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**JOB PERFORMANCE, TURNOVER  
AND  
WAGE GROWTH**

**John H. Bishop**

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Center for Advanced Human Resource Studies  
New York State School of Industrial and Labor Relations  
Cornell University  
Ithaca, NY 14851-0952  
607/255-2742

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## ABSTRACT

### JOB PERFORMANCE, TURNOVER AND WAGE GROWTH

The paper tests and finds strong support for the hypothesis that in the nonunion sector of the economy, turnover is negatively selective on a worker's job performance. At establishments with about 17 employees, a worker who is one standard deviation (21 percent) less productive than average during the first few months on the job is 11 percentage points more likely to be laid off or fired and 7 percentage points more likely to quit during the succeeding year. At large nonunion establishments and in small labor markets, productivity has very large effects on risks of an involuntary separation but almost no effect on the propensity to quit. Productivity appears to be positively related to layoffs and quits at unionized establishments.

## I. Introduction

When an employment contract is initiated, neither party knows how well the match is going to turn out. As the match is experienced, some workers are discovered to be less productive than others and some are discovered to be more productive. This may cause the employer or employee to become dissatisfied with the terms of the original agreement. A common contract form has the more reliable party -- the employer -- promising to give larger wage increases to the more productive workers. For those with about one year of tenure at the firm, relative wage rates are influenced by contemporaneous measures of relative productivity even when background characteristics are controlled. The response is not very large, however. The elasticity of wage rates with respect to a supervisory assessments of productivity on a ratio scale is only .2 at establishments with 17 employees and roughly zero at nonunion establishments with 400 or more employees (Bishop 1987).

A number of reasons have been proposed for the apparent preference of workers and employers for contracts which limit how contingent pay is on individual job performance: the unreliability of the feasible measures of individual productivity (Hashimoto and Yu 1980), risk aversion on the part of workers (Stiglitz 1974), productivity differentials that are specific to the firm (Bishop 1987), the desire to encourage cooperation by coworkers (Lazear 1986) and union preferences for pay structures which limit the power of supervisors. In addition, rewards for better than average job performance may be stretched out over many years or come in non-pecuniary forms -- praise from one's supervisor, more relaxed supervision, or a high rank in the firm's social hierarchy (Frank 1984).

The other way employers may respond to productivity differentials between workers is by promoting the most productive and firing the least productive (Barron and Loewenstein 1985). Many employment contracts (both explicit and implicit) limit the firm's flexibility in setting wage rates but offer it great flexibility in releasing unproductive new hires during a probationary period that may last as long as 6 months or a year. One reason why firms fire less-productive workers rather than offering them a lower wage is that it can be very costly to individually negotiate wages each year. As a worker gains tenure on the job, the specificity of the job match increases. Renegotiating wage rates after specific training is completed will be very costly because the gap between the threat points of each party can be quite large and the incentives for strategic behavior are strong (Hashimoto and Yu 1981).

A second reason for such contracts might be morale considerations. Retaining an unproductive worker who has been chastened by receiving a salary cut or demotion may be bad for morale. The bitterness that such an event causes may result in grievances being filed against the company, efforts to organize a union, further declines in the worker's productivity, damage to the morale and cohesiveness of the work group, and sabotage (Akerlof 1982).

This paper examines the impact of differentials in realized productivity on the differentials in turnover and promotion of new hires occupying the same job. In the process we expect to gain a better understanding of the reason for the weak response of wage rates to relative productivity. To the extent that the small effect of differentials in relative productivity on within-firm relative wage rates is attributed to the unreliability of productivity measures, to worker risk aversion or to union pressure, turnover and

promotions would be expected to be equally unresponsive to measures of productivity. On the other hand, if the primary cause of the weak response of wages to productivity is the specificity of worker skills, the need to promote worker cooperation,<sup>4</sup> or the value placed on relative status in the firm, one would expect productivity differentials between coworkers of equal tenure to have much larger effects on turnover and promotions than on within-firm relative wage rates. If rewards for exceptional performance are stretched out over many years in order to generate incentives for the most capable to stay and for the least capable to leave voluntarily, we would also expect productivity differentials to have strong effects on both turnover and promotions.

