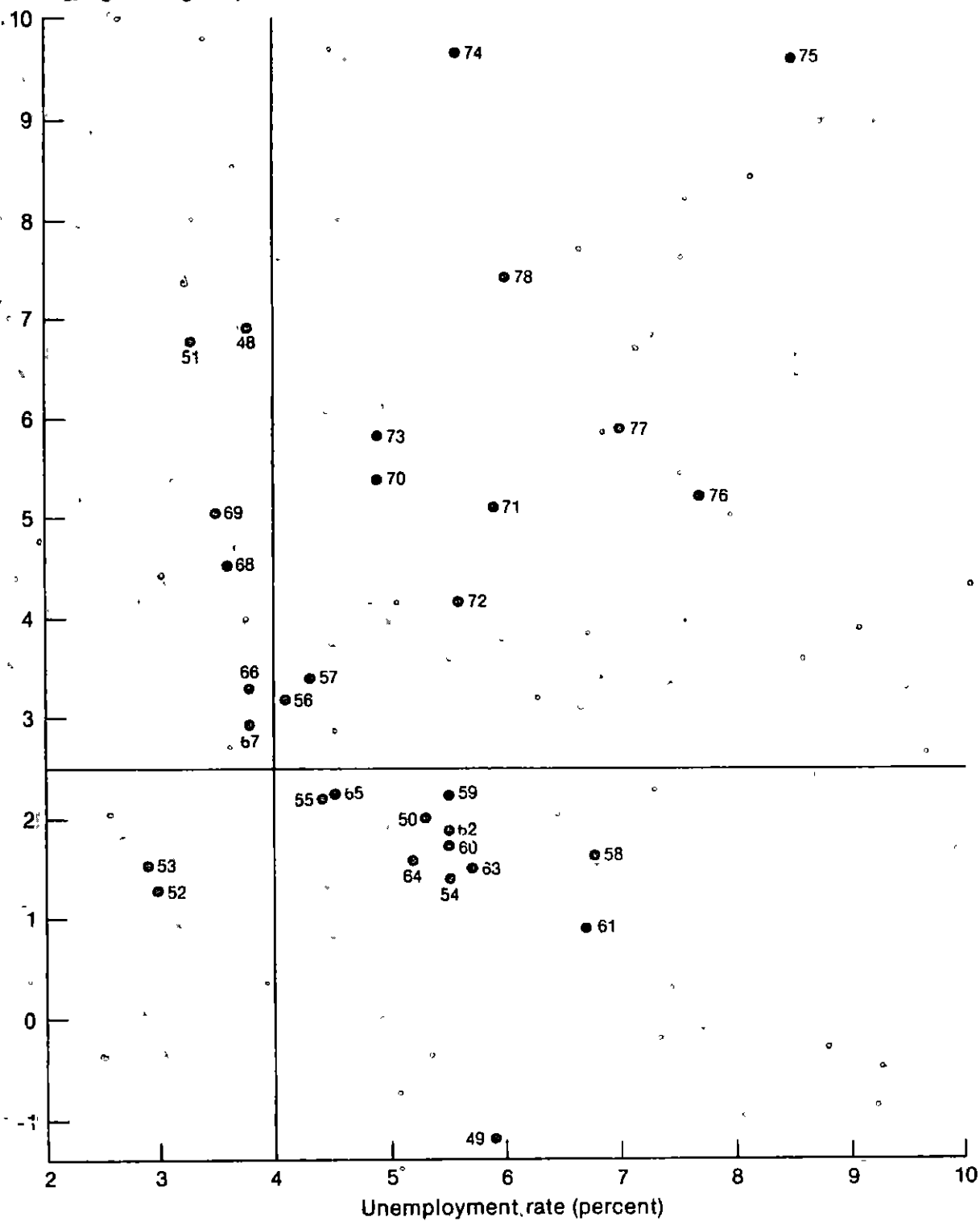
Yet the textbooks are not without explanations. This article examines two ideas introduced into the economics literature since the mid thirties but does not review the extensive literature defending and attacking them. These ideas help to explain how the problem arises and they point to ameliorative policies. The first of these ideas comes from J. M. Keynes' theory of interest as modified and improved upon by J. R. Hicks. The Keynes-Hicks formulation of the mid thirties helps to clarify why broad monetary and fiscal policies began to fail during the late sixties. The second idea, directly from Keynes, teaches us to look at the economic structure beneath the broad aggregates to understand and explain how inflation and unemployment can be simultaneous. A third idea, of more recent origin and not dealt with in

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Figure 1

# Inflation and the Unemployment Rate, 1948-78

Percentage change in price



Note Numbers in field of chart are years, 1948; 1949 and so on

*Unemployment and inflation used to be seen as bipolar events. Since 1970 events have taught many of us to see them as possibly correlated or independent rather than as substitutes*

this article, pertains to international linkages—policies which alleviate a domestic problem may aggravate a foreign one

## INTEREST RATES AND AGGREGATE ECONOMIC POLICY

Keynes' theory of interest, published in 1936 in his *General Theory*, deviated sharply from the classical explanation which depended on the supply and demand for loanable funds in a smoothly functioning competitive market for real goods and services (2).<sup>1</sup> Keynes thought the supply of loanable funds depends not on the interest rate but on the level of income and the propensity to save. The interest rate depends on the supply and demand for money in a smoothly functioning portfolio market apart from and in addition to the supply and demand for real goods and services. The demand for money reflects liquidity preference—the desire to remove money from the circular flow of spending and hold it idle. The supply of money can be controlled, at least to an extent, by the central monetary authority. With this formulation, the quantity of money could play an active part in public policies dealing with inflation and unemployment. For example, an increase in the money supply could result in a lower rate of interest which would, in turn, induce invest-

ment and lead to an increase in income, output, and employment.

