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ABSTRACT

In the post-World War II period, wage and price levels reacted much less to business contractions than they did in earlier times. Inflation prevailed and its persistence increased. The contractions themselves became relatively short and mild. All these developments have some common roots in the major structural, institutional, and policy changes of the era.

This paper takes a look at the assumptions concerning wage and price behavior in types of contemporary macroeconomic theories and their implications for the analysis of the business cycle. The various hypotheses of real and nominal "rigidities" are then related to each other and to alternative theories of how markets clear.

Long-term stable wage and price arrangements or contracts have important equilibrium aspects that are consistent with high degrees of competition; or, to put it differently, there are good reasons for market clearing by nonprice mechanisms. Further, imperfections of competition, information, and markets make some stickiness of wages and prices inevitable. Changes in relative prices and costs, productivity, and profitability play an important role in the process of propagation of business cycles.

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Background, Motivation, and Procedure

There is sufficient evidence to establish that business recessions were on the whole shorter and milder in the last four decades than before World War I and II. Certainly, such severe depressions as ocurred on six occasions between 1873 and 1938 were conspicuously absent in the postwar era. Moreover, certain structural, institutional, and policy changes help explain the moderation of the business cycle (for an analysis of these factors, see Zarnowitz 1989). There are admittedly large problems with historical data, but they do not invalidate any of the above statements.[1]

A comparison of standard historical estimates and recent data suggests that the general price changes were more volatile and more cyclical in the earlier periods than after World War II. This is strongly supported by the available long wholesale price series (Zarnowitz and Moore 1986, sec. 9.10; Zarnowitz 1989, Chart 2, Table 1, and text). Consumer prices have always been much less variable, and here the change in behavior is subject to doubt. The standard estimates for the GNP deflator may have greatly overstated the historical price volatility by using only wholesale and not consumer prices (Balke and Gordon 1989, pp. 71-75). However, even consumer prices responded with significant declines to some of the business contractions of the past (see, e.g., ibid., Fig. 1), whereas after 1979 neither producer nor consumer price levels did. Inflation prevailed throughout the postwar period,[2] and generally procyclical movements in the rate of inflation replaced the earlier procyclical fluctuations in the price level.

Thus, it appears that the age of reduced cyclical instability was also an age of increased downward rigidity of prices (and, it will be shown, money wages). This presents a problem because the classical and still prevailing

view in the profession is that stickier wages and prices make the real economy more unstable.

In large part, the voluminous and rapidly expanding literature on "microfoundations" of macroeconomics consists of attempts to rationalize why wages do not adjust promptly and fully to changes in the demand for labor, and prices to changes in the demand for output, which would have drastically reduced if not eliminated the business cycle problem. But great differences in the degree of price and wage flexibility (or stickiness) are found in historical studies and cross-sectional and cross-country comparisons (see, e.g., Sachs 1979, 1980; Branson and Rotemberg 1980; Gordon 1982, 1983; Bruno and Sachs 1985). Apparently, business cycles coexist with a broad range of behavior in labor and product markets, though they may influence, and be influenced by, changes in that behavior. It is these interactions that should ultimately be of primary interest to students of macroeconomic performance and policy, not a postulated dichotomy of flexprice and fixprice models.

For good reasons, however, little is known as yet about what causes what here. Macroeconomics deals with a limited number of aggregate variables and potential sources of overall growth and instability; it finds it exceedingly difficult to deal with an evolving economy and heterogeneity of market firms and participants. Yet it is useful to ask how the main contemporary macro models and micro hypotheses bearing on business cycles and broadly defined price flexibility are related to each other. This paper and its sequel seek to answer this question by selectively reviewing work in this area and assessing its major implications and problems in the light of statistical and historical evidence.

I begin by taking a brief look at the major assumptions concerning price behavior in types of contemporary macroeconomic theories and some of their

implications for the analysis of the business cycle (I). The various hypotheses of real and nominal "rigidities" are then related to each other and to alternative theories of how markets clear, in critical assessments that center first on wages (II) and then on prices (III). There is a brief concluding section (IV).

I. Flexible and Sticky Prices in Macroeconomic Theories

1. Market-Clearing Models

In the classical Walrasian prototype model, with instantaneous price and wage adjustments clearing all product and labor markets continually, the relative prices and quantities of all outputs and inputs are determined in the position of the overall "full employment" equilibrium independently of the general price level. Here the aggregate supply (AS) curve is vertical at the equilibrium level of total output, and rises and declines in the aggregate demand (AD) curve can only result in rises and declines of the price level. Hence, in this model shifts in AD cannot produce business cycles defined as sequences of expansion and contraction in real economic activity (output and employment). Shifts in AS can generate output movements but it is difficult to see how they could give rise to the persistent and pervasive fluctuations of the type observed in the history of business cycles.

With complete competitive markets, full information, and perfect foresight, the classical model has no sources of friction, error, or maladjustment. Changes in technology and hence productivity and real wages, or changes in preferences, can induce intertemporal substitution of labor, that is, people may choose to intensify work effort in times of high expected returns. But technical progress tends to be gradual (operating over horizons longer than the business cycle) and diffuse (having differential sectoral and

muted aggregate effects), and an overall technical regress is hardly ever experienced. The model leaves no possibility for cyclical unemployment to arise as a social problem. The AS shifts generate an inverse association between price movements and output movements, but the historically observed relationship is predominantly a positive one. In sum, it seems fair to conclude that the deterministic, frictionless version of the Walrasian system cannot account for even the most basic aspects of business cycles. (See Table 1, column 1, for a schematic characterization of some relevant features of the theory.)

The recently much cultivated group of "real business cycle" (RBC) models can be viewed as a stochastic version of the Walrasian prototype, simplified in some respects but elaborated in others, mainly concerning the dynamics of intertemporal substitution of consumption and leisure. Rational expectations (RE) replace perfect foresight, and exogenous technological shocks drive the economy's motion. Otherwise, the assumptions and implications of RBC models and the older classical model are the same; in particular, all these theories involve neutrality of monetary policy and preclude business cycles due to shifts in AD caused by exogenous changes in the money stock or investment flow and the associated credit demands (cf. Table 1, columns 1 and 2).

The assumption of competitive markets with full flexibility in all prices implies a strong stabilizing role for price adjustments. Hence, there are no multiplier effects to amplify external disturbances, so the latter must be sufficiently large in the aggregate to account for the size and persistence of the observed cyclical movements in total employment and output. This would seem to require that the technology shocks in the RBC models be large, pervasive, and persistent to a degree which is not easily rationalized or documented.

The response of the new equilibrium model builders is to assume that the

effective supply of labor is highly elastic to changes in the total return on work effort. That return depends positively not only on the real wage but also on the real interest rate, since a higher rate rewards the extra saving and asset acquisition made possible by higher income. With a stable and slightly rising labor supply, large shifts in labor demand attributed to changes in technology and marginal productivity can produce wide swings in employment accompanied by small procyclical changes in real wages. This combination of results is broadly consistent with the evidence but the posited conditions are not, unless all of the estimates of low labor supply elasticities are wrong.[3] If labor supply is not elastic with respect to real wages, then the analysis must take a different track, namely that supply shifts along with demand or that workers are off the competitive labor supply curve.

The earlier contemporary equilibrium theories differ from the RBC models in that they assume incomplete information, which makes unanticipated changes in the money supply and the price level a source of errors in production and investment decisions. Although data on money and prices in outside markets and the economy at large are taken to be known only with a significant lag, the product and labor markets are still treated as if they cleared continuously. The assumption of RE is retained, but random errors of misperception of general for relative price movements are taken to be sufficiently large, pervasive, and continual to drive the business cycle. Monetary policy is not neutral in the sense that its vagaries produce the price misperceptions. Thus aggregate demand shocks have a major role in incomplete-information equilibrium models of this type, unlike in the aggregate-supply driven RBC models (cf. Table 1, columns 2 and 3). The investment accelerator, however, is an important propagation factor in both groups of theories.

2. Departures from Price Flexibility

The price misperceptions model shares several features of the earlier monetarist theory, notably the view of monetary policy as a source of shocks to money supply and aggregate demand (cf. columns 3 and 4). But there are also important differences: expectations are adaptive rather than rational in the older theory, and anticipated as well as unanticipated shifts in the money supply influence real economic activity in the short run. Price flexibility in competitive markets has a major stabilizing role over time, but there is much short-term inertia (or predetermination) in wages and product prices. That is, product markets require significant lags to clear in response to changes in demand, and labor markets clear with longer lags yet.

Monetarism was, among others, a reaction against the neglect of the role of money in business cycles, as attributed to Keynes and his followers. The more recently stressed charge is that Keynes assumed nonrational behavior in form of rigid wages. But this applies only to one phase in the development of Keynesian economies, not to the initial and now again widely shared view that wages adjust only gradually. The real differences lie elsewhere, in Keynes' beliefs that (1) business investment is volatile because of the prevailing uncertainty; and (2) downwardly more flexible wages and prices can make for more, not less, instability (cf. columns 4 and 5). The reason for (1) is that future returns on investment cannot be confidently predicted; the reason for (2) is that, with cyclically flexible prices and sufficiently elastic price expectations, deflation can generate expectations of further deflation and contribute to the severity of a depression.