Consequently, findings regarding the response of turnover to relative productivity have implications for the important theoretical issue of why it is efficient for employers to limit the degree to which job performance affects pay. If turnover, promotions and wage rates are all unresponsive to relative productivity, the inference will be that the cause of productivity's small impact is probably measurement error, risk aversion and/or union pressure. If dismissals, quits and promotions are all responsive to differentials in job performance, the inference will be that immediate rewards for outstanding job performance are modest because (1) rewards are postponed in order to induce negatively selective attrition, (2) wage differentials between coworkers are kept to a minimum to encourage cooperation, (3) wage differentials need not be great because the performance differentials are specific to the firm and/or (4) wage differentials need not be great because other forms of compensation (eg. praise, perks, and high relative status in the firm) suffice to reward and retain outstanding employees.

The extent to which turnover is negatively selective on realized relative productivity is also quite important to job-worker matching models of turnover and wage growth. If "wages always equal expected marginal products for all workers, the [matching] model generates (an average) wage growth as tenure increases" (Jovanovic 1979, p. 974). The sorting/matching model offers an explanation of rising wages with age and tenure at a firm that is thought by some to be a potential substitute for the theory of on-the-job training. In his recent review of the empirical studies of job matching, John Garen (1988) concluded:

The evidence surveyed in this paper does not reveal any consensus about the importance of the job matching model. The results from the studies of wage determination are mixed. Some of the findings imply that matching accounts for nearly all of the wage-tenure correlation, while others suggest only a part is explained by this model.

Garen attributes the inconclusiveness of the empirical work on the subject to the fact that "it is an argument about determinants of wages and turnover that are not observed with currently available data, i. e., the quality of the worker-firm match. If it were observed, the controversy is easily settled by entering such a variable into the estimation."

This paper analyzes a unique data set which contains measures of one component of the quality of the match between job and worker--the reported productivity of the individual worker relative to coworkers. The paper conducts the simple and robust test of job matching theory that Garen proposes. Sorting's effect on the growth of wages with tenure will be directly measured by determining the degree to which turnover selects out the poor performers and by calculating how much of the general rise in average productivity with early tenure is due to the sorting phenomenon.

The paper also examines how the response of turnover and promotions to productivity differentials varies across establishments and what causes this variation. Bishop's (1987) study of the effects of productivity on relative wage rates found that the wages were least responsive at unionized plants, at large establishments and in small communities. These same interactions will be tested in the turnover analysis. Unions press for seniority based layoffs and promotions and restrict the firms ability to dismiss workers. We hypothesize, therefore, that unions reduce the dependence of involuntary turnover and promotions on relative job performance. Our earlier paper suggested that the smaller responses of wages to productivity at large plants and in small communities was primarily due to the greater firm specificity of productivity differentials at large firms and in small communities. Skills are more firm specific in small labor markets because each firm has fewer local competitors. If this is the case, we would expect involuntary turnover to be more responsive to productivity differentials at large firms and in small communities. Walter Oi (1983) and Barron, Black and Loewenstein (1987) suggest instead that large establishments have different turnover behavior because of their higher monitoring costs. These hypotheses will be tested below.

The analysis will also yield insights into the causes of voluntary turnover. Some portion of the observed differences in productivity between workers in a job are not specific to the match but are instead the outcome of unobserved differences in general ability. Fama (1980) has observed that "When the firm's reward system is not responsive to performance ... the best are the first to leave." Fama's hypothesis predicts that at large unionized establishments in small communities (the environment, where wages do not respond to productivity) greater productivity will be associated with higher quit rates. All

of these hypothesis are to be tested.

The paper is organized as follows. The next section of the paper describes the data set employed in the analysis and presents and discusses tabulations of the reported productivity of new hires by whether there has been a separation and by the type of separation. The third section presents the paper's analysis of the effects of match quality on voluntary and involuntary turnover. Section 4 examines the effect of match quality on promotions. Section 5 summarizes the findings and presents estimates of the effect of the negative selectivity of turnover on the growth of the mean productivity of workers as tenure increases.

