Title
Worth Waiting For? Delayed Compensation, Training and Turnover in the United States and Japan

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Abstract

This paper utilizes a rich data set on workers and their employers in the US and Japan to test several predictions of human capital theory. The data set incorporates both prospective and retrospective measures of turnover, includes multiple measures of training, and provides a basis for calculating plant-specific returns to tenure.

Contrary to human capital theory, there is no evidence that establishments with high levels of training have either high returns to tenure or low levels of turnover. Surprisingly, establishments with high returns to tenure do not have low levels of turnover.

I. Introduction

This paper tests two basic predictions of human capital theory: (1) establishments that provide high levels of training will have high returns to tenure; and (2) establishments with high returns to tenure will have low rates of turnover.

These predictions are tested with a unique data set containing information on over 4000 employees of more than 80 manufacturing plants in the United States and Japan. The data set is quite rich along several dimensions. It is the first to provide a basis for calculating plant-specific returns to tenure for tests of human capital theory. The data incorporate both prospective and retrospective measures of turnover, as well as absences. Furthermore, the data include five measures of training; while each is imperfect, most other data sets with information on training have contained only a single imperfect measure.

The predictions of human capital theory are not supported in either the United States or Japan. Establishments with particularly high returns to tenure do not have high levels of training. Furthermore, establishments with high returns to tenure do not have low levels of turnover. Finally, establishments with high levels of training do not have low levels of turnover. Thus, there is no evidence in these data for the hypothesis that differences in training underly the differences in turnover and wage profiles observed between the US and Japan.

At the individual level, workers who report that their jobs keep them learning new things have lower intentions to quit, as predicted by human capital theory. However, this relationship appears to be due to the increased satisfaction with their enriched jobs, not due to changes in current and future wage levels as stressed by human capital theory. In short, the data are not strongly supportive of human capital theory.

The ability to test both the relation between wage profiles and turnover, and the relation between training and turnover adds credibility to the results: the first set of tests does not rely upon the possibly mismeasured training, while the second set of test does not rely upon the possibly mismeasured wage profiles.

II. Literature Review

Several basic implications of the human capital model are summarized by Jacob Mincer and Yoshio Higuchi:

> That greater volumes of job training imply steeper wage profiles on the job and over longer work experience is a theorem in human capital analysis. A similar theorem predicts a negative effect of job training on turnover, on the plausible assumption that larger volumes of training also contain more firm-specific training, even if the latter is not a fixed part of the former. (1988: 101)[1]

The reason for the hypothesized positive relation between training and wage profiles differs depending on whether the company provides general training (i.e., training that is valuable at many employers), or provides training that is firm-specific. For firms providing general human capital, wages are high for senior workers since both their productivity and their market wages are higher after training.

For firm-specific human capital, wages increase with tenure as a way to reduce turnover. Specific training early in a career leads to quasi-rents that are divided between the worker and the firm. It is unclear how much of the returns to training will be captured by trained workers. Firms will share some of the quasi-rents in order to discourage turnover, but the precise solution to the bargaining problem with bilateral monopoly is indeterminate. For both general and firm-specific training, competition for the high wages paid to trained workers leads to entry-level wages being bid down.

There are numerous theories in addition to human capital theory that predict positive returns to tenure. Most of these theories also predict lower turnover in jobs with high returns to tenure. In the incentive model, paying high wages to workers late in their careers provides incentives for workers to work hard (Becker and Stigler, 1974; Lazear, 1981). In the selection model, upward-sloping wage profiles select for workers who have low discount rates and are unlikely to quit (Salop and Salop, 1976). The selection model is closely related to the standard human capital model, but stresses the unobservable nature of some human capital. The matching model predicts upward-sloping returns to tenure because high-quality and high-wage matches are the most likely to persist (Jovanovic, 1979).

While the theory of human capital has been an important part of economics for a generation, testing of the model's detailed

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1. Both of the theorems of human capital theory rests upon auxiliary assumptions, discussed below. Furthermore, many implications of human capital theory are also consistent with other theories; thus, their acceptance is not exclusively evidence in favor of human capital, and their rejection does not always bode well for other theories of labor market behavior.

implications has begun only recently. Most early research concerning on-the-job training (OJT) did not directly measure training. Data limitations constrained economists to examining the shape of wage-tenure profiles. As predicted by human capital theory (and the other theories noted above) wages increased with tenure.

