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# RECENT DEVELOPMENTS IN THE THEORY OF INFLATION AND UNEMPLOYMENT

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The paper examines the theoretical literature of the past decade on the causes of inflation and unemployment. The basic theme is the pervasive impact of sluggish price adjustment on the validity and relevance of recent models. The insulation of real output from anticipated monetary changes, derived in the recent rational expectations literature, loses its validity when prices adjust slowly to changes in demand. The search literature explains only part of unemployment when layoffs rather than wage cuts are the major tool of employment adjustment in recessions. The 'new–new' microeconomics of implicit contracts, idiosyncratic exchange, and default penalties is reviewed, as are the implications of sluggish price adjustment for both 'domestic monetarism' and for the monetary approach to balance-of-payments theory.

'*The writer on inflation is fortunate that his subject is generally well understood by economists*' Smithies (1942).

'*La théorie de l'inflation est un des points les plus faibles de la pensée économique contemporaine*' Biacabe (1962, p. i).

## 1. Introduction and background

Theoretical and empirical research on the causes, costs and cures of inflation and unemployment preoccupies a substantial portion of the economics profession. Any comprehensive survey of this body of work, while perhaps providing substantial revenue for the paper and ink industries, would be too indigestible to attract serious readers. Instead, this paper takes a selective rather than comprehensive approach and is concerned with the causes of inflation but not with its costs or cures; with theoretical developments but not with the results of empirical tests (except insofar as the empirical results bear on the relevance of theoretical assumptions); and with papers written during the last decade but not those written earlier.[1] The paper's scope includes the causes of unemploy-

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[1]For a much more comprehensive approach, see the recent survey by Laidler and Parkin (1975). This paper differs from theirs in its greater emphasis on the causes of unemployment and on microeconomic models of labor-market behavior, and in its relative lack of attention to empirical results, to the detailed specification of econometric wage-price models, and to the costs of inflation. For a more general, shorter, and more readable introduction to the inflation literature, see Solow (1975).

ment as well as inflation, because the most interesting recent papers have treated both phenomena as part of a single analytical problem, e.g. those which model the optimal adjustment by firms of employment and wage rates in response to unexpected changes in product demand.

The literature surveyed here spans the period since 1963, a starting point chosen not only because of the simultaneous appearance in that year of inflation surveys by Bronfenbrenner and Holzman (1963) and Johnson (1967), but also because 1963 antedated the late-1960s acceleration which so greatly influenced current views of the nature of inflation, and also because the span of roughly a decade ma . this paper a companion piece to the survey of monetary theory by Barro and Fisher (1976).

Novel theoretical contributions of the past decade can be most easily distinguished from those repeating earlier themes, if we examine the reactions of a hypothetical modern-day Rip Van Winkle who had become well acquainted with the earlier inflation literature but who only recently awoke from a decade-long nap. What were the major elements in the body of inflation theory which Rip had assimilated when he fell asleep after reading the Johnson and Bronfenbrenner–Holzman survey articles?

## 2. What Rip knew when he went to sleep

### 2.1. *Demand-pull vs. cost-push inflation*

Theories of the causes of inflation were generally classified into two major groups, 'demand-pull' and 'cost-push,' and can be distinguished with the aid of fig. 1, where real output is plotted on the horizontal axis and an aggregate price index on the vertical. In each frame the aggregate demand curve $DD$ is negatively sloped and represents those combinations of price and real output which clear *both* the commodity and money markets for a given level of the money supply, fiscal variables, and parameters in private spending functions. A higher price level reduces the real money supply and requires for money-market equilibrium a higher interest rate and hence lower level of real output to achieve a lower real demand for money.[2] An increase in the money supply or a fiscal stimulus, except in well-known extreme cases, shifts the $DD$ curve rightward, e.g. from $D_1D_1$ to $D_2D_2$. The aggregate supply curves $S_0S_0$ and $S_1S_1$ represent alternative assumptions about the combinations of real output and the price level which keep factors of production (firms and workers) in equilibrium.

A 'demand-pull' inflation was initiated by some event, whether a monetary or fiscal policy change or a change in private spending behavior, which shifted $DD$ to the right. 'Demand-pull' theories were divided between the quantity theory,

[2]If the demand for real output is interest inelastic (the $IS$ curve is vertical) then the $DD$ curve will be vertical also. A complete development of the graphical apparatus is contained in Branson (1972).

which emphasized the causative role of monetary changes, and Keynesian theories of inflation, which emphasized nonmonetary impulses. The quantity theory differed, first, in its dynamic setting, which attributed a steady inflation to a continuous upward shift in $DD$ fueled by a continuous monetary injection. Keynesian inflation models, in contrast, could explain an increase in the price level from $P_0$ to $P_1$ or $P_2$ as initiated by fiscal or other nonmonetary disturbances if the dynamic process were stable, and explosive inflation with unstable para-

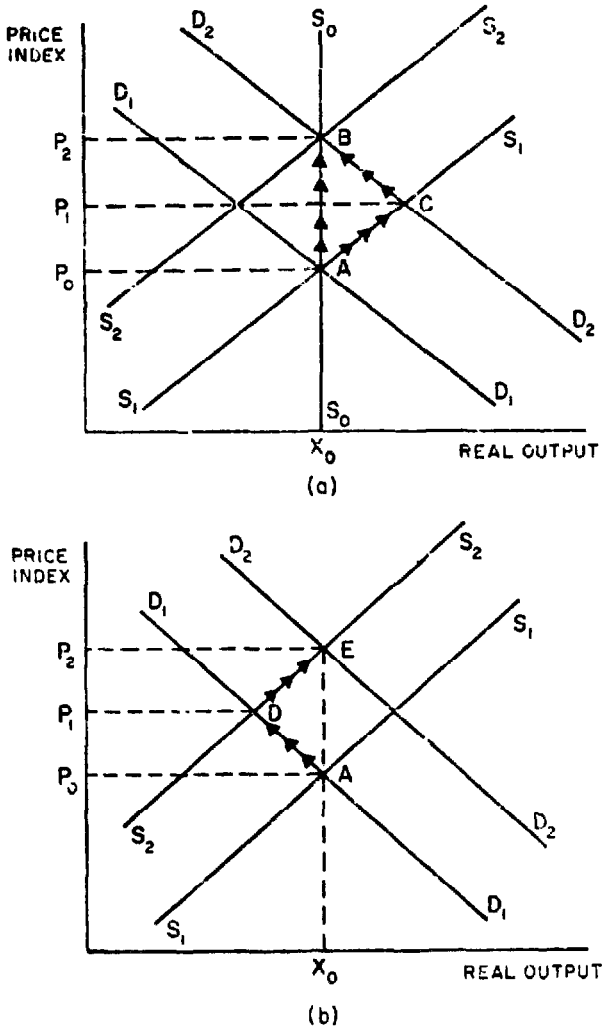


Fig. 1

meters, but could not explain a continuing inflation without the implicit assumption of an unlimited supply of idle money balances or a passive monetary accommodation.

A second difference was the quantity theory assumption of a vertical supply curve, which, although not logically connected with the monetary source of the $DD$ shift, had been part of the quantity theory tradition since Hume [3] With the

[3]See Friedman's (1975) citations from Hume.

vertical supply curve $S_0S_0$, a continuous money-fueled inflation shifted the economy in fig. 1(a) from point $A$ to $B$ to further points directly north. The effect of a steady inflation on the real economy was limited to a redistribution from money holders to money issuers, especially the government, through the inflation tax. In contrast, Keynesian models emphasized shifts in the saving–investment balance as income was redistributed during the inflation process, through a wide variety of assumptions about the stickiness or constancy of some aspect of wage- or price-setting behavior, e.g. money illusion, lags, progressive taxation, differences in price-setting behavior between sectors, etc.[4] Since the very process of inflation generated real effects, a demand-induced price increase could be accompanied by an increase in real output, as along supply curve $S_1S_1$, in fig.1(a). Money illusion, for instance, might induce an increase in the price level, and allow the economy to move from point $A$ to $C$. If workers were allowed to 'learn,' shifting the supply curve to $S_2S_2$, point $B$ would eventually be reached, as in the quantity-theory approach.

'Cost-push' inflation was initiated in its various versions by a wage-push from small unions facing an inelastic demand curve for labor, rivalry among groups of unions, profit-push generated through administered pricing, or, more generally, a struggle for income shares among any set of subgroups in society. In fig. 1(b), $S_1S_1$ shifted to $S_2S_2$ as a result of the spontaneous increase in costs and, as most writers recognized, caused a reduction in output and employment unless the push was ratified by monetary accommodation, which could maintain the original output level if the money supply were increased sufficiently to shift aggregate demand from $D_1D_1$ to $D_2D_2$.

The distinction between cost-push and demand-push was largely spurious, because a one-shot spontaneous wage- or profit-push could only raise the *level* of prices, not permanently increase their *rate of change*, unless accompanied by faster monetary growth. If there were an existing state of union or firm monopolies, but the *degree* of monopoly had not been increasing, monopoly power could not be a source of continuing inflation. Thus, in retrospect any sustained inflation became 'always and everywhere a monetary phenomenon.'[5] A demand-pull inflation initiated by a continuous monetary stimulus moved the economy from $A$ to $B$ to points further north in fig. 1(a), while a cost-push inflation accomodated by monetary growth followed exactly the same path in fig. 1(b) ($A$ to $E$ and points north). The two main types of inflation could be distinguished in retrospect only if adjustment speeds were slow. A demand inflation followed path $ACB$ if lags or money illusion temporarily delayed the upward shift of

[4]Sections II, V, and VI of the Bronfenbrenner–Holzman Survey (1963) are all primarily devoted to innumerable assumptions which generate redistributions of income during an inflation.

