WORKER EFFORT DECISIONS AND EFFICIENT GENDER-SPECIFIC WAGE-TENURE PROFILES

JONI HERSCH and PATRICIA B. REAGAN*

Despite theoretical arguments that predict the opposite, empirical estimates of workers' returns to tenure tend to be greater for female than for male workers. This paper develops an agency model of wage contracts to explain this empirical finding. If male and female workers differ only in the expected length of their working lives, efficient wage-tenure profiles are steeper for women than men as a direct result of their shorter working life. This result implies that returns to tenure for women and men will become comparable as women's and men's labor force attachments converge.

I. INTRODUCTION

During the past thirty years women have increased their labor force participation. Female labor market intermittency has decreased and women's total labor market experience and years of tenure with the current employer have increased. What these trends imply about the evolution of the gender gap in wages depends in part on gender differences in returns to tenure. It is, therefore, surprising that economists have all but ignored the empirical finding that women have higher returns to tenure than do men over a significant portion of their working lives. One reason why this finding has been ignored or treated as an anomaly may be the lack of theoretical constructs which predict an inverse gender gap in returns to tenure.

Several labor market models predict that women should have lower returns to tenure than men. Human capital theory offers the most frequently cited explanation of flatter earnings profiles for female workers. According to human capital theory, gains from specialization and exchange lead to one household member specializing in home production and the other in market work. Since only women bear children, historically the outcome of the exchange has been that women have specialized in home production. Indeed, all surveys of time use indicate that women spend on average two to three times as long on housework as men. As a consequence of this allocation, women anticipate intermittent labor force participation and fewer years overall in the labor force than men. This pattern too is borne out in national surveys, which invariably find shorter average tenure and fewer total years of labor market experience for women than for men. Women typically have shorter completed job spells as well. Hall [1982, Table 5] presents evidence that the gender gap in completed job duration is quite large. He estimates that 63.8 percent of men, but only 49.6 percent of women hold jobs with eventual tenure of at least five years, with 37.3 and 15.1 percent of men and women, respectively, holding jobs with eventual tenure of at least twenty years.

Because of the greater intermittency and shorter anticipated work history for women than men, women will find it optimal to acquire less human capital than men.1 Lesser quantities of general human capital.

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1. E.g., Mincer and Polachek [1974], Polachek [1975].

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capital tends to flatten both the observed earnings-experience profile and the observed earnings-tenure profile. Two factors contribute to this pattern. First, skills deteriorate during periods out of the labor market, as in Mincer and Polachek [1974], which flattens the earnings-experience profile for women relative to men. Second, women anticipating discontinuous work histories select into occupations with flatter earnings profiles to minimize the penalty to labor force withdrawals, as in Polachek [1981].

The effects of firm-specific human capital on gender differences in wage-tenure profiles vary across models. For example, Kuhn [1993] constructs an elegant game theoretic model of gender differences in training and wages. If women have a higher exogenous exit rate than men, in equilibrium they will be placed in jobs with lower levels of firm-specific training. With a positive relation between training and productivity and a common share rate of the costs and benefits of specific training for men and women, the wage-tenure profiles of men will be steeper than those for women.

In contrast, Becker and Lindsay [1994] argue that firm-specific human capital leads to higher returns to tenure for women than men. Becker and Lindsay assume that men and women have the same level of firm-specific training. However, women have greater variance in their opportunity cost of remaining with a firm and so are more likely than men to separate inefficiently. By giving women a greater share of both the costs and benefits of firm-specific human capital through a steeper wage-tenure profile, firms reduce undesirable turnover.

Although human capital arguments dominate the literature on gender differences in the labor market, other models of wage growth predict flatter wage-tenure profiles for women. In self-selection models, such as those of Salop and Salop [1976] and Barron, Black, and Loewenstein [1993], steeply sloped wage-tenure profiles are used to discourage workers with high turnover propensities from seeking employment in firms whose production processes require long commitments to their firm. Thus women are predicted to select into jobs with flatter wage-tenure profiles as a consequence of their (assumed) higher turnover propensities.

Lazear and Rosen [1990] argue that gender differences in the probability of promotion, generated by the assumed higher opportunity cost of non-market time for women, lowers the level of women’s wages and their wage growth rate. Milgrom and Oster [1987] develop a model which implies lower returns to human capital investments for disadvantaged workers (e.g., “invisibles”) as employers receive rents and conceal the ability of disadvantaged workers from potential outside employers. This concealment permits the current employer to pay high ability invisibles less than their marginal product. Goldin [1986] develops an agency model in order to explain late nineteenth century gender differences in methods of compensation. She assumes that women work only one period whereas men work multiple periods. Thus men, but not women, have access to deferred compensation contracts. Goldin argues that these differences led to positively sloped wage profiles for men and to piece-rate compensation for women, which precludes wage growth over time.