The most recent class of models in Table 1 is labeled "new Keynesian" (column 6). Here the emphasis is on the perceived failure of labor and product markets to clear, which is ascribed primarily to informational deficiencies or asymmetries. However, most authors in this group regard wage

and price flexibility as stabilizing, hence desirable in principle. They see shifts in aggregate demand, whether due to fluctuations in real investment and credit or in money supply, as an important source of business cycles.

Table 1 is schematic and ignores many nuances of views held within each of the broadly characterized groups of theories. Some of these differences are considered later in this paper, with references to the literature and the relevant historical evidence.

II. Why Are Wages Not More Responsive to Declines in Demand?

1. On Hypotheses of Wage and Price Inertia

For a long time Keynesian macroeconomics focused on the inflexibility of nominal wages rather than prices as the main link between fluctuations in demand and output. But the image of rigid wages and more variable prices finds little support in the data. In a growing economy, money wages rise faster than prices most of the time, as would be expected. The main exceptions are rapid and unanticipated spurts in inflation when wages lag behind so that workers have temporary losses (there are corresponding windfall gains in times of unexpected disinflation or deflation). The short-run fluctuations around the trend of nominal wages are not necessarily smaller than those of consumer prices. Indeed, if it were typically the case that prices fall in business contractions while money wages do not, then real wages should tend to be countercyclical. But the evidence, as reviewed below, is that wages deflated with consumer prices are generally acyclical or weakly procyclical, while wages deflated with producer prices are at most weakly countercyclical.

The unexamined premise that nominal wages are inflexible in the sense of

being unresponsive to cyclical demand fluctuations has too long been maintained in Keynesian macroeconomics. It would seem more plausible to expect that money wage rates will on the average rise faster than the value of the marginal product of labor in periods of high employment and will rise more slowly or even decline in periods of low employment. The tendency for real wage changes to reflect productivity changes would then manifest itself mainly in the long run.

To be sure, a competitive firm will not knowingly pay real product wages in excess of the employee's marginal product, except transitionally and when it expects to recoup its short-term loss in the longer run. Similarly, the worker will not knowingly accept less than his/her marginal product, except under analogous circumstances. So any discrepancies between wages and productivity must be due to any or all of the following: (1) lack of knowledge by the firm and/or the worker of what the relevant marginal products currently are; (2) uncertainty about the economic conditions facing the firm and the workers; and (3) departures from competition, mainly in the direction of bargaining between large oligopolistic companies and large labor unions.

Conditions (1) and (2) are probably of long standing. However, productivity is particularly difficult to assess in various service industries, such as finance, insurance, trade, health, and education; also, in professions and sales, clerical, technical, and managerial occupations. Many of these areas gained greatly in relative importance in recent times. Some large shifts of type (3) certainly occurred as well, but so did important countermovements in the direction of more global competition. The question of what the net effects of all these changes are is important and needs to be considered.

Research confirms the common observation that few labor markets are of

the competitive auction type, where nominal wage adjustments clear the market continuously. Explicit contracts negotiated by unions and corporations determine wages of organized labor over staggered periods of one to three years. Implicit contracts whose durations run over years fix wages and salaries of career job holders. Here current compensation is an installment payment on a long-term employment relationship. It is often in the best interest of both employer and employee to maintain such association on multivariate terms that are not very responsive to those changes in general economic conditions which are considered transitory.[4]

Contractual arrangements between buyer and seller also exist in product markets, at least for limited time periods, and they tend to be associated with low frequency and small average size of price changes. But prices often remain unchanged over very long time periods even where no such contracts exist (e.g., newstand prices of magazines). It is generally accepted that transaction prices must be free to adjust to insure an efficient allocation of resources, and they are in fact widely unrestricted in market economies. Yet there is substantial evidence that product prices in many industries, particularly those that are more concentrated, change only infrequently.[5]

All this explains why the emphasis on wage rigidity gave way to more attention to price rigidity in the recent years. The shift suggests the general notion that the main reason why workers lose jobs in recessions is not that real wages rise but that prices do not fall even though sales do. Also, it recognizes that, up to a point, prices can decline despite temporarily sticky wages when allowed by some combination of gains in productivity and reductions in nonlabor costs and profit margins. However, should wage rigidity be pervasive and persistent enough, it would clearly be a major problem in itself and probably induce much price rigidity. Labor compensation

is, after all, the largest component of both total income and cost of output.

2. Real and Nominal Rigidities

In the business cycle context, it is particularly important to ask how changes in the aggregate demand for real output (Q) influence the levels of nominal prices and wages (P,W). If P does not react promptly or fully to a change in Q, at any given level of W, there is some real price rigidity. Analogously, if W does not react promptly or fully to a change in Q, at any P, there is some real wage rigidity. These partial adjustments involve changes in price-over-wage markups or real wages. They are complemented by interactions between changes in P and W, given Q. If P does not react promptly or fully to a change in W, there is some nominal price rigidity; in the opposite case, there is some nominal wage rigidity.

One way to formalize this double dichotomy and isolate the parameters that embody each of these "rigidities," as implemented in Blanchard 1987a, is to estimate and analyze equations of the type

(1) $p = \mu w + \alpha q$, and

(2) $w = \eta p + \beta q$.

Here q might be represented by output in (1), employment in (2). Each variable (p, w, and q) involves a lag polynomial applied to the logarithms of levels, or alternatively to log differences (e.g., $p = a(L)P$ or $p = a'(L)DP$). The smaller the values of μ and η, the greater the nominal price and wage rigidities, and the smaller the values of α and β, the greater the real price and wage rigidities, respectively. Unless $\mu = 1$, p does not adjust fully to changes in w, and the same applies, mutatis mutandis, to η, α, and β. Depending on the time frame and type of the analysis, the adjustments can differ with respect to both how complete (or partial) and how

fast (or slow) they are.[6]

To close this simple model, it is necessary to make q a function of some exogenous factors. Keynes attributed business cycles to shifts in real aggregate demand, due mainly to instability of investment. In contrast, contemporary models that bear the broad Keynesian label relate the cycles to shifts in nominal aggregate demand, due mainly to instability of money supply. Given this orientation, q is often taken to be proportional to real balances (m - p), where m is the log of the nominal money stock. Realistically, however q should be thought of as depending on the demand side on both monetary factors and nonmonetary ones (e.g., shifts in government spending and taxes, exports, etc.).

There are many good reasons for an inertia in the response of relative wages and prices to changes in real demand, and the degree of that inertia may be high, as will be shown below. Some but not all of these explanations require major deviations from the basic competitive model. On the other hand, the problem of nominal rigidities simply does not arise under perfect competition. Suppose a sudden tightening of monetary policy causes a fall in aggregate demand, while no change occurs in technology or preferences. Under the classical competitive paradigm, since the equilibrium structure of prices remains unaltered, all nominal prices must decline proportionately. It is only in this way that the previous equilibrium levels of real money balances and real economic activity can be restored (or, rather, maintained: the process is executed promptly and smoothly by continuous price changes directed from open auction markets at atomistic agents).

It is clear that any appearance of significant nominal rigidities signals the presence of some market imperfections and/or departures from pure competition. More generally, understanding the macroeconomic role of sticky

prices and wages depends critically on considerations of both the market structure and micro decision-making.

3. Relative Wages and Efficiency Wages

For Keynes (1936, chs. 2 and 19), the idea which marks a key departure from "classical economics" is that labor is an aggregate consisting of groups which, whether or not formally organized, have as their main objective the protection of their relative real wages. Each group watches the others it compares itself with, and bargains to obtain a possible advantage but at least not to fall behind. Thus, in a depression any group will resist an attempt to reduce its money wage. While a uniform across-the-board wage cut may be acceptable to labor under conditions of prevailing weak prices and profits, there is no practical way to engineer it in a diversified economy in which there is some dispersion of market power. The stickiness of relative earnings thus translates into a stickiness of nominal wage rates in general, and such partial reductions in these rates as come about are apt to do more harm than good, mainly by contributing to the spread of deflationary expectations and inhibiting spending. In contrast, reflationary policies, by raising the price level and so lowering real wages overall, can provide the needed adjustments without disturbing the wage structure in ways to which labor objects.

If relative wages is what matters to groups of workers, then the net productivity of labor should be a positive function of these wages. In a sufficiently strong form, this relationship implies that a decline of real wages below a certain norm is associated with higher, not lower, unit labor costs. Here the old emphasis on the dependence of wages on productivity is replaced by a new emphasis on the reverse causation, the dependence of productivity on wages. Stiglitz (1986, pp. 182-192; 1987) provides the model

for this analysis; for criticisms and references, see also Katz 1986 and Murphy and Topel 1988.

Suppose that, as the real wage of the i-th labor group, ω_i, increases up to ω_i^*, the productivity of the group, λ_i, rises more than proportionately, while a further increase in ω_i is associated with less than proportionate gains in λ_i. Hence the cost per effective unit of labor service is U-shaped with a minimum at ω_i^*. The firm that employs i-th labor will pay the "efficiency wage" ω_i with the intention of minimizing unit labor costs; it will not extend employment to people who offer their services at a lower wage as it believes that this would reduce productivity and raise costs. The unemployed cannot underbid the "insiders" if they are viewed as sufficiently less productive or likely to raise the effective costs of labor to the firm.