## II. Data and Specification

The NCRVE Employer Survey conducted in the late Spring of 1982 provides a unique data set for examining how the quality of the match between job and worker effects turnover. It provides retrospectively longitudinal data on the wage rates, turnover and reported productivity of 3377 new hires at 2594 different firms. Most of the respondents were the owner/manager of small firms who were quite familiar with the performance of each of the firm's employees. At larger firms interviews were typically conducted with both the personnel director and a line supervisor. The personnel director provided information on the company and the background of the employees selected for study and the supervisor provided data on the training costs and productivity of the individuals. The data is described in greater detail in the appendix.

A unique feature of this data set was the effort (that was successful in 659 cases) to obtain data on two recent hires. The first member of the pair of recently hired employees was obtained by asking the main respondent to select "the last new employee your

company hired prior to August 1981 regardless of whether that person is still employed by your company." The second member of the pair was obtained by asking the employer to select "another employee you hired [within the past 2 years] for the same or similar position but with some prior vocational training." In the event the first person selected had prior vocational training, the second person selected was not to have had such training.

While the data set does include some professional and managerial employees, high level jobs tend to be under represented because it is a sample of new hires not employees and accession rates are lower in high level jobs and because establishments in low wage industries were over sampled by the survey. Relative to their share of all employment, large establishments, low turnover establishments and companies that never hire vocationally trained workers are also under represented. While the jobs and establishments studied are not randomly selected, once the job is selected, the selection of new hires for study appears to be close to random if one abstracts from the fact that the two new hires are selected to have different amounts of vocational training and the second new hire selected was hired an average of 6 months earlier.<sup>2</sup>

The survey asked the employer (or in larger firms the immediate supervisor) to report on productivity of the typical individual hired in the job after 2 weeks, during the next 11 weeks and at the end of 2 years at the firm. The supervisor was asked to do the rating on a "scale of zero to 100 where 100 equals the maximum productivity rating any of your employees in (NAME'S) position can obtain and zero is absolutely no productivity by your employee." For the full data set at the mean values of these indexes of reported productivity were 49.0 for the first 2 weeks, 64.6 for the next 11 weeks and 81.4 at the time of the interview.

The interview questions about the productivity of recently hired employees were intended to provide ratio scale indicators of the relative productivity of one worker at different points in time or two different workers in a particular job. They do not attempt to measure productivity in any absolute sense and therefore are not comparable across firms or across jobs in a firm. The question asking for a rating of the productivity of particular workers have remarkably low nonresponse rates. Only 4.4 percent of respondents asked about a particular new hire's productivity during the first 2 weeks responded with a "don't know" or refused to answer. Comparably defined nonresponse rates for other questions about the new hire were 8.2 percent for previous relevant experience, 3.2 percent for age, 6.7 for education, 8.6 percent for time spent in informal training by a supervisor, and 5.7 percent for a 3-question sequence from which starting wage rate is calculated. The low nonresponse rate implies that our respondents felt that they were capable of making such judgments and augurs well for the quality of the data that results.

The fact that the employer is reporting on the past productivity of particular employees may generate biases in the data. Some of these employees quit or were fired, some were promoted and some were awarded substantial wage increases. These events might influence our respondent's memory of how productive the worker was during the first three months on the job. If this occurs, it would probably magnify the estimated effect of early productivity on subsequent turnover and current wage rates. In Bishop (1987) early productivity did not have significant positive effects on the current wage when current productivity was controlled so this does not appear to be a problem for the current wage rate models. The second potential source of bias--measurement error in the productivity indicators--acts in the opposite direction. It has no effect on table 1 and 4 but

it does bias the productivity indicator coefficients toward zero in the multivariate analysis presented in tables 2 and 3. With these caveats in mind, let us turn to the results.

Table 1 compares the productivity ratings (during the 3rd through 13th week at the firm) of new hires who separate to the productivity ratings (for week 3-13) of the 70 percent of new hires who stay at the firm at least through the date of the interview. Dismissed workers are considerably less productive (25 percent less in week 3-13) than workers who stay at the firm. This is true for all types of firms. For other types of turnover, however, there are important differences across types of establishments in the selectivity of turnover. At unionized establishments the individuals who were laid off or who quit were reported to be more productive during week 3-13 than the workers who were retained. Fired workers were reported to be substantially less productive, but, consistent with the results of other studies (Freeman and Medoff 1984), very few (only 2.7 percent of the new hires) were fired. As a result, it would appear that total turnover may not be negatively selective at these unionized establishments.