Hicks, in an effort to show that Keynes' ideas were not inconsistent with what Keynes called the classical formulation, developed a generalized version of Keynes' general theory. Hicks' version, published in 1937 in his "Mr. Keynes and the Classics," allowed for feed-

back between the real and monetary sectors (1). He showed that the interest rate provided a close link between two markets—the supply and demand for money in the portfolio market which was emphasized by Keynes, and also the supply and demand for real goods and services which was emphasized in the classical system. Hicks saw Keynes'

Table 1—Inflation, the unemployment rate, and the interest rate 1948-78

| Year | Inflation rate <sup>1</sup> | Unemployment rate | Interest rate <sup>2</sup> |
|------|-----------------------------|-------------------|----------------------------|
| 1948 | 6.90                        | 3.80              | 3.24                       |
| 1949 | -1.02                       | 5.90              | 3.47                       |
| 1950 | 2.00                        | 5.30              | 3.42                       |
| 1951 | 6.77                        | 3.30              | 3.24                       |
| 1952 | 1.27                        | 3.00              | 3.41                       |
| 1953 | 1.52                        | 2.90              | 3.52                       |
| 1954 | 1.38                        | 5.50              | 3.74                       |
| 1955 | 2.16                        | 4.40              | 3.51                       |
| 1956 | 3.15                        | 4.10              | 3.53                       |
| 1957 | 3.37                        | 4.30              | 3.88                       |
| 1958 | 1.60                        | 6.80              | 4.71                       |
| 1959 | 2.21                        | 5.50              | 4.73                       |
| 1960 | 1.70                        | 5.50              | 5.05                       |
| 1961 | .89                         | 6.70              | 5.19                       |
| 1962 | 1.83                        | 5.50              | 5.08                       |
| 1963 | 1.47                        | 5.70              | 5.02                       |
| 1964 | 1.56                        | 5.20              | 4.86                       |
| 1965 | 2.21                        | 4.50              | 4.83                       |
| 1966 | 3.28                        | 3.80              | 4.87                       |
| 1967 | 2.94                        | 3.80              | 5.67                       |
| 1968 | 4.49                        | 3.60              | 6.23                       |
| 1969 | 5.03                        | 3.50              | 6.94                       |
| 1970 | 5.35                        | 4.90              | 7.81                       |
| 1971 | 5.10                        | 5.90              | 9.10                       |
| 1972 | 4.14                        | 5.60              | 8.56                       |
| 1973 | 5.80                        | 4.90              | 8.15                       |
| 1974 | 9.66                        | 5.60              | 8.24                       |
| 1975 | 9.59                        | 8.50              | 9.50                       |
| 1976 | 5.20                        | 7.70              | 10.61                      |
| 1977 | 5.87                        | 7.00              | 9.75                       |
| 1978 | 7.40                        | 6.00              | 8.97                       |

<sup>1</sup> Annual percentage change in Implicit Price Deflator

<sup>2</sup> Moody's Corporate Baa Bond Yield

Source: *Survey of Current Business*

<sup>1</sup> Italicized numbers in parentheses refer to items in References at the end of this article

*The critical point is that monetary and fiscal policies are not symmetrical. In general, one cannot offset easy fiscal policies with tight monetary policies*

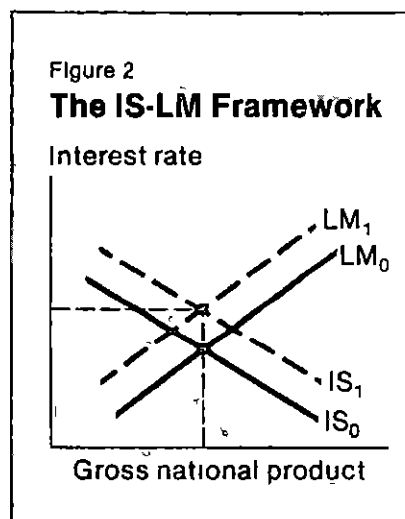
published view and the classical view as special cases of his own more general system

Hicks said his improvements in Keynes' version were suggested by "mathematical elegance" (1, p. 156). Keynes must have objected to this method because he had said, when presenting his theory, that

Too large a proportion of recent 'mathematical' economics are mere concoctions, as imprecise as the initial assumptions they rest on, which allow the author to lose sight of the complexities and interdependencies of the real world in a maze of pretentious and unhelpful symbols (2, p. 298)

Hicks' symbols have proved exceedingly helpful in explaining the interactions among Keynesian variables and his generalizations have been supported by empirical evidence accumulated later. The Keynes-Hicks idea is referred to as the IS-LM framework (fig. 2). This framework suggests that real flows of goods and services can be described by an equation relating the interest rate to the level of aggregate income (the IS curve), and that monetary flows can be described by another equation involving the same two variables (the LM curve) (Hicks called it the LL curve).

