How Increased Product Market Competition May Be Reshaping America's Labor Markets

John V. Duca
Senior Economist and Assistant Vice President
Federal Reserve Bank of Dallas

New theoretical arguments and empirical evidence support—but do not conclusively prove—the view that increased product market competition has been reshaping America's labor markets.

In recent years, inflation has drifted lower as the unemployment rate has fallen below trigger levels that have been associated with rising inflation. Indeed, since mid-1996 the unemployment rate has been 5 percent or lower—well below the 5.5 percent to 6 percent trigger-point estimates of many economists—while core inflation has remained low.[1] Although wage inflation has drifted higher and worker shortages abound, there is less upward wage pressure than prior experience would suggest.

These developments have spurred a reexamination of the view that there is a trigger level of unemployment, below which inflation tends to rise and above which inflation tends to fall (see Phelps 1967; Friedman 1968). This trigger level is called the nonaccelerating inflation rate of unemployment (NAIRU). Some critics argue that the concept should be abandoned (Galbraith 1997), while others argue that the NAIRU is so imprecisely estimated it has limited use as a policy guide (Staiger, Stock, and Watson 1997). However, these critics do not shed light on *why* the relationship between unemployment and changes in inflation has apparently shifted. Others maintain that the NAIRU needs to be modified for factors such as changing demographics (see Gordon 1997), sociological changes (Blanchard and Katz 1997), or the impact of unemployment spells on worker skills (also known as hysteresis effects; see Blanchard and Katz 1997). The weaknesses of these conclusions are that demographic adjustments to the unemployment rate cannot explain the behavior of the 1990s, sociological factors are difficult to track, and the evidence on hysteresis effects for the United States is weak.

Another shortcoming of these arguments for modifying the NAIRU is that they are inconsistent with both the U.S. economy's performance in the 1990s and the perceptions of firms and workers about why the relationship between inflation and unemployment may have changed. For example, while inflation, GDP growth, and unemployment imply that the U.S. economy has performed well at a macroeconomic level in the mid-1990s, there has been an increased sense of job insecurity at the firm or industry level, after adjusting for different phases of the business cycle.

An alternative explanation for the combination of these macro- and microlevel developments is that we are in a new era in which technological innovation and global trade are curtailing inflation. Under this new paradigm, two sources of low inflation are (1) cheaper

imports from higher worldwide capacity and (2) innovations that boost productivity.

The jury is still out on these two sources. First, although import prices have fallen, much of the drop is a result of a stronger dollar and declining oil prices. Consequently, it is difficult to decipher any impact of global capacity. Second, it is not yet clear that long-run productivity growth has risen above its post-1972 average. Even if statistics understate growth in productivity, an upward shift in productivity growth does not necessarily mean that the NAIRU is lower. Faster productivity growth may *initially* offset increasing wage growth resulting from low rates of unemployment. However, the NAIRU hypothesis implies that keeping unemployment at current levels will spur continued increases in wage growth that eventually will more than offset the higher level of productivity growth and will boost inflation.[2]

Another explanation for the combination of low unemployment and low inflation is that fiercer product market competition has restrained firms from hiking prices and wages and is inducing firms to change the ways they employ and pay workers. This explanation is sometimes associated with "new paradigm" arguments, but it is not based on faster productivity growth (Duca 1998). The "competition" explanation is consistent with reports from Federal Reserve Beige Book respondents (see the box entitled "Federal Reserve Beige Book Reports of Competition and Inflation"). This article reviews how and why increased product market competition *may* be reshaping America's labor markets.

The analysis focuses on three important trends in U.S. labor markets. The first is the declining use of medium-term nominal wage contracts. This trend is evidenced by the falling share of private workers represented by unions, which negotiate labor contracts that typically set future nominal wages (*Figure 1*).[3] Another important trend has been a decline in the share of union contracts that index or adjust wages for inflation according to a preset formula. As Figure 2 indicates, inflation risk, as tracked by the percent change in the U.S. Consumer Price Index (CPI), is positively correlated with the use of indexation. The drop in inflation since the early 1980s likely explains much of the decline in indexation—especially in the 1980s (Holland 1995). However, inflation is not the only factor behind this decline because inflation in the early 1990s was at levels near those of the 1950s, while indexation was twice as prevalent in the earlier period. Duca and VanHoose (forthcoming b) provide theoretical arguments and evidence that this difference may reflect a greater degree of product market competition. The third significant trend has been the rise of profit sharing (Duca and VanHoose, forthcoming a), as shown in Figure 3, which plots the incidence of profit sharing in pension plans (Bell

Federal Reserve Beige Book Reports of Competition and Inflation

Several Federal Reserve Beige Book reports are consistent with the view that heightened competition has curtailed inflation in recent years. While the anecdotal reports are suggestive and are not sufficient evidence alone, they are consistent with the view that the degree of competition is higher now than in previous expansions. With this in mind, consider the following noteworthy excerpts from recent Beige Books covering the mid-1990s:

Manufacturers note that competitive pressures are restraining prices for most products. (April 1994, iii)

Most Districts report that competitive pressures continue to temper price increases on the output side. (June 1994, iv)

Price increases are noted among a broad range of business materials.... However, virtually all Districts report that competitive pressures are holding prices down at the retail level.... (July 1994, ii–iii)

Industrial materials prices edged up further, but businesses say that competitive pressures continue to restrain price increases on finished goods. (September 1994, i)

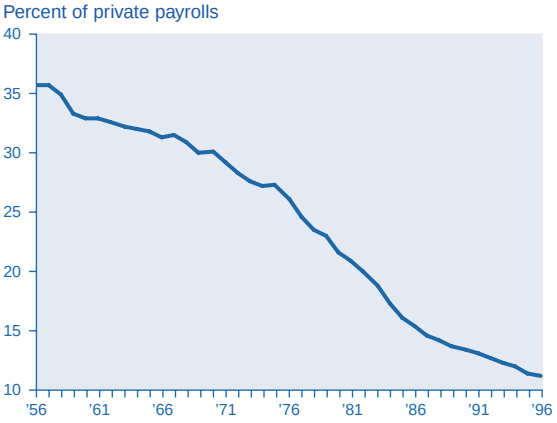
Chicago, Kansas City, and Dallas report that intense competition among retailers kept prices flat despite increased input costs. (March 1995, v)

Contacts in the temporary services industry said despite wage pressures they could not raise fees because of fierce competition. (November 1995, v)

Competition continues to drive down retail prices in mall stores. (Boston District, November 1995, I-1)

Several districts attribute the modest size of upward price movements to competitive conditions. (March 1996, iii)

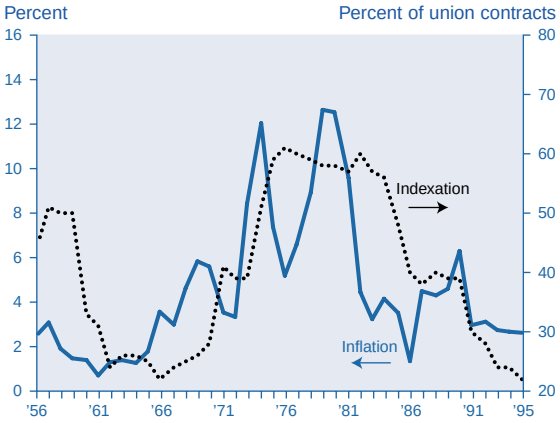
Figure 1
Unions on the Decline



SOURCES: Troy and Sheflin (1985); Bureau of Labor Statistics; Duca and VanHoose (1998b).

Figure 2

Fewer Union Contracts Are Indexed for Inflation Than in the 1950s



SOURCE: Bureau of Labor Statistics.

and Kruse 1995). Together, these trends can be viewed as making work and pay more sensitive to market conditions (Duca 1998).