The large (200+ employees) nonunion establishments also had low dismissal rates (3.0 percent), and who was laid off appeared to be unrelated to job performance for the laid off workers were reported to be 9 percent more productive (during week 3-13) than those retained. The largest group of separating employees, those who quit were also reported to be slightly more productive than the stayers. As a result, total turnover of new employees at large nonunion establishments appears to have only a very weak negative correlation with job performance. Thus, at the unionized and large nonunion establishments where compensation does not appear to be responsive to performance, positively selective quitting behavior appears to prevail, just as Fama predicted. It would also appear that

while dismissals are clearly negatively selective, turnover as a whole may not be.

Consequently, Jovanovic's job matching model may not apply to this sector of the labor market.

It is the small and medium sized nonunion establishments that appear to have negatively selective turnover. Discharge rates are higher at these firms, layoffs appear to be partly based on job performance (at small establishments) and, most important of all, the workers who are least productive appear to have somewhat higher quit rates. It would appear that the relatively modest response of relative wage rates to relative productivity documented in Bishop (1987) is sufficient to generate negatively selective quitting behavior. Since turnover is clearly negatively selective, Jovanovic's job matching model appears to be a good characterization of turnover behavior in this segment of the labor market.

There are, however, reasons for being cautious when interpreting table 1. The table implicitly compares the reported productivity of people at different firms and in different jobs. Yet, the question was not intended as a measure of relative productivity across jobs and firms. Different employers have different rating standards. For example, an employer who has a generally negative view of the world may give all his employees a low rating and may, in addition, be more prone to fire them. If so, the numbers in table 1 would be biased. The paper develops and implements a method of testing hypotheses about the selectivity of turnover that are free of biases caused by unobserved differences in jobs or raters.

The solution involves estimating models which compare two workers hired for the same or a very similar job. Differences in their productivity and required training during the first three months in the job are used to predict differences in subsequent tenure,

turnover and promotions. By analyzing differences in turnover between pairs of workers hired for the same job, the problem of comparing productivity across firms and jobs is avoided and the effects of the firm, the job and the supervisor's personality are held constant through what amounts to a fixed effects procedure.<sup>3</sup> Limiting the sample to those who stayed at the firm at least three months means that a measure of training investment and two measures of productivity during the first three months are available that are not contaminated by turnover events. The models, therefore, characterize the effect of the training provided in the first three months and the productivity achieved during that period on subsequent turnover and promotions.<sup>4</sup>

Models were estimated predicting differences in the log of actual tenure and probabilities of voluntary and involuntary separations. The specification employed is given below:

$$(1) \quad \ln(AT_1/AT_2) = a_1(P_1-P_2) + a_2(T_1-T_2) + a_3\ln(PT_1/PT_2) + a_4[(\ln PT_1)^2 - (\ln PT_2)^2] + A(X_1-X_2) + a_5 + u$$

$$(2) \quad (F_1-F_2, Q_1-Q_2) = b_1(P_1-P_2) + b_2(T_1-T_2) + b_3\ln(PT_1/PT_2) + b_4[(\ln PT_1)^2 - (\ln PT_2)^2] + B(X_1-X_2) + b_5 + v$$

where  $AT_1, AT_2$  = the actual tenure of person 1 and 2. If the worker

separates, AT is the time between date of hire and date of separation. Otherwise  $AT=PT$ .

$F_1, F_2$  = zero one dummies indicating whether person 1 or 2 was laid off or fired.

$Q_1, Q_2$  = zero one dummies indicating whether person 1 or 2 quit.

$P_1-P_2$  = The difference between person 1's productivity and person 2's productivity during the first 3 months at the firm.

$T_1 - T_2$  = the difference between person 1's required training time and person 2's required training time.

$PT_1, PT_2$  = the potential tenure of person 1 and 2. Potential tenure is the calendar time between date of hire and date of interview.

$X_1 - X_2$  = a vector of differences in credentials, background characteristics and job characteristics between person 1 and 2.

