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WORK INCENTIVES AND THE DEMAND FOR PRIMARY AND CONTINGENT LABOR

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ABSTRACT

This paper presents an incentive-based dual labor market model. Three implications of the model are emphasized. First, in equilibrium, there is an excess supply of workers to primary jobs. Second, when demand is uncertain, firms may choose a mix of primary and contingent workers to perform the same job, even when these workers are perfect substitutes in production. Third, firms prefer to hire into primary jobs workers with strong job attachment and workers whose preferences lead them to prefer long work hours. We argue that industries with high proportions of part-time workers will tend to have large concentrations of contingent workers. The empirical finding that the wages and benefits of full-time workers are significantly reduced in industries with large concentrations of part-time workers appears consistent with this hypothesis.

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I. INTRODUCTION

According to conventional microeconomic theory, identical commodities should sell for the same price in a freely competitive market. Short-run deviations from this equilibrium state will be competed away as buyers abandon high price commodities for their low price equivalents.

The theory of dual labor markets argues this law of one price does not prevail in labor markets. Instead market processes tend to produce "primary" jobs characterized by high wages and long job tenure and "contingent" (or "secondary") jobs offering low wages and short tenure. Equilibrium in dual labor market theory is characterized by an excess supply of qualified workers to primary jobs. Mobility between contingent and primary jobs is therefore limited and "good" workers may find themselves in "bad" jobs—perhaps for long periods of time.

The theory of dual labor markets has generated a rich qualitative and quantitative literature.[1] However, until recently, the development of a microeconomic theory of dual labor markets has been limited by the absence of formal models explaining: (1) why firms offer primary and contingent jobs and (2) how an excess supply of workers to primary jobs persists in equilibrium.

Recently developed theoretical models have attempted to address these issues by analysing the differences in work incentives used in primary and contingent jobs. The models begin by postulating unobserved, cross industry variation in labor monitoring technology (see, for example, Bulow and Summers, 1986). Primary jobs arise in industries where it is difficult to monitor job performance. These industries use dismissal threats to motivate workers to provide high quality work effort.[2] Since the effectiveness of dismissal threats depends upon the cost to the worker of job loss, primary employers will be inclined to set wages above market clearing levels. Contingent jobs, in contrast, occur where it is easy to monitor the activities of workers. In this situation, employers do not rely upon dismissal threats to maintain work intensity and wages tend towards market clearing levels.

This paper extends the work incentive approach to dual labor markets by introducing uncertain product demand into an analysis of the demand for primary and contingent workers. This innovation leads to the results that: (1) dual labor markets can arise even in the absence of variation in monitoring technology across industries and (2) primary and contingent workers need not be segregated into separate industries. Indeed, we demonstrate that a single, profit maximizing firm may find it optimal to offer both contingent and primary jobs. This mix of primary and contingent jobs may occur even when workers are homogeneous and perfect substitutes in production.

The remainder of the paper proceeds in three sections. In section II, we present our theoretical model of dual labor markets. In sections III and IV, we extend the model to argue that firms or industries with large concentrations of part-time workers will also have large concentrations of contingent workers. Consistent with this hypothesis, we find that in industries with high concentrations of part-time workers, the wages and benefits of full time workers are significantly reduced.

II. A MODEL OF DUAL LABOUR MARKETS

The logic of our dual labor market model can be briefly summarized. Firms create incentives for their primary employees to work hard by dismissing workers who are discovered to be putting forth substandard effort. These dismissal threats are made effective by wage premia guaranteed to persist throughout the period of employment. The longer the credible promise of future employment, the lower is the wage premium a firm must offer to convince primary workers to work hard.

When firms face variations in product demand, there is a chance that these firms will lay off some of their primary workers. Firms have an incentive to reduce the probability of layoff because by so doing they increase anticipated job tenure and reduce the wage premium paid to primary workers. These considerations motivate firms to hire contingent workers on the spot market for labor. The contingent workers form a buffer of last-hired first-fired workers that reduce the layoff probability (and therefore the wages) paid to primary workers.[3]

For our purposes, it is analytically convenient to discuss work incentives in the form of dismissal threats. The use of these threats are also consistent with the "employment at will" legal doctrine governing United States labor law.[4] However, the logic of our model would not be fundamentally altered if the sanctions available to the firm rested upon changes in the probability of promotion rather than changes in the probability of job termination.

A. Primary and Contingent Employment Contracts

We consider firms that hire homogeneous workers under one of two types of employment contracts, primary or contingent. Under the contingent contract, workers are hired with no promise of future employment. Firms pay contingent workers the wage that clears the spot market for labor, w_2. In contrast, primary workers are offered jobs that persist until the worker is laid off due to a reduction in the firm's demand for labor or dismissed for poor work effort. These workers are paid a wage set by the firm, w_1.

Workers are presumed to work at two levels of intensity, "high" and "low". In any period, a firm can always ascertain whether an employee is working below the minimal level of work intensity. However, firms detect the minimal-effort work behavior only with probability $D < 1$. Contingent workers, who have no future with the firm, will provide the perfectly observable low level of work intensity. Primary workers, however, can be induced to work at the high level of work intensity if the expected cost of dismissal for substandard work exceeds the gain in utility from working at low intensity.

In order to highlight the incentive aspect of our model we assume that workers are risk neutral. In particular, we assume that the utility workers derive from employment in any period is $u(w, e) = w - e$, where w is the wage, and e is the level of effort expended on the job. The level of work effort takes the value e_1 if the intensity is high, and e_2 if the intensity is low. Of course, $e_1 - e_2 > 0$. Workers who provide low level of work effort are said to be "shirking".

Due to fluctuations in product demand, primary workers are not assured continued employment in their current jobs. In each period, workers who hold primary jobs face a fixed probability, $b < 1$, of being laid off. The probability a non-shirking worker remains in the primary job the next period is $(1 - b)$. By shirking, the worker risks detection and dismissal, and thus reduces the probability of remaining in the primary job from $(1 - b)$ to $(1 - b)(1 - D)$. We assume that primary workers who loose their jobs always find employment in a contingent job.

Workers make effort decisions consistent with the maximization of expected lifetime utility. Let V^N be the expected discounted flow of utility for a non-shirking worker in a primary job, V^S be the present value of expected utility for a shirking worker in a primary job, and V^C be the present value of expected utility for a worker employed in a contingent job. If we adopt the assumption that workers are infinitely lived we can write:[5]

$$V^N = w_1 - e_1 + \frac{(1-b)V^N}{(1+r)} + \frac{bV^C}{(1+r)}, \tag{1}$$

$$V^S = w_1 - e_2 + \frac{(1-b)(1-D)V^S}{(1+r)} + \frac{[1-(1-b)(1-D)]V^C}{(1+r)}, \tag{2}$$

and

$$V^C = w_2 - e_2 + \frac{sV^N}{(1+r)} + \frac{(1-s)V^C}{(1+r)}, \tag{3}$$

where r is the workers discount rate and s is the probability in any period that a worker holding a contingent job finds a primary position.