Despite the prevalence of theoretical literature predicting flatter earnings profiles for women, the empirical literature does not provide consistent support for such predictions. In section II, we discuss a number of studies using direct measures of tenure and experience. These studies consistently find returns to tenure for women at least as great as those for men, and in some cases, substantially higher.

We then provide a theoretical rationale for this commonly observed steeper wage-tenure profile for female workers. We develop an agency model in which a worker’s productivity is a function of ef-
fort. If all workers work multiple periods, but men work more periods than women, our model predicts higher returns to tenure for female workers as a direct consequence of their shorter working lives. However, workers with similar work histories will have similar returns to tenure. This result suggests that the inverse gender gap in returns to tenure is primarily generational and will disappear as women’s and men’s labor force attachments converge.

II. SURVEY OF ESTIMATES OF RETURNS TO TENURE

While the theories discussed above make predictions about returns to tenure, much empirical research has been based on data sets that either lack years of tenure, years of experience, or both, or do not have samples of men and women of comparable ages. Indeed, the bulk of empirical research on earnings differences by gender uses potential experience, defined as age – years of schooling – 5, rather than actual work experience, as the only control for work history.

Not surprisingly, the waves of the University of Michigan Panel Study of Income Dynamics (PSID) which ascertain detailed information on work history for both men and women are widely used to investigate differences in earnings between men and women. Part A of Table I presents estimated returns to tenure from studies using data from various years of the PSID. Since a number of these studies used identical specifications of work history, but different control variables, a comparison of the sensitivity to specification of estimates of returns to tenure is possible.

The first set of studies presented in Part A of Table I, by Corcoran and Duncan [1979], Duncan and Hoffman [1979], Hill [1979] and Wellington [1993], all use the 1976 PSID. Wellington also uses the 1985 wave in addition to the 1976 wave. Tenure is divided into three segments, which are entered linearly into the wage equation. Estimated returns to tenure for white women tend to be larger than for white men, although the differences are not significant.

Becker and Lindsay [1994] use data from the 1983–87 waves of the PSID. Their empirical specification differs from the other studies discussed above, but tenure is also entered linearly into their wage equations. Their results find little difference between the return to tenure by gender for individuals who ended their jobs with less than five years of tenure, but substantially larger differences by gender, favoring women, for those with more than five years of tenure in 1987.

By examining the estimated effects of tenure on wages in the studies allowing a quadratic effect of tenure (Gronau [1988], using the 1976 PSID; Sorensen [1990], using the 1984 PSID), we see that women appear to have significantly steeper initial returns to tenure than men, with an earlier peak. This suggests that allowing only a linear effect of tenure may bias downward the true effect of tenure on wages, with the magnitude of the bias greater for women than for men.

Since these studies use a common data set, albeit over different years, in a sense they do not genuinely provide independent evidence on returns to tenure. Part B of Table I presents estimated returns to tenure from studies using other data sets,
<table>
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<tr>
<th>Author</th>
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<td>Tenure</td>
<td>Tenure²</td>
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<td>PART A: Studies using Michigan Panel Study (PSID)</td>
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<td>Gronau 1988</td>
<td>1983–87 PSID</td>
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<td>-.0003 (.0007)</td>
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<td>PART B: Other studies with data on both tenure and actual experience</td>
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<td>1984</td>
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<td>-.0001 (.0025)</td>
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<td>.0115 (.0027)</td>
<td>.0133 (.0024)</td>
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<td>Malkiel &amp; Malkiel</td>
<td>professional employees of a single firm employed in 1969</td>
<td>H.</td>
<td>.049 (.007)</td>
<td>.001 (.0002)</td>
<td>.074 (.009)</td>
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<td>Hersch</td>
<td>employees of 18 firms in 1986</td>
<td>I.</td>
<td>.027 (.005)</td>
<td>-.006 (.0002)</td>
<td>.057 (.008)</td>
<td>-.002 (.0003)</td>
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Samples:
A. 1976 PSID, household heads and wives age 18-64, employed in 1976 who worked at least 500 hours in 1975.
B. 1976 and 1985 waves of PSID. Samples included individuals who were white, either head or wife, ages 25-62, not self-employed, employed at least 250 hours in preceding year, and employed at time of interview. Estimates were done using 1976 and 1985 cross-sections as well as using individuals meeting the criteria in both 1976 and 1985.
C. 1983-85 PSID white, non-self-employed.
E. 1984 PSID. All household heads and wives at least 18 years old who report hourly earnings.
G. 1940 Women's Bureau Bulletin of male and female clerical workers.
H. Professional employees employed in 1969 at a single firm.
I. Wage and salary workers employed in 18 firms in Oregon in 1986.