[5]This phrase originated with Friedman (1966, p. 18), albeit in the post-1963 period. There have been exceptions, as he pointed out, including the 1933–37 period, during which the NRA and Wagner Act raised the level of firm and union monopoly power, and which can be cited as an instance of cost-push inflation.

supply curve $S_1S_1$ in fig. 1(a), and a supply inflation followed path $ADE$ in fig. 1(b) if monetary accommodation were delayed.[6] In drawing a sharp line between demand and supply inflation, what people may have had in mind was a combination of slow adjustment speeds together with a succession of demand or supply shocks which occurred without enough pause between episodes to allow the dynamics to work themselves out.

Ruling out as implausible and empirically unproven an infinitely elastic supply of idle balances, a Keynesian demand inflation generated by shifts in fiscal policy or private spending propensities, or a cost-induced inflation generated by autonomous increases in wage or profit demands, had to be validated by the monetary authority. Could one therefore argue that a distinction should have been made *not* between demand-pull and cost-push inflation, but rather between inflations in which the role of money was active vs. passive? Even this potential basis for classification became blurred when one recognized that, even in most classic wartime or postwar money-fueled inflations and hyperinflations, the role of the monetary authority had been passively to finance deficits resulting from the unwillingness or inability of politicians to finance expenditures through conventional taxation. Keynesian fiscal-induced money-accommodated inflation and quantity-theory money-initiated inflation had, in almost all actual cases, amounted to one and the same thing.[7] Thus a more general view implicit in pre-1963 developments, and explicitly set out in Reder's (1948) classic analysis, attributed inflation to the passivity of the monetary authority in the face of a 'tripartite' set of pressures emanating from all groups in society – labor, management and government. A notable feature of the pre-1963 literature, at least in the U.S., was the disproportionate concern with unions and the bargaining process as the source of pressure, due presumably to the occurrence in the U.S. of the 1955–57 inflation during a period of government surplus.

Within this more general framework the basic unsettled issues can be divided into two basic categories:

(1) Why do the pressures on the monetary authority from the private and public sectors differ across time within the same country, and differ across countries at any given time?

(2) What structural features of the economy influence the ability of the monetary authority to resist pressure? In particular, what fraction of a monetary

[6]Empirical tests by Selden (1959), Attiyeh (1959) and Phelps (1961) attempted to distinguish supply from demand-induced inflations along these lines but were generally inconclusive, as one might expect either if the supply curve shifted up rapidly following an initial demand shift, or vice versa. Far better opportunities for such empirical tests have been provided by events during the past decade, during which the 1964–66 acceleration in inflation was unambiguously accompanied by an increase in output, while the 1973–74 inflation was accompanied by a pronounced decrease in output.

[7]Among the few U.S. examples of monetary growth independent of government deficits were (1) 1919–20 in the U.S. when money expanded while the Federal budget was in surplus, and (2) 1929–33 when money contracted while the Federal budget was in deficit.

contraction takes the form of a reduction in output as compared to a reduction in prices, i.e. what is the slope of the short-run supply curve (e.g. $S_1S_1$ in fig. 1 above) and under what conditions does the curve shift downward?

### 2.2. *Where the Phillips Curve fitted in*

The Phillips Curve began as the result of an empirical investigation of U.K. wage behavior by Phillips (1958), was extended and put into a theoretical disequilibrium context by Lipsey (1960), and was applied to the U.S. and set in a policy context by Samuelson and Solow (1960). The relationship had originally been investigated by Irving Fisher thirty years previously in a long-neglected and recently rediscovered paper (1926). In Lipsey's version, the rate of change of wages in a single labor market was positively related to the excess demand for labor, and the unemployment rate was negatively related to the excess demand for labor. If one then aggregated and added the assumption that the price level was 'marked-up' over the wage rate by a relatively stable proportion, one obtained a negative relationship between the rate of inflation and the rate of unemployment. If by happy coincidence this negatively sloping Phillips Curve crossed the zero-inflation point (on the vertical axis) at an unemployment rate (on the horizontal axis) generally regarded as 'full,' or 'optimal,' no policy problem arose. If, however, full employment and price stability were not compatible, policymakers were forced to choose among a set of second-best points along the Phillips Curve. It was common in the U.S. for economic advisers to Democratic Presidents to recommend the choice of a point on the curve northwest of the target of Republican advisers.

As he fell asleep in 1963, Rip Van Winkle was puzzled at the failure of either survey author – Bronfenbrenner–Holzman or Johnson – to integrate the Phillips Curve with fig. 1, where a higher aggregate price level could not induce a permanent increase in output once workers and firms in individual product markets had reevaluated their higher wage offers and individual product prices in terms of the higher aggregate price level. Adjustment lags and/or money illusion were required in fig. 1(a) for a demand shift to increase output permanently, so Rip wondered how higher output and an excess demand for labor could persist permanently, as implied by the immobile Phillips Curve. He was also disturbed by the absence of any rigorous theory explaining the determinants of the zero-inflation unemployment rate. Why was the 'full-employment' unemployment rate so high, particularly in the U.S., and why was the zero-inflation rate even higher than that?

## 3. Rip awakes and views the past decade

Immediately after awakening, Rip rushed to the nearest good library to bring

himself up to date on the development of inflation and unemployment theory.[8] His reactions follow and emphasize primarily those developments which he found surprising, novel and important: (1) the quantity theory resurgence (the natural rate hypothesis, the rise of monetarism, and the application of rational expectations to problems of monetary control); (2) the microeconomic theory of wage and employment adjustment (first as an explanation of voluntary unemployment, later as an explanation of layoffs and involuntary unemployment); and (3) the international transmission of inflation among open economies.

### *3.1. Revival and extension of the quantity theory approach to inflation theory*

#### *3.1.1. The natural rate hypothesis: Implications and critique*

Early in the past decade, Rip was relieved to discover, the conflict between fig. 1 and the Phillips Curve tradeoff was independently resolved by Friedman (1966, 1968) and Phelps (1967). Friedman was the first clearly to state that 'there is no long-run, stable trade-off between inflation and unemployment' (1966, p. 60). Friedman's labor-market analysis (1968) differed from Lipsey's in its explicit assumption that both the demand for and supply of labor depended on the *real* wage rather than on the nominal wage. Since the nominal wage was evaluated in terms of the current actual product price by employers and in terms of the expected average consumer price level by workers, employment could increase only as long as the expected price level lagged behind the actual level (thus simultaneously allowing a *lower* actual real wage to induce increased hiring by firms, and a *higher* expected real wage to induce a higher labor supply by workers). In equilibrium the expected and actual price level were equal, and so in equilibrium only one level of employment and output was possible. Friedman dubbed the associated unemployment rate (given population, technology, and labor-force participation) as the 'natural rate of unemployment,' and later (1975) regarded his role as merely restating in dynamic form Hume's original proposition that a monetary expansion could 'excite' real output only temporarily.

The 'natural rate hypothesis' (NRH) completely changed the framework of optimum stabilization policy. Policymaker indifference curves drawn on the inflation-unemployment axes, which had formerly allowed the choice of an optimum point on a stable Phillips Curve, were now irrelevant.[9] The Council of Economic Advisers was now to be divided into two independent branches, one group of labor economists which would tally up the costs and benefits of manpower programs designed to shift the natural unemployment rate, on which monetary and fiscal policies by themselves had no effect, and a second group

[8]The library was indeed a good one, since it contained many papers which, as of mid 1975, had scarcely been written, much less published.

[9]'Democratic' indifference curves were steep, with a point of tangency at a relatively high inflation rate and a low unemployment rate, whereas 'Republican' indifference curves were more gently sloped.

of monetary economists which determined the optimum rate of inflation as a function of the growth rate of real output and the interest rate paid on money, and the marginal costs of levying conventional taxes [see Bailey (1957), Friedman (1969) and Tower (1971)].

Phelps (1972) pointed out, however, and Hall (1976) later demonstrated in computer simulations, that this labor–money policy dichotomy implicitly assumed a zero rate of time preference, implying that if the economy was presently operating at an inflation rate ($p$) above the optimum ($p^*$), a period of unemployment above the natural rate would be suffered temporarily, but that this transition cost had no bearing on the recommendation that $p$ should be reduced to $p^*$ for the infinite future. The policymakers' utility function regained relevance, however, when their rate of time preference was positive. Starting from a position in which $p > p^*$, a deliberate 1970-style recession might be rejected if the near-term social cost of extra unemployment was judged to exceed the long-term benefits of reducing $p$ to $p^*$. Similarly, even if $p = p^*$ initially, the benefit of sub-natural unemployment in the near future might outweigh the permanent legacy of $p > p^*$ in the far future.

The Friedman–Phelps NRH was widely misunderstood and continuously disputed during most of the decade. A basic misunderstanding was the belief that the NRH had, in and of itself, revived the quantity-theory proposition that the rate of inflation ($p$) was determined by the rate of growth of the money supply ($m$). Consider the quantity identity

$$p = m + v - x, \tag{1}$$

where lower-case letters represent proportional rates of growth, $v$ is velocity growth, and $x$ is real-output growth. Whether or not the Phillips Curve tradeoff is stable, a fixed unemployment rate is associated with a given rate of growth of 'potential' output (the growth in the labor force plus technical progress). Assuming that velocity growth is exogenous (determined by the income elasticity of money demand and the rate of introduction of money substitutes at any given level of interest rates), the rate of inflation is fundamentally determined by the rate of monetary growth. This basic proposition was not altered in the slightest by the NRH, which was novel not by associating money with inflation, but rather in its claim that changes in the rate of monetary growth could not cause the rate of unemployment permanently to diverge from its 'natural rate' without a continuously accelerating inflation or deflation.