A primary worker who maximizes the present value of expected utility from employment will shirk unless $V^N \geq V^S$. Firms who offer primary jobs choose the lowest wage sufficient to discourage shirking. Using equations (1), (2) and (3), we derive the no-shirking wage,[6]

$$w_1 = w_2 + (e_1 - e_2) + \frac{(e_1 - e_2)(r + s + b)}{D(1-b)}. \tag{4}$$

There are two implications of this no-shirking condition that we wish to emphasize. First, the utility of employment in a primary job exceeds the utility of employment in a secondary job. Thus in equilibrium there will be a persistent excess supply of contingent workers who are able and willing to accept primary jobs at the prevailing wage. Second, we notice that the wage paid primary workers varies positively with the layoff probability, b:

$$\frac{dw_1}{db} = \frac{(e_1 - e_2)(1 + r + s)}{D(1 - b)^2} > 0. \tag{5}$$

All else equal, firms that employ primary workers will prefer to reduce the probability that any primary worker is laid off. The determinants of layoff probabilities are considered in the next section.

B. Layoffs as a Response to Uncertain Product Demand

We consider firms whose revenue in any period is given by $Pf(L_1)$, where P is the price of the output price, and $f(L_1)$ is a concave function having as its only input the firm's primary labor force, L_1. Uncertainty is introduced into the model by allowing P to be an i.i.d. draw from a known probability distribution, $\phi(P)$.

The timing of the model is as follows: At the beginning of each period firms offer L_1 primary employment contracts at the wage w_1. Firms and workers then learn the value of the random price draw, P. At this point firms decide how many of the primary workers hired *ex ante* they wish to lay off. With the labor force in place, production proceeds, and workers are paid the promised wage. The number of workers a firm will lay off *ex post* depends of course on the realized product price. If this draw is favorable, the firm will retain all of the workers initially hired. On the other hand, if P is low, layoffs may be necessary. Let $\hat{L}_1(P) \leq L_1$ represent the number of workers the firm retains as a function of the realized price, P. Given this *ex post* retention policy, the probability of layoff for any worker is[7]

$$b = \frac{\int_P \phi(P)[L_1 - \hat{L}_1(P)]dP}{L_1}. \tag{6}$$

As we have noted, the no-shirking wage, solved in equation (4), depends on this layoff probability. Firms thus face a tradeoff between the wage that it pays and the continuity of employment offered. The greater a firm's reliance on layoffs in when demand is slack, the higher will be the wage the firm must pay to assure no shirking.

We can explore this insight formally using functional derivatives. Given a firm's retention rule, $\hat{L}_1(P)$, expected profit is

$$E(\pi) = \int_P \phi(P)Pf(\hat{L}_1(P))dP - w_1(b)\int_P \phi(P)\hat{L}_1(P)dP, \tag{7}$$

where we have written w_1 as a function of b to emphasize that the no shirking wage depends on the layoff probability. Let $\hat{L}_1^*(P)$ represent the optimal retention policy for a firm, given some initial level of hiring, L_1, and let $g(P)$ be a function representing a deviation from this policy. Then if expected profits are expressed as

$$E(\pi) = \int_P \phi(P)Pf(\hat{L}_1^*(P) + \delta g(P))dP - w_1(b)\int_P \phi(P)[\hat{L}_1^*(P) + \delta g(P)]dP, \tag{8}$$

it is clear that expected profits will be maximized when δ equals zero. Moreover, the first order condition,

$$\left.\frac{dE(\pi)}{d\delta}\right|_{\delta=0} = 0,$$

must hold for any $g(P)$ when $\hat{L}_1(P)$ is set to its optimal path, $\hat{L}_1^*(P)$. This first order condition thus implies

$$\int_P \phi(P)Pf'(\hat{L}_1^*(P))g(P)dP - \frac{dw_1}{db}\frac{db}{d\delta}\int_P \phi(P)\hat{L}_1^*(P)dP - w_1\int_P \phi(P)g(P)dP = 0. \tag{9}$$

Using equations (4), (5), and (6) we rewrite this expression,

$$\int_P \phi(P)g(P)[Pf'(\hat{L}_1^*(P)) + \frac{(e_1 - e_2)(1+r+s)}{D(1-b)} - w_1]dP = 0. \tag{10}$$

For (10) to be hold for any $g(P)$, it must be the case that whenever layoffs are utilized by a firm, the number of workers retained, $\hat{L}_1^*(P)$, satisfies

$$Pf'(\hat{L}_1^*(P)) - w_1 = \frac{-(e_1 - e_2)(1+r+s)}{D(1-b)}. \tag{11}$$

This suggests that in the event of slack demand, the optimal strategy for a firm is to hoard labor, i.e., to retain workers for whom the value of marginal product is less than the wage. Notice that this labor hoarding occurs even though firms have not made any investment in firm-specific human capital. Put differently, the use of dismissal based incentives causes firms to act as if they had invested in the skills of their incumbant work force.

C. The Demand for Contingent Workers: A Cobb-Douglas Example

In the previous section, we study how firms respond to variations in product demand by laying off primary workers. In this section we also consider the possibility that firms may respond to variations in product demand by hiring contingent workers on the spot market for labor.

We modify our model only slightly. Suppose revenue accruing to the firm is $Pf(L)$, where L is the firm's "effective" labor input. We assume that primary and contingent workers are perfect substitutes in production:

$$L = L_1 + \alpha L_2, \qquad 0 < \alpha < 1, \tag{12}$$

where L_2 is the number of contingent workers used by the firm, and α indicates the productivity of these workers relative to that of primary workers.

With this set-up a variety of outcomes are possible. If $w_2/\alpha < w_1$ firms will never offer primary contracts. On the other hand, if $w_2/\alpha > w_1$ firms may decide to either make exclusive use of primary workers or to make use of both primary and contingent workers. We illustrate this latter possibility with the following example.