I begin with a discussion of the theoretical intuition for how changes in the degree of product market competition may have spurred these changes in labor practices. I then review and interpret empirical evidence on these theoretical implications.

THEORETICAL LINKS BETWEEN LABOR PRACTICES AND THE DEGREE OF MARKET COMPETITION

To analyze how goods market competition may affect labor practices, this article draws on several papers by Duca and VanHoose (1991, 1998a, forthcoming a, and forthcoming b), who combine the multisector frameworks of Blinder and Mankiw (1984) and Duca (1987) with the monopolistic competition framework of Ball (1988). The multisector approach permits the analysis of sectoral as well as aggregate shocks and allows for heterogeneity in labor practices. Thus, it is flexible enough to analyze how different susceptibility to sectoral shocks may affect pay practices and why some sectors may adopt nominal wage contracts or index such contracts for inflation while others do not. Incorporating Ball's monopolistic competition framework permits the analysis of how labor practices are affected by changes in the overall price elasticity of demand. The greater this elasticity, the greater the extent to which firms compete in product markets. Thus, by combining aspects of multisector and monopolistic competition frameworks, it is possible to analyze how changes in the degree of product market competition can affect labor practices in a world where firms face aggregate and industry-specific shocks.

Rather than rederiving the results of other papers, the section below describes the basic theoretical framework common to these studies and then reviews the intuition behind key findings on contracts, indexation, and profit sharing, using charts or simple equations.

Basic Theoretical Framework

The economy contains a continuum of sectors, indexed by j, that are distributed uniformly between one and zero, which allows for aggregation of sector outputs. Each sector contains a large number of representative firms and workers, and relationships are expressed in logs (lowercase letters) with constants suppressed. A representative firm in sector j produces output (y) with employment (l) according to

$$(1) \qquad y_j = \alpha l_j + \theta,$$

where $0 < \alpha < l$, and θ is an aggregate supply shock raising output per hour in all sectors.

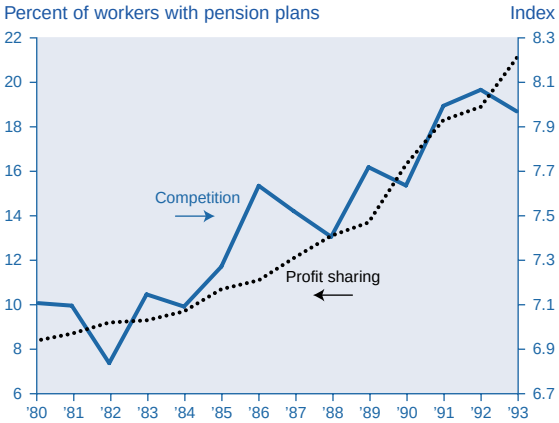
Following Ball, assume that the demand for a firm's output in sector j (y_j) as a share of total output (y) depends on relative prices according to the log-linear equation

$$(2) \qquad y_j - y = -\epsilon(p_j - p) + \delta_j,$$

where ϵ is the absolute size of the price elasticity of demand, the aggregate price level $(P) = (\int P_j^{(1-\epsilon)} d_j)^{1/(1-\epsilon)}$, the log of the price level (p) $= \int p_j d_j$, and δ_j reflects sector-specific (independently and identically distributed) demand shocks that sum to zero.

Figure 3

The Rise of Profit Sharing and Goods Market Competition



SOURCES: Bell and Kruse (1995); author's calculations.

For simplicity, aggregate demand accords with the quantity theory of money

$$y = m + v - p, \tag{3}$$

where m is the log of the money stock and v is a velocity shock common to all sectors. The shock to aggregate demand shock is $(m + v)$, but for simplicity, money shocks are zeroed out to reduce notation and avoid adding complications associated with different monetary policy rules. For simplicity, each of the aggregate shock variables (θ and v) has an expected value equaling zero in logs, is independently and identically distributed, and has a fixed variance (σ^2_θ for θ and σ^2_v for v).

Sectors differ in how much sectoral demand shock variance they face, which is assumed to equal $\sigma^2_\delta(1 - j)/j$. Because the index number j is distributed normally between zero and one, the sectoral demand shock variances range from infinity for sector $j = 0$ to zero for sector $j = 1$.

Converting Equations 1 through 3 into levels, combining the resulting terms into an expression for profits ($\pi_j = P_jY_j - W_jL_j$), and differentiating implies labor demand is

$$l^d_j = [-\epsilon(w_j - p_j) + (v + \delta_j - p_j) + (\epsilon - 1)\theta]/[\alpha + \epsilon - \alpha\epsilon]. \tag{4}$$

The first term in the numerator reflects that labor demand is declining in the nominal wage but increasing in terms of the sector-specific price. The second term reflects that labor demand rises to the extent that aggregate demand shocks boost overall prices relative to the sector j price or that sectoral demand shocks raise the relative demand for sector j's output. The last term in the numerator implies that a supply shock that raises productivity will boost labor demand. To make the model solvable, assume that labor is immobile across sectors in the short run owing to specialization and that labor supply is

$$l^s_j = c(w^s_j - p), \tag{5}$$

where c is a parameter > 0, reflecting that labor supply depends on the real purchasing power of wages. Equations 4 and 5 yield a reduced-form solution for the market-clearing wage, which reflects a balance between labor supply and labor demand, where the former depends on the real wage and the latter depends on the marginal revenue product of labor (MRPL) in that industry. As goods markets become more competitive, ϵ is higher and labor demand becomes more sensitive to the MRPL. Consequently, the market-clearing wage in an industry depends more on supply shocks and sectoral demand shocks affecting the MRPL and less on the real purchasing power of wages (see Duca and VanHoose 1991).

Illustrative Arguments

A firm's labor demand depends on the change in total revenue due to a small change in labor hired. Under perfect competition, labor demand equals the price times the marginal physical product of labor (MPPL). The MPPL is related to the marginal cost of producing output (MC), shown in the left panels of Figure 4. Since the MPPL tends to fall as more labor is used, holding other factors constant, the competitive demand for labor (L^D_j) is downward sloping (upper right panel of Figure 4). Holding aggregate prices and price expectations constant, the labor-supply curve is upward sloping and shifts in line with changes in aggregate prices or price expectations. Since wages and employment reflect both labor supply and demand, the competitive outcome is given by point A. Under wage contracts, firms employ as much labor as they desire at a constant nominal wage that equals the prior time period's expectation $(t - 1)$ of conditions at time t: $E_{t-1}(w_t)$. Thus, contracts replace the spot labor-supply curve with a horizontal wage-contract curve, which only shifts in period t if a contract is indexed for inflation or profits.