The initial reaction of U.S. mainstream economists to the NRH was that the policy implications of NRH could be safely ignored, on the empirical grounds that U.S. price and unemployment were inconsistent with it. In the following inflation equation,

$$p_t = \alpha p_t^e + f(U_t - U_t^N), \tag{2}$$

$p_t^e$ is the expected rate of inflation (expected at the beginning of period $t$), and $U_t$ is the actual and $U_t^N$ the natural rate of unemployment during that period. (2) is consistent with the NRH, i.e. $U_t \neq U_t^N$ implies $p_t \neq p_t^e$, only if $\alpha = 1$. Until 1971, published empirical tests for the U.S., including those by Perry (1966, 1970), Solow (1968) and Gordon (1971), yielded estimates of $\alpha$ which were significantly less than unity. Two sets of influences gradually defused this line of criticism of NRH. First, the gradual acceleration of inflation during 1966–70 caused the computer to yield ever higher values of $\alpha$ as the passage of time provided additional observations until finally, as demonstrated by Gordon (1972), tests with a sample period including early 1971 were unable to reject statistically the hypothesis that $\alpha = 1$. Second, Lucas (1972a, 1976) claimed that policy simulations with econometric models including fitted equations like (2) above could not provide guidance for policy decisions, because the fixed estimated parameters were based on the particular environment of the sample period, whereas the true parameters might vary with each alternative policy. Lucas' point had been anticipated in Johnson's (1963) survey article in a brief speculation that the Phillips Curve might not prove to be stable 'if an attempt were made by economic policy to pin the economy down to a point on it' (1963, p. 133).

Both Eckstein–Brinner (1972) and Gordon (1972) developed models in which the $\alpha$ parameter was allowed to vary in response to changes in the inflationary environment. Firms and workers might not have paid much attention to the overall expected rate of inflation in setting wages and product prices if the rate of inflation in the past had fluctuated fairly randomly around a mean of zero, but they would have an economic incentive to adjust fully once the price level had developed a noticeable positive trend which was not expected to be reversed.[10] The 'threshold' hypothesis allowed NRH to be reconciled with U.S. postwar data which had previously appeared to be in conflict with it.

A second criticism of the NRH has been its lack of validation in recession and depression episodes. When $\alpha$ equals unity, and when we add the additional hypothesis that expectations are formed adaptively, according to (2), a period when the unemployment rate remains above the natural rate for a substantial period should be characterized by an accelerating decline in the first derivative of prices and eventually in an accelerating deflation. During the Great Depression the unemployment rate remained above 8.5 percent for twelve straight years in the U.S. (between 1930 and 1941) without the slightest sign of an accelerating deflation.[11] This criticism, however, confuses two quite separate issues – the values in (2) of $\alpha$ and the shape of the $f(\ )$ function. It might be true that $\alpha$ equals unity but at the same time that $f'(U_t - U_t^N)$ equals zero for some range of unemployment rates, if, for instance, the short-run Phillips Curve $f(\ )$ were

[10] This hypothesis is developed more formally in my discussion of Lucas (1976).

[11] Between 1934 and 1940 the U.S. GNP deflator rested on a flat plateau, with a maximum deviation of only 2.5 percent above and below the mean.

convex and became flat in the range of unemployment rates achieved during the 1930s. In this case the natural rate hypothesis would remain completely valid for all situations in which the unemployment rate remained outside of the flat range and, in particular, might have remained valid throughout the postwar period.

Nevertheless, a proper interpretation of the behavior of prices and unemployment during the Great Depression is crucial for the current formulation of anti-inflation policy. Even if the NRH remains valid when $f'(\ )$ is negative, an attempt to 'beat the inflation out of the system' by the deliberate creation of a major recession could be costly if $f'(\ )$ were very small in the range of unemployment rates above the natural rate and could be impossible if $f'(\ )$ were approximately equal to zero in that range. How strong is the evidence from the Great Depression that $f'(\ )$ is approximately equal to zero at 'high' unemployment rates, and what are the precise unemployment numbers which we now define as 'high'?

The basic fact of wage and price inflexibility during the last two-thirds of the Great Depression cannot be disputed. In 1940 the CPI was eight percent higher than in 1933, and average annual earnings per full time employee was 24 percent higher.[12] During the same 1933–40 interval the civilian unemployment rate did not fall below 14.3 percent. Two lines of argument are available to counter the conclusion that the $f(\ )$ function is virtually flat at high unemployment rates.

The first claims that the government encouraged price and wage increases during the 1930s, particularly through the NRA and the Wagner Act, and thus shifted the $f(\ )$ schedule upward, effectively disguising its negative slope. While the deliberate creation of a climate favorable to wage and price increases during the brief NRA period of 1933–34 cannot be denied, the attribution of post-1934 wage inflexibility to the Wagner Act is not convincing. Presumably the Wagner Act had its major effect on wages by encouraging the unionization of major industries, thus shifting workers from low-paid nonunionized activity to higher-paid unionized activity and raising the average level of earnings per worker in the economy. But available data indicate a uniform downward inflexibility of wage rates not only in the total private economy, which reflected the shift to unionized work, but within trades (e.g. printing and construction) which were already unionized before 1935, and in the market for hired farm labor, which was not unionized at all until the 1960s. Consider the percentage changes in wage rates between 1934 and 1940, the basic Wagner Act period (see table).[13]

If high unemployment does reduce the rate of change of wages relative to the expected rate of inflation, adjusted for trend productivity growth, then an explanation of actual wage behavior during the late 1930s, particularly in the nonunionized farm labor sector, requires the assumption of a substantial positive expected rate of inflation.

[12] Darby (1976, table 4).

[13] *Sources*: Line 1, Darby (1976, table 4); lines 2–9, U.S. Bureau of Labor Statistics (1974, table 92); lines 10–11, U.S. Bureau of Labor Statistics (1974, table 46).

| | |
|---|---|
| (1) Average full-time earnings, all industries | 19.2 |
| (2) Union wage rates, all building trades | 24.5 |
| (3) Union wage rates, building journeymen | 23.9 |
| (4) Union wage rates, building laborers | 31.0 |
| (5) Union wage rates, all printing trades | 15.6 |
| (6) Union wage rates, printing book and job | 14.1 |
| (7) Union wage rates, newspapers | 18.5 |
| (8) Union wage rates, local trucking drivers | 14.7 |
| (9) Union wage rates, local transit | 14.4 |
| (10) Farm labor wage rates, with board | 30.0 |
| (11) Farm labor wage rates, without board | 28.0 |

A second argument claims that the behavior of wage rates during the high unemployment period 1934–40 was not so surprising because the unemployment rate was actually not so high. Darby (1976) has recently pointed out that when unemployment during this period is recalculated excluding government employees in 'emergency relief programs' (e.g. WPA, CCC), the minimum Depression unemployment rate reached during 1937, officially 14.3 percent, falls to 9.2 percent. At least three questions can be raised about the Darby attempt to explain 1934–40 wage behavior by redefining the unemployment data.

First, the minimum unemployment rate reached during 1937 still remains higher than the rate reached during any calendar quarter of the postwar era and so does not conflict with the standard impression that Depression unemployment was unusually high, that there was a substantial excess supply of labor, and that the wage rate should have exhibited some signs of downward flexibility if the $f(\ )$ function in (2) above is downward sloping. Second, the average wage received by government employees in the emergency relief programs during 1934–40 was 46.3 percent of the average private sector wage, virtually the same as the 48.6 percent ratio of unemployment compensation benefits to average after-tax earnings in 1971.[14] Since the relevant question in this context is the downward pressure placed on private sector wages by the 'reserve army of the unemployed,' a backward look from the present suggests that, since the employed government workers had the same incentive as today's insured unemployed to refuse private employment, those employed under government emergency stabilization programs should be counted as unemployed when compared with the postwar unemployed, who are largely insured, but should be counted as employed when compared to those unemployed before 1933, who are entirely uninsured (this argument assumes zero nonpecuniary benefits of leisure and becomes stronger if benefits are positive).

[14]Gordon (1973, pp. 152–153).

Third, while 'Darby's millions' reduce the apparent size of the 'reserve army' in the 1930s relative to the pre-1933 period (not relevant to the present period), 'Lebergott's millions' work in the opposite direction. Lebergott's adjustment affects the denominator of the unemployment rate rather than the numerator. Since farmers and small business proprietors could be poor but never by definition unemployed without actually closing their businesses, the proper denominator for the unemployment rate consists of the civilian labor force minus farm and nonfarm business proprietors. An unemployment rate calculated with Lebergott's denominator differs from the official rate by a progressively greater amount for earlier years, e.g. the respective rates are 11.2 and 5.0 percent in 1900 but 6.1 and 5.6 percent in 1974. Even in the Depression years the nonfarm unemployment rate is substantially higher than the official rate, e.g. in 1937 the respective rates are 17.6 and 14.3.[15] A 'fully adjusted' rate incorporating Darby's numerator and Lebergott's nonfarm denominator has a minimum Depression value of 11.3 percent in 1937 and is still as high as 13.2 percent in 1939.