More recently several data sets have included questions concerning training, permitting more direct tests of human capital theory. As noted below, the results so far have been mixed.

Do plants with high returns to tenure provide high levels of training? This is the first paper to examine the relation between an establishment's returns to tenure and its training policies. Human capital theory predicts that plants that provide high levels of training will reward senior workers with high wages. Thus, differences in the returns to tenure across establishments are largely due to differences in training intensities.

Do higher returns to tenure lower turnover? High returns to tenure (i.e., particularly high wages for senior workers) are a reward for long tenure. Thus, plants with high returns to tenure should have lower rates of voluntary turnover.

Very few studies have examined the links between wage profiles and turnover. The paper closest to the current study is Mincer and Higuchi (1988). Like the present paper, they utilize data on individuals both in the United States and in Japan to study the relation between turnover and the returns to tenure. They estimate industry-specific returns to tenure for 16 industries. They then augment an equation predicting job separations with these estimated returns to tenure. They find that separations are low in industries with high returns to tenure (Mincer and Higuchi, 1988: 110). Although they interpret this result as support for human capital theory (assuming that returns to tenure are measuring OJT), the negative relation between separations and returns to tenure is also consistent with the incentive and selection models described above.

The current work extends Mincer and Higuchi in several dimensions. Data limitations require them to assume that steep wage profiles are associated with training; the current data set has direct measures of both formal and informal OJT, permitting this assumption to be tested. Furthermore, Mincer and Higuchi assume that any links between returns to tenure and turnover are due to training, an assumption that is testable with the data set used here. Finally, Mincer and Higuchi use cross-sectional differences in the returns to tenure across industries; the

current study examines differences in the returns to tenure across establishments, the unit of analysis relevant for establishment-specific human capital.

Do trained workers turn over less frequently? Human capital theory predicts that OJT (assuming it has any firm-specific component) reduces turnover by creating an incentive for employers and workers to maintain the value of their investment. In this paper, this hypothesis is tested by augmenting turnover equations with measures of training. These tests are independent of the previous tests that rely upon the estimated returns to tenure to predict turnover; this independence is important since the measurement of the returns to tenure is cross-sectional, and does not reflect the precise pattern that a worker experiences over a career.

Past researchers have generally found that training lowers turnover. Mincer, using the Panel Study on Income Dynamics, finds that an extra year of training lowers separation rates and lengthens job durations (1988).

Working with this data set, Douglas Wholey finds that tenure does not depend upon informal training, but is higher for workers with higher levels of formal OJT (1990). He notes that this result is not consistent with the stress placed upon informal OJT in the literature on long-term employment relations. The current research extends Wholey's work by examining a larger number of outcome variables in addition to tenure (e.g., quit rate, absenteeism, and so forth) and a larger set of OJT measures.

III. The Data

The data are from 1982-83 surveys of manufacturing establishments in the Indianapolis area in the US and from the Atsugi region (outside of Tokyo) in Japan. The population was sampled from lists of employers provided by the Chambers of Commerce and government agencies. Within this population, organizations were stratified by employment size and by industry, and randomly selected. One hundred forty US establishments were contacted, and 52 (37%) provided usable data. (Lincoln and Kalleberg [1990] discuss the data in more detail.)

The industrial mix of both regions are quite similar to that of the nations as a whole. The establishments were spread fairly evenly among seven manufacturing industries: electronics, chemicals, metals, food processing, non-electrical machinery, transportation and automobiles, and printing.

Within each establishment, structured interviews were conducted with top management personnel, and a questionnaire was

administered to a sample of full-time, non-temporary employees. Means and standard deviations for all variables are presented in Table 1. Variables that are plant-wide averages of individual responses are marked with the suffix "_P".

The summary statistics appear inconsistent with common wisdom concerning Japan and US industrial relations: that is, Japanese workers do not have substantially higher training, satisfaction, and tenure than do US workers. The surprisingly high levels of US tenure and training are due to the recession in Indiana during the survey period: junior workers with low training had been laid off. Language and cultural barriers to cross-cultural comparisons between the US and Japan (e.g., concerning the satisfaction questions) are discussed in Lincoln and Kallenberg (1990).