Efficiency wages are paid for any or all of several reasons. (1) The perceived relative wage determines an employee's effort and indeed willingness to work. On one view, this is merely an individualistic version of Keynes' notion that any labor group is averse to a reduction in its nominal wage, which is inevitably a relative wage cut. A sufficiently strong and general self-validating convention of this kind could in principle, for a decentralized market economy, generate a pervasive downward stickiness of wages. But historically money wages fell in depressions and wage concessions are not uncommon even during shorter and less severe contractions (as in the early 1980's). Considerations of fairness may well be very important but economic self-interest should be stronger still. High unemployment will increase the value of holding a job and the incentive to work hard. Should prices fall more than wages, as they did in the early 1930's, these motivations will be further enhanced, and the role of relative wages could

well be greatly diminished.

(2) In the modern versions of the theory, it is not labor's resistance to lower wages that is stressed but rather management's strategy to give workers incentives in form of relatively high earnings and benefits. The idea is that this is required to attract and keep high-quality employees and have them work at high levels of effort. They will then be less prone to search for better opportunities while on the job, to quit, or to join a union and exercise more bargaining power collectively. As a result, the firm will benefit from lower labor turnover costs and higher returns on the specific training offered the workers. The efficiency wages ω^* are set by firms with some (perhaps only informationally based and short-run) monopsony or oligopsony powers in the labor markets so as to maximize profits. In this interior solution, small deviations of wages from long-term equilibrium cause only second-order losses to the firm, so that non-adjustment of wages to minor shocks is "near-rational" (Akerlof and Yellen 1985). This class of models, then, shows that the effect of efficiency wages is to decrease the fluctuations in wages and increase those in employment.

(3) Shirking and negligence can cause large damages to firms, particularly where many workers perform sensitive tasks using complex machinery and equipment (so can fraud and stealing which may be more diffuse). The detection of such misconduct is taken to be costly in the so-called primary (high-wage) sector of the labor market, but not in the secondary (low-wage) sector. Hence, the primary jobs pay a premium above the market-clearing wage for secondary jobs, so as to deter shirking, even if the workers are all alike in ability (Shapiro and Stiglitz 1984; Bulow and Summers 1986). Critics point out that superior market-clearing solutions for the shirking problem exist in form of explicit or implicit contracts that involve

performance bonds posted by employees. Direct and complete bonding is apparently rare, perhaps because of limited ability or willingness to borrow, mistrust between the parties, etc., but there are practical alternatives observed in long-term employment relationships. Workers may in effect buy responsible high-paying jobs gradually, by accepting initially low wages for simple, easily monitored tasks, then proving themselves and advancing along the job ladders within the firm.[7]

4. Implications for Unemployment and Some Evidence

To rationalize involuntary unemployment in the sense of excess supply of labor, the theory must rule out the existence of a sufficiently attractive and expandable flexible-wage sector which could absorb all those who are denied employment at efficiency wages. In the model with dual labor markets, workers in the secondary market have menial jobs with low prospects and high turnover, and this in itself acts as a reputational barrier against the employment of these workers in the primary market. Searchers for the rationed primary jobs must wait in queues for vacancies and are counted as unemployed. The high wages in the primary market discourage shirking, and so do the associated risks of facing resentment of fellow workers, detection, and becoming either unemployed or a secondary worker. Thus job losses from shirking should not be frequent, and the data do not suggest that they are. It follows that unemployment in this setup is mainly frictional and long-term, due to the high incidence of quits and separations in the secondary sector and to the job rationing and queues in the primary sector. Static models of this type provide no explanation of cyclical unemployment.

All of the considered labor market hypotheses produce sticky real wages

(although a model with a primary wage at a fixed differential above a flexible secondary wage would not). It is theoretically possible for the wage that minimizes unit labor cost to be constant (Solow 1979). However, some of the models suggest the possibility of cyclical unemployment associated with sticky nominal wages. Two ideas are relevant here. One is that relative wages are important to labor morale and productivity, and hence to business (Summers 1988). The other is that the costs of wage and price inertia are second-order small relative to shocks to the equilibrium of firms that already maximized their profits internally (this is the menu-cost argument, about which more later).

The evidence bearing on these theories is limited and mixed. There is evidence that long-tenure career jobs are indeed very important in the U.S. labor markets today; e.g., as shown in Hall 1982, about 40% of workers aged 30 and above are likely to hold jobs that will last twenty years or more. Current compensation for work of this type may be viewed as an installment payment on a long-term employer-employee association, and as such its influence on current employment is apt to be small. By contrast, there is understandably no direct knowledge of the empirical importance of efficiency wages as defined in theory, i.e., rates in excess of market clearing set unilaterally by firms to elicit effort from individual workers.[8]

According to data for men who changed employers and industry or occupation between successive years in 1977-83, 23.7% of new hires in high-wage industries and 29.5% in low-wage industries experienced some unemployment spells (averaging 3.0 and 3.6 weeks, respectively) during the year past. These statistics do not support the hypothesis that hiring from a queue of long-waiting jobless searchers is particularly important in the primary as distinct from the secondary labor market (see Murphy and Topel 1988, Table 2

and text).[9]

It is commonly observed that people look for better jobs while employed and do not deem it necessary to quit in order to search more efficiently. It is unsatisfactory for a theory to rely on assuming the opposite. Intersectoral mobility of labor is impeded but certainly not precluded by the considerable costs and lags that are associated with it. Moving to a higher-wage industry or occupation should be easier in a business expansion than in a contraction, and quits are unambiguously procyclical. During a slowdown or contraction, layoffs increase, more workers complete for fewer jobs, and the average duration of unemployment lengthens. In the short run, one would expect most labor movements to be intrasectoral. Shifts of employment within firms play a major role at all times, but here again there are probably important cyclical effects such as speedier career promotions and job upgradings in expansion. It stands to reason that large and complex organizations have large internal labor markets; the theory of dual labor markets locates such firms, and hence the rich promotion opportunities they offer, predominantly in the high-wage primary sector. But it is difficult to define what this means, let alone test the theory, since industries and occupations generally overlap both the primary and secondary sectors (Doeringer and Piore 1971; Lang and Leonard 1987).

Shifts in the aggregate demand for output and in the derived demand for labor presumably have less effect on the efficiency wage than on the completely flexible market-clearing wage. This suggests that employment and unemployment should be more demand-sensitive, and probably more cyclical, in the primary sector (the assumed locus of efficiency wage) than in the secondary sector (where the wage is hypothesized to be competitive).

Other considerations also suggest that secondary unemployment may not be

very cyclical. Primary workers have large amounts of human capital, much of it firm-specific; their spells of joblessness are likely to be infrequent, concentrated in bad times, but also long because they are motivated and financially able to search extensively. Secondary workers have less human capital and are less attached to jobs which have relatively low pay and promise; hence they are unemployed much more often in both good and bad times, but generally over shorter periods as their incentives and opportunities to search are limited.

To test for such dichotomies, one would like to have time series on unemployment and wages by industry and occupation, well matched and in sufficient detail, but such data are not readily available. Table 2 takes only a first exploratory step here, using major industrial categories of origin for the unemployment among private nonfarm wage and salary workers. Even for this broad breakdown, large interindustry differences in percentage amplitudes of cyclical movements in unemployment are very evident (columns 1-3).[10] There are positive correlations between these amplitudes and both the overall level and variability of average hourly earnings in the same industries ($r_{37} = 0.72$; $r_{38} = 0.75$).[11] Industries with higher unemployment rates have also more variability in these rates, which in turn is associated with higher average levels and standard deviations of wages ($r_{56} = 0.82$; $r_{67} = 0.72$; $r_{68} = 0.62$).

These findings point to several problems and ambiguities. Where average hourly earnings are higher they are also more variable over time; should this be confirmed by a detailed analysis, it would be difficult to reconcile with the hypothesis that higher wages are the sticky efficiency wages. The high-wage industries may be associated with more cyclical unemployment for reasons other than those advanced by the sticky-wage theory, including the reverse-

causation argument that higher wages are paid in part because of the greater instability of employment. Moreover, there are some well-known factors that help explain the interindustry differences in sensitivity to business cycles, notably the durability and storability of products. In sum, the evidence is not necessarily inconsistent with the ideas discussed in section I.5 above, but it is not particularly encouraging either. Clearly, there is need for working out the dynamics of these theories, e.g., the interactions between changes in productivity and wages. And testing will be difficult here even with much better and more disaggregate data.

5. The Role of Long-Term Labor Contracts

Explicit employment arrangements or contracts cover a large proportion of workers who stay on the job. Firms routinely extend employment and grant raises from year to year, especially to employees on salaries. Contracts are formally negotiated with labor unions for periods of one to three years ahead. Presumably much more widespread, however, are implicit contracts that benefit the firm and its work force and are therefore, as long as they are so perceived, complied with by both, despite the absence of express, legally enforceable agreements.

If workers are generally more risk averse than businessmen and have less access to capital markets, they may in effect wish to buy from firms insurance against income decreases in bad times in return for smaller increases in good times. The underlying assumptions seem reasonable. In the same implicit bargain, the firm is conceded much latitude in varying the volume of employment over time. Again, this is not surprising, given the normal functions and requirements of business, and the realization that fluctuations in the demand for firm's output must be accepted as exogenous. Both the firm

and labor gain if hours and effort rise (decline) when there is more (less) work to be done. Convincing arguments attribute considerable efficiency at the micro level to contracts that include a variety of risk-sharing arrangements and such devices as temporary layoffs, overtime pay, and cost-of-living adjustments (see in particular Hall 1980). But even optimal contracts are constrained by inevitable gaps and inaccuracies of information and cannot allow for all contingencies that are hidden from foresight in the world of uncertainty; if they could, any related macroeconomic inefficiencies would presumably be also eliminated, or at least greatly reduced.