Dependent variables and control variables:
i. log of hourly wage; years out of labor force since completing school, pre-employer work experience and its square, years of training completed on current job, proportion of total working years that were full time, 1975 hours of work missed due to illness (of others and to own illness), limits on job hours or location, plans to stop work for non-training reasons, education, city size, whether South.
ii. log of hourly wage; years of training completed, pre-employer work experience and its square, education, city size, whether South.
iii. log of hourly wage; marital status, number of children under 18 in family unit, whether South, city size, education, years out of labor force since completing school, pre-employer work experience and its square, years of training completed, proportion of total working years that were full time, whether had many different kinds of jobs, annual hours worked in 1975 and its square, whether has disability, 1975 hours of work missed due to illness (of others and to own illness), limits on job hours or location, plans to stop work for non-training reasons.
iv. log of hourly wage; years out of labor force since completing school, pre-employer work experience and its square, years of training completed on current job, number of years worked full time, currently working part-time, previous year's hours of worked missed due to illness (of others and to own illness), education, city size, whether South.
v. log of real wage; age and its square, experience and its square, schooling, children, married, industry dummy variables.
vi. log of hourly earnings; estimated jointly with labor force separations. Other controls are education, experience, union status, whether government job, marital status, race, whether South, years of training required, on-the-job training, time out of labor force, whether health impairment.
vii. log of hourly earnings; proportion female in occupation, education, college degree, advanced degree, actual work experience and its square, home time, region, city size, race, marital status, children, full-time last year, 5 job characteristics from Dictionary of Occupational Titles, government employment, union status, detailed industry.
viii. log of weekly wages; years since beginning work and its square, years in present employment and its square, marital status, education.
ix. log of full time salary; total experience and its square, whether work with current employer has been continuous, number or proportion of years worker has been furloughed, marital status, years of education, home time (for women).
x. log of annual salary; education, Ph.D., publications, marital status, whether education provided critical skills for firm, absence rate.
xi. log of hourly wage; experience and its square, education, race, whether handicapped, marital status, number of children, time on housework and on child care, training time, firm size, union status, supervisory status, job hazards, job responsibilities, physical requirements of job, travel time.
which have data on both tenure and actual work experience.

Eichengreen [1984] uses historical data from wage earners in California in 1891–92. Using a quadratic specification for tenure, he finds significantly steeper wage-tenure profiles for women with an earlier peak. Goldin [1986] estimates wage equations using data on clerical workers. Tenure is entered linearly in the wage equation. As we found for the linear tenure specifications using the PSID, the returns to tenure are larger, but not significantly so, for women than for men.

Malkiel and Malkiel [1973] and Hersch [1991] both use firm-level data to estimate quadratic specifications of the returns to tenure.² Both studies find significantly steeper wage-tenure profiles for women, with an earlier peak.

Finally, the steeper return to tenure for women has been noted in other studies. Kuhn [1987] used data from the 1977 Canadian Quality of Life Survey, in which tenure is presented as a series of categorical variables. He notes that women have a greater return to tenure in the Canadian survey. Megdal and Ransom [1985] note that for faculty at the University of Arizona, female salaries have grown faster, and sometimes significantly so, than male salaries. Using Canadian data on displaced workers, Crossley, Jones, and Kuhn [1994] find similar returns to tenure for men and women in their pre-displacement jobs, with women experiencing greater wage losses due to displacement than men.

A number of authors have noted that OLS estimate of wage-tenure effects may be biased due to unobserved individual heterogeneity and job match quality.² Topel [1991] proposes a two-step estimator which yields a lower bound on the returns to tenure. Hersch and Reagan [1990] control directly for job match quality. Both Hersch and Reagan and Topel find that OLS estimates are not substantially biased, and the linear estimates reported in Table I fall approximately in the range estimated by Altonji and Williams [1992]. These findings give credence to OLS estimates of gender differences in the returns to tenure.