### III. Determinants of Turnover

The results of estimating (1) and (2) are presented in Table 2. Since the intercept terms are not significantly different from zero, we may reject the hypothesis that the small differences between the selection protocols for person 1 and person 2 have resulted in unobserved differences in turnover propensities (ie. that cannot be attributed to the differences in background and job performance that are included in the model).

When the analysis is conditioned on the job, firm and labor market, turnover outcomes for those who survive at least three months in a job are determined by the worker's performance on the job--a measure of the employer component of match quality, not background characteristics that proxy for alternative opportunities or the worker taste for the job. The background and credentials of the new hire are represented by 9 variables--gender, years of schooling, a dummy for received relevant vocational education, a dummy for received vocational education at a private for-profit technical institute, a dummy for being hired as part of a cooperative education program, relevant work experience and its square, and total work experience and its square. In the tenure equation only one of the background characteristics -- cooperative education student -- is significant at the 10 percent level. In the involuntary separation equation only schooling is significant and it has the wrong sign (greater schooling is associated with a higher probability of dismissal). In the quit equation only the gender dummy is significant. Women have significantly lower quit rates. F tests found that the simultaneous entry of these nine variables into each model does not significantly increase the explanatory power of the regression. The predominance of the variables measuring supervisory assessments of productivity is consistent with a matching model of job turnover in which jobs are experience goods such

as the one developed by Jovanovic (1979). The poor showing of the credentials variables representing alternative opportunities and tastes in the quit equation suggests that the original contract between the new hire and the firm may have been fine tuned to eliminate predictable differences in quit rates between new hires. The poor showing of the credential variables in the <sup>involuntary</sup> separation equation may suggest that most firms indeed follow their announced policy of basing dismissals and layoffs on tenure and job performance only, not the worker's background.

### Productivity Effects

By contrast, the key measure of the employer component of match quality, the new hire's productivity in the 3rd through 12th week of employment, has large and significant effects in all 3 equations. The productivity variables range between zero and one. The means are .51 for the first two weeks of employment and .661 for the next 11 weeks. The within-firm standard deviation of productivity during the 3rd through 13th week is .143. A one standard deviation increase in productivity during this period lowers the probability of an involuntary separation by 11 percentage points, lowers the probability of a quit by 7 percentage points, and increases tenure by 42 percent ( $\exp(.35)$ ). If both productivity variables increase simultaneously, the response of involuntary separations to productivity becomes somewhat larger but the response of quit rates and tenure diminish. A one standard deviation increase in both productivity variables decreases involuntary separation probabilities by 13.5 percentage points, quit probabilities by 2.2 percentage points and increases tenure by 25 percent ( $\exp(.22)$ ). In other words, turnover during the 2nd, 3rd and later quarters of employment depends on productivity at the end not the beginning of the first quarter. If the worker stays to the end of the first quarter, low initial productivity

levels are forgiven. In fact, rapid improvements in productivity appear to improve morale, for quit rates decline and tenure increases. The fact that tenure goes up when reported productivity is higher suggests that the productivity differentials between workers largely reflect differences in skills that are specific to the firm or known only to the firm. This interpretation is supported by Topel and Ward's (1987) finding that within career innovations to wages have substantial effects on turnover.

### Training Differential Effects

The primary prediction of human capital theory about job turnover is that workers who have a great deal of specific training should have lower rates of turnover (Parsons 1975). This proposition applies to workers who have completed their training or whose training is well underway. If the employer has paid for most of the costs of specific training, we would expect involuntary separations to be negatively related to the amount of specific training. If the employee has paid for most of the specific training, we would expect voluntary separations to be negatively related to the amount of specific training. Either way tenure should rise.

When, however, one compares new hires for a particular job, differences in training received during the first three months are primarily caused by differences in previous training and work experience and in rates of skill acquisition. Additional training is a sign of deficiency in one of these two dimensions. Workers who receive additional training may improve their skills more than others but since they start from a lower base their productivity at the end of the training may still be below those receiving less training. If the need for extra training is a surprise to employers, we would expect additional training to be positively correlated with turnover. However, many employers appear to anticipate

which new hire will require extra training. Evidence for this conclusion comes from Bishop's (1987) analysis of differentials in starting wage rates where it was found that lower starting wage rates are offered to new hires who require greater than average amounts of training. If they discovered the need for extra training after the fact, we would further expect the wage penalty associated with additional training to grow with tenure. This, however, does not occur during the first year. Bishop (1987) found that the wage penalty per 100 hours of training was 2 percent for starting wage rates and 2.4 percent for the current or most recent wage rate. This suggests that some new hires are recruited for their potential, not for their experience. Extra training can, therefore, signal a belief in the worker's potential. Under these circumstances there is no reason to expect higher overall turnover for these employees. This is confirmed by the analysis, for the coefficient on training in the tenure equation is small and not significant.