Suppose the firm's output is produced according to Cobb-Douglas technology:

$$f(\hat{L}_1 + \alpha\hat{L}_2) = (\hat{L}_1 + \alpha\hat{L}_2)^{\theta}. \tag{13}$$

The firm selects L_1, the initial number of primary contracts offered, so as to maximize expected profit. Once the output price is realized, the firm adjusts *ex post* labor utilization, $\hat{L}_1$ and $\hat{L}_2$, in a manner consistent with expected profit maximization. (Notice that output is a function of the *ex post* labor utilization—the workers actually used in the production process.)

We can derive the *ex post* labor demand for primary workers, given the *ex ante* hiring of primary workers, L_1, as follows. From equation (11), we know that if the price is low enough so that layoffs occur, the firm will adjust its use of primary labor so that the value of marginal product equals $\bar{w}$, where

$$\bar{w} = w_1 - \frac{(e_1 - e_2)(1 + r + s)}{D(1 - b)}, \tag{14}$$

or, equivalently (using equation 4),

$$\bar{w} = w_2 - \frac{(e_1 - e_2)(1 - D)}{D}. \tag{15}$$

Define the price P_1 to be the price below which the firm begins to use layoffs:

$$P_1 = \frac{\bar{w} L_1^{1-\theta}}{\theta}. \tag{16}$$

Then the *ex post* demand function for primary workers is

$$\hat{L}_1(P) = \begin{cases} \left(\frac{P\theta}{\bar{w}}\right)^{\frac{1}{1-\theta}}, & \text{if } P < P_1; \\ L_1, & \text{if } P > P_1. \end{cases} \tag{17}$$

We find the *ex post* demand for contingent labor in similar fashion. If the realized price is high enough, firms find it advantageous to supplement its core of primary workers with contingent labor. In particular, let P_2 be the price above which a firm will wish to use contingent labor, given the firm's *ex ante* employment of L_1:

$$P_2 = \frac{w_2 L_1^{1-\theta}}{\alpha\theta}. \tag{18}$$

Then the *ex post* demand function for contingent workers is

$$\hat{L}_2(P) = \begin{cases} 0, & \text{if } P < P_2; \\ \left(\frac{P\theta}{w_2}\right)^{\frac{1}{1-\theta}} \alpha^{\frac{\theta}{1-\theta}} - \frac{L_1}{\alpha}, & \text{if } P > P_2. \end{cases} \tag{19}$$

Two features of these labor demand functions are worth noting. First, both P_1 and P_2 are increasing functions of L_1. Decreases in the *ex ante* number of primary contracts offered reduce the range of prices for which layoffs occur and increases the range for which contingent labor is utilized. Second, notice that $P_2 > P_1$. This implies that there exist a range of demand within which employment is rigid. Specifically, if the realized price falls between P_1 and P_2, the firm will retain a fixed number of primary workers, and will hire no contingent labor.

For our example, we take the output price to be a random variable distributed uniformly between 0 and 1. Thus the expected utilization of primary labor, conditional on the quantity of primary labor hired *ex ante* is

$$E(\hat{L}_1) = \int_0^{P_1} \left(\frac{P\theta}{\bar{w}}\right)^{\frac{1}{1-\theta}} dP + \int_{P_1}^{1} L_1 dP. \tag{20}$$

Evaluating this expression, we find that the layoff probability for a primary worker is

$$b = 1 - \frac{E(\hat{L}_1)}{L_1} = \frac{\bar{w}L_1^{1-\theta}}{(2-\theta)\theta}. \tag{21}$$

Not surprisingly, the layoff probability is an increasing function of the *ex ante* labor hiring decision, L_1. When offering these contracts firms must consider a tradeoff: Increasing L_1 results in a higher layoff probability and thus a higher no-shirking wage, but also on average reduces the number of (relatively costly) contingent workers that will be utilized.

Given the production technology and price distribution in our example, expected profits are

$$E(\pi) = \int_0^{P_1} [P\hat{L}_1(P)^\theta - w_1(b)\hat{L}_1(P)]dP + \int_{P_1}^{P_2} [PL_1^\theta - w_1(b)L_1]dP$$
$$+ \int_{P_2}^{1} [P(L_1 + \hat{L}_2(P))^\theta - w_1(b)L_1 - w_2\hat{L}_2(P)]dP. \tag{22}$$

Using expressions (16) through (19) and (21), we can evaluate the integrals, and derive the expected profits as a function of a firm's *ex ante* employment of primary workers, L_1:

$$E(\pi) = \left[\theta P_2 - \frac{\theta P_2^2 + \theta P_1^2}{2(2-\theta)}\right] L_1^\theta - (1-b)w_1(b)L_1 + \frac{(1-\theta)^2}{(2-\theta)} \left(\frac{w_2}{\alpha\theta}\right)^{\frac{\theta}{\theta-1}}. \tag{23}$$

As we have noted, if the unit cost of contingent workers (w_2/α) is very high relative to primary workers, firms will strictly rely on primary workers. Conversely, if the relative cost of contingent workers is very low, firms will abandon incentives and hire only contingent workers. Expression (23) allows us to illustrate a third possibility—that there are many sets of parameters for which an individual firm will hire a *mix* of primary and contingent workers. Figure 1 illustrates one particular case. We set $\alpha = 0.5$, $\theta = 0.7$, $e_1 - e_2 = 2$, $D = 0.5$, $r = 0.01$, and $s = 0.02$. The market clearing wage for contingent labor, w_2 is $7.00. Given these parameters, we plot expected profits as a function of L_1. This expected profit function has a maximum at $L_1 = 152$. The firm will supplement this primary labor force whenever the output price exceeds $0.75, and will lay off primary workers when the price falls below $0.27. In our example, the primary wage offered by the firm is $10.19.

[Figure 1 about here.]