Wages: In the United States the wage measure is the log of hourly earnings. In Japan the wage measure is the log of annual earnings, including the annual bonus and small bonuses based on family characteristics. A set of four dummy variables that control for amount of overtime work was included in all Japanese wage equations. (All results were replicated using annual wages in the United States, with no substantive change in results.)

OJT measures: There are four individual-level measures and one organizational-level measure of training available in the data set. At the individual level, the questions concern the time required to train someone for the job (TRAIN: 0 = "A few hours," 6 = "Five years or more"), the level of agreement that "My job makes me keep learning new things," (NEWLEARN: 1 = "Strongly disagree," 5 = "Strongly agree"), the importance of formal on-the-job training in this company as a source of skills (FORMAL: 0 = "Never had," 4 = "Very important"), and (in the US only) the importance of informal on-the-job training in this company as a source of skills (INFORMAL, same codes). TRAIN measures whether a job requires high OJT, while the NEWLEARN focusses on whether the job is currently providing OJT.[2]

At the establishment level the OJT measure is ORIENT, a dummy equal to one if the firm has an orientation procedure for new hires. This measure captures only a fraction of organizational differences in training policies.

The training referred to by these measures occurs at different times. ORIENT occurs at the time of hire, while NEWLEARN refers to ongoing learning. Unfortunately, some portion

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2. Mincer (1988) and Reuben Gronau (1988) both use responses to questions very similar to TRAIN.

of the training measured by TRAIN may not be OJT, but may already have occurred before hiring.

None of these measures is perfect. For example, TRAIN lacks any measure of training intensity, and is unclear whether it refers to the training time required for a new hire, or for a current insider at a subordinate position. While keeping in mind the limitations of these OJT measures, it should be noted that most other research on training relies upon only one or two measures of OJT. Furthermore, many of the measures others have employed have problems quite similar to those encountered here. Because the measures of OJT have different effects both theoretically and empirically, it is important to utilize multiple measures of training.

Turnover and performance: Three measures for turnover are available in this data set. QUITS is the quit rate at the plant in the year preceding the survey; it is collected at the plant level. LOOKFOR is an individual-level variable assessing the degree of agreement that the employee is likely to look for a new job in the next year. LOOKFOR is coded so that high values represent low self-reported probability of looking for a new job. Past researchers have found that measures of intention to quit are quite good predictors of actual quit behavior (e.g., Mobley, Horcer, and Hollingsworth [1976: 409] and the references therein).

ABSENCES is an individual-level measure of the days absent in the last month. It is only available in the United States. According to the incentive model of wage profiles, individuals at plants with high returns to tenure have an incentive to avoid being dismissed, and should have lower rates of absenteeism (Lazear, 1981).

IV. Results Using Wage Equations

Baseline wage equations: Table 2 presents wage equations without OJT controls for the United States and for Japan. The log of hourly wage in the US and the log of annual earnings in Japan is regressed upon a standard list of demographic and human capital controls.

The results accord well with past research on wages in the United States and in Japan (e.g., Lincoln and Kalleberg, 1990). Japanese firms have higher returns to age and tenure, while US wages have higher returns to education. Larger establishments pay higher wages, and wages of observably similar workers differ significantly by industry (columns (1) and (3)). When establishment effects are added, we see that within industries

there are establishments that pay very different wages (columns (2) and (4)).

Many coefficients are smaller than reported in typical regressions using national data. The differences are probably due to the fact that the sample only contains manufacturing workers in a single region.

OJT and wages: The wage equations in Table 3 are identical to those in Table 2, except that the individual-level measures of OJT are entered (i.e., TRAIN, NEWLEARN, and FORMAL in both countries, and INFORMAL in the US). In addition to the OJT measures, the interactions of TRAIN, FORMAL, and INFORMAL with tenure are also entered. The reasoning is that OJT should only raise wages for workers who have completed the training--that is, the senior workers. (Since NEWLEARN reflects current OJT, it is not interacted with TENURE. When entered, the coefficient on the interaction was tiny and not significant.)