The critical point is that monetary and fiscal policies are not symmetrical. In general, one cannot offset easy fiscal policies with tight monetary policies. Consider an economy initially in equilibrium as indicated by the intersection of  $IS_0$  and  $LM_0$  in figure 2. According to the Keynes-Hicks theory, if a fiscal policy of deficit spending is embarked upon to fight unemploy-



ment, output and employment will increase. (In the figure, this is shown by a shift from  $IS_0$  to  $IS_1$ .) If the total money supply is held constant as aggregate business activity rises, then as more money is used to support the increase in transactions, less money is free to satisfy liquidity preferences. As money disappears from idle balances, efforts to maintain liquidity will cause interest rates to rise.

On the other hand, expansionary monetary policies used to fight unemployment would increase output and employment but would decrease interest rates. This is because more idle monetary balances

would be available. Both policies create jobs, but they have opposite effects on the interest rate. Because of this asymmetry, an expansion resulting from fiscal policy cannot be cancelled by tight monetary policy. The initial level of aggregate demand is restored but the interest rate is higher. (In the figure, this is shown by a shift from  $LM_0$  to  $LM_1$ .)

Now apply this framework to the monetary and fiscal activities in the United States since late 1965. The economy then was close to full employment and inflation was moderate (table 1 and fig. 1). Deficit spending was incurred to pay for the Vietnam War, fiscal policy was political, not economic, in purpose. But the policy had economic consequences. It spurred inflation by pushing aggregate demand beyond existing production capacity. Some economists at the time suggested that one way to fight the coming inflation was to raise taxes. This policy would have held aggregate demand at noninflationary levels. Once the economy reallocated resources to produce less butter and more guns, inflationary pressures would ease, full employment would be sustained, and interest rates could be maintained at accustomed levels.

A tax increase was not forthcoming, however. Neither was a curtailment of government spending. Tight monetary policy became the only remaining recourse. Such a policy could reduce aggregate demand to noninflationary levels and maintain full employment. But, as explained by the IS-LM framework, it would raise interest rates further. High interest rates, according to the

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Keynes-Hicks theory, limit aggregate demand by discouraging investment, thus they can ease inflationary pressures

However, a counter force fanned the inflation. Higher interest rates increased the cost of production and pressed up the very prices they were intended to limit. Demand-pull inflation from deficit spending was eliminated, but cost push inflation from high interest rates was introduced. Each of the 11 years of relatively high interest rates since 1968 was also a year of relatively high price increases. Figure 3 suggests a correlation between interest rates and the price level, but correlations are silent about cause and effect.

The consequence of the attempt to offset fiscal policy with monetary policy was to pay for the Vietnam War with inflation. In the subsequent decade, monetary and fiscal activities continued to be reflected in larger deficits and higher interest rates. The net result was to hold aggregate demand below productive capacity, allow more unemployment than was considered acceptable, hold interest rates at historic highs, and maintain inflationary pressures. Most policy debates on how to cope with these problems overlooked the Keynes-Hicks explanatory model.

The theory, however, does have an important weakness. This weakness helps to explain why monetary policies which maintain relatively high interest rates were useful, after all, for the past decade. Hicks' theory assumes a closed economy—one with no exchange among nations of goods, capital, people, and ideas—whereas we live in an open economy.

The closed economy version of the IS-LM framework suggests that, since 1966, we should have had policies of reduced government spending, higher taxes, and easier money to maintain full employment with lower interest rates and stable prices. An open economy version might prescribe tight money and high interest rates on the grounds that interest rates lower domestically than abroad would induce capital outflows and induce a balance of payments problem. Slow real growth resulting from high interest rates also would ease the international monetary imbalance by limiting our propensity to import.

A domestic equilibrium of full employment and stable prices need not be one of balanced international payments. As it has turned out, policies which would have ameliorated domestic problems would also have exacerbated international ones. If we have had the correct policies after all for limiting the capital drain, it is small comfort to know that we have had them for the wrong reasons. Worse, had we understood the reasons, we might have found alternative policies. For example, a reinstatement of the tax on the flow of capital out of the country could have limited the tendency to a capital drain.

Relatively tight money and relatively large Federal deficits for the past decade have increased domestic inflation and unemployment, limited the size of the private sector by inhibiting private investment, and expanded the size of the government sector by deficit spending. Domestic and international imbalances associated with these monetary and fiscal activities have

spread the costs of the problem deeper—into the structure of the economy. This brings us to the second of Keynes' ideas which can help us to understand the economic problems of the economy over the past decade.