Thus, the early implicit contract models (Baily 1974; Azariadis 1975) can account for sticky real wages but not cyclical unemployment. It is not clear why workers should be so strongly concerned about wage fluctuations but not about the risk of job losses during a recession. The contract theories face various problems related to the observability and verifiability of the events covered, the complexity and enforcement of the contracts, moral hazard, and adverse selection. In particular, the more complicated models with asymmetric information depend on special assumptions on how firms and workers differ with respect to what they know and what their attitudes to risk are (cf. Grossman and Hart 1983). Some of the more questionable premises are that generally firms are risk-averse, workers uninformed about the state of the economy, and contracts effectively explicit but of short duration. The resulting contracts are complex in the sense of being conditioned on the state of the world, and there is no evidence that contracts of the required type actually exist. However, it is suggested that some reasonable limitation on the costly complexity of the contracts may help relate the behavior of wages and unemployment (Stiglitz 1986).

Coordination or externality problems are inherent in systems with

imperfect information and incomplete markets where wages and prices are set by decentralized decisions of parties to a contract or transaction. The reason is simple: any change so decided concerns a relative or real price (of a commodity, labor, or asset), since it is made given other prices. Thus nominal rigidities arise from real rigidities, no matter what degree of micro efficiency in real terms the implicit contracting may achieve. However, it would seem that institutional means or contractual contingency provisions are readily available to reduce the nominal stickiness, at least in wages, by indexation. But informational lags and errors do not allow a complete wage indexation in practice. Moreover, to the extent that indexation does produce an approximately fixed real wage, it aggravates the effects of real shocks even as it reduces those of nominal shocks, so that, for example, the economy may suffer less from demand disturbances but more from supply disturbances (Gray 1976, Fischer 1977). Also, if indexation is believed to reduce governments's interest in pursuing consistent counterinflationary policies, the case for it is at least politically weakened (Fischer and Summers 1989).[12]

I conclude that the theory of optimal contracting cannot explain cyclical fluctuations in employment and unemployment. Indeed logically, the more efficient the contracts are in foreseeing or providing for contingencies, the less room should they leave for persistent departures from full employment. But inefficient labor contracts that incorporate informational asymmetries imply underemployment or work sharing rather than the excess of layoffs over hires during business contractions. Simpler models with relative wage contracting (Taylor 1983; Summers 1988) may prove more helpful on nominal rigidities and unemployment but their consistency with rational expectations and optimizing behavior continues to be questioned.

6. A Summary of Wage Hypotheses

Table 3 provides for the reader's convenience a synopsis of the attempts to explain why wages are or appear to be sticky. After the preceding discussion, only a few additional points remain to be made.

The first hypothesis is that real wage movements clear the labor market but are small because the supply of labor is highly elastic. This is consistent with the simple competitive model and assumed as a part of the recent RBC theoretical framework. It is contradicted by most tests of intertemporal substitution of leisure (see references in Zarnowitz 1985, section IV.3) and generally by micro estimates of labor supply elasticities (see note 3 above). Some estimates based on aggregate data show large elasticities (Kennan 1988) but they depend critically on prior assumptions and are very imprecise, the contemporaneous correlation between real wages and employment or hours being essentially zero (Taylor 1988).

Bargaining between a labor union with a fixed number of members and a sectoral monopolist can produce a sticky negotiated real wage in the presence of fluctuations in demand and employment, assuming that the unemployed members have an alternative source of income and that there is little variation over the cycle in the wage elasticity of labor demand. Let this situation prevail in the "primary sector", while the competitive "secondary sector", offers much poorer jobs at a much lower flexible wage. Then unemployment will consist of those on temporary layoffs from the primary sector and those who wait for jobs in that sector. Aggregate demand fluctuations will be absorbed mainly by employment adjustments in the primary sector, by wage and employment adjustments in the secondary sector. A fall in demand during a recession will widen the intersectoral wage differential. The models that give these results are worked out in McDonald and Solow 1981, 1985. Hypothesis 3 in Table 3 states the relationship between unions and relative wage rigidity in general terms.

III. Market Structure and Sticky Prices

1. Competition, Costs, and Nonprice Market Clearing

A combination of highly elastic supply and fluctuating demand would obviously yield relative price stability in equilibrium, which then might be mistaken for a disequilibrium phenomenon of "real price rigidity". This is a simple and attractive theoretical possibility, which must be considered.

The competitive firm's short-run supply function is horizontal at the minimum of its average variable cost (the threshold of profitable production and a special condition which may be unlikely to persist). At higher market prices, this function equals the firm's marginal cost (MC) curve, which slopes upward because of diminishing returns. The firm has strong incentives to operate in this portion of the MC curve, as close to the capacity output (where MC rises steeply) as the price will allow. The supply curve for a competitive industry as a whole will tend to be still steeper because an expansion of industry output is apt to raise input prices and so shift upward the MC curves of all firms concerned.

This argument against the hypothesis suggested above is not conclusive, however, because it is not only the short-run supply responses that matter to what concerns us here. Since business cycles consist of movements measured in quarters and years, during which all factors of production become variable as technology advances and real capital stock grows gradually, the analysis should include longer-run responses as well. It stands to reason that even over short periods of time firms will see some price changes as more "permanent" than others, and may differ in these assessments, so that what is being observed represents a changing mix of short-run and longer (mostly "intermediate") adjustments.[13]

The more variable the inputs, the more responsive output can be, hence

the standard proposition of price theory that supply elasticities tend to be greater in the long than in the short run. Abstracting from innovations and new entry and assuming open access to the available technology, it is possible for low output levels to be associated with low and stable marginal costs of inputs, higher output levels with rising MC curves. The resulting intermediate-run industry supply curves would then be nonlinear: flat in the region of low constant costs and increasingly upward-sloping at higher rates of production which drive up MC. If the aggregate supply curve had this shape, upward shifts in aggregate demand into the high-output range would cause mainly rising prices, downward shifts into the low-output range would cause mainly falling output. Such asymmetry is often assumed (but not explained) in macroeconomic texts, presumably because it accords with the popular view that prices are sticky downward but not upward.[14]

It follows that the simple microeconomics of a competitive industry is not necessarily inconsistent with the story that the MC function is approximately horizontal over some region of the industry's output, yielding a stable relative price in equilibrium for time horizons which are relevant for the analysis of business cycles. What is inconsistent with this theory, however, is the notion of demand-induced persistent fluctuations in output that coexist with stable prices. When high levels of production are reached in a business expansion, overtime hours of work at extra pay rates become common and prices of many inputs rise sharply; at low output rates in a business contraction, average workweek is cut and some input prices fall. There is little doubt that the MC curves are typically upward-sloping under these conditions, i.e., that marginal costs increase in booms and decrease in slumps. Yet many industrial product prices remain unchanged over long time intervals which must overlap these business cycle phases. Thus the evidence

in Carlton 1986, 1987 shows average durations of price rigidity exceeding one year in most cases and two or even three years in some. On the other hand, those input prices that often do decline during major slowdowns and recessions are likely to originate in competitive markets. They include notably the spot market prices of raw industrial materials known as "sensitive" and probably also wages of some categories of unskilled and unorganized workers.

The evidence of long periods of rigidity in prices of numerous diverse products cannot be reconciled with a competitive model in which price always adjusts promptly to equate supply to demand. It is simply improbable that both demand and supply schedules do not move or that their shifts persistently offset each other so as to leave the price unchanged. Some common observations are also inconsistent with the model of market clearing through price change only: at times there is unintended inventory accumulation of goods held for sale, at times queues for goods that are in short supply (so either sellers or buyers are unsatisfied). These considerations lead naturally to the question of what mechanisms may help clear markets in addition to price, and how they are related to the competitive model.

I suggested long time ago that the endogenously determined variable delivery period (k) is an important equilibrating device (Zarnowitz 1962). Prompter delivery enhances the value of the product and so raises the quantity demanded (ordered) per unit of time; it also raises the average cost of the quantity supplied. This implies, as a condition for profit maximization by the firm, that

(3) $dP - dc = -(D_k/D_p - C_k)dk = 0,$

where $D_p = \partial D/\partial P < 0$, $D_k = \partial D/\partial k < 0$, and $C_k = \partial C/\partial k < 0$ based on the demand function $q^d = D(P,k)$ and the cost function $c = C(q^s,k)$. For any quantity demanded, say q^d_1, there is an indifference curve in the price/

delivery period (P,k) space, and for the same quantity supplied, q^s_1, there is an indifference curve in the cost/delivery period (c,k) space. Joint optimization of P and k requires that the slopes of these loci be equal, so that

(4) $dP/dk = dc/dk$ and $C_k = -(D_k/D_p)$

in conformity to (3).

Given the system of indifference curves generated by this simple model, the effects of shifts in demand on P and k will depend on the slopes and positions of these curves and the resulting properties of the paths connecting the optimal points on them. As long as there is some substitutability between P and k, these paths will slope upward. This means that the fluctuations of demand will in general be met partly by changes in price and partly by changes in delivery period, inducing a positive correlation between the two variables. Any responsiveness of k should make P more stable over time, but a variety of outcomes is possible, reflecting the characteristics of the product and the state of the market.