For TRAIN, more detailed interactions are also entered: (TRAIN = 5 and TENURE $\geq$ 3) and (TRAIN = 6 and TENURE $\geq$ 5). Since TRAIN = 5 when the job requires "A few years" of training, only workers with (approximately) three or more years of training should receive higher wages in these jobs. Similarly, TRAIN = 6 when the job requires "5+ years" of training.

The OJT measures are entered as continuous variables. In results not shown, they were also entered with separate dummies for each level of each variable. The results were not economically or statistically significantly different; thus, the more easily interperted results are displayed in Table 3.

Consistent with past research (surveyed in Mincer (1989)) there is evidence that increasing OJT increases wages. In both the US and Japan, for a worker with mean tenure, an increase in TRAIN of one standard deviation (approximately 1½ points) increases wages by approximately 3%. By way of comparison, this effect is roughly as large as that from increasing education one standard deviation. In the US, NEWLEARN also has a statistically significant coefficient, although it is somewhat smaller. The magnitude of the training effect on wages increases our confidence that the OJT variables are valid measures of human capital.

Consistent with human capital theory, in the US wages for workers whose jobs required high levels of training were increased after sufficient tenure had occurred to permit that training. That is, the coefficients on (TRAIN = 5 and TENURE $\geq$ 3) and (TRAIN $\geq$ 5 and TENURE > 5) are both large and significant.

Contrary to the predictions of human capital theory, the multiplicative interactions of tenure and the three OJT measures are neither individually nor jointly significant. Furthermore, neither the joint test of FORMAL and FORMAL*TENURE nor the joint test of INFORMAL and INFORMAL*TENURE is significant; thus, there is no evidence that FORMAL or INFORMAL OJT raises wages for senior workers.

Does OJT explain wage anomalies? From the point of view of neoclassical theory, the results in Table 2 contain several important anomalies. Specifically, in both the US and Japan males (particularly those who are married), and employees in large establishments earn high wages. In Japan, married women earn less than unmarried women. In both countries there are high and low wage industries, and within industries there are high and low wage employers. For example, in the US moving from an establishment that is average to one that is one standard deviation above average moves wages by roughly 18%--equal to roughly 10 years of education. It is not obvious why each of these factors affects wages, since they are not obviously measuring productivity.

It has often been posited that the explanation of these anomalies lies in unmeasured human capital such as on-the-job training. That is, these other factors affect wages because they are proxying for OJT. For example, Mincer and Higuchi do not control for firm size in their wage equations, but claim "human capital differences which characterize firm size differentials are captured by our independent variables," where their independent variables are proxies for OJT (1988: 102).

The hypothesis that OJT explains wage anomalies can be tested by examining the anomalous coefficients when OJT measures are added to a wage equation; that is, by comparing the estimates in Tables 2 and 3. If the coefficients fall in absolute value, and if the standard deviation of the firm and industry effects decline, then (at least in part) the anomalous effects are due to the omission of OJT.

The addition of the three OJT measures in Table 3 have only a small role to play in eliminating most of the anomalies. There is a modest increase in R^2 when OJT measures are included (from .515 to .537 in the US in column 1 of Tables 2 and 3, and from .718 to .724 in Japan in column 3). More importantly, the coefficients on gender, marital status, and establishment size are almost identical to the estimates without OJT controls, and are never statistically significantly different. Furthermore, the industry effects (columns 1 and 3) and the firm effects (columns 2 and 4) remain virtually unchanged after controlling

for OJT. The correlations for industry effects and for firm effects with and without OJT are all over 0.98 in both countries, and their standard deviations do not systematically decline.

Returns to age (proxying for experience) and tenure are so closely tied to the theory of human capital that they are not generally considered anomalous. It is, thus, particularly surprising that including the measures of OJT leads to virtually no change in the estimated returns to age in either country, or to tenure in Japan. The returns to tenure do decline substantially in the US (from .009 per year, to .005, in column 1 of Tables 2 and 3). That is, almost half of the returns to tenure in the US are accounted for by workers in jobs that require "A few years" or "Five years of more" of TRAINing.[3]

These mostly negative results accord with a more general finding that job characteristics are not very important in explaining wage anomalies (Levine, 1990a). It is true that the four measures of OJT in this data set are all quite imperfect, and it remains possible that better measurement would lead to substantially greater success at explaining wage anomalies. Nevertheless, these data do not support human capital theorists' hypothesis that women, employees of small firms, employees in low-wage industries, and employees in low-wage firms more generally, receive their lower wages largely because they have lower levels of on-the-job training.