## STRUCTURAL BOTTLENECKS

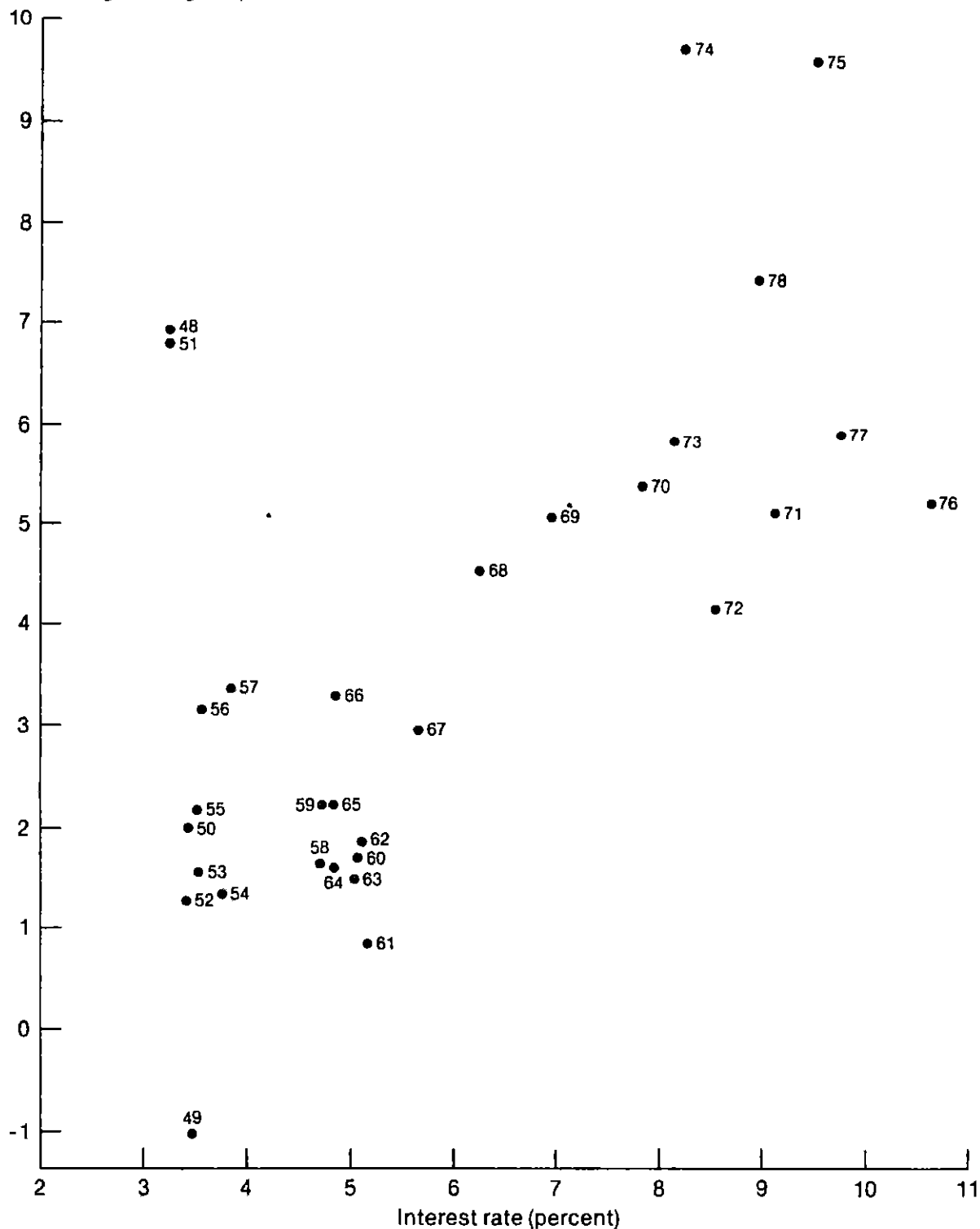
It is common in macroeconomics to use simplified aggregate models which explain either (1) unemployment assuming stable prices or (2) inflation assuming full employment. Keynes, in his *General Theory*, never intended that we accept such extreme assumptions. Every chapter recognizes that prices can be rising in an economy experiencing unemployment. But chapter 21, "The Theory of Prices," contains the material of prime importance to explain the 11 years of simultaneous inflation and unemployment we have experienced since World War II.

In this chapter, Keynes seeks to remove what he calls "a haze where nothing is clear and everything is possible" (2, p. 292). Removal of the haze follows from his distinction between what we now call microeconomics, "the theory of the individual industry or firm," and macroeconomics, "the theory of output and employment as a whole" (2, p. 293). He also distinguishes statics from dynamics. He defines his subject as what we would now call dynamic macroeconomics, although his dynamics concentrate on the role of money, expectations, and aggregate demand. We would today characterize his theory as

Figure 3

# **Inflation and the Interest Rate, 1948-78**

Percentage change in price



Note Numbers in field of chart are years, 1948, 1949 and so on

*Keynes' goal was not tradeoffs, but elimination of both offensive events. Keynes did not consider inflation and unemployment as bipolar in the sense that to move toward one is to move away from the other*

static with respect to plant capacity, technology, and aggregate supply

Keynes begins by making the simplifying assumptions required to provide models which would have been adequate to explain 20 of the past 31 years of inflation and unemployment

If there is perfectly elastic supply so long as there is unemployment, and perfectly inelastic supply as soon as full employment is reached [it follows that] So long as there is unemployment, *employment* will change in the same proportion as the quantity of money, and when there is full employment, prices will change in the same proportion as the quantity of money (2, p 295)

We could substitute the phrase "aggregate demand" for "quantity of money" to make his meaning clearer for modern readers

Immediately after reaching this conclusion, Keynes relaxes the simplifying assumptions on which it depends. He considers five possible complications which will, in fact, influence events (2, p 296). Having experienced simultaneous inflation and unemployment, he knew that these complications needed to be understood. The U.S. economy had two such periods about which Keynes must have known—one just before World War I and another near its close. His five factors which help to explain rising prices when there is unemployment included diminishing returns and rising pressure on wage rates as the capacity of plants and of the labor force are approached. The complexity of concern in this article is number three.