A final problem in the recent development of NRH does not concern the validity of the basic proposition that the economy should be neutral in the long run to a change in the expected rate of inflation, but rather involves the assumption in the major theoretical papers which have popularized NRH that all changes in employment result from the voluntary choices of workers, without any role for layoffs or involuntary unemployment. In response to a decline in the expected real wage, Friedman's (1968) workers willingly reduce labor input by some combination of lower labor-force participation rates and fewer hours per week, and there is no mechanism to generate changes in unemployment. In the Lucas–Rapping model (1969) increases in unemployment occur when workers regard wage rates at which they could currently be employed as temporarily low; workers quit their jobs and voluntarily choose to wait or search for improved conditions. Other models developed by Phelps (1970) and Mortensen (1970a) in the tradition of the 'new microeconomics' both incorporate the NRH and explain higher unemployment as the voluntary decision of workers to refuse job offers when falling product demand reduces wage offers relative to their "acceptance' or 'refusal' wage.

In all of these models individual actors are induced to change their provision of labor input or output by prior changes in wages or prices relative to expectations. Unemployment and output fluctuations thus depend entirely on misinformation. This theoretical tradition based on the neoclassical price–output chain of causation has had a high fertility rate, spawning a literature on rational expectations which requires misinformation for output changes. But skeptics can question whether high unemployment in the 1930s or in 1975 was caused

[15]Lebergott (1964, p. 512). A comprehensive econometric study of twentieth century wage behavior using Lebergott's unemployment data was recently published by R.A. Gordon (1975); this study is not affected by Darby's data revisions, since it excludes the period 1930–53.

entirely by misinformation. This theme recurs below when we examine the rational expectations literature in more detail.

### 3.1.2. *The rise of monetarism and steps toward political theories of inflation*

The popularization of the NRH and the rise of 'monetarism' occurred simultaneously in the late 1960s, and the two have occasionally been considered as one and the same idea, partly as a result of Johnson's brilliant but misleading analysis (1971) of the monetarist counterrevolution, in which the success of monetarism is attributed to the acceleration of inflation in the late 1960s. Three separate statements must be distinguished:

(a) Monetary changes are the dominant cause of changes in nominal income, swamping the temporary and minor influence of fiscal changes.
(b) The NRH is valid.
(c) Wages and prices are relatively flexible, so that the short-run Phillips function [$f'(\ )$ in (2)] is relatively steep.

Statements (a) and (b) constitute the essence of monetarism. The rise of monetarism was not due just to the acceleration of inflation in the late 1960s, which helped win converts to (b), but was due also to the evidence resulting from the 1966 monetary squeeze and 1968 tax surcharge that monetary effects on nominal income dominated fiscal effects when the two were operating in opposite directions, which helped win converts to (a).

Johnson's analysis becomes particularly misleading when he claims that 'the triumph of monetarism has been short-lived... partly because... the monetarists vastly exaggerated the potency ... of monetary restraint as a means of stopping inflation once inflation is well under way' (1971, p. 13). A rapid impact effect of a deceleration in monetary growth on the rate of inflation depends on the validity of proposition (c), which is logically separate from (a) and (b). Thus the evidence from the 1970–71 episode of a sluggish downward response of wage rates to high unemployment has not prevented a continued conversion of the economics profession to (a) and (b).[16] Nevertheless, given the importance of (c) for their standard policy recommendations of monetary restriction to fight inflation, it is surprising that monetarist authors have done so little empirical research on the short-run dynamics of wage and price behavior. This lack of

[16]Regarding (a), a recent conference on monetarism (proceedings forthcoming in 1976 in a North-Holland conference volume edited by J. Stein) appeared to yield agreement by major monetarist authors that a change in government spending or tax rates could cause a one-time change in the level of velocity, and agreement by major nonmonetarist authors that deficits induced by fiscal policy must be continuously financed (until the economy raises tax revenues enough to eliminate the deficit), requiring attention to the stock effects of the continuous injection of money or bonds. Regarding (b), the leading nonmonetarist author Modigliani has implicitly adopted the validity of (b), at least for $U < U^N$, in his recent use of the concept 'noninflationary rate of unemployment' ('NIRU') (1975).

interest in (c) can perhaps be explained by a low rate of time preference among monetarists, so that in the Phelps–Hall optimum policy framework the benefits in the far future of reducing the rate of inflation to the optimum rate outweigh the near-term costs of recession, whatever the time duration of the latter. In any case, work on Friedman's (1970) 'missing equation' has been almost entirely in the hands of the nonmonetarists.

In addition to their lack of investment of research effort in the short-run dynamics of wage and price adjustment, monetarist authors have been slow to shift their attention from the role of money as the basic determinant of income and price changes to the more fundamental underlying determinants of changes in money. Although Friedman and Schwartz (1963) have informally discussed the motives of the monetary authorities in various episodes, and Barro (1975) has estimated econometric equations which describe the response of money to changes in the economic environment, there have been few other attempts to probe into the variety of economic and noneconomic factors which can affect monetary growth. Instead, monetarists have tended to regard any claim that inflation is caused by noneconomic factors, especially those generally falling under the label 'cost push,' as a *contradiction* of the monetary approach, a clear step backward from the 1963 environment in which there was widespread recognition [as reflected in Bronfenbrenner–Holzman's survey (1963, esp. p. 614)] that cost-push pressure causes a reduction in output unless accommodated by monetary expansion. The 'hard-line' or 'anti-cost-push' version of monetarism states, for instance, that the 'basis of the world inflation is the expansion of the world money supply,' and any attempt to bring in other factors, particularly those of the cost-push variety, represents a distressing resort to 'amateur sociology and politics' which can play 'no part whatsoever in the problem.'[17]

A more general view [Gordon (1975b)] attempts to combine cost-push and political elements with the economic literature on optimum inflation. Too much money tends to be created when governments are faced with 'a demand for inflation,' i.e. pressure to raise the rate of money creation either when increased marginal benefits of government expenditures call for a spending increase which is best financed by a combination of conventional and inflation taxation, as during a war, or when pressure groups in society negotiate increases in wages or in other costs which raise the unemployment rate if not accommodated by more rapid money creation. The 'supply of inflation,' i.e. the extent to which the government bows to these pressures, depends on the future electoral losses of resistance. When voters are sufficiently myopic, governments may regularly attempt to blow up the economy before elections and deflate it afterwards, and this policy, as Nordhaus (1975) and Sjaastad (1975) have shown, increases the mean inflation rate over the course of the political business cycle. An accommodative monetary policy may also yield a vote harvest when institutional arrange-

[17]Johnson (1972a). See also Johnson (1972b). Typical of the refusal of monetarists to consider monetary and cost-push theories as complementary rather than competitive is Zis (1975).

ments minimize the political power of rentiers; when the incumbent party is one which relies on campaign contributions from groups which care more about taxes and unemployment than about inflation; when the perceived negotiation cost of 'visible' compromise on tax changes is high relative to the 'invisible' compromise available through monetary accommodation; and when wages are relatively rigid downward in the short run, which raises the unemployment cost and hence the vote cost of nonaccommodation.

### *3.1.3. Can the impotent policymaker be rejuvenated? – Searching for the loophole in rational expectations*[18]

While denying a permanent output–inflation tradeoff, the NRH allows the monetary authority to cause *temporary* deviations in the unemployment rate from the natural rate if it causes the actual rate of inflation during a given period of time ($p_t$) to diverge from the rate which is generally anticipated at the beginning of that period ($p_t^e$). When (2) is rewritten in a linear form with $\alpha = 1$, and when unemployment is also allowed to depend on a random term ($\gamma_t^s$) representing unanticipated changes in productivity, hours, or labor force participation, we have

$$U_t = U_t^N - \frac{1}{\beta}(p_t - p_t^e) + \gamma_t^s. \tag{3}$$

Since the $\gamma_t^s$ term is assumed to be an exogenous 'supply shock' (with mean zero) outside of the control of policymakers, a deviation of $U_t$ from $U_t^N + \gamma_t^s$ requires the authorities to operate on $p_t$ without simultaneously affecting $p_t^e$.

This may be difficult when the expectation of inflation is 'rational' in the sense of Muth (1961, i.e. an unbiased predictor of actual inflation ($p_t$) given all the information available just before the period begins, say $I_{t-1}$:

$$p_t^e = E(p_t \mid I_{t-1}), \tag{4}$$

where $E$ is the expectations operator. This implies that $p_t$ and $p_t^e$ differ only by a random forecast error $\varepsilon_t$,

$$p_t - p_t^e = p_t - E(p_t \mid I_{t-1}) = \varepsilon_t, \tag{5}$$

where $\varepsilon_t$ is uncorrelated with everything known before the beginning of the period; any correlations which are present are part of $I_{t-1}$ and can be exploited

[18]Readers are advised that this section overlaps with the section on 'Rational Expectations and the Phillips Curve' in the Barro–Fischer (1976) survey in this issue of the *Journal of Monetary Economics*. The treatment here is less comprehensive, more critical, and, perhaps, more accessible to readers who are new to this set of issues.

to improve the forecast value $p_t^e$. If, for instance, the stuctural relationship between the rate of inflation and the rate of growth of money ($m_t$) is

$$p_t = m_t + \gamma_t^d, \tag{6}$$

where $\gamma_t^d$ is a random variable representing unpredictable demand shifts, then a rational expectation of the inflation rate would be

$$p_t^e = m_t^e.^{19} \tag{7}$$

How are expectations formed on the future growth rate of the money supply? Let us assume that the monetary authority follows a simple 'proportional' feedback control rule for the growth rate of money:

$$m_t = \lambda_0 + \lambda_1(U_{t-1} - U_{t-1}^N) + \gamma_t^m. \tag{8}$$

Here the authority attempts to make money grow at a constant rate $\lambda_0$, plus some fraction $\lambda_1$ of last period's deviation of the unemployment rate from the natural rate. Monetary growth cannot be perfectly controlled by the authority's feedback rule, as indicated by the random element $\gamma_t^m$ (having a mean of zero), which causes monetary growth to deviate in an unpredictable way from the path intended by the authority. $\gamma_t^m$ can also represent deliberate monetary 'surprises' engineered by the authority. Individuals can use past observations on the behavior of the authority to form their expectation of current monetary growth,

$$m_t^e = \lambda_0 + \lambda_1(U_{t-1} - U_{t-1}^N). \tag{9}$$

The portion of monetary growth which cannot be predicted in advance is, from (8) and (9),

$$m_t - m_t^e = \gamma_t^m. \tag{10}$$

When (7) is subtracted from (6), we can substitute from (10),

$$p_t - p_t^e = m_t - m_t^e + \gamma_t^d = \gamma_t^m + \gamma_t^d, \tag{11}$$

Now (11) can be substituted back into the Phillips Curve (3), and we obtain

$$U_t - U_t^N = \gamma_t^s - \frac{1}{\beta}(\gamma_t^m + \gamma_t^d). \tag{12}$$

[19](6) is the structural equation for prices assumed by Sargent and Wallace (1975b, p. 5).