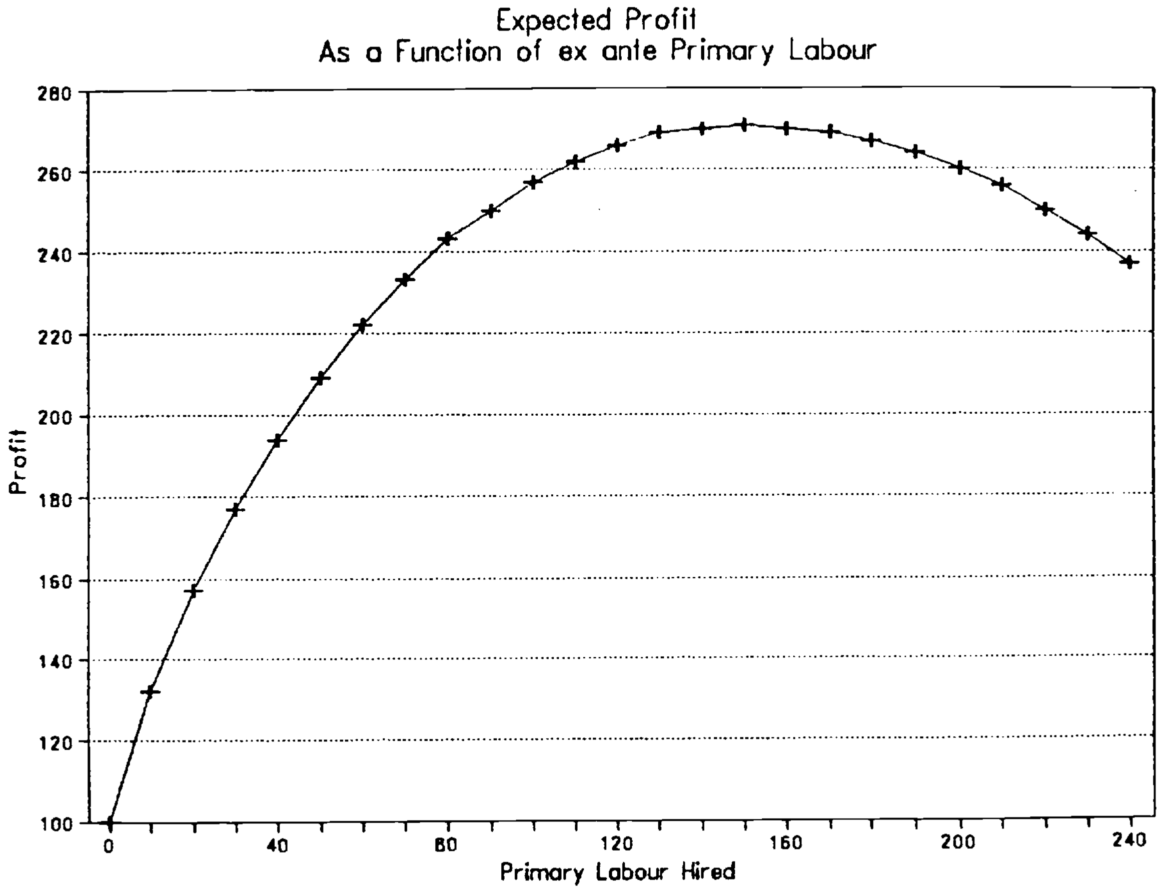
These results illustrate a striking property of our dual labor market model. A profit maximizing firm may hire a *mix* of perfectly substitutable primary and contingent labor inputs even when these inputs have different prices. In an environment with uncertain product demand, one may therefore find contingent workers and primary workers at work in the same firm or industry.

III. PART-TIME WORK AND CONTINGENT WORKERS

In the United States it is very difficult to identify which workers are working under conditions resembling primary or contingent employment contracts. No official government statistics are kept on contingent or primary workers and many of the relevant aspects of employment relationships are implicit and therefore not recorded by firms. This section presents theoretical and empirical considerations arguing that part-time workers will tend to be contingent workers.

A. Primary Jobs and Quit Propensities

An easy modification to our model involves introducing the possibility that workers


Expected Profit
As a Function of ex ante Primary Labour
Profit
280
260
240
220
200
180
160
140
120
100
0
40
80
120
160
200
240
Primary Labour Hired

in primary jobs may leave their positions for reasons other than being fired or laid off. Following Bulow and Summers (1986), we assume that workers have an exogenously determined probability of quitting a primary job, q. The no-shirking condition can be solved for this case:

$$w_1 = w_2 + (e_1 - e_2) + \frac{(e_1 - e_2)(r + s + b + q)}{D(1 - b)(1 - q)}. \tag{24}$$

Notice that the higher a worker's quit propensity, q, the higher will be the wage needed to assure no shirking. To the extent that part-time workers have a more tenuous commitment to the labor market, such workers will tend to be expensive primary workers. All else equal, firms will avoid using such workers to fill primary positions.

B. Desired Hours of Work and the No-Shirking Wage

Our model has so far abstracted from the determination of work hours. Once hours of work, N, are introduced, we express a worker's utility as a function of income, wN, the disutility of work effort, which is now a function of work hours, $e(N)$, and the amount of leisure itself. For simplicity, we adopt a quasi-linear utility function:

$$u(w, e, N) = U(wN - e) + G(\bar{N} - N), \qquad G' > 0,\ G'' < 0,\ e' > 0,\ e'' < 0, \tag{25}$$

where $G(\bar{N} - N)$ is the utility of leisure when an individual works N of $\bar{N}$ available hours.

Defining the work hours in primary and contingent jobs as respectively N_1 and N_2 hours, and maintaining the assumption of risk neutrality in income, the no-shirking condition becomes

$$w_1 = e_1(N_1) + \frac{E(N_1)(r + s + b + q)}{(1 - b)(1 - q)D(N_1)N_1} + \frac{w_2 N_2 - e_2(N_2)}{N_1} + \frac{G(\bar{N} - N_2) - G(\bar{N} - N_1)}{MN_1}, \tag{26}$$

where M is the marginal utility of income, $E(N_1) = e_1(N_1) - e_2(N_1)$, and $D(N_1)$ is the probability in each period of detection and dismissal for shirking primary workers who work N_1 hours.

To highlight the role played by differences in preferences for income and leisure, we assume that $E(N)$ and $D(N)$ are each linear functions of hours worked.[8] In this situation, workers in both primary and contingent jobs will choose work hours such that the marginal utility of income equals the marginal utility of leisure.

Differentiating equation (26) with respect to M, we discover that

$$\frac{dw_1}{dM} = \frac{G(\bar{N} - N_1) - G(\bar{N} - N_2)}{M^2 N_1}. \tag{27}$$

Given our utility function, N_1 exceeds N_2, and thus $dw_1/dM < 0$.

The finding that $dw_1/dM < 0$ has strong intuitive appeal. The effectiveness of dismissal threats rests on denying shirking workers access to high future income streams. All else equal, one would expect that workers with higher marginal utilities of income would require a smaller wage premium (and therefore a smaller w_1) to assure no shirking. The implication is that workers who place a high value on money relative to leisure, i.e., workers with preferences for longer hours, will be cheaper primary workers. Even if part-time workers have the same turnover rates as full-time workers, part-time workers will thus be less desirable for primary positions.