The third of his five complicating factors is the one to which the phrase "structural unemployment" refers.

Since resources are not interchangeable, some commodities will reach a condition of inelastic supply whilst there are still unemployed resources available for the production of other commodities (2, p 296).

From this and the other complicating factors, Keynes concludes that we have, in fact, a condition of rising prices, not stable ones, as unemployment continues.

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 (2, p 296).

Some readers of Keynes may interpret this to imply a Phillips Curve, but it does not—for two reasons. First, the Phillips Curve focuses on tradeoffs, its purpose is to estimate how much inflation must be endured to reduce unemployment. Keynes' goal was not tradeoffs, but elimination of both offensive events. Keynes did not consider inflation and unemployment as bipolar in the sense that to move toward one is to move away from the other. He recognized explicitly that they can occur simultaneously and he aimed to avoid both.

Second, the Phillips Curve is an empirical formulation which describes the history of price changes and unemployment rates. One can see from the pre 1970 data in figure 1 how the empirical idea of the Phillips curve caught on. Keynes' formulation, however, is a theoretical one which can help to explain history with the intent of finding

economic policies to avoid repeating the past.

The remainder of chapter 21 considers each of the five complicating factors in turn. The next section presents an empirical test of factor three.

### **An Empirical Test of Keynes' Structural Hypothesis**

Keynes expanded on his structure hypothesis as follows:

In general, the demand for some services and commodities will reach a level beyond which their supply is, for the time being, perfectly inelastic, whilst in other directions there is still a substantial surplus of resources without employment. Thus as output increases, a series of 'bottle-necks' will be successively reached, where the supply of particular commodities ceases to be elastic and their prices have to rise to whatever level is necessary to divert demand into other directions (2, p 300).

Keynes' hypothesis that simultaneous inflation and unemployment for the aggregate economy reflects a weighted average of inflation in some sectors and unemployment in others is tested below through the use of data on price, quantity, employment, and wages by industry. These data, from the *Survey of Current Business* (3), are shown as annual percentage changes for 1978 from a year earlier in table 2. Comparable data examined from the same source annually from 1966 are not shown, but analysis of them is included.



*The correlation between employment and price changes by industry is moderate The correlation between quantity and price changes was negative in every year examined*

### Pairwise Analysis

To test the hypothesis directly, we should compare changes in industry price with the extent to which idle resources are available to an industry. Unemployment is not available by the industries in table 2, so we will try other tests. First, we can compare price changes with changes in employment.

The correlation between employment and price changes by industry is moderate. The  $R^2$  was less than 0.30 each year since 1966-67, and was often close to zero. For about half the years, the regression coefficient was positive, and half negative. For most years the slope was not significantly different from zero. Only the change from 1976 to 1977 significantly agrees with Keynes' statement that "we have in fact a condition of prices rising gradually as employment increases" (p. 296). That is, industries which were creating jobs during 1976-77 tended to be raising prices, those with stable prices tended not to be creating jobs.

The correlation between quantity and price changes was negative in every year examined. The  $R^2$  ranged from close to zero up to more than 0.50. A regression line explaining change in price as a function of change in quantity had a slope significantly less than zero for more than half the observations. This result agrees with Keynes' idea that the supply of some commodities, those with idle resources, is elastic and responds to an increasing demand by an increase in quantity but has little effect on prices, while the supply of other commodities "ceases to be elastic

and their prices have to rise to what ever level is necessary" (2, p. 300). That is to say "A series of 'bottle necks' will be successively reached" (2, p. 300). Some industries are seen to respond to an increase in aggregate demand with increases in output, while others respond with higher prices, as suggested by the structural unemployment hypothesis.

The correlation between changes in wage rates and changes in price ranged from zero up to 0.34 for the 12 observations. The slope of a regression line explaining change in wage rates was positive for 8 of the years, but significantly positive only for 3 of the years. Keynes hypothesized the relation would be positive. "A proportion of any

increase in effective demand is likely to be absorbed in satisfying the upward tendency of the wage-unit" (2, p. 301). He called this a position of "semi-inflation" (2, p. 301), determined in part by the psychology of workers and by policies of employees and trade unions. His "semi inflation" involves some of what we would call today a cost push inflation, or a wage-price spiral. He distinguished this from "absolute inflation" (2, p. 301) or "true inflation" (2, p. 303) when "a further increase in the quantity of effective demand produces no further increase in output and entirely spends itself on an increase in the cost unit" (2, p. 303).