Since $m_t$ does not appear in (12), but rather $\gamma_t^m$, we conclude that the monetary authority cannot cause even temporary changes in unemployment unless it does the unexpected, i.e. manipulates $\gamma_t^m$ in a totally unpredictable way. Any systematic feedback-type monetary policy rule which incorporates past information becomes part of the information set $I_{t-1}$, is incorporated in $p_t^e$ via eqs. (7) and (9), and hence cannot cause the deviation of $p_t$ from $p_t^e$ which is necessary (according to NRH in (3)) for unemployment to diverge from the natural rate.

This rather dramatic attack on policy activism has recently attracted considerable attention, as a result of innovative papers by Lucas (1972b) and Sargent and Wallace (1975a, 1975b), with recent extensions by Barro (1976). To put the point in a more general way, the monetary authority can change output only if it can find some handle which moves $p$ while not simultaneously moving $p^e$ by the same amount, but if the public can predict how money will behave in reaction to previous history, and knows the structural connection between money and $p$, any predictable money change must simultaneously alter $p$, $p^e$, nominal income, the nominal interest rate, and other nominal magnitudes, and cannot alter unemployment, output, or other real magnitudes. Either the monetary authority can choose to follow Friedman's constant-growth-rate monetary rule, thus giving up the goal of controlling output, or it can choose to exercise its control in a totally unpredictable fashion (expanding money in reaction to some but not all increases in unemployment, chosen randomly). What it cannot choose is a systematic derivative or proportional 'formula flexibility' feedback rule which reacts to past deviations of target variables from their desired values, of the type analyzed by Fischer and Cooper (1973) and others.

The Application of Rational Expectations to Economic Policy (AREEP) constitutes a major attack on policy activism, and a radical contribution to the theory of inflation and unemployment; any predictable change in the rate of monetary growth has 100 percent of its effect on inflation *even in the short run*, and zero percent of its effect on unemployment. Where can one find loopholes in the powerful logic? An easy criticism of AREEP is that a monetary feedback rule can affect real output if the monetary authority has superior information, so that its monetary changes in reaction to events unknown to individuals are treated by them as unexpected random events. But differential access to information is an implausibly weak reed upon which to rest a counterattack against AREEP in an economy like the U.S. in which government statistics are publicized in newspapers only a few days after they are compiled; there would be too great a payoff to close study by economic agents of the monetary authority's procedures.

My own preferred line of criticism questions the assumption of perfect price flexibility and the associated chain of causation from prior price movements to subsequent output movements upon which most 'new microeconomic' models incorporating NRH, as well as the more recent Lucas–Sargent–Wallace–Barro

contributions, have been based. The entire thrust of AREEP requires that the effect of monetary changes reach real output by the route of changes in prices relative to expectations. Consider as an alternative extreme case a world of fixed wages and prices of the type analyzed by Barro and Grossman (1971). Starting from an equilibrium position at which firms and workers sell all they want, let us fix this wage and price level and reduce the money supply. Firms and workers now are able to sell less than they want at the going wage and price; they have been thrown off their voluntary 'notional' supply schedules onto 'effective' schedules constrained by the policy-imposed limit on sales. Any change in nominal income, whether engineered by monetary or fiscal policy, is completely reflected in a change in the sales constraint, output and employment. Once we discard the notional supply schedule relating output to the deviation of actual from expected prices, rational expectations become irrelevant to the output effect of systematic policy rules.

This criticism does not require the extreme assumption of completely rigid wages and prices, but is valid as long as wages and prices are less than perfectly flexible. Starting from an initial equilibrium set ($W^*$, $P^*$), a decline in the money supply requires a reduction to ($\hat{W}$, $\hat{P}$) if both firms and workers are to be able to sell all they want at that set of wages and prices. Any incomplete adjustment, for instance to ($W'$, $P'$), where $\hat{W} < W' < W^*$ and $\hat{P} < P' < P^*$, will once again impose a sales constraint on firms and workers and prevent them from operating on their voluntary supply curves.

Faced with this criticism, the AREFP group might counterattack by denying the possibility of incomplete price adjustment to a preannounced monetary change. Rearrange (3) and write

$$p_t = p_t^e - \beta(U_t - U_t^N - \gamma_t^s). \tag{13}$$

Next, allow the change in the actual unemployment rate from one period to the next to be determined by deviations in the actual rate of growth of the money supply from the constant-unemployment monetary growth rate ($m_t^*$):

$$U_t = U_{t-1} - h(m_t - m_t^*), \tag{14}$$

where (6) above is modified to define

$$m_t^* = p_t + x_t^* - \gamma_t^d, \tag{15}$$

and $x_t^*$ is the constant-unemployment rate of growth of 'potential' real output (normal velocity growth is assumed equal to zero). Assuming that the economy starts in equilibrium with $U_{t-1} = U_t^N$, we substitute (14) and (15) into (13) to obtain

$$p_t = \frac{p_t^e + \beta[h(m_t - x_t^* + \gamma_t^d) + \gamma_t]}{1 + \beta h}. \tag{16}$$

A typical U.S. quarterly econometric model with estimates of $\beta = 0.2$ and $h = 0.3$ would estimate a sluggish 0.057 (= 0.06/1.06) percent reduction in the quarterly rate of inflation in response to a 1.0 percentage-point reduction in the rate of growth of money, assuming that $p_t^e$ is completely predetermined. The AREEP group, however, would point out that expectations must incorporate all available information, including (16). Setting $p_t^e = p_t$ in (16) yields

$$p_t = p_t^e = m_t - x_t^* + \gamma_t^d + \frac{\gamma_t^s}{h}, \tag{17}$$

in which a 1.0 percentage point reduction in monetary growth reduces the rate of inflation (and hence $m_t^*$) by a full 1.0 percent, averting in (14) *any change in unemployment*.

Thus rational expectations implies that prices *out of logical necessity* must be perfectly flexible following preannounced monetary changes. The debate on the relevance of AREEP thus raises once again the crucial issue of the short-run dynamics of price and wage adjustment. Four types of evidence are available which tend to point in the direction of sluggish price adjustment:

(*a*) Structural models of wage and price behavior, several of which are available in Eckstein (1972), indicate moderate lags in the response of prices to change in wages, but long lags in the response of wages to prices. Thus a change in aggregate demand takes a long time to work its way through the system.
(*b*) A reduced form relationship in Gordon (1975c) between inflation and the rate of change of money in the postwar U.S. has a mean lag of *four years*, and seven years are necessary for the total monetary effect to work itself out.
(*c*) Barro's (1975) tests indicate that the effect of monetary surprises on unemployment persists for three years.
(*d*) Hall (1975) has shown that only 1.7 percent of the quarterly variation in U.S. unemployment during 1954–74 remains unexplained in a simple two-quarter autoregression, in contrast to (11) above, in which the unemployment rate can differ from its equilibrium value only by a serially uncorrelated random disturbance.

It is important to recognize that sluggish short-term price adjustment is not 'irrational' and does not in any way contradict the idea that expectations should be formed rationally. Recent theoretical developments, summarized below in section 3.2.2., have built a convincing case that there are some circumstances in which firms and workers optimize by fixing prices and wages (or by limiting their flexibility). If so, firms and workers may not calculate price expectations by reduced forms like (17) above, but instead may at least partly form their expectations adaptively by extrapolating recent events. First, they may not know enough about the structure of the economy to estimate the market-clearing $\hat{P}$ or the

relative shares of the economy made up of 'customer markets' with slowly changing prices vs. 'auction markets' with flexible prices. Second, as demonstrated by B. Friedman (1975), if individuals gradually learn about the true structure of the economic system by a least-squares learning procedure, rational expectations closely approximate adaptive expectations. Finally, even if individuals do know the structure and do know the share ($\sigma$) of the economy made up of auction markets, a rational expectation of inflation will be a weighted average of (4) for auction markets, and adaptive expectations for customer markets.