III. A MODEL OF WORKER EFFORT AND WAGE-TENUREPROFILES

The essential focus of our model is on the wage structure needed to elicit worker effort. Whereas the usual explanations of gender wage-tenure differences focus on human capital and self-selection concerns, our analysis addresses the link between the wage-tenure profiles firms design and worker effort decisions. The optimal wage structure for inducing effort will differ with the expected period of employment. As this period increases, flatter wage-tenure profiles will suffice to induce optimal effort. The reasoning is that workers with a long expected duration at the firm will have more to lose from being fired if caught shirking than would workers with shorter expected duration. Shorter duration workers will require higher wages sooner to induce the same effort, since deferred wage payoffs for hard work will matter less. The model below will formalize this result that optimal wage-tenure profiles for shorter duration workers are steeper.

The practical consequence of this result is that women will be assigned to occupations for which the wage-effort incentive mechanism provides for adequate work incentives given their shorter expected work duration at the firm. These wage structures will involve steeper wage-tenure profiles. The finding that women have a higher rate of return to tenure does not imply that women have higher wage levels. Gender differences in other human capital characteristics will affect wage levels. Our basic model makes the simplification that males and females have other-

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² Malkiel and Malkiel also present estimates for every year of the 1966–71 period. We present only the year 1966 as an example.

wise identical human capital. The model can therefore be interpreted as describing the relation between wages and tenure, net of the effects of general and firm-specific human capital. The closest analogy to the interpretation of our model’s predictions is to the coefficient on tenure in a wage regression that controls for education, experience, and training. After presenting the basic model, we discuss how differences in human capital can lead to differences in wage levels, without affecting the basic result that women have greater returns to tenure.

The treatment of firm-specific human capital is the key difference between our model and that of Becker and Lindsay [1994] which also predicts steeper wage-tenure profiles for women. In the Becker and Lindsay model, firm-specific human capital investments are assumed to be identical for men and women, although women are assumed to have greater variance in their opportunity cost of remaining with the firm. Their results rely solely on these assumptions. The Becker and Lindsay model makes no predictions about gender differences in wage-tenure profiles for workers in jobs without firm-specific capital. However, empirical evidence does not seem consistent with the assumption that men and women have equal amounts of specific human capital. Duncan and Hoffman [1979] and Lynch [1992] find that women have lower levels of specific human capital. In contrast, our model does not require firm-specific human capital: with or without specific capital, steeper wage-tenure profiles serve a productive function by inducing higher levels of work effort.

Workers

We assume that there are two types of workers—\( F \) and \( M \)—identical in every way except the lengths of their working lives. Type \( F \) works two periods, whereas type \( M \) works three periods. The information structure is straightforward. We assume that firms can observe the worker’s type and know the worklife of each type. We assume the firm can observe the number of periods that a worker has been in the labor market, for instance through employment applications or personnel records.

In each period a worker chooses whether to exert a fixed positive level of effort, \( e = e^* > 0 \), or to shirk and exert no effort, \( e = 0 \). If the worker exerts positive effort, the value of the output produced is \( h \). On the other hand, if the worker shirks, the value of the output is \( s \), with \( h > s \). The firm cannot directly observe the level of effort chosen by the worker, nor can it observe the output of a particular worker and thereby infer effort. However, the firm does have some ability to monitor effort, although the monitoring technology is imperfect. The only source of asymmetric information derives from the firm’s inability to perfectly observe effort. This informational framework has been used by numerous authors.\(^6\) The simplest way to capture the imperfection of monitoring is to assume that if the worker shirks, there is an exogenous probability, \( 0 < \mu < 1 \), that the firm detects the shirking.\(^7\) A worker caught shirking is fired. The threat of termination is the sole deterrent of shirking. As in other efficiency wage and incentive contract models, the expected future wages that a worker earns by remaining with the current employer are strictly greater than the expected wages to be earned by starting a job with a new employer.

The cost to a worker of shirking is the threat of termination and the loss of quasi-rents created by the upward-sloping wage-tenure profile that we prove is the equilibrium wage structure of the model. The benefits of shirking are two-fold. First,

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7. The predictions of the model are unaffected if \( \mu \) is stochastic, since we assume workers are risk-neutral and maximize expected utility. In this case \( \mu \) should be replaced with \( E(\mu) \) throughout the derivation of the wage contracts.
the worker avoids the direct disutility of effort. Second, workers who shirk consume other goods, such as leisure, which provide direct utility. Let $\theta$ denote the level of consumption that shirking provides. Since the realized consumption value of shirking is likely to vary across individuals and over time, we assume that, for both types of workers, $\theta$ is an identically and independently distributed random variable. We assume, without loss of generality, that $\theta$ has a uniform density on $[0,1]$.\footnote{The predictions of the model are unaffected by the particular distributional assumption that we make on $\theta$. Note that all gender differences in labor force patterns are subsumed in the assumption that men work more periods than women. Therefore, assuming gender specific distributions of $\theta$ adds complications, but otherwise does not affect the predictions of our model.}

We assume that the distribution of $\theta$ is known by all, but that its per period realization is the worker’s private information. Firms pay wages at the beginning of each period. The worker then receives private information about $\theta$ and, based on expected utility maximization, chooses whether or not to shirk.