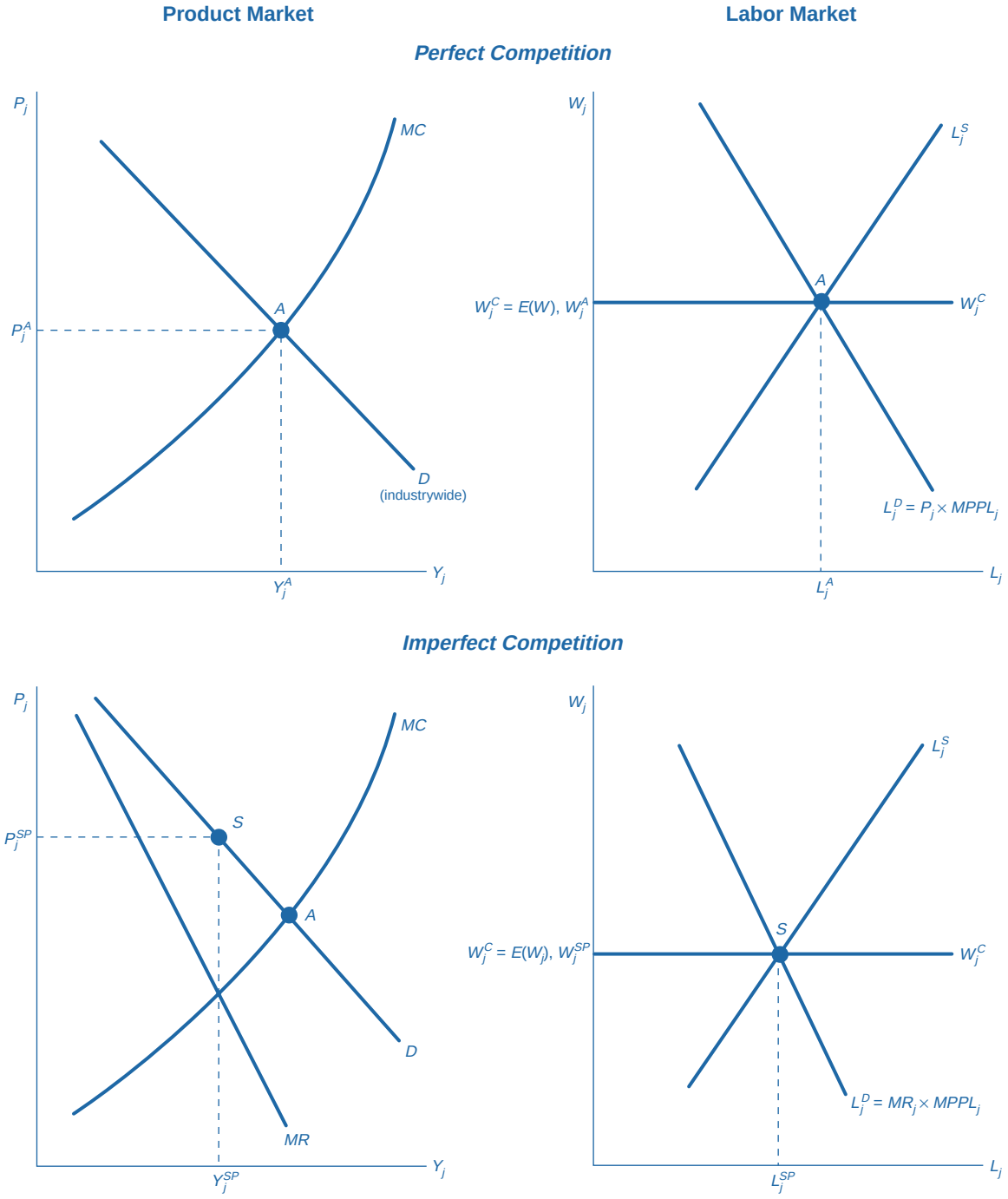
Under imperfect competition (lower panels), labor demand reflects the MRPL, which equals the marginal revenue of one more unit of output (MR) times the MPPL. Since boosting output lowers prices for an imperfectly competitive firm, marginal revenue is always below price. Thus, such firms produce at an output level below the perfect competition solution such that marginal revenue equals marginal cost (point S; superscript SP denotes spot market variable solutions).

Nominal Wage Contracting

To analyze the extent of nominal wage contracting, assume that a share (Ω) of firms set contracts in period $t - 1$ that cover period t and set the nominal wage equal to the $t - 1$ expectation of the next period's market-clearing wage. The remaining share $(1 - \Omega)$ of firms pays spot market wages. For now, assume that contracts are not indexed for inflation and there is no profit sharing. In addition, assume that workers choose between spot and contract wages to minimize a weighted average of the expected squared deviations of employment and the real wage from their market-clearing levels. While other loss functions are plausible, this assump-

Figure 4

Labor Markets Under Perfect and Imperfect Competition



tion yields solutions that permit one to infer the qualitative impact of altering either the degree of market competition or the variances of the different shocks under reasonable parameter assumptions.

Solutions reveal that relative to spot wages, wage contracts raise the exposure of real wages to aggregate demand shocks but reduce the exposure to sectoral demand shocks. Contracts also lower the variance of real wages in the face of supply and sectoral demand shocks but raise the variance of employment. Thus, trade-offs emerge, and the extent of contracting depends on how workers weigh real-wage versus employment stability.[4] This model yields an interior solution such that there is a critical sector that is indifferent between using contract or spot wages, with workers more likely to opt for contracts in industries facing above-average sectoral demand variance. This

result arises for two reasons. First, for each sector, wage contracts introduce the same degree of employment and real-wage instability in the face of aggregate shocks. Second, since sectors face differing degrees of sectoral demand variance, contracts pose more real-wage stability relative to higher employment variance for workers in sectors with high sectoral variance.

By assumption, the range of sectoral variance is so wide that workers in sector $j = 0$ face an infinite sectoral variance and will always choose to use contracts because the sectoral variance dwarfs the variances of aggregate shocks, whereas those in sector $j = 1$ face zero sectoral variance and will never use contracts. While these are theoretical extremes, the qualitative implications accord with the higher unionization rates in more cyclical industries. For some intermediate value of j, the sectoral and aggregate shock variances balance out, implying that there is some sector that is indifferent between nominal wage contracts and spot wages. This balance depends on the degree of product market competition. As the price elasticity of demand rises, the cost of potential job losses induced by nominal wage contracts rises relative to the benefits of real-wage stability, thus reducing the net benefits of wage contracts and causing some sectors to shift from wage contracts to spot wages.

To analyze how the degree of competition affects the extent of nominal wage contracts, suppose that the price elasticity of demand rises. On the one hand, this reduces the responsiveness of each firm's price to a given-size demand shock, implying that such shocks have smaller effects on the marginal revenue product (and labor demand) and on spot wages as product demand becomes more price sensitive. At the same time, the greater demand elasticity implies that labor demand falls more in response to a given gap between contract wages and lower spot wages. As a result, greater goods market competition lowers the net benefit of nominal wage contracts in the face of sectoral demand shocks by reducing the volatility in spot real wages relative to the volatility of employment under nominal wage contracts. On the other hand, in the face of aggregate demand shocks, greater competition implies that wage contracts pose somewhat lower downside costs in terms of real wage and employment volatility. However, greater competition clearly boosts the degree to which labor demand responds to aggregate supply shocks and thereby the extent to which contracts boost the volatility of employment—a key downside cost of contracts.