Even a physically identical commodity differs economically to the user depending on the date of its availability. An impatient buyer will pay a little more for an earlier purchase but a sufficiently large differential over the expected or stated future price will cause postponement or placement of an order for future delivery. If cost or demand changes today affect both present and future prices, intertemporal substitution in the use of producer and consumer goods may increase the equilibrating role of delivery lags and reduce that of current prices. Thus when demand is elastic with respect to P but inelastic with respect to k, more of the market clearing will be accomplished by variations over time in k and less by variations in P. These conditions appear to prevail in several major industries, according to the

analysis and evidence presented in Carlton 1979, 1987.

2. Inventories, Backlogs, and Pricing

Some industries produce largely to order: they wait for or solicit orders in advance of production and delivery, and hold large backlogs of unfilled orders and small (or no) inventories of finished goods. Other industries produce largely to stock: they make goods and hold them in finished-goods inventories for sale. Products that are customized and particularly costly or risky to store tend to be made to order. There is much evidence that production to order is very important (especially in durable-goods manufacturing), and that it is associated with high variability and cyclicality of backlog-shipment ratios representing average delivery lags and relatively small fluctuations in prices (Zarnowitz 1973).

Market-determined changes in delivery periods and unfilled orders, which reflect shifts in demand and cost conditions, are consistent with a high degree of competition (Zarnowitz 1962, 1973; Carlton 1983, 1987). Large procyclical movements in k are indeed widely observed, as shown by the index of "vendor performance" based on data on delivery lags reported by purchasing managers. But they need not be indicative of noncompetitive behavior causing excess rigidities in P. Instead, their principal explanation may be simply that when buyers choose or consent to wait, smaller or slower price fluctuations are needed to clear the markets. Demand is likely to be often more sensitive to changes in P than to changes in k.

Where inventories of finished goods are held, they absorb the impact of temporary shifts in demand at least in some part, thereby permitting avoidance, reduction, or deferral of price changes. However, the production-smoothing (buffer) role of inventories seems to be in the main limited to

short unexpected demand shocks: for inventory investment to act as a strong buffer against longer fluctuations, it would have to be countercyclical, but instead it is on the whole procyclical and destabilizing. Thus, GNP varies more over the cycle than final sales. The costs and risks of holding inventories should be inversely related to local trends and expectations of sales and prices. As stocks of unsold products accumulate in slowdowns and recessions, prices of the affected items weaken and decline. (In the economy as it is, temporary rebates and marked-down sales are widely used to "move" the stocks). But reductions in inventories must be selective and are limited by the need to maintain the assortment of goods customers desire and avoid costly stockouts. For some time after the demand slackens, backlogs of unfilled orders for many products are still high, which helps to keep up production and employment, attenuating the downward pressure on prices.

To the extent that changes in both inventories and unfilled orders reflect widely diffused cyclical fluctuations in demand, they must be viewed as interacting with output and price movements in industries that cover the entire range of different types of market structure and conduct. Where competiton is perfect or nearly so, firms observe the changing market conditions, and determine their production in each period as best they can, taking prices as given. Where competition is reduced by small number of sellers, collusion, regulation, or differentiation of products, firms have discretion over more variables and must consider the effects of their actions on present and potential rivals and customers over longer spans of time. The basic textbook analysis, however, is limited to price-quantity solutions for given cost functions: the firm faces a downward-sloping demand curve and sets P above MC = MR (marginal revenue). The optimal markup is $P/MC = \eta/(1 + \eta)$, where η = elasticity of demand (ordinarily negative). The smaller η is in

absolute value, the larger is the firm's market power and the appropriate markup.

The static microeconomic theory of profit maximization by price setting assumes full knowledge of demand and cost functions that firms in dynamic environments do not possess. Reliably estimating the current and future values of η is difficult and may not be feasible when demand is subject to unpredictable fluctuations and, particularly, when uncertainty obscures the effects of the firm's own price adjustments on the behavior of other market participants. Suppose the firm sees the uncertainty associated with price variations as greater than the uncertainty associated with output variations which are to some degree reduced by changes in delivery lags and order backlogs or by changes in inventories. Then the firm's preferred strategy would be to use price adjustments sparingly and conservatively, and to rely more on quantity adjustments in response to fluctuations in demand that may prove transitory.[15]

If the firm knows that $P > MC$, it will always wish to sell more at the current price, either from inventory or under contract for future delivery. However, the firm may be reluctant to reduce price lest this should fail to stimulate sales sufficiently and so result in lower profits. More generally, it is to be expected that managers who are risk-adverse and diffident about their ability to predict reactions of competitors and demand will exercise caution and keep the frequency and size of price adjustments relatively low. Accordingly, they will leave more scope for the various types of nonprice mechanisms to do their work of matching supply to demand over time.

For a firm with some market power, linear demand and cost functions, and a homogeneous product, there will be more downward than upward price rigidity if the cost of shortages and stockouts exceeds the cost of inventory holding,

and vice versa (Amihud and Mendelson 1983). This is an interesting notion but it remains to be seen how it would fare under less restrictive assumptions. What is particularly needed, to extend this and related work (see, e.g., Reagan 1982), is the recognition of variable delivery periods and the distinction between made-to-stock and made-to-order goods, both empirically important phenomena.[16]

Unfilled orders (U) are on average much larger relative to shipments (S) in highly concentrated industries such as machinery and nonautomotive transportation equipment than in less concentrated industries such as paper and textiles. The higher the U/S ratio, the lower is the variability of the industry's price change (ΔP) relative to its backlog change (ΔU). These results based on early postwar data (Zarnowitz 1962, Table 4) are consistent with new measures of elasticities of demand with respect to price and delivery period (η_p, η_d) and standard deviations of lags of price and delivery period (s_p, s_d) for several major industries (Carlton 1987, Tables 2 and 3). Paper has low η_p/η_d and high s_p/s_d, while the opposite applies to steel and nonelectrical machinery; the two ratios are inversely correlated. The early evidence suggests to Scherer (1980, pp. 195-196) that variations in order backlogs are particularly important in oligopolistic industries, but other interpretations find them entirely compatible with the extended competitive model, as already noted.

3. Some Macroeconomic Implications of Market Power

Several recent studies (Hall 1986, 1988; Shapiro 1987; Domowitz, Hubbard and Petersen 1988) present estimates of markup ratios P/MC which, for many diverse industries, exceed substantially the competitive benchmark of unity. Hall argues that spatial separation and product differentiation result in a

wide dispersion of market power but not of extra profit opportunities, because high setup, advertising, and fixed costs create much persistent extra capacity that discourages new entry. Hence firms operate most of the time above their (large) minimum efficient scales of production but below the maximum efficient scales, i.e., where their MC curves, still lower than the corresponding long-run average cost, are perhaps just slightly rising or nearly horizontal. So the observed "stickiness" of prices is viewed as reflecting the hypothesized stability of costs under a regime of monopolistic competition. If both MC and η were (approximately) constant, firms would have little to gain from active pricing policies.

Data for manufacturing indicate that plant capacities designed to meet peak demands are often considerably underutilized in cyclical slowdowns and recessions, even though the minimum efficient scales of operation are typically not large. The equilibrium solution with excess capacity and flat MC does not apply under several alternative hypotheses that are consistent with the evidence on plant scale economies.[17] Several "stylized facts" established by studies in business cycles can be interpreted to favor the idea that MC is rising (probably steeply in the short run). In addition to the already noted cyclical sensitivity of the average workweek in manufacturing, there are the short but persistent lags of employment, and the longer lags of inventories and unfilled orders, which suggest the presence of important costs of adjustment in labor input and production, respectively.

A very strong and well observed regularity is that employment varies less than output so that labor productivity is basically procyclical (Hultgren 1950, 1965; Fair 1969; Moore and Cullity 1983; Bernanke and Powell 1986). An old and widely accepted explanation is that there is labor hoarding when business is sluggish, because adjustments of capacity and the associated labor

input take time and speeding them up is costly, particularly under uncertainty about demand. This hypothesis can also account for the tendency of output per hour to lead at business cycle turns, especially peaks. However, the existence of idle labor in a recession should make marginal costs of increasing output very low. Under the competitive flexible-price rule, P = MC should then fall correspondingly, which is not seen in the data. This leads to the argument that labor hoarding must be combined with a sufficient degree of price rigidity to explain cyclical behavior of labor (and total factor) productivity under constant returns to scale (Rotemberg and Summers 1988). The alternative is to assume increasing returns and P > MC, as in Hall 1988, where large departures from competition, presumably toward oligopolies and product differentiation, are inferred from high estimated markup ratios.

A third possibility, at the other end of the theoretical spectrum, is represented by the group of equilibrium models of real business cycles (Kydland and Prescott 1982; Long and Plosser 1983; King and Plosser 1984). The RBC models are driven by exogenous technological shocks, that is, they treat fluctuations in productivity as a major cause, not a consequence, of business cycles. Their authors have so far shown little interest in the problems under discussion here, competition and price flexibility being to them maintained premises rather than tentative hypotheses.