When, for instance, expected inflation is a weighted average of a rational expectation and past inflation, the latter representing the simplest form of adaptive expectations, we have

$$p_t^e = \sigma E(p_t \mid I_{t-1}) + (1-\sigma)p_{t-1}. \tag{18}$$

Substituting into (16), we obtain, in place of (17), the more general form

$$p_t = \frac{(1-\sigma)p_{t-1} + \beta[h(m_t - x_t^* + \gamma_t^d) + \gamma_t^s]}{1-\sigma+\beta h}. \tag{19}$$

(19) becomes (16) when $\sigma = 0$ and becomes (17) when $\sigma = 1$. In the general case ($0 < \sigma < 1$) output is once again determined by the Barro–Grossman sales constraint, and policy regains its short-run potency. The speed of adjustment of prices, and hence the persistence of unemployment, depends on the importance of long-term price and wage contracts, the average length of contracts, and the slope of the short-run Phillips Curve ($\beta$).[20]

### 3.2. *Microeconomic models of voluntary unemployment, layoffs and indexing*

The preceding section reviewed, first, the NRH demonstration that the Phillips Curve is vertical in the long run, and the application of rational expectations to economic policy (AREEP), which makes the Phillips Curve vertical even in the short run. This line of theoretical development was criticized on the grounds that sticky price of adjustment throws economic agents off the voluntary output supply curves assumed in the AREEP literature, and that the weight of the past on the present through long-term contracts makes agents guess the prices which will be set by others at least partly by means of an adaptive rather

[20]Fischer (1975a), while accepting the flexible-price framework of AREEP, has shown that if long-term, e.g. two-period, wage contracts fix the wage rate one period ahead, the monetary authority can alter output by manipulating the price and through it the real wage which determines the voluntary notional supply decisions of firms. Phelps and Taylor (1975) reach essentially the same result by assuming, less plausibly, that both the wage rate and price level are fixed one period in advance.

than an extrapolative procedure. How convincing are recent theoretical models of wage and employment adjustment as explanations of imperfect wage and price flexibility, and what role is played in them by long-term contracts?

### *3.2.1. Voluntary unemployment in the 'new microeconomics'*

Soon after he and Friedman had proclaimed the NRH, Phelps and others produced a remarkable group of essays (1970) which collectively became known as the 'new microeconomics' of inflation and employment theory.[21] With the single exception of Holt (1970), the contributing authors build models of wage and price adjustment which incorporate NRH. Beyond exploring the implications of NRH, the authors are mainly concerned with the factors which (1) make the natural unemployment rate greater than zero, and (2) explain the negative short-run Phillips-Curve relationship between wage change and actual unemployment.

Costly information and heterogeneous jobs and workers are sufficient to answer the first question. Workers sample from an array of job offers and firms sample from an array of workers. Both benefit by searching until it is no longer profitable to do so, where, for instance, workers apply the rule that a wage offer is refused unless it exceeds the 'acceptance' wage, which in turn is set to equate the marginal cost of further search (costs of physical search plus foregone earnings net of unemployment benefits and taxes) with the marginal benefit of search (the expected value of further sampling from a known wage distribution).[22] Unemployment is a voluntary activity, but all voluntary unemployment is not necessarily socially beneficial; in fact only a small portion of unemployed time is spent in actual search, and government unemployment benefits tend to stretch out the interval between searches, imposing a social cost through the taxes levied on some to support the idleness of others.[23]

The new microeconomic papers by Phelps (1970) and Mortensen (1970a) explain the second question, the causes of the relation between wage change and higher unemployment, as the result of a rational tendency of workers to quit their jobs more frequently and take up search activity when firms cut their wages in response to a decline in product demand. As in the above discussion of rational expectations models, the chain of causation is explicitly from price wage change to subsequent quit decision and resulting increase in unemployment. The models strain reality by forcing all entry to unemployment through the mold of voluntary quit decisions, with no explanation for firing or layoffs.

The lack of reality in the standard 'new microeconomics' model is vividly illustrated in Phelps' well-known 'island parable' (1970a, pp. 6–7), in which

[21] Named after the title of Phelps' introduction to the volume.

[22] A clear and mercifully brief exposition of this approach is presented by Mortensen (1970b), who allows for differences in both wage offers and worker quality.

[23] Empirical estimates of time spent in search are contained in appendix C of Gordon (1973), and the adverse allocative effects of unemployment benefits have been most strongly criticized by Feldstein (1973, 1976).

individual firms are represented by separate islands lacking any inter-island communication links. Since an employee does not learn instantaneously of wage rates on other islands, but rather gains this information only after a slow trip by raft, individual firms face upward sloping rather than horizontal labor supply curves. When a firm suffers a decline in product demand during a recession, it reduces the wage rate to the level at which its demand for labor intersects its supply schedule. Some (but not all) employees quit on the assumption that the firm's behavior is unique, boarding their rafts to sample wage offers on other islands. Only after several inter-island voyages do they realize that the recession-induced decline in demand is universal, and that they will be no better off in a new job than with the original firm.

Real-world employees are not nearly as mindless as the parable suggests. We live in a world of underground telephone cables between desert islands, in which almost any white-collar worker can search for an alternative job using a company telephone on company time and without any prior need to quit. A blue-collar worker is only slightly less privileged and can substitute the neighborhood bar or the extended family gossip circle for the company phone, with ample opportunity to react to his wage cut by polling employees of other firms before he tenders his resignation. A cautious reaction is particularly probable when wages depend positively on seniority, e.g. when employees through learning-by-doing accumulate firm-specific skills over time, since quitting to search for a new job then involves a reduction in the employee's wage rate. As evidence that employees are in a position to acquire information on employment conditions in other firms before they depart, voluntary quits in the U.S. actually *decline* during recessions, whereas the parable implies countercyclical fluctuations in quits.

During a recession layoffs increase, but neither the parable nor any of the detailed formal models of the 'new microeconomics' provide an economic explanation of layoffs. In these models economic booms and recessions are entirely symmetrical, in contrast to the real world where a firm has a single option in a boom, to attract more labor input by raising its wage offer, and two options in a recession, either to reduce the wage offer or to discharge employees.[24] The greater the extent to which firms elect to react by discharging employees, the less flexible wages will be in a downward direction as compared to their flexibility in an upward direction. Because the 'new microeconomic' models are symmetrical they yield a second counterfactual implication, that the long-run Phillips Curve is vertical throughout, and hence a period when unemployment remains above

[24]An additional choice, which is symmetrical in booms and recessions, must be made between changes in the number of employees and changes in hours worked per employee. It has been suggested that compulsory overtime is the reverse equivalent of layoffs in an economic boom, but the parallel is inexact because employees maintain the freedom to quit when compulsory overtime becomes objectionable, whereas in a recession there is no such alternative to an employee who is discharged. Compulsory overtime would be parallel to layoffs only in a society with slavery.

the natural rate for a number of years will be characterized by an accelerating *deflation.*

The 'new microeconomics' labor market models are not identical. In the 'continuous auction market' models of Friedman (1968) and Lucas–Rapping (1970), a reduction in the wage rate relative to the expected price level causes an instantaneous withdrawal of workers from the labor force, whereas in the 'search' model of Mortensen (1970a), a reduction in the wage rate relative to the acceptance wage of workers causes an increased flow of quits into unemployment and a reduced flow of hires out of unemployment, i.e. an increase in both the number of unemployed and the duration of their unemployment. But there is no difference between the two approaches in their inability to explain layoffs and 'no help wanted' signs and in their implication that the long-run Phillips Curve is vertical throughout its range, and that the quit rate varies countercyclically. The major difference between the two approaches is in the ability of the search model rigorously to explain a positive rather than a zero 'natural rate' of unemployment.

### *3.2.2. The 'new–new' microeconomics of price and wage rigidity, implicit contracts and layoffs*

Very recently there have been signs that research resources are beginning to shift from model-building exercises in which output changes are caused by price 'surprises,' to those which attempt to explain price and wage contracts, and hence sluggish price adjustment, as the result of microeconomic optimizing behavior. The proponents of the contractual view do not claim that contracts are universal, but rather analyze factors which cause some product and labor markets to be governed by contracts and slow price adjustment, while other 'spot auction' markets are characterized by price flexibility and continuous market clearing.

Okun (1975) has provided the best rationale for long-term contractual arrangements in what he calls 'customer' (product) markets. His essential hypothesis is an outgrowth of the search literature: costly search makes customers willing to pay a premium to do business with customary suppliers. Firms, in turn, have an incentive to maintain stable prices to encourage customers to return, using yesterday's experience as a guide. 'A kind of intertemporal comparison shopping' discourages firms from changing price in response to short-run changes in demand in order to avoid giving customers an incentive to abandon the no-search relationships and to begin exploring.

Okun's model shares with several others examined below a reliance on negotiation and legal costs to explain why contracts remain implicit rather than formally spelled out in writing. Unwritten contracts only work if participants on both sides agree on conventions of fair play, in the style of the British unwritten constitution. Customers appear willing to accept as 'fair' an increase in

price based on a permanent increase in cost, since in the extreme few firms can stay in business when costs double while product prices are fixed. Transitory events, either an increase in demand or a reduction in productivity, are not generally expected to last long enough to cause bankruptcy and so are not considered sufficient justification for price increases, according to the rules of fair play.