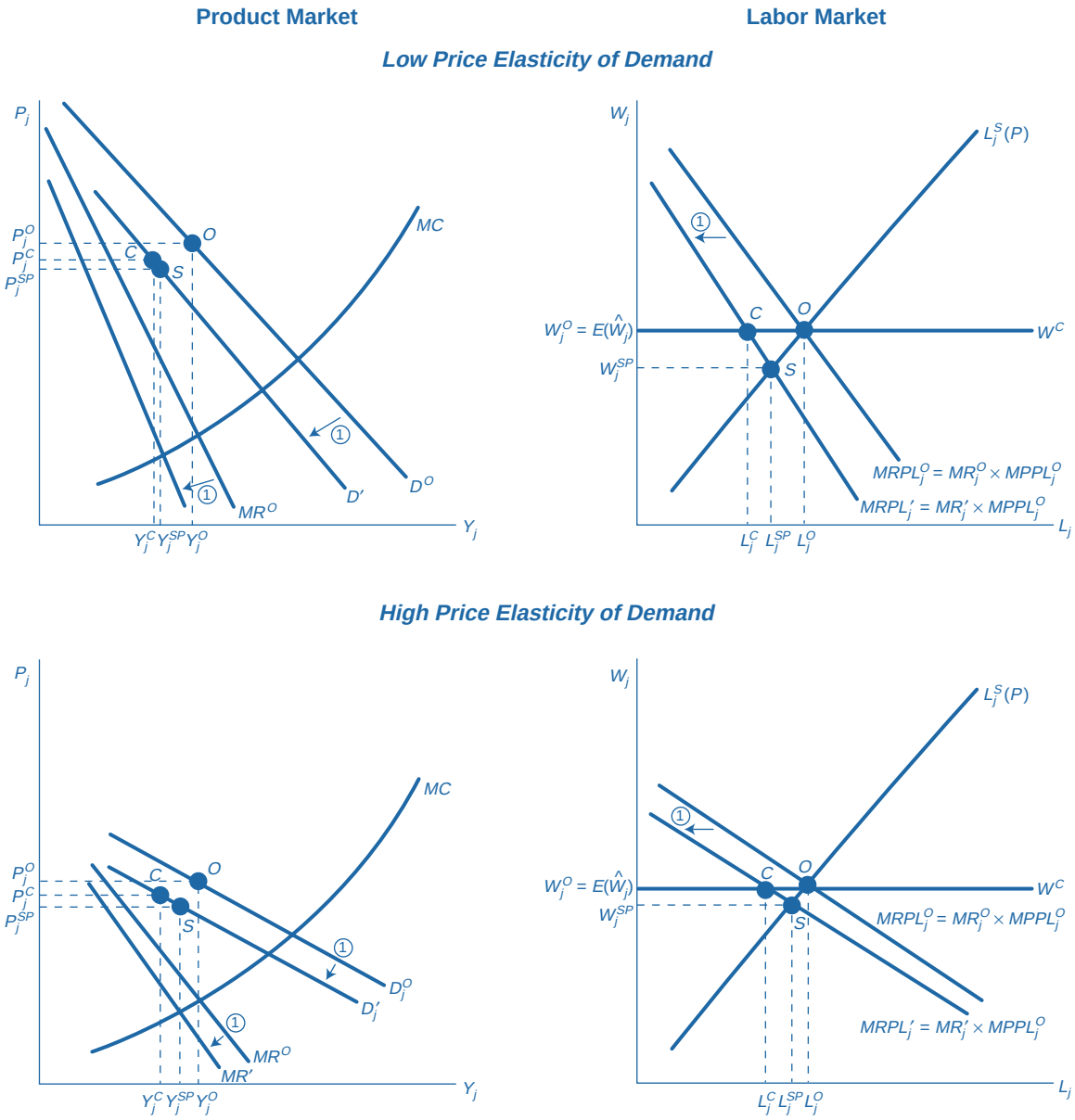
To demonstrate these results, focus on the case in the upper panels of Figure 5, where the economy starts in a zero shock equilibrium (point O) and the price elasticity of demand is low. Suppose an unanticipated sectoral demand shock puts downward pressure on the price of industry j's product but has no effect on overall prices. Since aggregate prices and price expectations are unaffected, the labor-supply curve is unaffected. However, the drop in the relative demand for industry j's product shifts the demand and marginal revenue curves for industry j left (shift 1). Since profit-maximizing firms produce at levels where marginal cost equals marginal revenue, output falls in the upper left panel from Y_j^o (point O) to Y_j^{sp} if contracts are not used. In labor markets, market-clearing or spot wages and employment fall from W_j^o and L_j^o (point O) to W_j^{sp} and L_j^{sp} (point S), respectively. However, if wage contracts are used, employment falls further to L_j^c (point C), where the marginal cost of labor equals its marginal revenue product, and output falls further to Y_j^c. Thus, nominal wage contracts protect real wages from sectoral demand shocks but at the cost of increased volatility of employment.

Now consider what happens under a high price elasticity of demand, where the MRPL (marginal revenue times MPPL) curve is flatter and prices fall less. The MRPL curve in the lower right panel shifts by less than in the upper right panel. Despite the flatter slope of the MRPL curve in the lower panel, it can be shown that wages and employment fall by slightly less than in the upper panel under each wage practice. Nevertheless, when relative demand shocks occur, the flatter MRPL curve implies that less real-wage stability is gained relative to extra employment instability induced by using wage contracts.

Now consider an aggregate demand shock (left panels of Figure 6), where the analysis differs in that the labor-supply function shifts out to the extent that a negative aggregate demand shock lowers aggregate prices. For this reason, the labor supply curve shifts right, leaving spot employment unchanged at L_j^o, spot nominal wages lower at W_j^{sp}, and spot real wages (W/P, not shown) unchanged. Since contracts prevent a decline in wages relative to sectoral demand shocks, aggregate demand shocks induce bigger employment and real-wage deviations from spot market and initial values under wage contracts. However, wage contracts pose less real-wage volatility in the face of aggregate demand shocks because such shocks affect prices less under tougher market competition.