Table 2—Change in price, wage, employment, and quantity by industry, 1977-78

| Industry                | Price<br>of output | Quantity<br>of output | Wage  | Employment |
|-------------------------|--------------------|-----------------------|-------|------------|
| Percent                 |                    |                       |       |            |
| Farms                   | 21.64              | -0.58                 | 7.98  | -2.99      |
| Forestry and fisheries  | 4.29               | 15.38                 | 7.22  | 15.13      |
| Mining                  | 9.37               | 4.52                  | 9.54  | 6.72       |
| Construction            | 9.12               | 4.59                  | 5.60  | 10.75      |
| Nondurable goods        | 4.50               | 3.38                  | 8.21  | 1.91       |
| Durable goods           | 7.72               | 5.87                  | 7.95  | 5.84       |
| Railroad                | 6.94               | 4.95                  | 9.14  | -1.90      |
| Trucking                | 5.80               | 9.13                  | 8.99  | 6.23       |
| Airline                 | 10.27              | 9.38                  | 8.52  | 5.21       |
| Other transportation    | 15.49              | 0.00                  | 8.27  | 4.94       |
| Telephone and telegraph | 0.54               | 12.12                 | 11.04 | 3.39       |
| Radio                   | 7.23               | 7.14                  | 8.91  | 5.92       |
| Electricity and gas     | 7.13               | 3.19                  | 8.19  | 3.95       |
| Wholesale               | 4.71               | 6.12                  | 8.00  | 5.23       |
| Retail                  | 7.56               | 4.05                  | 6.29  | 5.97       |
| Finance and insurance   | 7.49               | 5.46                  | 8.31  | 5.28       |
| Real estate             | 5.79               | 4.85                  | 11.65 | 5.81       |
| Service                 | 7.94               | 6.02                  | 8.47  | 5.58       |
| Government              | 7.03               | 1.94                  | 7.30  | 1.73       |

Keynes' pairwise statements were not confirmed in the three simple tests above. But neither were they denied. He did not explicitly venture a hypothesis in chapter 21 about multivariate relationships. We look at two such relationships below. One examines the role of technology. The other supports the three hypotheses which were tested separately above and, at the same time, adds further insight into the interplay of wages, employment, and quantity of output. The multivariate analysis shows that the failure of the two-variable analysis just described to find a significant relationship results from a problem of interaction among the data and not a lack of validity in Keynes' hypotheses.

### Technology

The ratio of change in output to change in employment indicates change in technology, or in labor productivity. This measure is negatively correlated with the change in price. The  $R^2$  ranged up to 0.65 for the years examined. A regression line explaining change in price as a function of change in productivity of labor has a slope less than zero in every case, significantly so in two-thirds of the cases. Keynes took "technique as given" (3, p. 294) and did not discuss in chapter 21 the dynamics of changes in technique. The result is implicit, however, in his hypothesis of a negative correlation of price with quantity (which is in the numerator of the measure of technical change) and of a positive correlation with employment (which is in the denominator). The result supports the conviction that indus-

tries which are adopting more efficient techniques reduce inflationary pressures. Industries which adopt output-increasing technologies tend to have stable prices, those with no advance in technology tend to have rising prices.

### Multivariate Analysis

The four data series we have studied—price, quantity, wage, and earnings—have been related empirically to one another in various studies by means of an equation containing a single parameter. Consider the equation

$$k = \frac{WE}{PQ} \quad (1)$$

where  $W$  is wages,  $E$  is employment,  $P$  is the price level, and  $Q$  is the level of output. One interpretation is that the earnings of workers are a constant share of the total value of output,  $k$  is a measure of the share. Another interpretation is that the aggregate production function is a Cobb-Douglas equation,  $k$  is a measure of the elasticity of production of labor, and the above equation is a necessary condition for competitive equilibrium.

A regression line was fit to the industry earnings and value of output for the 13 years from 1966 to 1978. These were absolute levels of earnings and value from the *Survey* (3), not annual percentage changes such as shown in table 2. The equation was

$$(WE) = a + k(PQ) \quad (2)$$

The value of the constant term  $a$  was not significantly different from zero in any year. This result makes equation (2) identical in informational content to equation (1). When  $a$  was set equal to zero, the resulting value for  $k$  ranged from 0.62 to 0.67 and the  $t$ -ratio was greater than 10.00 in each year. The  $R^2$  ranged from 0.85 to 0.87 after adjustment to reflect the absence of a constant term. This suggests the assumption of a constant value for  $k$  is tenable for the cross-sectional data under consideration.

Let us rewrite equation (1) a third way

$$P = \frac{WE}{kQ} \quad (3)$$

Using the notation  $\dot{P}$  for the derivative with respect to time, we can derive from equation (3)

$$\frac{\dot{P}}{P} = \frac{\dot{E}}{E} + \frac{\dot{W}}{W} - \frac{\dot{Q}}{Q} \quad (4)$$

This equation says the percentage change in price equals the percentage change in employment plus the percentage change in wages less the percentage change in output under the assumption that  $k$  is a constant. Were  $k$  not constant, an additional (negative) term showing the percentage change in  $k$  would appear in the equation.

A regression line was fit to the change data such as in table 2 for each of the 12 years for the following version of equation (4)

$$(\% \Delta P) = a + b_1 (\% \Delta E) + b_2 (\% \Delta W) + b_3 (\% \Delta Q) \quad (5)$$

*This analysis supports Keynes' hypothesis of structural bottlenecks as an explanation of simultaneous inflation and unemployment*

where ( $\% \Delta P$ ) means the annual percentage change in price. The regression constant ( $a$ ) differed significantly from zero in only 2 of the 12 regressions. It was significantly positive for 1971-72 and again for 1977-78. The constant term was set equal to zero and the equation was fit again. If  $k$  is constant, then we anticipate from equation (4) that  $b_1 = 1$ ,  $b_2 = 1$  and  $b_3 = -1$ .

Table 3 shows regression results for fitting equation (5) to data such as those in table 2 for annual percentage changes in price, wages, employment, and quantity since 1966. With the constant at zero, the annual regressions explained from 49 to 91 percent of the variation in price, according to the  $R^2$ 's listed in table 3. These  $R^2$ 's are adjusted as is appropriate when there is no constant term. They are, therefore, slightly higher than the unadjusted  $R^2$ 's.