For simplicity we assume that workers are risk neutral and have identical, separable utility functions each period. With suitable normalization, we write the realized per period utility of exerting positive effort as

$$U(w, e^*, \theta) = w - 1,$$

where the disutility of effort is normalized to $-1$. Likewise, we can write the realized per period utility of shirking

$$U(w, 0, \theta) = w + \theta.$$ 

Workers choose effort each period to maximize the expected present discounted value of utility, with a discount factor $\beta$. Given the parameterization of the problem, we assume that $1 < h - s < 2$. This assumption is necessary for shirking to be efficient in some, but not all, periods.

Wage Contracts. Contracts consist of wage rates, paid at the beginning of each period, over the life of the contract. We assume that firm can credibly offer multiperiod contracts and terminate workers if and only if they are caught shirking.\footnote{It is well understood that when the wage exceeds the value of the marginal product of labor in latter periods of a multiperiod contract, the firm has an incentive to behave opportunistically and terminate workers. We make the conventional assumption that the value of a reputation as an honest employer, determined outside of our model, solves this problem (e.g., see Lazear [1981], Shapiro and Stiglitz [1984]).} Let $w_i(j)$ denote the wage in period $i$ on a contract that lasts at most $j$ periods. Thus firms initially offer a wage-tenure profile

$$W[2] = [w_1(2), w_2(2)]$$

and

$$W[3] = [w_1(3), w_2(3), w_3(3)]$$

to types $F$ and $M$ respectively. Type $M$ workers caught shirking in period one and terminated are then offered $W[2]$. Since both types of workers are identical except for the length of their working lives, there is no difference in the two-period wage-tenure profiles of type $M$ workers caught shirking in period one and the two-period wage-tenure profile initially offered to type $F$ workers. Either type caught shirking in the next to last period receives only the spot wage, $W[1] = w_i(1)$, in the last period of their working lives.

Expected tenure is determined endogenously since some of the workers who shirk will be caught and fired. Men will have higher expected tenure than women as a consequence of their longer working lives.

Workers’ Shirking Decisions. Let $x_i(j)$ denote the probability that a worker shirks in period $i$ on a contract lasting at most $j$ periods. Working backwards recursively, we derive the worker’s utility-maximizing shirking rule for each period. The aim is to determine the range of values of $\theta$ over which the worker shirks and from that cal-
calculate the ex ante probability of shirking in each period. Workers shirk if the gain exceeds the expected value of the quasi-rents. The incentive compatibility constraints determine the probability that workers shirk as a function of the wage profiles offered by the contracts.

In the final period of each of the three contracts there are no future quasi-rents and workers shirk with probability one. In other words, for all values of \( \theta \) the worker exerts no effort. Thus,

\[
x_t(1) = x_2(2) = x_3(3) = 1
\]

The expected utility from the consumption that shirking provides is

\[
\int_0^1 \theta d\theta = \frac{1}{2}.
\]

Working backwards recursively, workers shirk in period one of the two-period contract for values of \( \theta \) such that

\[
\theta \geq -1 + \beta \mu[w_2(2) - w_1(1)].
\]

The probability of shirking in period one of a two-period contract is

\[
x_t(2) = \int_{\theta \geq -1 + \beta \mu[w_2(2) - w_1(1)]} \theta d\theta = 2 - \beta \mu[w_2(2) - w_1(1)].
\]

The expected disutility of effort plus the expected utility of consumption from shirking in period one of a two-period contract is

\[
y_2(3) = 1 - (\beta \mu[w_3(3) - w_1(1)])^2 / 2.
\]

Workers shirk in period two of the three-period contract for values of \( \theta \) satisfying\( ^{11} \)

\[
\theta \geq -1 + \beta \mu[w_3(3) - w_1(1)].
\]

The probability of shirking is

\[
x_2(3) = 2 - \beta \mu[w_3(3) - w_1(1)].
\]

The expected disutility of effort plus the expected utility of consumption from shirking in period two of a three-period contract is

\[
y_4(3) = 1 - (\beta \mu[w_3(3) - w_1(1)])^2 / 2.
\]

Similarly, workers shirk in period one of a three-period contract for values of \( \theta \) in which\( ^{12} \)

\[
\theta \geq -1 + \beta \mu[w_3(3) + \frac{1}{2}] + \beta \mu[w_1(1) + \frac{1}{2}]
\]

Again the left-hand side is the expected utility of shirking and the right-hand side is the expected utility of exerting effort. The expression is analogous to the shirking condition in period one of the two-period contract.