V. Firm-specific returns to tenure, OJT, and turnover

A two-stage procedure is utilized in this section to examine the relations among OJT, turnover, and the returns to tenure. The first stage calculates the returns to tenure across different establishments. In the second stage, these establishment-specific returns to tenure are used to test whether establishments with high returns to tenure have higher training and lower turnover. Also, the direct relation between training and turnover is examined.

The wage regressions including firm-specific returns to tenure are presented in Table 4. These wage equations are run with both plant-specific starting wages and plant-specific returns to tenure. The plant-specific starting wages were estimated by plant dummies, while plant-specific returns to

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3. This test is related to the mini-literature spawned by James Medoff and Katharine Abrahams, who inquire "Are Those Paid More Really More Productive?" (1981) They test whether the estimated returns to tenure can be reduced by controlling for performance evaluations; the current paper tests whether the estimated returns to tenure can be reduced by controlling for OJT.

tenure were estimated by interacting individual tenure levels with plant dummies. This formulation perimits each establishment to have a unique starting wage and return to tenure. (Other controls are as in Table 2, except that TENURE and TENURE^2 are omitted.) The returns to tenure across companies differ substantially: in the US (Japan) the mean return to tenure is 1.1% (1.1%), with a standard deviation across firms of 1.7% (1.3%).

Does OJT increase the returns to tenure? As noted above, human capital theory predicts that firms that provide high levels of training (either general or specific) will have high returns to tenure. Table 5 presents regressions that attempt to predict each firm's starting wage and wage profile. The estimates yield no evidence that firms with greater levels of OJT have high returns to tenure.

In the US, an F test cannot reject the hypothesis that the firm-level OJT measure ORIENT and the three or four averages of individual-level OJT (NEWLEARN, TRAIN, FORMAL, and INFORMAL) are jointly useful for predicting the returns to tenure (column 2, F(41, 5) = 3.8, **). Unfortunately for human capital theory, the signs are incorrect on four of the five measures. A one standard deviation increase in each of the four measures of training lowers the predicted returns to tenure by 1.4%--almost one standard deviation. These results are unchanged in the presence of additional controls for industry, size, and union status. (Industry coefficients were small and jointly not significant, while non-union and independent plants had steeper profiles.) On the other hand, if we drop the extreme values of estimated returns to tenure, the coefficients remain predominantly of the wrong sign, but are smaller and no longer statistically significant (F(4, 37) = 2.0).[4]

In Japan, an F test fails to reject at the 10% level the hypothesis that the firm-level OJT measure ORIENT and the three firm-wide averages of individual-level OJT (NEWLEARN_P, TRAIN_P, FORMAL_P) are jointly useful for predicting which firms have steep wage profiles (column 4; F(4, 42) = 2.9 *). While three of the four signs on the training measures are positive, increasing each of the four OJT measures by one standard deviation would reduce wages by a tiny amount, although the total effect is not significantly different from zero (-.018).

These negative findings are some of the key results of this paper. Mincer and Higuchi, for example, assume that differences

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4. For regressions on plant-level variables (Tables 5, 6 and 7) there are between 31 and 46 degrees of freedom. Thus, tests significant at the 10% level are reported.

in wage profiles across industries are due to differences in training (1988). In fact, their assumed relation does not appear to hold across plants in either the United States or Japan.

To test for robustness, a variety of specification tests were performed. These negative results remain if ORIENT is excluded from the tests (since orientations occur prior to any accumulation of tenure). In regressions not shown, these results are unchanged in the presence of controls for industry, size, and union status, and if we drop the extreme values of the returns to tenure. To correct for any biases due to the assumption of linearity, the regressions in Table 4 that estimated the plant-specific returns to tenure were re-run with the addition of $TENURE^2$ and with separate dummy variables for workers with tenure=0 and for workers with tenure=1. The estimated returns to tenure were correlated at above the .90 level with the returns to tenure reported, and the results in Table 5 were not altered by this change. The results were also robust to the omission of the rank controls (worker, manager, supervisor), and to dropping workers with tenure less than or equal to one year. Finally, the mean and the standard deviation of tenure of each plant were added to the regressions in Table 5. Again, the results were unchanged. (Similar robustness checks were performed for all of the results described below.)