Figure 5

Negative Sectoral Demand Shock and Nominal Wage Contracts

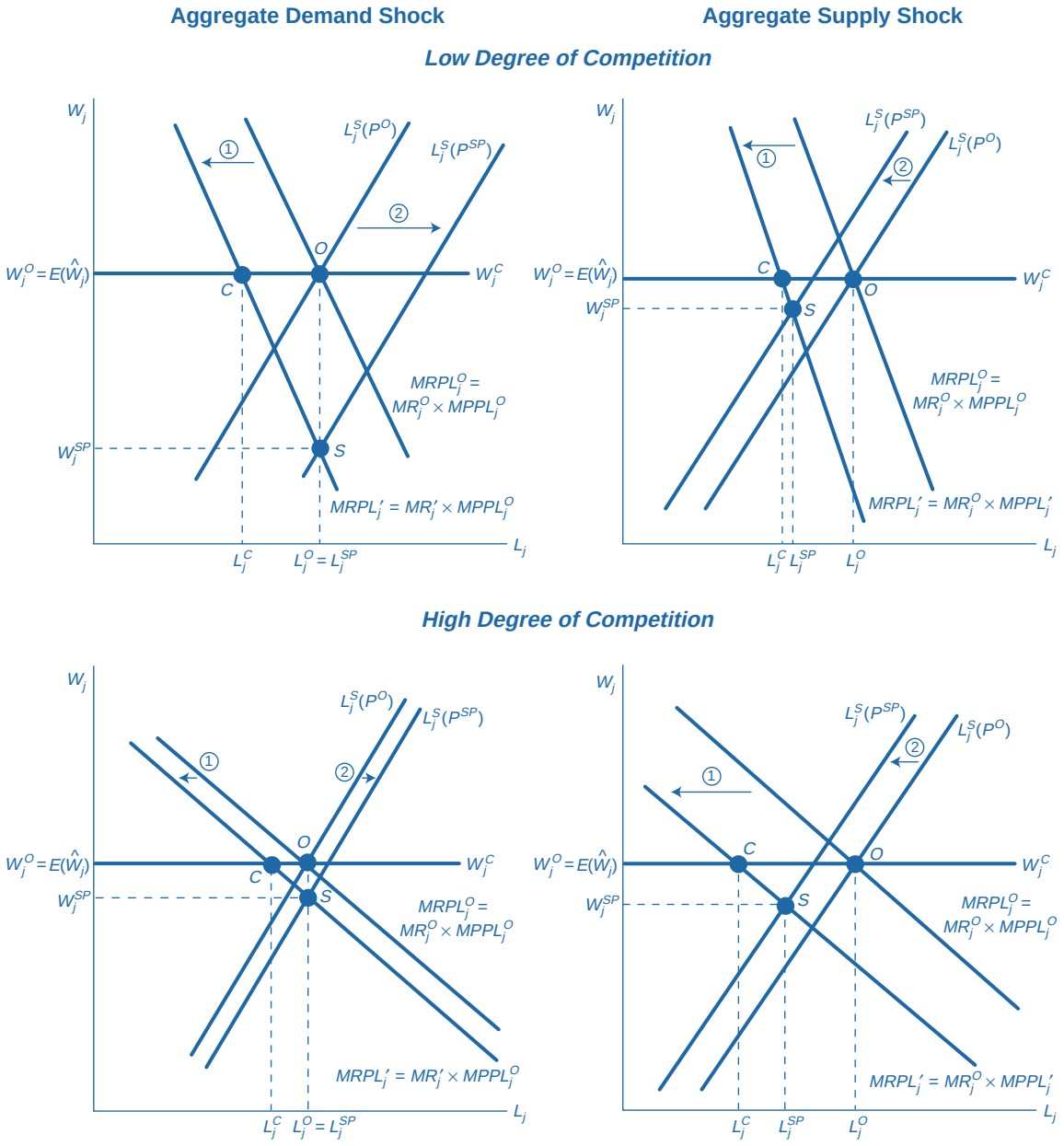


In contrast, the downside costs of wage contracts stemming from aggregate supply shocks are much greater when product markets are more competitive. Consider a negative aggregate supply shock that shifts the MRPL curves of every industry inward by a given distance (right panels of Figure 6, shift 1). In addition, the aggregate supply shock causes an overall rise in prices, which induces an upward shift (shift 2) in the spot labor supply curve equal to the aggregate rise in prices. Spot wages and employment fall from W_j^o and L_j^o (point O) to W_j^{sp} and L_j^{sp} (point S), respectively, while contract employment falls further to L_j^c (point C). Comparing the upper and lower right panels, the extent to which nominal contracts exacerbate employment losses when supply shocks occur is much higher when competition is more intense. Fundamentally, the fiercer the competition, the more falling spot wages cushion the drop in output. Thus, the downside of using contracts when supply shocks occur increases as the price elasticity increases.

In summary, on the one hand, greater competition slightly lowers the downside risk of using contracts in the face of aggregate demand shocks. On the other hand, it also cuts the net benefit of contracts when sectoral demand shocks occur and clearly raises the disincentive to contract because of supply shocks. If sectoral

Figure 6

Negative Aggregate Shocks and Nominal Wage Contracts



demand and aggregate supply shocks are large enough relative to aggregate demand shocks, then use of nominal wage contracts will arguably fall as the degree of product market competition rises.

Wage Indexation

Thus far I have assumed that workers and firms choose only between spot wages or wages that are set ahead of market conditions. In practice some contracts include clauses that adjust wages for inflation or profits, according to a previously arranged formula. For now, consider whether a firm indexes nominal wages for inflation.

Indexation protects real contract wages from aggregate demand variations by keeping contract wages close to their market-clearing level, which moves with inflation. The intuition behind this result is that an expansionary aggregate demand shock will push up inflation and the spot nominal wage. Hence, indexation helps limit deviations of contract wages from market-clearing wages when aggregate demand shocks occur. However, as Gray (1976) shows, indexation moves contract wages further from their full information level when aggregate supply shocks happen. Intuitively, a negative aggregate supply shock boosts inflation and lowers the

real marginal product of labor. In such cases, the spot real wage would fall, whereas cost-of-living escalator clauses would prevent a decline in the real contract wage toward its new spot market level. As a result, the presence of aggregate supply shocks makes incomplete indexation optimal, and a trade-off emerges in which indexation is more attractive the greater the *ex ante* variance of aggregate demand shocks relative to the *ex ante* variance of aggregate supply shocks.

For plausible variation in aggregate demand and supply shocks, this trade-off implies that a sector exists that is indifferent between indexing and not indexing. Suppose the degree of product market competition rises. Then each firm's price and marginal product of labor curve become less sensitive to aggregate demand variations. Thus, employment at contract firms is also less sensitive to demand shocks, reducing the incentive to index. Increased competition also means that aggregate supply shocks pose greater downside costs in the form of employment losses from indexing wages.

In analyzing the impact of the degree of competition on indexation choices, it is relevant to consider aggregate rather than sectoral shocks because, by definition, only aggregate shocks affect the overall price level. For ease of exposition, comparisons are made between nonindexed wage contracts and contracts fully indexed for inflation.

First, consider a negative aggregate demand shock that shifts the MRPL curve leftward (left panels of Figure 7, shift 1). The flatter slope of the marginal revenue curves in the high price elasticity case (lower panel) implies a smaller shift of the MRPL curve. Because indexation shifts the wage-contract curve (W_j^c) down (shift 3) in line with the shifts in the MRPL curves and spot labor-supply curve (shift 2), work hours and real wages are unaffected whether the price elasticity is high or low (depicted by point I).

However, if contract wages are not indexed, these inward shifts imply a decline in employment and a rise in real wages (depicted by point C in both left-hand panels) because the wage contract curve does not move. The extent to which either employment or real wages are affected by not indexing can thus be seen as proportional to the benefit of indexing. Suppose the price elasticity of demand is relatively low, as in the upper left panel. If contract wages are not indexed, then employment falls by the gap between L_j^o and L_j^c in the upper left panel and real wages rise by the gap between W_j^c and W_j^{SP} since prices fall by that magnitude. But when demand is more elastic (lower left panel), the drop in contract employment and the change in the real contract wage are smaller. This occurs because the MRPL curve shifts less in response to aggregate demand shocks when demand is more elastic. Thus, the fiercer the degree of goods market competition, the lower the incentive is to index in the face of aggregate demand shocks because indexing poses smaller benefits.

To analyze the downside cost of indexing when aggregate supply shocks occur, consider a common supply disturbance that shifts the MRPL curves downward, shown in the right panels of Figure 7 (shift 1). Under indexation, the higher price level would shift the wage curves in these panels upward (shift 3) so that the nominal wage would rise as much as the overall price level, leaving the real wage unchanged if employment remained at L_j^o. However, because labor demand has shifted left (shift 1), the nominal spot wage (W_j^{SP} at point S) is below the level that maintains a constant real wage (W_j^I at point I). If contracts are not indexed, the labor-supply curve does not shift and employment falls to L_j^c (point C). However, if contract wages were indexed for inflation, the wage-contract curve (right panels) would shift up so that the real wage would be unchanged (point I), inducing a rise in wages to W_j^I and a bigger fall in employment to L_j^I. While aggregate supply shocks cause employment under wage contracts to deviate from its market-clearing level in both cases, the deviation is larger under indexation. In addition, the greater the degree of market competition, the flatter the MRPL curve is (lower left panel) and the more indexation pushes employment and wages from their full information levels (point S).