Just as product heterogeneity and costly information can explain sluggish price adjustment in product markets, so can worker–job heterogeneity explain sluggish wage adjustment in labor markets when information is costly. Continuous recontracting in a spot auction labor market might occur if the unemployed were regarded by firms as perfect substitutes for incumbent workers. But, as Williamson, Wachter and Harris (1975) emphasize, building on the earlier work of Doeringer and Piore (1971), almost every job is 'idiosyncratic,' involving some specific skills. 'Incumbents who enjoy nontrivial advantages over similarly qualified but inexperienced bidders are well situated to demand some fraction of the cost savings which their idiosyncratic experience has generated.'[25] Nor can incumbents be expected to capitalize prospective monopoly gains and make lump-sum payment bids to bribe firms to hire them into idiosyncratic on-the-job training ladders, because of liquidity constraints and negotiation and free-rider costs created by the interdependence with other workers. This analysis can be linked together with Okun's. Just as firms in customer product markets delay or avoid raising prices in response to higher demand, so firms avoid or delay raising wages, both because employees earn monopoly rents which would be lost by quitting, and because 'fair play' leads to seniority rules which 'pay back' the employee's high-demand wages lost by not quitting in the form of wages gained from the fixity or sluggishness of wage rates in recessions.

An interesting split has developed in the 'new–new' microeconomics between the approach reviewed above, which relies on costly information and worker–job–product heterogeneity and uses relatively informal analytical tools, and a second more formal group of papers, which attempt to rationalize wage rigidity and layoffs without assuming heterogeneity or information costs.[26] Three simultaneously written and independent contributions by Azariadis (1975a), Baily (1974) and D. F. Gordon (1974) (A–B–G) share two common assumptions. First, employees are relatively more averse to risk than their employers, partly because of the limits on diversification in human capital imposed by the prohibition of slavery and, more important, because entrepreneurs are self-selected individuals who are relatively indifferent toward (or actually lovers of) risk. Second, A–B–G analyze contractual arrangements between firms and employees which may be implicit and unwritten but which nevertheless constrain behavior.

[25]Iwai (1974) analyzes the effects on wage-setting behavior of uncertainty in a more general context.

[26]An exception is Bewley's (1975) study of transaction costs as an explanation of discrete jumps in prices in a rather general context which does not analyze the source or determinants of the transactions' costs.

Firms maximize profits by minimizing the variability of income to their workers, who dislike variability, thus in effect providing a compensation package which consists partly of pecuniary wage payments and partly of insurance services.

Up to this point, however, the theory justifies only a fixed-income contract (tenure), whereas an explanation is needed for contracts which call for rigidity of wages together with variability in man-hours, in contrast to the classical spot auction labor market, in which wages are perfectly flexible and all variations in man-hours, if any, are voluntary movements along notional supply curves. Firms find that workers are not indifferent between a fixed-wage-more-variable-man-hour contract and the spot auction outcome even when total pecuniary income paid out by firms under both has the same mean and variance, if employees can earn some positive income during periods of reduced man-hours which is not paid directly or indirectly by firms, particularly, the value of leisure (or the reduced disutility of work), and any unemployment benefits or welfare payments which are financed at least partly by general government revenues rather than being financed by firm contributions based on their past unemployment experience.

As I have pointed out [Gordon (1976a)], the A–B–G theory as initially developed is incomplete. In the absence of government-financed payments, the superiority of the fixed-wage-more-variable-man-hour policy compared to the spot auction outcome relies entirely on the value to employees of the extra leisure consumed during periods of low demand, a result which depends on an asymmetric analytical procedure in which demand can fall below normal but never rise above. When symmetric demand fluctuations are allowed, the hours of leisure foregone in high demand periods outweigh the less valuable hours gained in low demand periods and tilt the balance back to a fixed-income (tenure) contract. Since the A–B–G theory cannot explain fixed-wage contracts without government payments, one can question its applicability to the period before the introduction of unemployment benefits in the late 1930s.

Two quite different considerations are capable of 'rescuing' the fixed-wage contract. Grossman (1975b), working within the A–B–G risk aversion framework, argues that both agents entering into an implicit contract must weigh the risk of default by the other. A positive probability that a worker will default from a fixed-income contract by shifting to the spot auction market during high-demand periods will sufficiently reduce profits to force firms to eliminate from consideration the fixed-income option. The optimality of the fixed-wage contract as compared to the no-contract spot market alternative then depends positively on the degree of risk aversion and the size of the default penalty. The appeal of Grossman's approach is its ability to explain why three different arrangements are observed in real-world labor markets – spot auction markets (when workers perceive a low default penalty and are only mildly risk averse), tenure fixed income contracts (when the default penalty is high), and fixed-wage-rate contracts (in intermediate cases).

I have suggested (1976a) a second approach which is able to explain a fixed-wage policy without any consideration of risk aversion. Faced with the option of reducing wage rates or man-hours when the demand for its product declines, a firm may prefer the certain reduction in its wage bill which can be achieved by a fixed-wage, quantity-rationing policy. In contrast, a reduction in the wage rate may yield a highly uncertain reduction in the wage bill, because the number of employees who will quit depends on their subjective and unpredictable evaluation of alternative wage rates and employment opportunities open to them at that particular time.

These initial modelling efforts measure labor input along a single dimension, man-hours, and do not provide an explanation of the relative reliance on layoffs and reductions in hours per week when firms choose a fixed-wage policy. More recently both Baily (1976) and Feldstein (1976) have introduced hours per man and the number of men employed separately into firm production and worker utility functions; both illustrate the increased reliance of firms on layoffs as opposed to reductions in hours when there is an increase in unemployment benefits relative to the taxes a firm has to pay to finance benefits for its own employees.

The absence of any significant downward movement of wage rates during periods of high unemployment, e.g. 1934–40, 1958–64, and 1970–71, together with the rather rapid response of wage change to periods of low unemployment, e.g. 1955–57 and 1966–69, has stimulated interest in theoretical explanations of asymmetric wage adjustment. This theoretical effort may be largely unnecessary, since convexity in the $f(\ )$ function in (2) above appears adequate to explain wage behavior without recourse to discontinuous linked functions. More charitably, the asymmetry literature may be regarded as providing a rationalization for convexity. For instance, Tobin (1972) develops a model in which the NRH is valid only for downward departures of the unemployment rate below the natural rate, but his aggregate result depends on wage rigidity in individual micro labor markets which is assumed rather than deduced from maximizing behavior. Grossman (1975a) deduces asymmetry from the fact that in the spot market both man-hours and the wage rate are high in booms, which makes its superiority over the fixed-wage contract in periods of above-average demand exceed its inferiority when demand is low, so that the alternative of the spot market places relatively greater pressure for revision of the fixed contractual wage during boom periods. Azariadis (1975b) emphasizes the greater cost of default for employers than for employees as a source of asymmetry. While both papers are suggestive, a more essential element of asymmetry needs to be incorporated: in a recession firms deal with an *existing* group of employees under an implicit or explicit contract, but if demand increases sufficiently in a boom, the potential for raising labor input by higher overtime hours from existing employees must eventually be exhausted, requiring firms to go outside and attract new employees at sufficiently appealing terms to lure them away from the spot market or from contracts at other firms.

### 3.2.3. *Effect of wage indexing on inflation and unemployment*

In the A–B–G work on labor contracts under risk aversion, firms sell insurance services to risk-averse employees. Since workers care about variance in real income, not just in nominal income, risk-neutral firms can profit by offering employees contracts which are 100 percent indexed to changes in the consumer price level, a point recently made by Fischer (1975a) and Feldstein (1976) but not brought out in the original A–B–G papers. The fact that wage indexation is only partial in real-world labor markets raises a question about the A–B–G assumption that workers are more risk averse than firms.

Full wage indexing would be optimal for the economy as a whole if prices were flexible and all disturbances were 'nominal,' i.e. caused by changes in the demand for commodities rather than the supply, leading wages and prices to change together but real output to remain unchanged following a disturbance. The greater instability of prices in the indexed economy would have no adverse welfare consequences if indexing were extended not only to wages but to financial assets, the tax system, and accounting rules. An indexed economy with flexible prices and nominal shocks is similar to a rational-expectations economy of the type described above.

As Gray (1975) and Fischer (1975b) have demonstrated, however, full wage indexing would increase the instability of real output if shocks were 'real,' i.e. changes in supply functions, since in that situation indexing would maintain a constant real wage instead of allowing the change in the real wage required to clear markets. If in 1974 U.S. wages had been totally indexed, the economy would have exhibited more inflation and greater unemployment in response to the food and oil supply shocks than actually occurred; as I showed in [Gordon (1975a)], a real 'indexing recession' can be avoided only by monetary accommodation of higher prices, leading to a very rapid inflation, the rate of which would depend on the lag in the indexing formula between the change in prices and the correction in wages. Fischer (1975b) remarks that the payment of interest on money would amount to automatic monetary accommodation in this situation and would have to be counteracted by Central Bank open-market sales. If most real shocks tend to occur outside of the domestic nonfarm part of the economy (i.e. in the foreign and farm sectors) the adverse effects of indexing could be eliminated if the wage-indexing formula were based on the domestic nonfarm rather than the consumer price index.

### 3.2.4. *Other developments: Markup pricing and taxes*

Most of the recent microeconomic theory reviewed above attempts to explain the wage-setting behavior of competitive firms which are price *takers*. Very little innovative recent work has concerned the setting of prices. Econometric models have typically pegged the price level to wage rates (adjusted for some mixture of

actual and normal productivity) by a 'markup fraction' which in turn is a function of the excess demand for commodities. This is the 'running man wearing a raincoat' view of inflation – price change can never get very far from wage change, even though the relationship may wiggle around a bit in response to demand movements, just as a raincoat can never get very far from the running man who wears it, even though the coat may ripple a bit in the wind.