Who initiates turnover is a different issue altogether. The effect of training on who initiates turnover depends on how the costs and benefits of training are shared. The training is inevitably partially specific and partially general. It raises productivity in the firm the most, but productivity outside the firm rises as well. Despite the partially general character of the training, it appears that most of the costs and most of the quasi rents generated by the training are incurred and received by employers. Evidence of this is (1) the small magnitude of the starting wage penalty for the new hires that require additional training, (2) the fact that the negative wage differential does not turn positive after the training is over and (3) the general finding that wage rates of individuals respond only modestly to the individual's productivity (Bishop 1987). If this is the case, extra training increases the employer's stake in the employee in a way that it does not increase the

employee's stake in the job. It should, therefore, lower the firm's propensity to dismiss or layoff the employee.

The results strongly support this hypothesis. One hundred hours of additional training during the first quarter lowers the probability of being fired or laid off during the subsequent period by 7 percentage points. It should also correspondingly increase the employee's propensity to quit. Their marketability outside the firm has improved but their wage rates remain behind their compatriots at the firm. This hypothesis was tested and the point estimate of the effect implies that an additional one hundred hours of training raises quit probabilities by 5 percentage points. However, the coefficient is not significant at conventional levels.

#### Interactions with Employer Characteristics

In the introduction it was hypothesized that the response of turnover to productivity would depend on unionization and the size of the establishment relative to its local labor market. These hypothesis were tested by specifying that the coefficients on the productivity differentials themselves depend on the logarithm of the number of employees at the establishment ( $S_j$ ), its degree of unionization ( $U_j$ ) and the logarithm of employment in the local labor market ( $L_j$ ):

$$a_1 = \tilde{a}_1 + \Theta_1 U_j + \Theta_2 (S_j - S) + \Theta_3 (L_j - L)$$

(3)

$$b_1 = \tilde{b}_1 + \phi_1 U_j + \phi_2 (S_j - S) + \phi_3 (L_j - L)$$

Productivity at the end of the first quarter is the productivity variable for which the interactions are specified. In order to make the main effects coefficients,  $\tilde{a}_1$  and  $\tilde{b}_1$ , more interpretable, establishment size and labor market size were deviated from their

respective means for the full NCRVE employer survey ( $S=2.85$ ,  $L=11.25$ ) before being multiplied by productivity. As a result, the main effects coefficients ( $\tilde{a}_1$ ,  $\tilde{b}_1$ ) describe the turnover response to productivity in week 3-13 at a nonunion establishment with 17.3 employees in a community with a labor force of 77,000. The results reported in table 2 demonstrate again that productivity during week 3 through 13 is the most important determinant of turnover. At our typical employer, a one standard deviation (0.143) rise in the productivity report raises expected tenure by 31 percent at a nonunion company with 17 employees. It lowers the probability of being discharged or laid off by 11 percentage points and the probability of quitting by 6.4 percentage points.

Now we turn to the effects of unions on the response of turnover to productivity. In the layoff/dismissal equation the coefficient on the unionization interaction is significantly positive and slightly larger than the main effects coefficient. This implies that relative job performance has no effect on one's probability of being laid off or dismissed at union establishments. This is consistent with other research which has shown that unions increase layoffs and reduce dismissals (Freeman and Medoff 1984). The interactions of productivity with establishment size and labor market size have the right sign and are highly significant. The results imply that the types of firms that choose not to vary wage rates with productivity (large firms in small labor markets) tend to compensate for this by being quicker to fire workers who are less productive. Being one standard deviation less productive at the end of the first quarter raises the probability of a layoff or dismissal by 17 percentage points at a firm with 200 employees and by 6.4 percentage points at a firm with 10 employees. Being one standard deviation less productive at a firm with 17.3 employees raises the probability of being dismissed 16

percentage points in a small community with a labor force of about 19,000 (1/4 the geometric mean). If the local labor force is about 300,000, the probability of being dismissed goes up only 5.7 points.