C. Do Part-Timers Resemble Contingent Workers?

The hypothesis that part-time workers are concentrated in contingent positions is indirectly supported by data indicating that as a group, part-time workers have many of the characteristics one would associate with contingent workers. Aggregate data suggests that part-time workers have a more tenuous connection to their employers than do full-time workers. Data from a recent U.S. survey, presented in Row 7 of Table 1 indicates that on average, the current job tenure of part-time workers (3.4 years) is considerably shorter than that of either female (5.7 years) or male (8.1 years) full-time workers. Row 8 also suggests that part-time employees have a weaker attachment to the labor force than do full-timers. Of those part-timers employed in 1983, 28.4 percent had left the labor force 12 months later. This figure compares with 5.3 percent and 2.9 percent for female and male full-timers respectively.[9]

[Insert Table 1 about here.]

TABLE I

Comparing Part-Time[a] and Full-Time Workers

	Part-Timers	Full-Timers Women	Men	Total
Percent Female[b]	69.5	100.0	0.0	39.9
Percent < 21[b]	29.0	5.7	4.8	
Percent > 65[b]	5.3	0.9	0.8	
Average Earnings per Hours($)[b]	5.48	6.57	9.74	
Percent with Health Insurance[b]	21.5	72.2	81.1	
Percent with Employer Offering Pension[b]	25.8	56.4	62.9	
Average Job Tenure (yrs.)[b]	3.4	5.7	8.1	
Propensity to Leave Labor Force[c]	28.4	5.3	2.9	

(a) The definition of part-time work used in this study differs slightly from the official Bureau of Labor Statistics definition. The BLS counts as part-time workers those who worked less than 35 hours per week in all jobs during the survey week. This pool is then divided into those who work part-time for economic reasons and those who work part-time voluntarily. The former group is typically counted as part of the full-time labor force. Nardone (1986) argues that a superior definition of part-time work would count as part-time all those who usually work less than 35 hours per week, regardless of reason. Nardone's cutoff however is based on the number of hours worked at <u>all</u> jobs. In contrast this study counts as part-time all workers who usually work less than 35 hours per week at their primary job. Since wage, tenure and benefit data all refer to the primary job, this definition is more appropriate in comparing full-time and part-time workers.

(b). Unweighted averages calculated for wage and salary employees in the non-agricultural, non-household, private sector using the May 1983 Current Population Survey described in the text.

(c) Percentage of wage and salary employees in the non-agricultural, non-household, private sector in May 1983 who were reported not-in the labor force during the survey week 12 months after the original CPS survey. Averages were constructed by matching the May 1983 respondents with those in the 1984 Current Population survey "earnings" file. This file contains the survey responses of all individuals in outgoing rotations in 1984. See Table 4 for details.

The preceding discussion suggests that workers with high quit propensities or workers whose preferences lead them to choose shorter work hours will, all else equal, be expensive primary workers. These individuals will be concentrated in the contingent labor force and will be more likely to be in part-time positions. The data presented in rows 1, 2, and 3 are consistent with these expectations. As a group part-timers are more female, young (less than 21 years old) and old (older that 65) than full-timers.

In addition to reduced job security and labor force attachments, part-time workers resemble contingent workers in having generally lower levels of wages and benefits. Row 4 of Table 1 compares the hourly wages of part time and full time workers. In our survey, the average wage of part-timers ($5.48) was considerably less than that of full-time females ($6.57) and males ($9.74). Similarly, part-timers were less likely to receive health insurance and pension benefits than full-time workers.

IV. CONTINGENT EMPLOYMENT AND THE WAGES OF FULL TIME WORKERS

Our dual labor market model suggests that in general primary and contingent workers will be found working in the same industry. Theoretical and empirical considerations further suggest that part-time workers are likely to be contingent workers. However, not all contingent workers will be part-time workers. In the absence of direct measures of the presence of full-time contingent workers, we hypothesize that sectors with a high concentration of part-time workers also will tend to have a high concentration of full-time contingent workers.

This hypothesis appears to be supported by evidence from the one group of contingent workers for whom direct data is available in the United States—employees in the temporary help industry. Consistent with the definition of "contingent" developed in this paper, Abraham (1987) found evidence indicating that employers use temporary workers (and other kinds of flexible staffing arrangements) to help adjust to fluctuations in product demand. A recent U.S. Bureau of Labor Statistics survey of employees in the temporary help industry found that the proportion of wage and salary workers who worked part time in that industry was 40 percent—more than double the average for all wage and salary workers (Howe, 1986).

If the presence of part-time workers is a good indicator of the presence of contingent workers in general, then all else equal, the wages of full-timers ought to be lower in industries with large concentrations of part-time workers. To examine this hypothesis, we estimate the following wage equation:

$$log(w_1) = B_1 + B_2(PT/FT)_i + B_3 FACTORS_i + \epsilon_i, \tag{28}$$

where $log(w_i)$ is the natural log of the hourly earnings of full time worker i, $(PT/FT)_i$ is the ratio of part-timers to full-timers in the industry, $FACTORS$ is a vector of other factors influencing hourly earnings, and ϵ is the error term. Our hypothesis suggests $B_2 < 0$.

In this study, PT/FT is measured using the ratio of part-time to full-time workers employed in two-digit census industries. $FACTORS$ is composed of variables commonly found in other wage studies to be important in determining hourly earnings. These include characteristics of the worker, characteristics of the workplace, characteristics of the local labor market, and characteristics of the industry and occupation. These variables are described in a data appendix.

Column 1 of Table 2 presents ordinary least squares estimates of equation (28) for a sample of over 7000 male, full-time workers. The coefficient on the key variable, PT/FT, has a statistically significant negative sign, indicating that the larger the fraction of the labor force employed part time, the lower are the wages paid to full-time male workers. Point estimates suggest that this "part-time effect" on the wages of full-time male employees is substantial. All else equal, a one standard deviation in PT/FT will reduce hourly earnings by 6.9 percent. At the mean wage in the sample ($9.87) this translates into $0.68 per hour, or $1,363 over a 2000 hour work year.

[Table 2 about here.]