4. Cyclical Changes in Cost, Productivity, and Profits

The accounting and engineering data available for statistical studies of production and cost functions on the plant, firm, and industry levels are scarce, often defective, and typically difficult to process. The heyday period of empirical microeconomic cost analysis seems to have been short, comprising just the late interwar and early postwar years. Most of the

estimated short-run MC functions turned out to be declining or constant; most of the long-run average cost functions, falling and so indicative of economies of scale. Critics charged that these results are due largely to techniques biased toward linearity, authors disputed this point (Johnston 1960). The verdict of a survey paper by Walters 1963 was that this literature fails to refute convincingly the classical hypothesis of U-shaped cost curves (for an opposite view, see Simon 1979).[18]

The early regressions include interwar data and, being based largely on observations for output levels well below plant capacity, do not rule out rising costs in higher operational ranges. More generally, such studies are not well suited to analyze the dynamic aspects of the behavior of costs and related variables over time. About these matters, there is more to be learned from work on cyclical movements in productivity, cost, and profits, which use aggregate time series in monthly or quarterly terms.

Indexes compiled and analyzed by Hultgren (1960,1965) show that labor cost per unit of output in manufacturing, 1947-61, declined often in the late stages of contractions and regularly during recoveries, then rose as expansions matured and at times also well after a downturn.[19] Total unit cost behaved similarly. Thus, declines in average cost coincide with phases of low output beginning to turn up and soon growing rapdily; rises, with phases of high output growing more slowly and then turning down. This observed pattern is in a general sense consistent with the theory of U-shaped curves, since it implies that unit costs fall in the lower range of output and rise in the higher range, at least near the capacity levels. But it suggests additional dynamic elements in that the costs appear to depend on the rates of change as well as levels of production.

A decline in unit labor cost takes place when output per hour of work

rises faster than the average hourly compensation, a rise when the opposite happens. The former conditions tend to prevail toward the end of a recession and notably during a recovery and high expansion; the latter conditions tend to prevail in slowdowns and downswings. As already noted, labor productivity is basically procyclical and leading; its largest gains come at cyclical upturns and in recoveries when real growth rates are usually very high. On the other hand, wages often increase most in late stages of expansion and near cyclical downturns when labor markets become tight and output growth slackens. It is then that unit labor costs, ULC, begin to increase faster than the level of prices of industrial products. Total unit costs, UC, usually rise even more because of the developing shortages of raw and intermediate materials-- inputs whose prices are known as particularly "sensitive".

As a result, markups on unit labor costs and total unit costs, P/ULC and P/UC, tend to turn down even while sales and output continue to grow. Profit margins, as inferred from aggregate accounting data, turn down with a similar early timing.

Chart 1 shows the average movements of output per hour, ULC, the P/ULC ratio, and the corporate profit margin before and during the recessions and recoveries of 1948-80.[20] Rates of change rather than levels are used for labor productivity and unit costs so as the eliminate the large but uneven upward trends in these variables. The resulting patterns demonstrate the strong inverse relationship between the cyclical change in average productivity of labor and the concurrent change in average costs of labor (see the left-hand half of the chart). The markup and profit margin variables are approximately stationary and here level data are used. The two series show most of the time nearly parallel cyclical movements, but the relative

amplitudes are greater for the corporate profit margin than for the P/ULC ratio. Profitability is highly sensitive in responding directly to changes in productivity, inversely to changes in cost.

In recent regression studies based on Census data, estimated industry markups of price over marginal cost are found to be procyclical for manufacturing as a whole, more so for concentrated industries (Domowitz, Hubbard, and Petersen 1986, 1988). But this is due to the nondurable-goods sector; the margins for the durable-goods sector are acyclical or slightly countercyclical. Another paper reports that the P/MC markups for manufacturing are procyclical in the United States but countercyclical in Japan (Morrison 1988). The mixed results suggest that different market structures can produce different cyclical behavior.[21] This may well be true but one should recognize that the findings are weak, despite much careful computational work behind them. It is difficult to estimate marginal cost and infer the cyclicality of the markups from data that are limited to twenty-odd annual observations (no matter for how many industries). In particular, the annual series cannot reveal the leads and lags of less than a year's duration, which could well be an essential part of the story.

The quarterly BLS series used in Chart 1 contain 132 observations each and permit a much more detailed study of cyclical behavior of the variables covered, but only in the aggregate and for average rather than marginal values. The mean duration of the six recessions in 1948-80 was 11 months, the distance between the vertical peak (P) and trough (T) lines in the graphs. For each recession-recovery sequence, each of the series was indexed to its level in the quarter of the business cycle peak and expressed in terms of two-quarter smoothed changes.[22] The graphs in Chart 1 represent averages of the resulting patterns. Measures of intercycle dispersion and inspection of the

individual patterns indicate that these averages are fairly representative. They certainly indicate cyclical behavior with important lags (in ULC) and leads (for other variables). The costs and margins often move in opposite direction, e.g., late in recession and during the recovery ULC, or at least its growth rate, typically declines, while the P/ULC margin rises. Thus they tend to offset each others, so that even relatively large changes in costs and margins are consistent with much inertia in the corresponding selling price index (after allowing for inflation in both costs and prices).

The process sequence involving productivity, cost, and markup changes was predicted in Mitchell 1913, a major early effort to explain business cycles, without the benefit of data such as those collected by Hultgren or used in Chart 1. Mitchell noted that total profits are unlikely to continue rising long after profit margins begin to decline (they can grow only as long as the effect of increasing sales outweighs that of decreasing margins). He expected that the encroachment of costs on prices, and the ensuing profit squeeze, would have a chilling effect on business plans to engage in new investment projects. Hence new commitments to invest in plant and equipment (capital appropriations, orders and contracts) would soon decline. Mitchell saw this chain of events as critical in bringing about a downturn in aggregate economic activity (along with some other real and nominal factors). A reverse sequence helps to explain the transition from a contraction to a recovery.

The stylized facts stressed in Mitchell's generalizations are relatively well established in data for several major industrial countries (Hultgren 1950, 1960, 1965; Kuh 1960; Moore 1975; Moore and Cullity 1983; Klein and Moore 1985). They suggest an important role in business cycles of changes in relative prices of inputs and outputs, which are associated with fluctuations in capacity utilization and labor productivity. This view implies that

cyclical variations in costs, margins, and profits deserve much more attention than they received in recent literature, the "stickiness" of prices perhaps much less. Some received and current ideas seem consistent with Mitchell's theory, notably that firms hoard labor in bad times to preserve their human capital investments and avoid high costs of large input adjustments; that increases in delivery lags help ration demand in booms; that recent and current changes in profit margins and sales influence the expected values of these variables and thereby business investment. Other ideas that are now popular are, or may be, in conflict with this approach.[23]

5. A Summary of Price Hypotheses

The attempts to explain price inertia are summarized in Table 4. The format of this conspectus is the same as that used for the theories concerning sticky wages in Table 3. Two of the five listed hypotheses require some discussion.

In oligopoly, the few sellers know that their pricing decisions are interdependent and act accordingly. Suppose each firm expects its rivals to match any price cut it would make but not a price hike, which means that each firm faces a demand curve that is kinked at the current price. This describes a situation in which the price would not change in response to moderate shifts in cost; it does not explain what the price is or how it was determined. Much of the time oligopolists may simply play it safe and settle for the implicit collusion outcome of the game. For example, it pays them to raise price simultaneously as soon as they recognize shared increases in cost or demand. Undercutting the collusive price can be individually rewarding, but the risks of a price war are large.[24] If each firm is reluctant to move first on the price front, long periods of price rigidity are likely; if price leadership

emerges, intermittent industry-wide price changes would be the expected result. (See point 3 in Table 4 for a general formulation and critique of this hypothesis.)

The argument, then, reduces to the already familiar theme that commitments to maintain relative prices produce nominal rigidities as firms refrain from initiating price changes (perhaps particularly reductions).[25] But empirically, the macroeconomic importance of the oligopoly case is at least uncertain (for an attempt at a generalization, see Woglom 1982).

A hypothesis that gained more attention recently relies on monopolistic competition where firms produce differentiated products and have some market power in price setting. Firms have profit functions that are flat at the top, with zero derivatives with respect to price at the optimum; hence small deviations from the equilibrium price involve only small (second order) reductions in realized profits. A firm that believes its price is set about right in relative terms has little incentive to change it, even when the "menu cost" of doing so is small. Yet the aggregate result of the individually rational decisions to keep prices unchanged is price level stickiness that can have large (first order) macroeconomic costs. Suppose reduced monetary growth lowers aggregate demand: if all firms reduced their prices even slightly, they would collectively benefit from an increase in real money balances and a decrease in the level of interest rates.[26]

The last section in Table 4 sums up the menu cost hypothesis in its simplest form. In short, this model raises the possibility that weak price rigidities (and wage rigidities, see Akerlof and Yellen 1985) may be associated with strong fluctuations in output and employment (Mankiw 1985; Parkin 1986). But the applicability of the idea is still to be established. The costs of producing new menus or price tags seem trivial, but it is worth

noting that price changes, unlike quantity (output, inventory, backlog) changes, must be publicized. The costs of calculational inconvenience to customers and possible goodwill losses may be much more important (Okun 1981; McCallum 1986). If the total menu costs are small, they will not necessarily prevent price adjustments to large shifts in aggregate demand. The less elastic the labor supply and MC, and the more elastic the demand curves, the larger are the required menu costs. Finally, the dynamics of the process, about which little is known, depends on whether prices are initially in equilibrium on the timing and staggering of pricing decisions, and on potentially important nonprice adjustments. Multiple equilibria are possible, which reflects how individual prices interact and react to changes in the price level (Rotemberg 1987; Blanchard 1986).