11. Workers shirk in period two of the three-period contract whenever

\[
\theta + \beta(1 - \mu)[w_3(3) + \frac{1}{2}] + \beta \mu[w_1(1) + \frac{1}{2}] \\
\geq -1 + \beta[w_3(3) + \frac{1}{2}].
\]

12. Workers shirk in period one of the three-period contract whenever

\[
\theta + \beta(1 - \mu)[w_2(3) + y_3(3) + \frac{1}{2}] + \beta \mu[w_1(1) + \frac{1}{2}]
\]

As before, the left-hand side of the inequality is the expected utility of shirking and the right-hand side is the expected utility of exerting effort.
\[ \theta \geq -1 + \beta \mu (w_2(3) + y_2(3) + \beta x_2(3)[\mu w_1(1) + (1 - \mu)w_3(3)] + \beta[1 - x_2(3)]w_3(3)) - \beta \mu (w_1(2) + y_1(2) + \beta x_1(2)[\mu w_1(1) + (1 - \mu)w_2(2)] + \beta[1 - x_1(2)]w_2(2)). \]

The probability of shirking is

\[ x_1(3) = 2 - \beta \mu (w_2(3) - w_1(2)). \]

The expected disutility of effort plus the expected utility of consumption from shirking in period one of a three-period contract is

\[ y_1(3) = 1 - (\beta \mu (w_2(3) - w_1(2)))^2 / 2. \]

**Zero-Profit Wage Contracts.** Competition in the labor market implies that firms earn zero expected profits on each of the three contracts. Using (1), (2), (4) and (6) the zero-profit conditions are:

(8.a) \[ s - w_1(1) = 0, \]

(8.b) \[ [1 - x_1(2)]h + x_1(2)s - w_1(2) + \beta[1 - \mu x_1(2)][s - w_2(2)] = 0, \]

and

(8.c) \[ [1 - x_1(3)]h + x_1(3)s - w_1(3) + \beta[1 - \mu x_1(3)][(1 - x_2(3)]h + x_2(3)s - w_2(3) + \beta[1 - \mu x_2(3)][s - w_3(3)] = 0, \]

where \([1 - \mu x_i(j)]\) is the probability that a worker on a \(j\)-period contract employed in period \(i\) will remain on the job in period \(i + 1\).

**Efficient Gender-Specific Wage-Tenure Profiles.** Efficient gender-specific wage-tenure profiles maximize the workers’ expected utility subject to the firm’s zero-profit constraint, given the information structure and the technology for monitoring and enforcing contracts. By assuming that firms earn zero profits, we are looking at one particular allocation of rents among the interested parties. However, our results hold qualitatively for any such allocation.

It follows directly from (8.a) that the equilibrium one-period contract is

\[ W*[1] = [w_1*(1)] = (s). \]

Given (1), the worker’s expected utility from a one-period contract is

\[ w_1(1) + \frac{\nu}{2} \]

Since there is a positive probability that a worker will be fired from a two-period contract, the worker’s expected utility from a two-period contract is in part a function of the utility from a one-period contract. The worker’s expected utility from the two-period contract is

\[ w_1(2) + y_1(2) + \beta[1 - \mu x_1(2)][w_2(2) + \frac{\nu}{2}] + \beta \mu x_1(2)[w_1(1) + \frac{\nu}{2}], \]

where \(x_1(2)\) satisfies (2), \(y_1(2)\) satisfies (3) and \(w_1(1)\) satisfies (9). The first term in the worker’s expected utility from the two-period contract is the first-period wage, which is paid with probability one. The second term is the sum of the expected disutility of effort and the expected utility of consumption from shirking in period one. The third term is the discounted value of the sum of the probabilities that the worker does not shirk and shirks, but is not caught shirking, times the second-period wage plus the expected utility of period-two consumption from shirking. The fourth term is the discounted value of the probability that the worker shirks and is caught times the utility of the one-period contract.