TABLE II

Male, Full-time, Non-Agricultural, Private, Wage & Salary Workers[a]

Dep. Var:	OLS LOG(W)	LOGIT HEALTH INSURANCE	LOGIT PENSION1	LOGIT PENSION2
PT/FT	-0.296	-1.817	-1.320	-0.639
	(0.025)*	(0.196)*	(0.167)*	(0.321)**
EDUCATION	0.0385	0.086	0.090	-0.002
	(0.002)*	(0.016)*	(0.013)*	(0.028)
TENURE	0.176	0.212		0.201
	(0.002)*	(0.015)*		(0.024)*
$TENURE^2/100$	-0.036	-0.404		-0.349
	(0.005)*	(0.050)*		(0.082)*
WHITE	0.117	0.297	0.099	-0.152
	(0.016)*	(0.129)*	(0.107)	(0.220)
AGE	0.052	0.130	0.175	0.171
	(0.002)*	(0.018)*	(0.016)*	(0.034)*
$AGE^2/100$	-0.056	-0.167	-0.175	-0.196
	(0.003)*	(0.023)*	(0.019)*	(0.041)*
UNION	0.103	1.318	1.069	0.543
	(0.011)*	(0.120)*	(0.079)*	(0.156)*
PLANT SIZE2	0.079	0.844	0.673	0.122
	(0.012)*	(0.091)*	(0.073)*	(0.154)
PLANT SIZE3	0.110	1.479	1.256	0.284
	(0.013)*	(0.128)*	(0.085)*	(0.164)***
PLANT SIZE4	0.183	1.390	1.600	0.261
	(0.020)*	(0.235)*	(0.151)*	(0.252)
PLANT SIZE5	0.215	1.762	1.831	0.346
	(0.016)*	(0.229)*	(0.128)*	(0.210)***
% UNION	0.014	0.688	1.355	0.215
	(0.041)	(0.384)***	(0.280)*	(0.557)
% MALE	0.205	-1.931	-1.080	0.410
	(0.033)*	(0.302)*	(0.219)*	(0.411)
INTERCEPT	-0.166	-2.954	-5.053	-3.101
	(0.793)*	(0.593)*	(0.521)*	(0.962)*
OCCUPATION CONTROLS	YES	YES	YES	YES
SMSA+DIVISION CONTROLS	YES	YES	YES	YES
OBSERVATIONS	7352	7313	6906	4363
$ADJ.R^2$	0.449			
MODEL CHI-SQUARE		2245.41	2003.43	416.43
ζ (b)		-0.142	-0.288	-0.029

TABLE II (continued)

Numbers in () are asymptotic standard errors.
*significant at 1% level; **significant at 5% level; ***significant at 10% level

Means of dependent variables are: LOG(W), 2.16; HEALTH INSURANCE, 0.814; PENSION1, 0.634; and PENSION2, 0.915.

The mean (and standard deviation) of PT/FT in colums 1-4 are respectively: 0.196 (0.234); 0.196 (0.232); 0.192 (0.230); 0.151 (0.186).

(a) All data from the May 1983 Current Population Survey. See Data Appendix for description of variables.

(b) Derivative of dependent variable with respect to PT/FT evaluated at the mean.

The coefficients on the remaining variables are not surprising. Tenure ($TENURE$ and $TENURE^2/100$) and age (AGE and $AGE^2/100$) have positive (and non-linear) effects on wages. White workers ($WHITE$), union members ($UNION$), employees in large plants ($PLANT\ SIZE2 - PLANT\ SIZE5$) and workers in heavily male industries ($\%MALE$) all enjoy earnings significantly above those received by otherwise comparable workers. Union concentration in the industry ($\%UNION$) had a small and statistically insignificant effect on hourly earnings.

Given these results, it is reasonable to ask if the presence of part-time workers in an industry has a negative association with dimensions of the compensation package other than hourly earnings. Column 2 of Table 2 presents logistic estimates of a health insurance equation. The dependent variable, $HEALTH\ INSURANCE$, is a dichotomous variable set equal to one if the respondent is included in a group health insurance plan at the present job. As was the case in the wage equation, the coefficient on PT/FT is negative and statistically significant. The magnitude of the effect appears also to be economically significant. A one standard deviation increase in PT/FT will, all else equal, reduce the probability that full-timers receive health insurance benefits by 3.3 percentage points.

As a rule, the remaining variables in the health insurance equation have measured effects similar to their counterparts in the earnings equation. Respondents who were white, or union members, or who worked at larger plants, all had a higher probability of receiving health insurance benefits. Similarly, older, more tenured and better educated respondents were more likely to be included in health insurance programs. Somewhat surprisingly, the more male the full-time labor force in the industry, the less likely were workers to be included in health insurance plans where they worked.

Column 3 of Table 2 presents logistic estimates of the determinants of pension coverage. The dependent variable, $PENSION1$, is a dichotomous variable equal to one if the employer (or union) contributes to a pension or retirement plan for *any* of its employees (or members). Since the availability of a pension plan at the employer is not influenced by the current tenure of the respondent, $TENURE$ and $TENURE^2/100$ were not included in the vector of variables which make up $FACTORS$. The estimates of the pension equation are consistent with those of the health insurance equation. All else equal, workers in industries with large concentrations of part-timers are significantly less likely to be working for employers who offer pensions plans. At the mean values of these variables, the derivative of the probability of a pension plan being offered with respect to PT/FT is -0.288. This implies that a one standard deviation increase in PT/FT reduces the probability an employer will offer a pension plan by 6.6 percentage points.

Column 4 of Table 2 examines workers employed at firms that offer pension plans in order to analyze the probability that the employee will be included in the pension plan. A logistic equation was estimated with the dependent variable, $PENSION2$, set equal to one if the respondent is included in a pension plan and 0 otherwise. The statistically significant negative coefficient on PT/FT indicates that, all else equal, full-time male workers employed in a firm offering a pension plan are less likely to be included in that plan if they work in an industry with a high concentration of part-time workers. The magnitude of this effect, however, appears small. At the mean, the derivative of the probability of inclusion in the pension plan relative to PT/FT is -0.029. This suggests that a one standard deviation increase in PT/FT will reduce the probability of being included in a pension plan by 0.5 percentage points.

Taken together, the estimates presented in Table 2 indicate that male full-time workers experience significant reductions in both wages and the availability of health and pension benefits if they work in industries with high concentrations of part-time workers. Table 3 presents estimates for full-time female workers analogous to those presented for males. Examination of the results indicates that the pattern for women is very similar to that found for men. Increasing the concentration of part-time workers in an industry: (1) reduces female wages, (2) reduces the probability a woman will be included in a group health plan, (3) reduces the probability a woman will work for an employer offering a

TABLE III

Female, Full-time, Non-Agricultural, Private, Wage & Salary Workers[a]