IV. Conclusions

The sensitivity of wage and price levels to cyclical declines was generally greater before than after World War II. The recent era was also one of more moderate fluctuations in real economic activity and more persistent inflation. Important structural, institutional, and policy changes contributed to all three of these concurrent developments. These linkages elude those analytical models that either disregard the evidence on the stickiness of industrial input and output prices or treat this stickiness as invariable, ubiquitous, and necessarily symmetrical.

Considerations of lesser risk and cost to long-term transaction partners may favor nonprice market clearing devices even under conditions of substantial competition, as illustrated by the importance of changes in delivery periods, quality and availability of products. Relative wage cuts

are disliked by nonunionized as well as unionized workers. The uncertainties about their consequences can deter frequent price changes even if the direct costs involved are small.

Imperfections of competition, information, and markets make some temporary rigidities of wages and prices inevitable, indeed probably often optimal. Over the business cycle, the aggregate measures of labor productivity, unit labor cost, price-cost ratio, and profitability all fluctuate, in part systematically. These factors participate importantly in the propagation of business cycles.

Footnotes

[1]For a discussion of the controversy on the extent to which the business cycle moderated, see Zarnowitz, 1989, part I. For new evidence supporting the view that the variability of real GNP decreased substantially, see Balke and Gordon 1989.

[2]The only extended declines in the producer price index since 1949 occurred in 1952 and 1986, both years marked by some slowdown but no recession.

[3]Studies of panel and experimental data suggest that the positive substitution effects of rising real wages are largely offset by negative income effects so that the supply curve of labor for men is steep or even backward-bending (for a survey, see Pencavel 1986). Long time series, reflecting the decrease in hours, also indicate an inelastic or slightly negatively sloped supply, but postwar time series show substantially higher elasticities, especially for countries other than the United States (see Greenwald and Stiglitz 1988, pp. 223-229, for evidence and references). In part, these differences are reconciled by the finding that the supply of labor for secondary workers is very elastic.

[4]For a critical review of the writings on implicit contracts, see Rosen 1985; further, on the stylized facts and theories of the labor market, cf. Parsons 1986, Stiglitz 1986, and Kniesner and Goldsmith 1987.

[5]See Carlton 1986. Other comprehensive studies of price adjustment and surveys of the large and growing literature include Gordon 1981, 1983; Blanchard 1987b, 1988; Rotemberg 1987; Ball, Mankiw, and Romer 1988.

[6]Blanchard constrains the estimates so that p and w react to each other fully in the long run, but this restriction may not be appropriate (see comment by Sims on his paper).

[7]Participation in costs of specific training programs and nonvested pension plans can also be interpreted as forms of bonding. On the role of seniority wages to solve the incentive problem, see Lazear 1981.

[8]The main type of indirect evidence in favor of the efficiency wage models is that they have implications consistent with the relatively large and stable interindustry wage differentials that are observed (see, a.o., Krueger and Summers 1987, 1988). The alternative hypothesis here is that these differentials are due to unobserved quality differences across workers (Murphy and Topel 1987, 1988). It is agreed that heterogeneity of labor, differentials compensating for nonwage aspects of the industry, and institutional factors such as unionization account for a substantial part of the wage structure, but the unexplained remainder appears to be large.

[9]The results for high-wage and low-wage occupations were very similar. "High" and "low" means here above-and below-average wages, conditional on the observable characteristics of the workers. The data are for prime aged men drawn from year to year matches of the March Current Population Surveys. The level of wages paid constitutes perhaps the main measurable distinction

between the "primary" and the "secondary" labor markets, although the jobs in the two differ according the several other important characteristics as well (see, e.g., Doeringer and Piore 1971).

[10]Note also that these fluctuations have a high degree of synchronism across the economy (they are shown for a common chronology of unemployment peaks and troughs) and symmetry (the correlation between columns 1 and 2, $r_{12} = 0.96$).

[11]These results are virtually unchanged when the amplitude measures are recomputed to cover the period 1964-82 only. The correlation between the levels and standard deviations of average hourly earnings $r_{78} = 0.94$).

[12]General indexation extending to prices as well as wages presents still other difficult problems such as the choice of a commodity standard or numeraire in proposed monetary reforms (Blanchard 1987b).

[13]In the long run, a competitive industry may have a horizontal, upward-sloping or downward-sloping supply curve, depending on whether the expansion of its output is associated with unchanged, increasing, or decreasing prices of its inputs. One can imagine different conditions that favor each of these respective cases under the usual assumptions (the shallow U-shaped long-run average cost curve; free entry and exit of firms). It is unclear what the macroeconomic implications of this diversity are.

[14]As already noted, there is macroeconomic evidence suggesting that commodity prices in general responded less to decreases than to increases in demand during the predominantly inflationary post-World II period, in contrast to a more symmetric cyclical behavior in earlier times. But the issue of what may be the microeconomic source of an asymmetric price behavior is still entirely open (Cagan 1979; Okun 1981). Indeed, no support for the existence of an upward (or downward) bias in price rigidity was found so far in studies of micro data sets on transaction prices (Stigler and Kindahl 1970; Carlton 1986). Surprisingly little price-theoretic work seems to have been done in this area. It includes some studies which show that the asymmetry can result from the pricing behavior of profit-maximizing firms with some market power, nondecreasing MC functions, and nonincreasing demand elasticity (Kuran 1983, 1986) or from differential effects of inventory and backlog adjustments (see section II-7 below).

[15]For a development of this argument, see Zarnowitz 1962, p. 390, and 1973, pp. 301-305. For a recent formulation of the hypothesis that managers tend to be more uncertain about the consequences of their pricing and wage decisions than about those of their output and employment decisions, see Greenwald and Stiglitz 1989 (where inventory changes are considered but variable delivery lags are not). Even when quantity adjustments are otherwise costlier than price adjustments, the uncertainty differential may cause firms to prefer the former to the latter.

[16]Thus, backlogs always exist in production in order: they are not just an excess-demand phenomenon and so their treatment as "negative inventories," though common enough, is much too limited and potentially misleading.

[17]Thus, excess profits from market power can be absorbed by large promotional campaigns or the introduction of new products which require high fixed

costs. This would prevent the dissolution of market power by new entry without implying that constancy of MC is characteristic of normal business conditions. This point is well recognized by all parties to the debate (see, e.g., Hall 1986, p. 315, and comment by Blanchard, p. 327).

[18]It is only for public utilities and railroads that the evidence is generally recognized to be broadly based and strong-- and these are regulated industries long considered to be "natural monopolies." Elsewhere the results are indeed meager and mixed. However, one should also note the findings from estimated production functions, which tend to provide more general support for constant returns to scale (for a review, see Jorgenson 1974 and comments).

[19]For railroads, a much longer record studied by Hultgren showed a stronger tendency for cost to be inversely related to output (in units of passenger and freight traffic).

[20]The data are quarterly, for all nonfinancial corporations, from the U.S. Bureau of Labor Statistics. The BLS series, published since 1972, begin in 1948; they cover costs and profits per unit of output and also comparable prices received.

[21]If the price elasticity of demand fluctuated procyclically along with the level of demand, the P/MC markup ratio should be countercyclical. But there is no evidence that either this condition or its opposite prevails.

[22]Specifically, the values used are ratios of the current quarter's index to the average index for the four preceding quarters. For more information, see Moore and Cullity 1983, Figure 16-5 and text, pp. 255-261.

[23]Probably the main source of the conflict is that Mitchell viewed business cycles as sustained by self-generated stresses and imbalances (as did other prominent scholars of his era), whereas most contemporary writers assume that macroeconomic fluctuations are cause by some "exogenous" shocks. Thus, Mitchell would agree with the modern RBC theorists that changes in productivity are procyclical and very important, but not that they are exogenous, generalized shocks to technology that on their own "drive" business cycles.

[24]According to Grace and Porter 1984 and Porter 1985, price wars are most likely to occur when demand is falling and some of the weakening of prices is attributed to a breakdown in the oligopolistic discipline. Thus the weekly railroad cartel data used by Porter suggest that intensive price wars occured during 1982-85, an severe business contraction accompanied by a major deflation. In contrast, Rotemberg and Saloner 1986 argue that the largest gains from secret price cutting can be mde during booms, so oligopolists reduce margins in expansions to discourage "checking". (They point out that rail shipments were strong in the years of the railroad price wars.)

[25]This is formally analogous to the case of labor groups that wish to protect their relative wages.

[26]On the other hand, a small increase in monetary growth that would leave prices unchanged (because of menu costs) would have a positive welfare effect in this model by raising output. The reason for this is that equilibrium output in this imperfectly competitive economy is suboptimal compared with the competitive model because of an aggregate demand elasticity (Blanchard and Kiyotaki 1987).

Table 1
Price Flexibility and Related Assumptions and Implications in Six Groups of Theories

Assumptions	Classical (prototype Walrasian) (1)	Real Business Cycle (2)	Price Misperceptions (3)	Original Monetarist (4)	Traditional Keynesian (5)	New Keynesian (6)
			Prevailing Assumptions[a]			
Product markets clear	Yes	Yes	Yes	Lg	Lg	No
Labor markets clear	Yes	Yes	Yes	LLg	LLg	No
Complete information	Yes	Yes	No	No	No	No
Expectations formation	PF	RE	RE	AE	U	RE
Flexibility stabilizing	Yes	Yes	Yes	Yes	No	Yes
Monetary policy neutral	Yes	Yes	No	No	No	No
			Sources of Shifts or Shocks That Cause Business Cycles[b]			
Money supply	No	No	Yes	Yes	NE	Yes
Investment demand & finance	No	NE	NE	NE	Yes	Yes
Technology (productivity	Yes	Yes	NE	No	No	No
Aggregate demand	No	No	Yes	Yes	Yes	Yes

[a] Lg = with lags; LLg = with longer lags; PF = perfect foresight; RE = rational expectations; AE = adaptive expectations; U = uncertainty, especially in long-term expectations for investment yields.