The two-period contract maximizes (11) subject to (8.b). The equilibrium contract is

\[ W*[2] = [w_1*(2), w_2*(2)] \]

\[ = [h - (h - s) / \mu, s + (h - s) / \beta \mu]. \]
By the above rationale, since a worker beginning three-period contract could be fired after either period one or period two, the worker’s expected utility from a three-period contract is a function of the expected utility from both the one- and two-period contracts. Formally, the expected utility from a three-period contract is

\[
(13) \quad w_1(3) + y_1(3) + \beta[1 - \mu x_1(3)]
\]

\[
(w_2(3) + y_2(3) + \beta[1 - \mu x_2(3)][w_3(3)]
\]

\[
+ \frac{1}{2} \beta \mu x_2(3)[w_1(1) + \frac{1}{2}]
\]

\[
+ \frac{1}{2} \beta \mu x_1(3)[w_2(1) + \frac{1}{2}]
\]

\[
+ \frac{1}{2} \beta \mu x_1(2)[w_1(1) + \frac{1}{2}],
\]

given (2)–(7), (9), and (12). The intuition behind each term in the expected utility from a three-period contract is similar to that of a two-period contract, although its formulation is more complex due to the additional potential for termination on the longer contract.

The three-period contract maximizes the worker’s expected utility subject to (8.c). The equilibrium contract is

\[
(14) \quad W^*[3] = [w_1*(3), w_2*(3), w_3*(3)]
\]

\[
= \frac{h - (h - s)}{\mu},
\]

\[
h + (1 - \beta)(h - s) / \beta \mu, s + (h - s) / \beta \mu.
\]

Notice that the equilibrium wage contracts in (9), (12), and (14) induce efficient shirking, where efficient shirking occurs if and only if \( \theta \geq -1 + h - s \).

The properties of equilibrium wage-tenure profiles are described below.

RESULT 1: \( W^*[2] \) and \( W^*[3] \) have positive slopes, and \( W^*[2] \) is more steeply sloped than \( W^*[3] \).

Proof: Comparing the equilibrium two- and three-period wage-tenure profiles, both are upward sloping because

\[
w_1*(2) < w_2*(2)
\]

and

\[
w_1*(3) < w_2*(3) < w_3*(3).
\]

Moreover, \( W^*[3] \) is concave with

\[
w_1*(3) - w_1*(3) = (h - s) / \beta \mu
\]

\[
> w_3*(3) - w_2*(3) = (h - s)(1 - \mu) / \mu.
\]

Finally, the two profiles have common starting and end points,

\[
w_1*(2) = w_1*(3)
\]

and

\[
w_2*(2) = w_3*(3).
\]

Therefore, \( W^*[2] \) is everywhere more steeply sloped than \( W^*[3] \).

Q.E.D.

RESULT 2: The average wage of the two-period contract is less than the average wage of the three-period contract.

\[
[w_1*(3) + w_2*(3) + w_3*(3)] / 3
\]

\[
> [w_1*(2) + w_2*(2)] / 2.
\]

Q.E.D.

We note that the prediction of our model for the divergence of wages from the expected marginal product of labor is consistent with those of other moral hazard models. Wages are below the expected marginal product of labor in the first period of both contracts and rise above it in the final period. We note also the dependence of our model on the assumption that both types of workers are employed in deferred compensation jobs.13

13. An alternative approach is to assume, as do Bulow and Summers [1986] and Goldin [1986], that there are two types of jobs in the economy: jobs that cannot easily be monitored on which workers receive deferred compensation, and jobs that are easily monitored and pay a spot wage equal to the marginal product. Under these conditions workers whose expected time in the labor market is sufficiently short may prefer the spot to the deferred compensation contract. With this kind of sorting of workers to jobs, workers with long expected job duration may have faster, not slower, average growth of earnings with tenure than workers with short expected job durations, even though the opposite relation would exist among workers employed in deferred compensation jobs. The net effect on average wage-tenure profiles is an empirical question.
The intuition underlying the properties is as follows. First, since we net out the effect of human capital, the terminal wages on the two- and three-period contracts are identical. This is because terminal period wages are set solely to induce efficient shirking in the previous period. The second period wage, \( w^*_3(3) \), is set to induce efficient shirking in period one of the three-period contract. It is lower than \( w^*_3(3) \) because part of the expected quasi-rents which deter period-one shirking come from the worker's probable claim on period-three quasi-rents. If \( w^*_3(3) = w^*_3(3) \) there would be too little shirking relative to the efficient level of shirking. The final point of comparison between the two- and three-period contract lies in the period-one wages, which are identical. First-period wages play no role in affecting shirking. They are determined residually by the zero-profit conditions. Intuitively, they are the same because inefficient shirking occurs only in the final period of the multi-period contracts.