Aside from Okun's (1975) informal discussion of customer markets, the most rigorous recent exposition of the markup approach to oligopolistic price behavior is presented by deMenil (1974), whose empirical work agrees with my conclusion (1971, 1975c) that the price–wage relationship is quite stable, and that the direct effect of demand on prices, as opposed to the indirect effect of demand on prices through the wage–unemployment relation, is minor but nevertheless perceptible. The major difficulty with the markup pricing approach is its insecure theoretical base. In his comprehensive survey of the markup literature, Nordhaus (1972) reached the surprising conclusion that markup pricing, which had been presumed to be justified only in noncompetitive industries, was actually optimal only under conditions of perfect competition and constant returns to scale. In general, price should not be set as a simple markup over labor cost, but should be a weighted average of labor plus capital cost (plus the prices of raw materials, if any). Clearly more work is required, perhaps building on Okun's, to explain why markup pricing appears to characterize some markets (automobiles, new houses) but not others (copper, wheat, plywood).

In recent years the analysis of tax effects on inflation has become much more sophisticated, perhaps stimulated in part by the failure of the 1968 U.S. tax surcharge to stem inflation, by the introduction of the value-added tax in the U.K., and by the growing importance of payroll taxes in all countries. The essential point is that higher taxes are a two-edged sword, on the one hand reducing aggregate demand, and on the other hand increasing the 'wedge' between the market price of output and the after-tax income of factors of production. In principle all taxes – sales, excise, payroll, corporate income and personal income – may be shifted forward in varying degrees to output prices, and the net effect of higher taxation may be inflationary if after-tax wage rates are only partially flexible downward. The empirical contribution of higher tax rates to the late-1960s inflation was first pointed out in [Gordon (1971)], and formal analytical models were used by Blinder (1973) and Dernberg (1974) to derive the conditions under which the effect on prices of a tax increase goes in the opposite direction from the standard textbook analysis. Parkin–Summer–Ward (1976) and I (1976b) have derived econometric wage and price equations from explicit labor market models where taxes of various types enter into both supply and demand behavior. In the context of the first section of this paper, then, tax changes become another 'cost-push' element which, while unable by themselves to generate a continuous inflation, add to the pressures for a higher rate of monetary expansion.

### 3.3. World inflation and the transmission mechanism

Almost all of the above literature, primarily developed by insular Americans, has concerned a closed economy. Three major questions immediately arise when one ventures beyond the national borders of the autarkic regime assumed explicitly or implicitly by most U.S. macro theorists: first, what determines the world rate of inflation; second, how are inflationary impulses transmitted from one open economy to another; and third, of what relevance for open economies is domestic inflation theory, and how can it be related to the view that the domestic price level is simply pegged to that of the world outside?

Two major frameworks for the analysis of open-economy inflation have developed in the past decade, the monetary approach to balance-of-payments theory, which claims to have an answer for all three basic questions, and the 'Scandinavian' or Aukrust–EFO approach, which only claims to deal with the second and third.[27] The monetary approach (MA) was developed primarily by Mundell and Johnson and their remarkable group of graduate students at the University of Chicago in the late 1960s. As summarized by Johnson (1972c), the MA answers the first question, the source of world inflation, essentially by repeating Friedman's dictum that 'inflation is always and everywhere a monetary phenomenon,' at least when the open economies of the world are linked by fixed exchange rates. This straightforward quantity-theory view is subject to the criticism as that directed above against domestic monetarism – most economists have long recognized that an inflation originating from any source must be ratified by monetary accommodation if it is to continue, so that a 'theory' which links world inflation to the growth rate of world money simply describes the symptoms of the disease rather than its causes and cure. A shallow response would attribute the increase in world money to the creation of an excess supply of dollars in the U.S., together with the acceptance of those dollars by other nations in the form of international reserve accumulations in place of the inflation-fighting alternative of exchange-rate appreciations.

A deeper response would require the merging of the MA with the rudimentary theory of the politics of inflation, which accepts the basic premise of the quantity-theory approach as its point of departure and analyzes the pressure on the monetary authority from public and private sources. An international extension of the political approach to those economies which do not have independent control over the domestic money supply would presumably examine the political power of exporters and import-competitors to resist revaluation. The political approach counters the implicit or explicit MA recommendation of U.S. monetary restriction as a cure to world inflation by pointing to the real social costs of output reduction when wages are set according to slow-changing contractual arrangements, and when a positive political rate of time preference

[27] See Aukrust (1975) and the 'EFO' volume (Edgren, Faxen and Odhner) (1973).

puts a positive weight on the near-term, albeit temporary, output loss (and, add the modelers of labor market asymmetry, 'temporary' may be a very long time).

Recent contributions on the international transmission mechanism are placed in perspective when contrasted with the alternative embedded in the large-scale econometric models of the mid-1960s, in which higher foreign demand reached the domestic price level by only two routes, the effect of higher exports on aggregate demand, both directly and via the Keynesian multiplier expansion, and through the appearance of import prices in the aggregate markup price equation. The MA added two additional channels, first in the 'purchasing-power-parity' assumption that all goods, at least in the simple Johnson version, are tradable with prices set in world markets, and, second, by allowing domestic holdings of foreign reserves to increase (raising the domestic monetary base and money supply), not just as the direct result of the export surplus, but more generally because the higher price level raises the demand for money relative to the initial supply.

The one-tradable-good assumption focused attention on the neglect in previous econometric models of the direct effect of foreign prices on exports, and of the substitutability of domestic import-competing goods with imports. The critical contribution of the attention to money-market equilibrium was to focus on world capital markets rather than the trade surplus as the source of additional liquidity during an export-led expansion. Dornbusch (1973) extended the one-good model by allowing for both traded and nontraded goods. In his version domestic nontraded goods prices are perfectly flexible and the labor market always clears, requiring in response to a foreign demand stimulus an initial increase in the single nominal wage rate and a drop in the relative price of nontraded goods. Eventually the inflow of reserves raises the domestic money supply by enough to finance an increase in the relative price of nontraded goods to the initial level. In the final equilibrium all nominal magnitudes, including the domestic supply of money, are increased by the same proportion as the increase in the world price level.

The transmission mechanism in the Scandinavian model is essentially a Dornbusch-type, two-sector model without money. An initial increase in traded goods prices raises wages in that sector (the bargaining process maintains a constant rate of return in that sector), and nontraded sector wages rise in imitation, in turn pulling up nontraded sector prices (the latter are determined by a markup or are equal by definition to wages in many proprietor-owned service industries). In contrast to the Dornbusch monetary approach, there is no attention to the source of the extra money needed to finance the higher price level; it is implicitly provided as needed and its availability does not, as in the Dornbusch approach, constrain the speed at which nontraded goods prices can rise. A positive contribution, however, is made by the Scandinavian emphasis on differential productivity growth rates in the nontraded sector as sources of long-run differences in the growth of consumer price indexes across countries.

Turning to the third major question, both the Scandinavian and Dornbusch versions leave no room for the domestic Phillips-Curve approach to wage determination, since excess labor-market demand and supply plays no role in the process of adjustment. Both models are uncomfortable hybrids; in the Dornbusch model, for instance, the process of monetary expansion is explicitly short run in nature, but the labor market is ruled by the long run assumptions of perfect wage and price flexibility and full employment. Recent papers which attempt to merge together a short-run Phillips Curve with these long-run theories include Calmfors' (1975) empirical demonstration that *both* the traded-goods price *and* excess labor demand determine Swedish wages in the short run, and my own theoretical analysis (1976b), which introduces imperfectly flexible price and wage adjustment and unemployment into the Dornbusch framework. But in the long run it is clear that the domestic Phillips Curve approach will not do. Any econometric simulation (e.g. those regularly turned out by operation LINK) which yields a steady long-run divergence of domestic from world inflation rates when exchange rates are fixed (leaving aside differential nontraded-goods productivity growth rates) implicitly depicts an economy which eventually reaches complete specialization in traded or nontraded goods.

## 4. Rip van Winkle's conclusion

Rip, breathless from his fast trip through a decade's literature, was extremely impressed at the progress made since 1963. The revival of the quantity theory and its application to both domestic and international problems had brought with it important insights on the role of expectations, the preconditions for inflation, and the international transmission mechanism. Frictional unemployment had received a rigorous theoretical underpinning, and a healthy realism had more recently been evident in the increasing number of papers which had attempted to explain wage rigidity, layoffs and asymmetric adjustment from microeconomic behavioral postulates. A basic thrust of the labor market literature had been a questioning of the 1940s and 1950s emphasis on full employment as an overriding goal, by its shifting of a substantial share of the observed unemployment from involuntary to voluntary in its motivation, explicitly in the case of the frictional unemployment analyzed in the search literature, and implicitly in the case of the temporary layoffs studied in the 'new new' contract literature.

The major remaining problems were, first, that too much attention was still being paid in popular and policy discussions to a simple-minded monetarist view which requires perfectly flexible prices for its validity. The extensive investment of resources in the flexible-price version of rational expectations had been carried too far, given the evidence on sluggish price adjustment provided by nonmonetarists. Some government agency needed to encourage a conference at which the AREEP group would be locked up in a room with the rigid-wage,

implicit-contract theorists for a discussion of the conditions under which their conclusions remain relevant. Second, the recent theoretical discussions of 'auction' and 'customer' product markets, and 'idiosyncratic' labor markets, needed to be formalized and merged with the more formal but less comprehensive literature on implicit contracts and risk aversion. Finally, attention needed to be shifted from the effects of money on prices and income to the politico-economic determinants of the behavior of money. More work needed to be done to determine why the rate of monetary expansion differed across time and space, and to test empirically the validity of the conjectural explanations which had thus far been provided.

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