[b] = not emphasized but not precluded.

Table 2
Unemployment and Wages in Private Nonagricultural Industries, 1948-82 and 1964-82

Line	Industry	Number of Unemployed Persons[a] Cyclical Change, Percent[b] Rise (1)	Fall (2)	Total (3)	Percentage Distribution[c] (4)	Unemployment Rate[d] Average Level (5)	Standard Deviation (6)	Average Hourly Earnings[e] Average Level (7)	Standard Deviation (8)
1	Total, exl. agricultural & government	95	-38	133	100.0	6.0	1.8	4.35	1.68
2	Mining	114	-38	152	1.5	4.6	2.4	5.62	2.57
3	Construction	127	-49	176	13.4	11.4	3.8	6.74	2.49
4	Manufacturing, durables	167	-53	220	20.2	6.0	2.9	4.96	2.03
5	Manufacturing, non-durables	96	-39	135	15.0	6.3	2.1	4.21	1.71
6	Transportation and public utilties	130	-45	175	5.6	3.7	1.3	5.60	2.40
7	Wholesale and retail trade	65	-26	91	23.5	6.4	1.7	3.58	1.35
8	Finance, insurance, and real estate	47	-11	58	2.8	3.2	0.8	3.91	1.37
9	Services	45	-14	59	17.9	5.4	1.2	3.81	1.53

[a]Private wage and salary workers in nonagricultural industries.

[b]Based on dates of specific cycle troughs and peaks in the monthly series on the total number of unemployed workers outside of agriculture and government. (Troughs: 10/48, 8/53, 10/56, 8/59, 10/66, 5/69, 10/73, 10/78, 7/81. Peaks: 7/49, 3/54, 3/58, 2/61, 2/68, 2/71, 3/75 12/82.) Each percentage rise is measured from trough to next peak, each fall from peak to next trough, using three-month averages centered on the above dates. Each entry in column 1 is a mean of nine rises, 1948-82; each entry in column 2 is a mean of eight falls, 1949-81; and each entry in column 3 is the sum of the corresponding entries in columns 1 and 2 (disregarding sign).

[c]Based on distributions of industry unemployment levels around the total unemployment level for private wage and salary workers in nonagricultural industries. Means of the percentage distributions at troughs and peaks, as defined in note b, for 1948-82.

[d]Based on unemployment rates for experienced wage and salary workers in private nonagricultural industries, annual data, 1964-82.

[e]Based on average hourly earnings of production or nonsupervisory workers on private nonagricultural payrolls, annual data, 1964-82.

Source: U.S. Department of Labor. Bureau of Labor Statistics. Columns 1-4: Bulletin 2096-1, Table A-27 (1948-78) and Bulletin 2306, Table A-22 (1978-82). Columns 5-8: Bulletin 2175, Tables 29 and 85.

Table 3

An Outline of Hypotheses About the Apparent Stickiness of Wages

Hypothesis	Critique
1. Supply of labor is highly elastic to transitory changes in the current and expected real return on work effort.	Tests do not support the idea that labor supply responds sensitively to current and expected changes in real wages and real interest rates. Evidence from panel data suggests that total labor supply elasticities are small.
2. Long-term implicit labor contracts insure flexibility of employment for firms and stable real wages for workers.	Whether motivated by workers' risk aversion or informational asymmetries, the contract theory contributes to an explanation of sticky wages but not unemployment. Efficiency of the contracts is questioned.
3. Unions gain for their members wages above the competitive equilibrium, which results in unemployment among nonmembers.	The ability of unions of obtain and keep high wages depends on the degree of control they have over the entry into the workforce. The hypothesis attracts more interest in Europe than in the U.S. because of greater power of European unions or "insiders".
4. Each labor group (unionized or not) protects, and in particular resists reductions in, its relative wage. This induces stickiness in wages generally.	A wage cut for any individual group may be resented as unfair and depress workers' morale. Coordinated wage cuts across a decentralized economy are not practicable. A possible reason for nominal as well as real wage inertia. Criticized mainly for lack of roots in optimizing behavior.
5. Efficiency wages above the competitive equilibrium are paid by firms to attract and keep high-quality, high-effort workers, and so minimize unit labor costs.	There are good reasons for productivity to rise with real wages, but the validity of the assumed form of this relation is uncertain. The links to relative wages and menu cost of wage change have some implications for cyclical unemployment, but most versions and elements of this hypothesis have none.

Note: See text for more detail and references.

Table 4

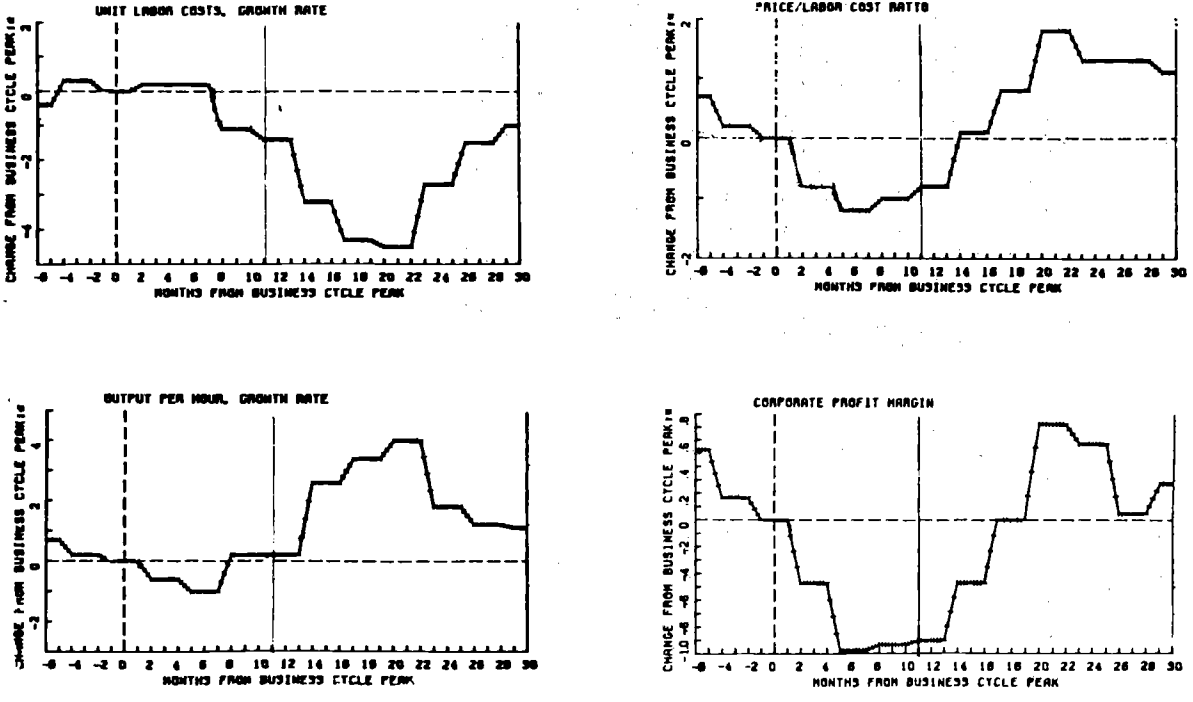
An Outline of Hypotheses About the Apparent Stickiness of Prices

Hypothesis	Critique
1. Marginal cost (MC) tends to be flat and stable over time, hence so is the competitive price P = MC.	Competitive auction markets cleared by price only are costly to organize and maintain. Most markets deviate from this model. MC should be rising for the firm in competitive equilibrium.
2. Monopolistic competition with flat and stable MC and constant elasticity of demand η, so P > MC by a stable margin.	MC should be rising at least near capacity (where overtime payments are common), unlikely to be constant over the large range of output covered by business cycles (BC). Average cost and profit margins vary during BC, in part in offsetting patterns.
3. Sticky oligopoly prices reflect kinked demand curves and/or desire to avoid costly price warfare.	Oligopoly prices may be sticky in response to moderate cost and demand changes, given the uncertainty about rivals' reactions. But large changes can induce the few sellers to alter price simultaneously.
4. Nonprice market clearing mechanisms reduce the frequency of price changes under various types of market structure.	Procyclical movements in delivery lags demonstrably help absorb changes in demand, but the price-smoothing role of changes in inventory is not clear. Factors that may favor nonprice instruments: intertemporal substitution, product heterogeneity, advertising, search costs, and steady customer relations.
5. Each price change has a fixed "menu cost", which is not worth incurring because the loss of profit from nonadjustment of price is second-order small.	The direct menu costs are probably very small, unlikely to prevent price adjustments to large changes in demand. The less elastic MC and the more elastic demand, the larger are the costs required to be effective. Results uncertain if prices initially not in equilibrium. Indirect costs, in terms of customer good will, etc., may matter more.

Note: See text for more detail and references.

Chart 1

Labor Productivity, Cost, Markup, and Profit Margin --
Patterns of Behavior During Recession and Recovery, 1948-80



Source: BLS Data cover the nonfarm business sector, except that the corporate profit margin series refers to all nonfinancial corporations.

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