Fama hypothesized that more productive employees are more likely to quit if they perceive little contingency in the reward structure. The analysis of quit probabilities supports his behavioral hypothesis for the types of firms that reward higher productivity with higher wage rates (small companies in large labor markets) were more likely to have their worst performers quit and were less likely to have their best performers quit. At establishments with 10 employees a worker who is one standard deviation more productive is 8.6 percentage points less likely to quit. At establishments with 400 employees, the more productive worker is 2.5 percentage points more likely to quit. As a result, the predicted tenure of the more productive employee (by one SD) is about 40 percent greater at establishments with 10 employees but only 20 percent greater at the 400 employee firm.

In labor markets of 300,000, a worker who is one standard deviation more productive is 12 percentage points less likely to quit than the typical new hire. If the labor market has only 19000 workers, the more productive worker is only 2 percent less likely to quit. As labor market size increases, the increasing sensitivity of quits to productivity tends to offset the declining sensitivity of dismissals to productivity. The result is that tenure's response to productivity does not change with labor market size.

#### IV. Training, Productivity and the Incidence of Promotions

About one-third of the sample of new hires was promoted before the interview date. The results of the estimations predicting promotions are presented in the fourth column of Table 2 and Table 3.

### Productivity Effects

Productivity during the 3d-12th weeks on the job was by far the single most important determinant of an individual's likelihood of promotion. Since promotion is a change of formal status in the firm's hierarchy, one would expect it to be at least as responsive to changes in job performance as to its level. Since initial productivity is controlled, the coefficient on productivity during the 3rd-13th weeks characterizes the effect of gains in the worker's performance. If two new hires are equally productive in the first two weeks, and then one becomes one standard deviation more productive than the other by the end of the first quarter, that employee is 17 percentage points more likely to be promoted.

A steady performance advantage has a smaller effect. A new hire who is steadily one standard deviation more productive than a peer has a 8.6 percentage point higher probability of being promoted. The coefficients on reported initial productivity are negative and statistically significant. This implies that low productivity in the initial weeks on a job is not held against a new employee being considered for promotion if learning is rapid and high levels of productivity are attained by the end of the first quarter at the firm.

There are a number of reasons for expecting the size of a plant to influence the level and determinants of promotions. At a large company job definitions are formalized so a change in job assignment generally requires a promotion. The pay system is formalized as well so promotions are necessary if a worker is to be given a wage increase recognizing the completion of training or outstanding performance. At small firms pay and job assignments can be changed without a promotion being involved. For all these reasons one would expect promotions to be more common at large firms. With more promotions

to hand out we would also expect the sensitivity of promotions to productivity and training differentials to be greater at large firms than small firms. When a large firm hires for potential rather than experience, the new hire is generally placed at a lower grade level than new hires with experience. When training is completed, a promotion would probably be automatic. At small firms training is more informal and promotions would often not result.

These hypotheses were tested by interacting productivity and training with establishment size. Who gets promoted appears to be more sensitive to the worker's productivity and training at large establishments than at small establishments. The coefficients on the size interactions are both significantly positive. If the establishment has 200 employees rather than 17, a one standard deviation productivity advantage raises one's promotion likelihood by 26 percentage points rather than 17 percentage points.

#### Training Differential Effects

There is a clear tendency for those who receive more intensive training in the first 3 months on a job to have a higher probability of subsequently being awarded a promotion. A 100 hour increase in training during the first 3 months is associated with a 7.5 percentage point higher probability of promotion at companies with 17.3 employees. At establishments with 200 employees, 100 hours of additional training are associated with a 25 percentage point increase in the probability of promotion. The positive effect of training on promotions contrasts with Bishop's findings regarding training's impact on wage increases. When models similar to (1) and (2) were estimated predicting wage increases, training intensity had no significant effects when productivity realizations were controlled. It would appear that wage increases are based entirely on the success of the training (as