Table 3 shows that the relation between wages and prices was significantly greater than zero for each of the 12 observations, and the relation between employment and prices for 5. The relation between quantity and prices was significantly less than zero for nine of the observations. These statistics tend to support Keynes' three hypotheses that were not supported in the pairwise analysis.

The wage coefficient was significantly different from 1.0 in the multivariate analysis in only 2 of the 12 years since 1966. A coefficient close to 1.0 helps to support the assumption that  $k$  in equation (1) is a constant which, in turn, supports equation (4) as a description of the relation among changes in the four variables.

The employment coefficient was significantly different from 1.0 only 3 times. The quantity coefficient

was significantly different from a minus 1.0 only 2 times.

These tests tend to support equation (4) as a descriptor of the relationship between changes in price, wages, employment, and quantity. The 19 industries tend to behave differently from one another in any given year in accordance with the pattern suggested by Keynes. This analysis supports Keynes' hypothesis of structural bottlenecks as an explanation of simultaneous inflation and unemployment.

## MONITORING INFLATION BY INDUSTRY

Equation (4) can be of assistance in monitoring industry behavior. Using equation (4), for which the coefficients are 1, 1, and -1, the estimated price changes are within 3 index points of the actual price

Table 3—Coefficients for regressions of changes in wages, employment and quantity on price changes, with comparisons, 1966-78

| Year  | Coefficient |            |          | Standard error |            |          | Standard errors from 0.00 (T-statistic) |            |          | Standard errors from 1.00 |            |          | $R^2$ |
|-------|-------------|------------|----------|----------------|------------|----------|---|------------|----------|---------------------------|------------|----------|-------|
|       | Wage        | Employment | Quantity | Wage           | Employment | Quantity | Wage                                    | Employment | Quantity | Wage                      | Employment | Quantity |       |
| 67-66 | 0.5976      | 0.7247     | -0.7782  | 0.1711         | 1.8360     | 1.8460   | 3.49                                    | 3.95       | 4.21     | 2.35                      | 1.50       | 1.20     | 0.62  |
| 68-67 | 0.8810      | 0.6972     | -0.8608  | 1.069          | 1.958      | 1.490    | 8.24                                    | 3.56       | 5.78     | 1.11                      | 1.55       | 0.93     | 0.85  |
| 69-68 | 0.9094      | 0.5729     | -1.0072  | 0.907          | 1.966      | 1.339    | 10.02                                   | 2.91       | 7.52     | 1.00                      | 2.17       | 0.05     | 0.90  |
| 70-69 | 0.7284      | 0.4826     | -0.7711  | 0.591          | 2.852      | 1.825    | 12.31                                   | 1.69       | 4.23     | 4.60                      | 1.81       | 1.25     | 0.91  |
| 71-70 | 0.8986      | 0.2807     | -0.5448  | 0.802          | 2.344      | 1.606    | 11.20                                   | 1.20       | 3.39     | 1.26                      | 3.07       | 2.83     | 0.89  |
| 72-71 | 1.0781      | 0.6506     | -0.8759  | 2.221          | 3.604      | 2.525    | 4.85                                    | 1.81       | 3.47     | 0.35                      | 0.97       | 0.49     | 0.72  |
| 73-72 | 1.3955      | 1.1916     | -1.7728  | 5.255          | 5.251      | 7.453    | 2.66                                    | 2.27       | 2.38     | 0.75                      | 0.36       | 1.04     | 0.49  |
| 74-73 | 1.0070      | 1.0435     | -0.6859  | 3.637          | 6.832      | 5.740    | 2.77                                    | 1.53       | 1.19     | 0.02                      | 0.06       | 0.55     | 0.62  |
| 75-74 | 0.9539      | 0.5019     | -0.4456  | 1.186          | 3.013      | 2.812    | 8.04                                    | 1.67       | 1.58     | 0.39                      | 1.65       | 1.97     | 0.82  |
| 76-75 | 0.8999      | 0.2087     | -0.2061  | 2.214          | 4.135      | 3.042    | 4.06                                    | 0.50       | 0.68     | 0.45                      | 1.91       | 2.61     | 0.70  |
| 77-76 | 0.8526      | 1.2586     | -0.9357  | 1.720          | 2.172      | 2.952    | 4.96                                    | 5.79       | 3.17     | 0.86                      | 1.19       | 0.22     | 0.88  |
| 78-77 | 1.3225      | 0.3812     | -0.9509  | 2.140          | 3.077      | 3.437    | 6.18                                    | 1.24       | 2.77     | 1.51                      | 2.01       | 0.14     | 0.81  |

*Keynesian economics includes two elements which help to explain why the United States experienced simultaneous inflation and unemployment during the seventies. The first element is that monetary and fiscal policies are not symmetrical*

changes for 15 of the 19 industries during 1977-78. For example, in the services industry, the percentage change in employment (5.58) plus the change in wage (8.47) minus the change in quantity (6.02) misses the actual change in price (7.94) by only 0.09 (table 2).

While the use of equation (4) works reasonably well, it is probably more accurate to use the regression estimate for equation (5) instead. Equation (5) is formulated to explain price in terms of least squares. In this form it is useful for monitoring inflation. An alternative formula might be used if the focus were on unemployment. The equation explains most, but not all, variation in price by industry. Something can be learned by identifying those industries which the equation fails to explain.