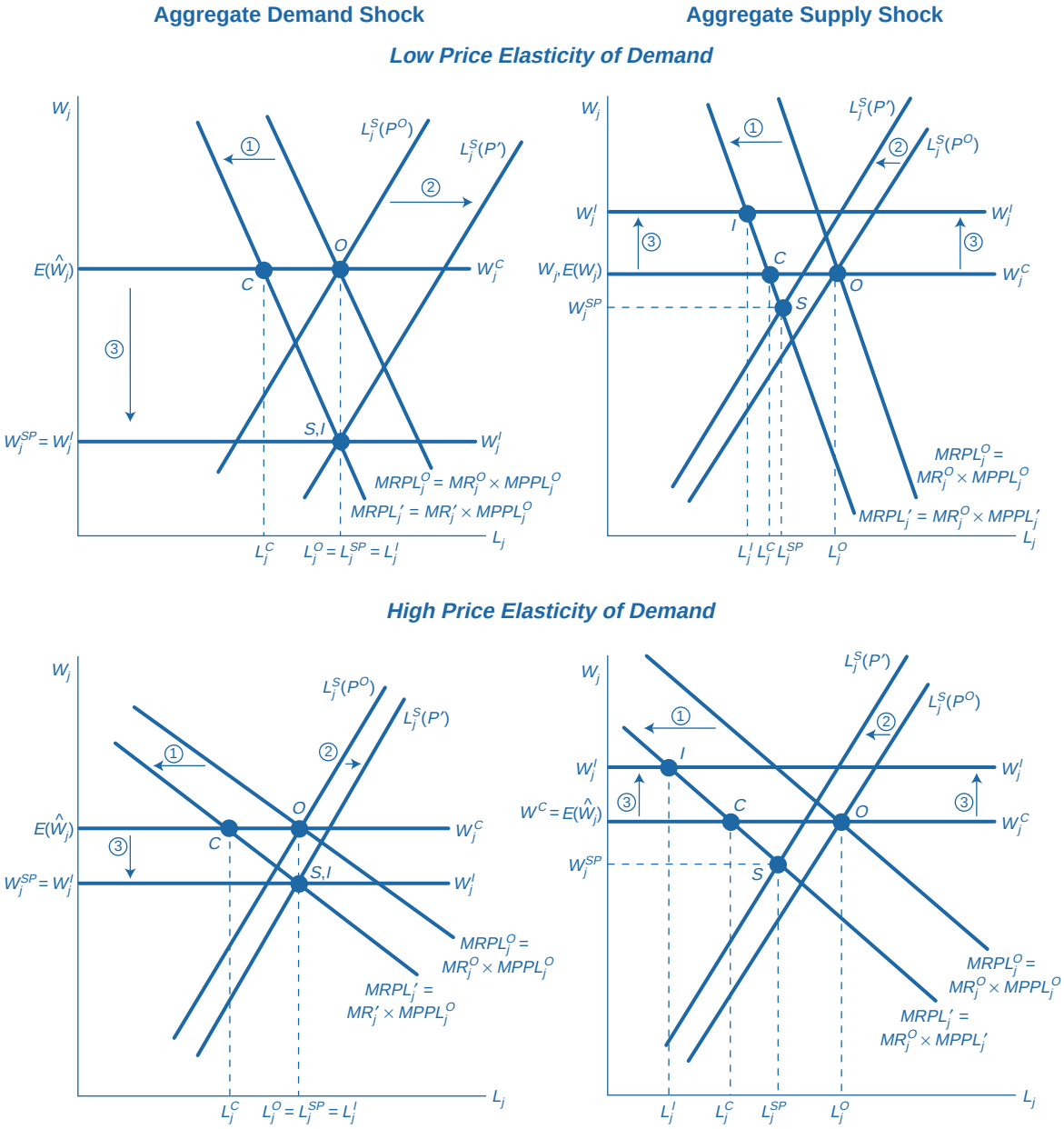
Since increased employment variation in the face of aggregate supply shocks is the major downside cost of indexing and less employment/real-wage variation in the face of aggregate demand shocks is the major benefit, there is less incentive to index when the degree of product competition is greater. As a result, the prevalence of indexation clauses in nominal wage contracts should fall as the degree of product market competition rises.

Profit Sharing

To analyze how increased product market competition affects the incidence of profit sharing in labor contracts, assume that the share of the labor force covered by contracts is constant, as in Duca and VanHoose (forthcoming

Figure 7

Negative Aggregate Shocks and Wage Indexation



b). As is standard in much of the wage indexation literature (Gray 1976; Karni 1983), assume also that the optimal contract minimizes deviations from the market-clearing wage and employment levels.

Under these conditions, the optimal wage contract adjusts the contract wage to mimic the spot wage, which equates labor supply with labor demand. The market-clearing wage reflects that labor demand depends on the marginal product of labor in that industry and labor supply depends on the real wage in terms of the overall price level. A higher degree of product market competition makes labor demand more elastic, as represented by a larger magnitude of ϵ in Equation 4. As a result, equilibrium wages and employment at firms with contracts become more sensitive to changes in the MRPL that arise from sectoral demand shifts. For this reason, the relative degree to which spot market wages reflect overall prices, rather than the sectoral marginal product of labor, is higher the greater the sensitivity of labor supply to the real wage and the greater the significance of labor in production. By contrast, profit sharing becomes more important and inflation indexation less appropriate as the extent of goods market competition rises, which makes labor demand more

sensitive to the MRPL. Although the market-clearing solution for sectoral wages is complicated, as markets become perfectly competitive ($\epsilon \to \infty$), the equilibrium wage implied by Equations 4 and 5 approaches

$$(6) \qquad w_j = \gamma(p_j + \theta) + (1 - \gamma)p,$$

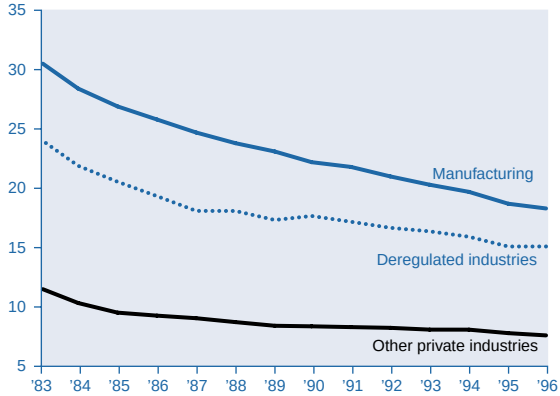
where $(p_j + \theta)$ can be interpreted as the sector-specific price adjusted for positive supply shocks, $\gamma = 1/[c(1 - \alpha) + 1] < 1$ is the weight on the MRPL in determining wages,[5] and $(1 - \gamma)$ is the relative importance of overall prices for spot wages.

In practice, one does not observe the explicit indexation or adjustment of wages to the MRPL in a particular industry, mainly because it is difficult to measure and verify this variable. However, as the degree of product market competition rises, the MRPL moves more in tandem with firm profits, a result formally shown by Duca and VanHoose (forthcoming b). Basically, greater competition reduces the extent to which firms boost prices rather than output when the relative demand for that sector's product rises. As a result, wages and profits more closely reflect the MRPL. For these reasons, greater market competition boosts both the incentive to index wages to the MRPL and the desirability of using profit sharing as a means of doing so.

EMPIRICAL EVIDENCE ON PRODUCT MARKET COMPETITION AND LABOR PRACTICES

Although increased product market competition can theoretically affect labor practices, there has been little empirical macro work on this issue. The few related studies done before the late 1990s were largely microeconomic studies that compared cross-sectional patterns of unionization or wage determination with industry patterns of market power. However, these studies did not assess the impact of macroeconomic factors. Inspired by Fischer (1977a, 1977b) and Gray (1976), empirical macroeconomic studies of wages and indexation have focused on traditional macroeconomic factors (such as inflation and aggregate supply shocks) but have ignored changes in market structure or the degree of product market competition (for example, see Ghosal and Loungani 1996).

Figure 8
Unionization Rates by Industry Groups
Percent of private payrolls



SOURCE: Bureau of Labor Statistics.