**Human Capital.** The model described above is a model of gender differences in returns to tenure and not a model of gender differences in wage levels. The common starting and ending wages are an artifact of the ceteris paribus framework in which the model should be interpreted. When general human capital is introduced into the model, the prediction that women have greater returns to tenure remains, but wage levels vary by gender with differences in the amount of human capital acquired.

We can demonstrate the effect of general human capital by considering work experience. Since men spend more years in the labor force than do women, they acquire more experience by the end of their working lives. Assume that each year of experience increases the wage level by \( g \). In Figure 1, the solid lines indicate the wage-tenure profiles, net of the returns to other exogenous variables. The dashed lines indicate wage-tenure profiles includ-

ing returns to experience. The diagram illustrates how, in our model, constant returns to experience raises men's terminal wages above women's terminal wages, without affecting the returns to tenure.

Firm-specific human capital can be introduced into the model by assuming all workers undertake some training in the first period. As usual in such models, workers and firms share the costs and benefits of firm-specific training, which affects the slope of the wage-tenure profile. The effect on the gender gap in wage-tenure profiles will depend on gender differences in the level of firm-specific human capital and on the efficient share rates. If women workers acquire less specific capital than men, the gender gap in returns to tenure will be narrower (or may disappear) than in the absence of specific capital. If women and men acquire the same amount of specific capital, but women have a higher share rate, as in the Becker and Lindsay model, the gender gap in returns to tenure may be even greater. However, given the empirical observations that women acquire less specific capital than men but nonetheless have steeper wage-tenure profiles, this suggests that for women, the incentive effects of steeper wage-tenure profiles dominate the dampening effect of less specific capital.

**IV. CONCLUDING REMARKS**

Although the dominant models of wage growth predict flatter returns to tenure for women workers as a result of shorter expected work histories, empirical estimates do not provide consistent support for this prediction. This paper provides a model which predicts a steeper wage-tenure profile for women than for men. Given the assumption that men and women differ only in the length of their working lives, the model predicts that efficient wage-tenure profiles are steeper for women than men as a direct result of their shorter working life, whether or not workers are in jobs with human capital.
It is well known that young workers of both genders have high turnover rates. There is also strong evidence that expected tenure is converging for younger men and younger women workers. Although women are still more likely to leave the labor force than men, men are more likely to leave one job for another. The trends over time suggest that younger male and female workers have increasingly similar median years of tenure, as calculations from the Current Population Survey indicate. Our model, thereby, predicts that differences by gender in the returns to tenure will be smallest among workers with similar expected tenure, with older workers having a larger gender gap in wage profiles.

The model also makes predictions about relative slopes of wage-tenure profiles for workers near and less near retirement. The wage-tenure profile of older workers who begin long term jobs will be steeper than that of comparable younger new hires. However, jobs taken by workers near retirement are often “bridge jobs” which do not offer deferred compensation and will have little wage growth with tenure. This sorting effect will dampen the estimated wage-tenure profile of older workers.

14. See Light and Ureta [1990].
Because of legal and institutional constraints, it is unlikely that the empirical finding of steeper wage-tenure profiles for women results from men and women receiving different returns to tenure within identical jobs. Instead, the gender gap in wage-tenure profiles is more likely to result from occupational segregation by gender, as firms offer steeper returns to tenure in occupations which predominantly employ women. Again, as occupational segregation by gender decreases, we expect convergence of the slopes of the wage-tenure profiles.

While we provide one model consistent with the empirical evidence, it is important to note that gender differences in wage-tenure profiles may be affected by factors other than shirking. For instance, statistical discrimination could lead to steeper wage-tenure profiles for women than men. Women who believe that their productivity is underestimated may accept a lower starting salary and experience more rapid wage growth as wages rise to correspond to revised estimates of their productivity.

Our model provides an alternative, or supplemental, interpretation to the observation that women’s earnings rebound rapidly after reentry into the labor market. Mincer and Ofek [1982] interpret the rebound as restoration of depreciated human capital. Corcoran, Duncan, and Ponza [1983] interpret the rebound as due to improved information about the productivity of the worker, or as due to an improved job match as the reentering worker learns more about the labor market and her abilities.

Despite the prominence of arguments attributing women’s lower earnings to lower returns to tenure due to intermittent labor force participation, the evidence presented here does not support this explanation of the gender wage gap. Narrowing of the gender disparity in levels of tenure should therefore lead to a continued narrowing of the wage gap, consistent with the observed narrowing of the gender wage gap over the 1970s and 1980s, as in Blau and Beller [1988] and O’Neill and Polacheck [1993].

REFERENCES