For 1977-78, the equation in the bottom row of table 3 explained 81 percent of the variation in prices. In that year, inflation rates among the 19 industries in table 2 ranged from a fraction of 1 percent up to about 21 percent. The standard error of the regression was 3.7 index points. For the 15 industries whose estimates were within 1 standard error of the regression (that is, for which the estimate was less than 3.7 points away from the observed value), the price change reported is consistent with changes in wages, employment, and quantity of production.

Take the "other transportation" as an example. The reported price change in table 2 was 15.49 percent and the change predicted by the equation was within 1 standard error of the regression. This was one of the

more rapidly inflating industries, yet the rate of change in price was explained adequately by changes in wages, employment, and quantity. Efforts to limit the price rise in that industry could have focused on (1) increasing the quantity of output which, in fact, had remained about the same as the year earlier level, (2) limiting the wage increase which was 8.27 percent compared with the industry average of 7.80 percent, and (3) creating new jobs, which had grown only 4.94 percent, about in line with the all-industry average. Each of these three strategies was suggested by Keynes in chapter 21 of his *General Theory* as a way to cope with structural inflation.

Agriculture and the air transportation industry had relatively large price rises during 1977-78—21.64 and 10.27 percent, respectively. Further, these gains exceeded the rise predicted by the equation by more than one standard error. This result would occur for an industry for which the coefficient  $k$  in equation (1) is not constant, but is decreasing. If the wage share is decreasing over time, equation (4) will have a (negative) term relating to the percentage change in  $k$ . Were a term with decreasing  $k$  included in the estimating equation, a higher price rise, closer to the actual price rise, would have been predicted. Consequently, one can infer that these price increases exceeded what was warranted by changes in wages, employment, and quantity. This may be interpreted to mean that the wage share (coefficient  $k$  in equation (1)) was declining in these industries and the share of returns to interest, rent, or profits was rising.

The nondurable manufacturing industry and the government had relatively moderate price rises during 1977-78—4.50 and 7.03 percent, respectively. Further, these rises fell short of the rise predicted by the equation by more than one standard error. Were a term with increasing  $k$  included in the estimating equation, a smaller price rise, closer to the actual price rise, would have been predicted. Consequently, one can infer that these price changes were less than warranted by changes in wages, employment, and quantity. This may be interpreted to mean that the wage share (coefficient  $k$  in equation (1)) was increasing in these industries and the share of returns to interest, rent, and profits was declining.

When the equation predicts closely the price change in an inflationary industry, it points to which explanatory variable—wage or employment or quantity—is critical. And when the equation fails to predict the price change, it tells us even more, it tells us whether the factor payment changes were favoring labor or management.

## CONCLUSION

Keynesian economics includes two elements which help to explain why the United States experienced simultaneous inflation and unemployment during the seventies. These elements first appeared in the economics literature during the thirties.

The first element is that monetary and fiscal policies are not symmetrical. Expansionary fiscal policy tends to raise interest rates while expan-

*The second element follows from the fact that not all industries, occupations, and regions share equally in national business activity*

sionary monetary policy tends to lower them. Hence, if an economy is overheated by fiscal deficits, tight monetary policies can not correct the situation. Aggregate demand can be restored to the equilibrium level, but the equilibrium level of interest rates will be higher, perhaps sufficiently high to create a disequilibrating, cost-push inflation. Further tightening of the money supply will result in limited private investment, more unemployment, rising interest rates, and accelerated inflation. The economy can become unstable, with simultaneous inflation and unemployment. Through deficit spending, the government will have an increasing share of the total economy, through the inhibiting effect of high interest rates on investment, the private sector will have a decreasing share. This persistently unstable situation may put industries out of balance relative to one another and set the stage for the second element from Keynesian economics.

The second element follows from the fact that not all industries, occupations, and regions share equally in national business activity. Some industries, those with access to idle resources and advancing technology for example, tend to respond to an increase in aggregate demand with an increase in output and with stable prices. Meanwhile,

other industries, already at capacity, tend to respond with higher prices instead. A weighted average of both types of industries will show higher prices (from one set of industries) and continued unemployment (from the other set).

Policy implications of these two elements called for higher taxes, reduced government spending, easy money, and policies which treat certain industries, occupations, and regions differently than others during a decade characterized by tax cuts, government deficits, tight money, and broad-brush policies. Of course, the actual world is more complicated than the IS-LM model and the structural model assume. In addition to demand pull, cost-push, and structural inflation discussed here, there are other problems:

- Inertia, where expectations of more inflation continue to be realized,
- Ratchets, where prices tend to move up, not down, and one price increase tends to induce others,
- Institutional breakdowns, where timing is off, decisions do not get made, and inefficiencies arise,
- International linkages where inflation is imported and where a negative balance of payments contributes to the international monetary crisis, and

- Monopoly, where prices are managed

The problems are complicated and the two models discussed here oversimplify. Yet, they point to economic policies quite different from those used during the past decade. There has been a tendency to run up government deficits and then to fight the ensuing inflation with monetary policies which raise interest rates and which can exacerbate the inflation while creating unemployment. And there has been a tendency to overlook structural problems and treat all sectors of the economy with the same broad-brush policies. It is time to think the matter through again.

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