Nominal Wage Contracts

The theoretical framework implies, under the assumption of constant money growth, that the use of nominal wage contracts is declining in the variances of aggregate supply and demand shocks and in the degree of product market competition. Consistent with this model, Duca and VanHoose (1998b) find that changes in the unionized share of private-sector workers (a proxy for nominal wage contracts) are negatively related to the variance of real oil prices (a proxy for the aggregate supply shock variance), the inflation rate (a proxy for aggregate demand shock variance), and the inverse of an adjusted profit-share measure (a proxy for the degree of goods market competition).[6]

Changes in the cross-sectional pattern of unionization also support the view that greater market competition reduces the use of nominal wage contracts. Some sectors are more suited to such contracts than others due to sector-specific conditions, which, at a point in time, can account for differences in unionization across industries. However, changes in how much competition a sector faces relative to others may explain why unionization rates have declined faster in some sectors. Indeed, data available since the early 1980s show that the largest declines in unionization have been in sectors facing increased foreign competition or in deregulated sectors (*Figure 8*).[7] Table 1 shows that many U.S. industries have been deregulated since the late 1970s, suggesting that competition has become tougher in product markets, not only for traded goods but also for nontraded services. Note that most of the overall drop in unionization since the early 1980s is the result of falling unionization rates within sectors, rather than shifts in jobs from more unionized industries to less unionized ones.[8]

The results are also consistent with a "rent-sharing" theory of unions (Layard, Nickell,

and Jackman 1994; Oswald 1982) and with microeconomic studies that test for links between firm monopoly power and unionization (for citations, see Mason and Bain 1993). According to the rent-sharing approach, imperfect competition or pricing power creates excess profits for a firm, which gives workers an incentive to incur the costs of unionizing. By forming a union, current workers can restrict the potential entry of other workers and thereby gain enough negotiating leverage to induce the firm to share excess profits by paying above-market wages. However, if the market structure changes so that new firms can more easily enter, then excess profits are bid down and there are fewer rents to share. From this perspective, deregulation and foreign competition have greatly reduced the economic benefits of unionizing. The shortcoming of rent-sharing models relative to the framework sketched here is that existing rent-sharing models tend to ignore that American unions generally negotiate only partially inflation-indexed wage contracts whose optimality is also affected by supply shocks. The advantage of the rent-sharing approach is that its assumption of restricted labor supply within a given sector can account for the tendency of union wages to be higher than nonunion wages.

Wage Indexation

The theoretical model implies that the use of indexation in wage contracts should be increasing in the variance of aggregate demand shocks, decreasing in the variance of aggregate supply shocks, and decreasing in the degree of product market competition. Consistent with these predictions, Duca and VanHoose (forthcoming b) find that the overall incidence of indexation clauses in union contracts is negatively related to the variance of real oil prices, positively correlated with the inflation rate and squared inflation expectation errors of households, and negatively related to the inverse of an adjusted profit-share measure. Indeed, Duca and VanHoose (forthcoming b) find that changes in the overall use of indexation in contracts are better tracked by an empirical model that adds the degree of product market competition to a more conventional empirical model having only measures of aggregate supply and demand shock variances. As with unionization rates, the cross-sectional pattern of declines in indexation are most pronounced in industries that either face foreign competition or have been deregulated since the late 1970s.

Table 1
Many U.S. Industries Have Been Deregulated Since the 1970s

SIC Industry*	Major Deregulatory Steps
Agriculture	—
Mining	Oil and gas: oil prices deregulated by a series of presidential executive orders beginning in 1976; natural gas prices deregulated by the Natural Gas Policy Act of 1978.
Construction	—
Manufacturing	Increased openness to trade, partly from the General Agreement on Trade and Tariffs (1979, 1993), the Canada–U.S. Free Trade Agreement (1989), and the North American Free Trade Agreement (1994).
Transportation	Trucking: truck rates liberalized in the late 1970s and deregulated by the Motor Carrier Act (1980).
	Airlines: the Airline Deregulation Act (1978) allowed entry in 1982 and deregulated airfares in 1983.
	Railroads: deregulated by Interstate Commerce Commission liberalization of rail rates in the late 1970s and the Staggers Rail Act (1981).
Communications	Telephones: largely deregulated following the AT&T court settlement of 1982.
	Cable television: deregulated in a series of Federal Communications Commission rulings in the late 1970s and by the Cable Television Deregulation Act (1984).
	Telecommunications: partly deregulated by the Telecommunications Act (1996).
Wholesale	—
Retail	—
FIRE (finance, insurance, and real estate)	Banking: partly deregulated by the Depository Institution Deregulation and Monetary Control Act (1980) and the Garn–St. Germain Depository Institutions Act (1982).

* Standard industry classification (SIC) of sectors at the one-digit-level classification code.

SOURCES: Winston (1993); author's compilations.

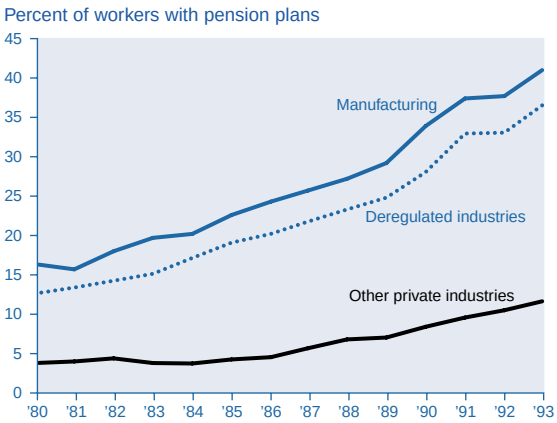
Profit Sharing

Profit sharing has risen dramatically since the early 1980s, as seen in Figure 3. As shown by Bell and Kruse (1995), most of these profit-sharing provisions include employee stock ownership plans or profit-based contributions to thrift plans but make relatively little use of non-deferred forms of profit sharing, such as cash bonuses.

Deferred profit sharing is more common because most workers do not have sufficient wealth to see their weekly take-home pay vary with market conditions. They are, however, better able to handle profit volatility over the long run, such as in the form of variable, but cumulative, contributions to their retirement accounts. Nevertheless, recent salary and Federal Reserve Beige Book surveys indicate that annual base/hourly pay is increasingly being comple-

Figure 9

Profit Sharing Rises in Manufacturing and Deregulated Industries



SOURCES: Bell and Kruse (1995); author's calculations.

mented by variable cash bonuses. This shift suggests that pay may be becoming more market responsive in both the short run and long run.

The theoretical framework presented in this article implies that under fiercer competition, profits are more closely aligned with workers' market value, with profits more closely reflecting prices minus unit labor costs (wage costs adjusted for productivity). As a result, profit sharing should trend upward with a measure of market competition, as seen in Figure 3, where the competition measure rises as the relative demand for goods becomes more price elastic. In this figure, the price elasticity of demand is measured using the inverted after-tax profit share of nonfinancial corporations, adjusted for swings related to the business cycle, oil prices, and exchange rates (Duca and VanHoose, forthcoming a, forthcoming b). Nevertheless, since available data cover a short period and have a missing data point (1987), the evidence is supportive, not conclusive. Thus, it is unclear whether greater competition rather than other factors has induced a rise in profit sharing.

One way around this inference problem is to compare deregulated or traded goods industries with others. Some sectors are more suited to profit sharing than others because the nature of work and the ability to monitor work vary across sectors. Such factors would account for why differences exist across sectors at a point in time, while changes in the attitudes of different generations might account for why profit sharing has risen overall. However, changes in the relative degree of competition across sectors might account for why profit sharing has risen more in some industries than in others. Indeed the biggest increases in profit sharing through 1993 have occurred in sectors facing increased foreign competition, such as manufacturing, or in deregulated sectors, such as transportation (*Figure 9*). While inconclusive, these trends are loosely consistent with the view that more intense product market competition is boosting the use of profit sharing.

CONCLUSION

Fiercer product market competition can theoretically reduce the prevalence of nominal wage contracts and of indexation in such contracts while boosting the use of profit sharing. Arguably, product markets have generally become more competitive in the United States since the late 1970s, owing to increased foreign competition in traded goods markets and the deregulation of many nontraded sectors. Consistent with this view, the after-tax profit share of nonfinancial corporations has moved within a lower range since the late 1970s, after adjusting for swings in temporary factors and net interest (Duca 1997).