Dep. Var:	OLS LOG(W)	LOGIT HEALTH INSURANCE	LOGIT PENSION1	LOGIT PENSION2
PT/FT	-2.001 (0.184)*	-1.922 (0.189)*	-1.574 (0.187)*	-0.630 (0.317)**
EDUCATION	0.303 (0.018)*	0.056 (0.020)*	0.093 (0.018)*	-0.004 (0.031)
TENURE	0.167 (0.014)*	0.170 (0.016)*		0.272 (0.026)
$TENURE^2/100$	-0.322 (0.047)*	-0.386 (0.056)*		-0.578 (0.086)*
WHITE	0.384 (0.107)*	0.040 (0.119)*	0.025 (0.106)	-0.011 (0.183)
AGE	0.169 (0.190)*	-0.023 (0.020)	0.109 (0.018)*	0.142 (0.032)*
$AGE^2/100$	-0.198 (0.023)*	0.014 (0.026)	-0.111 (0.022)*	-0.173 (0.041)*
UNION	0.522 (0.106)*	1.270 (0.157)*	0.771 (0.108)*	0.422 (0.174)**
PLANT SIZE2	0.214 (0.097)**	0.838 (0.095)*	0.596 (0.089)*	-0.240 (0.165)
PLANT SIZE3	0.466 (0.100)*	1.431 (0.114)*	1.247 (0.095)*	-0.260 (0.162)
PLANT SIZE4	0.925 (0.143)*	1.775 (0.202)*	1.970 (0.158)*	-0.451 (0.198)**
PLANT SIZE5	1.445 (0.132)*	1.750 (0.195)*	1.835 (0.147)*	-0.052 (0.205)
% UNION	0.686 (0.371)***	0.172 (0.475)	0.146 (0.371)*	1.225 (0.610)**
% MALE	0.715 (0.222)*	-0.022 (0.244)	-0.314 (0.216)*	-0.486 (0.355)
INTERCEPT	-3.901 (0.981)*	-1.873 (1.000)***	-2.601 (1.021)**	-2.585 (1.300)**
OCCUPATION CONTROLS	YES	YES	YES	YES
SMSA+DIVISION CONTROLS	YES	YES	YES	YES
OBSERVATIONS	4900	4872	4528	2588
ADJ. R^2	0.403			
MODEL CHI-SQUARE		1462.32	1136.86	362.68
ζ [b]		-0.311	-0.380	-0.069

TABLE III (continued)

Numbers in () are asymptotic standard errors.
*significant at 1% level; **significant at 5% level; ***significant at 10% level

Means of dependent variables are: LOG(W), 1.800; HEALTH INSURANCE, 0.725; PENSION1, 0.575; and PENSION2, 0.823.

The mean (and standard deviation) of PT/FT in colums 1-4 are respectively: 0.306 (0.320); 0.306 (0.319); 0.299 (0.312); 0.222 (0.221).

(a) All data from the May 1983 Current Population Survey. See TABLE 2 for description of variables.

(b) Derivative of dependent variable with respect to PT/FT evaluated at the mean.

pension, and (4) reduces the probability a woman will be included in a pension plan if an employer offers one.

[Insert Table 3 about here.]

The negative association between various dimensions of compensation and the presence of part-time workers in the industry is consistent with the hypothesis that many full-time workers in these industries are working under contingent employment contracts. However, the results do not rule out the possible alternative hypothesis that full-time workers in industries with high concentrations of part-timers are less productive than workers in other industries due to unmeasured personal or human capital characteristics. These two hypotheses can be distinguished by examining how the wages of individuals change as they change industries. If the "part-time effect" on wages were due entirely to spurious correlation with unmeasured personal or human capital characteristics, it should disappear in an empirical study tracking a single individual over time.[10]

By matching the responses of individuals included in both the May 1983 Current Population Survey and the May and June 1984 Current Population Survey, we estimate a wage change equation for the following form:

$$\Delta log(w_i) = C_0 + C_1(\Delta PT/FT)_i + C_2 \Delta FACTORS_i + \varepsilon_i, \tag{29}$$

where $\Delta log(w_i)$ is the change in the log of hourly earnings for individual i between 1983 and 1984 multiplied by 100, $\Delta PT/FT$ is the change in the industry ratio of part-timers to full-timers due to changes in industry status, and $\Delta FACTORS$ is a vector of other variables that change over time and are plausibly linked to wages.

The estimates of equation (29) are presented in Table 4. Due to the small number of individuals for whom job changes place them in different industries, male and female respondents were pooled into a single equation. The results are consistent with the cross-section findings. The variable $\Delta PT/FT$ has a statistically significant negative sign indicating that a worker moving into an industry with higher concentrations of part-time workers

TABLE IV

ORDINARY LEAST SQUARE WAGE CHANGE EQUATIONS[a]

Dependent Variable:	ΔLOG(W)
ΔPT/FT	-13.431 (4.192)*
ΔUNION	2.232 (1.600)
$\Delta AGE^2/100$	-0.030 (0.014)**
Δ% UNION	-0.257 (6.552)
Δ% MALE	5.744 (0.953)
INTERCEPT	9.132 (7.254)
CONTROLS FOR OCCUPATION CHANGES	YES
OBSERVATION	4,431
ADJ. R^2	0.012

Numbers in () are standard errors.
*significant at 1% level; **significant at 5% level.

(a) Private sector, non-agricultural, wage and salary workers. The longitudinal data required to estimate wage change equations were obtained by matching the respondents in the May 1983 Current Population Survey with those in the 1984 Current Population Survey earnings file. This earnings file contains the survey responses of all individuals in outgoing rotations for each month in 1984. Respondents were matched by household i.d. number, line number, age, race and gender. The 1984 responses did not include data on health, pensions, plant size or tenure. See the Data Appendix for a description of the variables.

experiences a fall in earnings. The magnitude of the earnings loss, however, is smaller than that implied by the cross-sectional estimates. Industry changes that increase PT/FT by 0.23 (about the one standard deviation change considered in the cross-sectional estimates) reduces hourly earnings by 3.1 percent. This compares with the 6.9 percent predicted on the basis of the cross sectional estimates presented in Table 2.

[Insert Table 4 about here.]

V. CONCLUSION

This paper has presented a model of dual labor markets in which jobs are difficult to monitor and product demand is uncertain. Three implications of the model are emphasized. First, in equilibrium, wages paid to primary workers will exceed those paid to contingent workers and there will be an excess supply of workers to primary jobs. Second, depending on monitoring and production technology, a firm may choose to hire all primary workers, all contingent workers, or a mix of primary and contingent workers to perform the same job. This property holds even when primary and contingent workers are perfect substitutes in production. Third, firms will prefer to hire into primary jobs workers with low quit rates and those workers whose preferences lead them to prefer long hours. Thus, part-time workers will tend to hold contingent jobs—although not all contingent workers will be part time.