Aggregate time-series evidence supports the view that increased competition has reduced the use of nominal contracts and indexation, as reflected in the declining rate of unionization and the falling incidence of CPI indexation clauses in union contracts. Limited, inconclusive data also support the view that greater product market competition has boosted the overall use of profit sharing. Consistent with aggregate movements in labor practices and a measure of the degree of goods market competition, industry-level data indicate that all three of these trends are most evident in sectors that have experienced either deregulation or increased foreign competition since the late 1970s. While more research needs to be done, particularly using industry-level data, new theoretical arguments and empirical evidence support—but do not conclusively prove—the view that increased product market competition has been reshaping America's labor markets.

NOTES

I would like to thank John Benedetto for providing research assistance; several human resource professionals, in particular Denise Duca and Joel Koonce, for helpful discussions about changing norms in labor compensation; and Evan Koenig, Stephen Prowse, and David VanHoose for helpful comments. Any errors are my own.

[1] This is true if core inflation is adjusted for methodological changes in recent years that have reduced the extent to which statistics have overstated consumer price inflation.

[2] This may have occurred in the 1960s when a run-up in productivity growth initially offset rising wages stemming from low unemployment, but eventually accelerating wage growth overtook productivity growth, causing unit labor costs and inflation to rise.

[3] Accompanying this change has been an increased use of temporary workers, a phenomenon examined by Segal and Sullivan (1995, 1997).

[4] Nevertheless, the incidence of sectoral demand shocks may reduce contracting in extreme cases in which workers place much more emphasis on minimizing deviations from market-clearing employment than on minimizing deviations from the expected real wage.

[5] In logs, the MRPL equals marginal revenue (p_j) plus the marginal physical product of labor (the sum of the two log-linear supply shocks).

[6] Prior studies (Evans 1991; Holland 1986) have found inflation uncertainty to be increasing in the level of inflation, which is consistent with arguments for pursuing price stability.

[7] For details on deregulation, see Duca and VanHoose (forthcoming a) and Winston (1993).

[8] Following Duca and VanHoose (1998b), the time series splices data from Troy and Sheflin (1985) with data from the Bureau of Labor Statistics. Similar trends in unionization rates are evident in recent estimates by Freeman (1998).

REFERENCES

Ball, Laurence (1988), "Is Equilibrium Indexation Efficient?" *Quarterly Journal of Economics* 103 (May): 299–311.

Bell, Linda, and Douglas Kruse (1995), "Evaluating ESOPs, Profit Sharing, and Gain Sharing Plans in U.S. Industries: Effects on Worker and Company Performance" (Manuscript, U.S. Department of Labor, March).

Blanchard, Olivier, and Lawrence F. Katz (1997), "What We Know and Do Not Know About the Natural Rate of Unemployment," *Journal of Economic Perspectives* 11 (Winter): 51–72.

Blinder, Alan, and N. Gregory Mankiw (1984), "Aggregation and Stabilization in a Multi-Contract Economy," *Journal of Monetary Economics* 13 (January): 67–86.

Duca, John V. (1987), "The Spillover Effects of Wage Rigidity in a Multi-Sector Economy," *Journal of Money, Credit, and Banking* 19 (February): 117–21.

——— (1997), "Has Long-Run Profitability Risen in the 1990s?" Federal Reserve Bank of Dallas *Economic Review*, Fourth Quarter, 1–14.

——— (1998), "The New Labor Paradigm: More Market-Responsive Rules of Work and Pay," Federal Reserve Bank of Dallas *Southwest Economy*, Issue 3, May/June, 6–8.

Duca, John V., and David D. VanHoose (1991), "Optimal Wage Indexation in a Multisector Economy," *International Economic Review* 32 (November): 859–67.

——— (1998a), "Has Greater Competition Restrained U.S. Inflation?" (Unpublished manuscript).

——— (1998b), "The Rise of Goods Market Competition and the Fall of Nominal Wage Contracting: Endogenous Wage Contracting in a Multi-Sector Economy" (Unpublished manuscript).

——— (forthcoming a), "Goods Market Competition and Profit-Sharing: A Multisector Macro Approach," *Journal of Economics and Business*.

——— (forthcoming b), "The Rise of Goods Market Competition and the Decline in Wage Indexation," *Journal of Macroeconomics*.

Evans, Martin (1991), "Discovering the Link Between Inflation Rates and Inflation Uncertainty," *Journal of Money, Credit, and Banking* 23 (May): 169–84.

Fischer, Stanley (1977a), "Long-Term Contracting, Sticky Prices, and Monetary Policy: A Comment," *Journal of Monetary Economics* 3 (July): 317–23.

——— (1977b), "Long-Term Contracts, Rational Expectations, and the Optimal Money Supply Rule," *Journal of Political Economy* 85 (February):191–205.

Freeman, Richard B. (1998), "Spurts in Union Growth: Defining Moments and Social Processes," in *The Defining Moment: The Great Depression and the American Economy in the Twentieth Century*, eds. Michael D. Bordo, Claudia Goldin, and Eugene N. White (Chicago: University of Chicago Press), 265–95.

Friedman, Milton (1968), "The Role of Monetary Policy," *American Economic Review* 58 (March): 1–17.

Galbraith, James K. (1997), "Time to Ditch the NAIRU," *Journal of Economic Perspectives* 11 (Winter): 93–108.

Ghosal, Vivek, and Prakash Loungani (1996), "Evidence on Nominal Wage Rigidity from a Panel of U.S. Manufacturing Industries," *Journal of Money, Credit, and Banking* 28 (November): 650–58.

Gordon, Robert J. (1997), "The Time-Varying NAIRU and Its Implications for Economic Policy," *Journal of Economic Perspectives* 11 (Winter): 11–32.

Gray, Jo Anna (1976), "Wage Indexation: A Macroeconomic Approach," *Journal of Monetary Economics* 2 (April): 221–35.

Holland, A. Steven (1986), "Wage Indexation and the Effect of Inflation Uncertainty on Employment: An Empirical Analysis," *American Economic Review* 76 (March): 235–44.

——— (1995), "Inflation and Wage Indexation in the Postwar United States," *Review of Economics and Statistics* 77 (February): 172–77.

Karni, Edi (1983), "On Optimal Wage Indexation," *Journal of Political Economy* 91 (April): 282–92.

Layard, Richard, Stephen Nickell, and Richard Jackman (1994*), Unemployment: Macroeconomic Performance and the Labour Market* (New York: Oxford University Press).

Mason, Bob, and Peter Bain (1993), "The Determinants of Trade Union Membership in Britain: A Survey of the Literature," *Industrial and Labor Relations Review* 47 (January): 332–51.

Oswald, Andrew J. (1982), "The Microeconomic Theory of the Trade Union," *Economic Journal* 92 (September): 576–95.

Phelps, Edmund S. (1967), "Phillips Curves, Expectations of Inflation, and Optimal Unemployment Over Time," *Economica* 34 (August): 254–81.

Segal, Lewis M., and Daniel G. Sullivan (1995), "The Temporary Labor Force," Federal Reserve Bank of Chicago *Economic Perspectives* 19 (March/April): 2–19.

——— (1997), "The Growth of Temporary Services Work," *Journal of Economic Perspectives* 11 (Spring): 117–36.

Staiger, Douglas, James H. Stock, and Mark W. Watson (1997), "The NAIRU, Unemployment, and Monetary Policy," *Journal of Economic Perspectives* 11 (Winter): 33–51.

Troy, Leo, and Neil Sheflin (1985), *Union Sourcebook* (New Brunswick, N.J.: Industrial Relations Data and Information Services).

Winston, Clifford (1993), "Economic Deregulation: Days of Reckoning for Microeconomists," *Journal of Economic Literature* 31 (September): 1263–89.