Our model thus implies that within an industry, some mix of primary and contingent jobs will typically exist. In industries with a high concentration of part-time workers, a relatively large proportion of full-time workers will also be contingent workers. The empirical finding that the wages and benefits of full-time workers are significantly reduced in industries with large concentrations of part-time workers appears consistent with this hypothesis.

The findings presented in this paper suggest a number of avenues for future research. On an empirical level, it is important to construct more direct measures of the numbers of primary and contingent workers and to estimate the extent of the excess supply of workers for primary jobs. On a theoretical level, it would interesting to explore how different macroeconomic regimes influence the quality of job offers by influencing firms' preferred mix of primary and contingent workers.

NOTES

1. See, for example, Doeringer and Piore (1971), Osterman (1975), Edwards (1979), Gordon, Edwards and Reich (1982), and Dickens and Lang (1985), as well as the studies reviewed in Cain (1976) and Lang and Dickens (forthcoming).

2. Dismissal based effort-regulation models are part of the larger class of efficiency wage models. Discussions of the properties of both efficiency wage and effort regulation models include Stiglitz (1987), Bowles (1985), and Gintis and Ishikawa (1987). Of these papers, our work is perhaps closest in spirit to Gintis and Ishikawa because of our interest in endogenously determined employee exit probabilities. Gintis and Ishikawa focus on firms' dismissal behavior, whereas we follow Rebitzer and Taylor (forthcoming) in examining the implications of uncertainty for firms' layoff strategies.

3. Numerous analysts have noted that firms make use of various types of contingent workers to buffer their primary work force from variations in product demand. See, for example, Abraham (1986), Applebaum (1987), and Mangum, Mayall and Nelson (1985).

4. See Krueger (1989) for a discussion of the lack of employee protections against dismissal in the United States.

5. These expressions presume that firms do not try to recall the primary workers they have previously laid off. Layoffs and recall are commonly used in the United States and they can be introduced into this model in a straight forward fashion. However, allowing firms to recall laid off workers considerably complicates the mathematics of our model without altering our fundamental conclusions. We therefore do not consider the issue of layoff and recall in this paper.

6. This derivation of the no-shirking wage presumes that workers do not post performance bonds and that workers are paid in each period prior to the observation of their work activities in each period. The possible role played by performance bonds in labor markets is controversial. For discussions of this issue see Lazear (1979), Lang (1989), Akerlof and Katz (1989) and Dickens, Katz, Lang and Summers (1989).

7. This expression for the layoff probability is based on the simplifying assumption that workers are laid off at random from the pool of primary workers hired *ex ante*.

8. Despite our concavity assumptions concerning $e_1(N)$ and $e_2(N)$, we cannot be cetain about the shape of $E(N)$. Similarly, $D(N)$ can in general be either concave or convex. Relaxing assumptions that $E(N)$ and $D(N)$ are linear introduces the possibility that workers in primary jobs may be "overworked" in the sense of working more hours than they would optimally choose or "hours constrained" in the sense of working less than their optimal hours. These issues are discussed at length in Rebitzer and Taylor (1990).

9. More detailed analysis also finds that job tenure is significantly reduced for part-time workers. Rebitzer (1986) presents an empirical examination of the determinants of job tenure. In an unpublished appendix to Rebitzer's paper, it is reported that after

controlling for personal characteristics, compensation at the current job, alternative job opportunities, non-wage union effects, education, job skills, and plant size, part-time status reduced female job tenure by 14 percent and male job tenure by 10 percent.

10. Freeman (1984) points out that measurement error is likely to increase in wage change equations. This error will tend to depress the observed "part-time effect" even in the absence of unmeasured personal characteristics.

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Data Appendix

Variables Used In Tables 2, 3, and 4

Dependent Variables:

log(*W*)[1] : The natural log of hourly earnings. Hourly earnings were calculated by dividing usual weekly earnings by usual weekly hours at the respondent's primary job. Questions on earnings and usual hours at the primary job were asked of out-going rotations in May and June of 1983. The June responses were matched to the May 1983 CPS survey of pension and retirement plan coverage.

HEALTH INSURANCE[1] : A dichotomous variable equal to 1 if the respondent was in a group health insurance plan at work.

PENSION1[1] : A dichotomous variable equal to 1 of the respondent worked for an employer who offered a pension plan.

PENSION2[1] : A dichotomous variable equal to 1 if the respondent was included in a pension plan at work.

Δ log(*W*)[2] : The change in the natural log of hourly earnings from 1983 to 1984 multiplied by 100.

Independent Variables:

PT/FT[1] : The ratio of part-time to full-time workers employed in two-digit census industries.

EDUCATION[1] : Years of schooling.

TENURE:[1] : Years with current employer.

WHITE[1] : A dummy variable equal to 1 if the respondent is white.

AGE[1] : Age.

UNION[1] : A dummy variable equal to 1 if the respondent is covered by a union or an employee association contract.

PLANTSIZE2 – *PLANTSIZE5*[1] : Four dummy variables indicating respondents' estimates of the number employed at the work site. Variables correspond to each of the following size categories: 25-99; 100-499; 500-999; and 1,000+.

%UNION[1] : The ratio of union members employed in an industry to all full-time workers in the industry.

%MALE[1] : The ratio of the full-time male workers in the industry to all full-time workers in the industry.

Δ*PT/FT*[2] : The change in the ratio of part-timers to full-timers as a result of changes in industry status between 1983 and 1984.

Δ$AGE^2/100$[2] : The change in [(AGE^2)/100] from 1983-1984.

ΔUNION[2] : Measures change in union status between 1983 and 1984. The variable is equal to 1 if an employee joined a union 1983-1984; -1 if the employee left a union; and 0 otherwise.

Δ%*MALE*[2] : The change in the ratio of male full-timers to all full-timers in the industry that occurs due to changes in industry status 1983-1984.

Δ%UNION[2] : The change in the ratio of union members to all full-timers in the industry that occurs due to changes in industry status 1983-1984.

OCCUPATION CONTROLS : Dummy variables indicating employment in one of 13 census occupation groups.

SMSA + DIVISION CONTROLS : Dummy variables indicating residence in 8 census divisions; in SMSA's with 1-3 million inhabitants; and SMSA's with more than 3 million inhabitants.

(1) Data taken from the May 1983 *CPS* survey of pension and retirement plan coverage.

(2) Data derived by matching 1983 respondents with responses in 1984 *Current Population Survey* earnings file. For a description of the construction of this data set see Table 4. Variables Δ*PT/FT* , Δ%UNION, AND Δ%*MALE*, were calculated under the assumption that industry values for *PT/FT* , %UNION , and %*MALE* were unchanged between 1983 and 1984.