Do firms with high levels of training and/or high returns to tenure have low starting wages? In a perfectly competitive world, competition for jobs at firms with high returns to tenure would lead to lower starting wages. Consistent with this prediction, the correlation between establishment-specific starting wages and establishment-specific returns to tenure is -.54 ($P < .01$) in the United States, and -.28 ($P = .11$) in Japan.

In Table 5, columns 1 and 3, the training measures are regressed against the establishment-specific starting wages estimated in Table 4. Consistent with human capital theory (as well as efficiency wage theories), in the US, ORIENT is statistically significantly related to starting wages (.17 (.075)*), implying that plants with orientations pay substantially higher starting wages. In Japan, the coefficient is small and not significant.

On the other hand, human capital theory predicts that workers should bid starting wages for jobs that provide training later in careers than orientations. This prediction is not supported. The non-ORIENT OJT measures are neither individually nor jointly statistically significant in Japan. In the US, TRAIN_P is significant and positive, but NEWLEARN_P and FORMAL_P have negative coefficients. In short, there is little evidence that starting wages are related to training opportunities at a

plant. (If the majority of training occurs in the first year at a plant, then these data are too coarse to test hypotheses that differentiate starting and post-training wages.)

Do high returns to tenure reduce turnover? A key prediction of human capital theory is that high returns to tenure reduce turnover. This reduction in turnover is held to be the reason that firms with specific training increase their returns to tenure. This prediction also follows from the incentive and selection models (Lazear (1981), Salop and Salop (1976)).[5] Unlike the previous sections, the tests in this section do not rely upon the measures of OJT.

The estimated plant-specific starting wages and returns to tenure are used to predict quit rates (QUITS), the average level of the intention to quit (LOOKFOR_P), and absenteeism (ABSENCES_P; Table 6).

The basic regression for the United States is found in Table 6, column 1. Establishments paying high starting wages had lower quit rates, as predicted by efficiency wage theories. On the other hand, the coefficient on the plant-specific returns to tenure is positive--giving no support to the hypothesis that firms with steep returns to tenure had lower quit rates. The starting wage measure is statistically significant at the 10% level, and the pair are are jointly significant at the 1% level. The correlation between quit rates and returns to tenure is 0.30, while the correlation between quit rates and establishment-specific starting wages is -0.47.

These negative results for human capital theory remain if the outliers are discarded. The signs remain unchanged, but the size and significance are reduced if controls for plant characteristics (i.e., industry, size, and union) are added.

Because the plant-specific starting wages and returns to tenure have been estimated, they are measured with error. When such estimated values are included as regressors, the coefficients are biased and inconsistent.

In results not shown, all the estimates in Table 6 were repeated using a consistent instrumental variable estimator that corrects for the measurement error. Two sets of instruments were employed. The first set consisted of the plant averages of the

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5. High returns to tenure will not be correlated with low turnover in an "up or out" environment, where there is extensive sorting (e.g., law firms where few associates are promoted to partner). There is no evidence to suggest that up or out job ladders are common in manufacturing.

OJT measures. The second set included the OJT measures, and also the proportion female, the proportion non-white (in the US), average age, average education, establishment size, whether the establishment is an independent company, and union status. In each case, the coefficients moved very little, and there was no pattern of increased support for the predictions of human capital theory.

The LOOKFOR results in the US also have opposite sign patterns predicted by human capital theory: plants with high returns to tenure had lower (but not significantly so) values of LOOKFOR (-2.2 (2.4), n.s.).

In the United States, establishments with high returns to tenure had statistically significantly more absences--the opposite of the predictions of Lazear's theory that high returns to tenure increase performance (Table 6, column 3). (No absences data were collected in Japan.)

In Japan the results on QUITS were also unfavorable for human capital theory (Table 6, column 4). Again, the high starting wages were common at plants with low quit rates (although the relation is small and not statistically significant), but there is a small not-significant positive relation between returns to tenure and quit rates.

Unlike the previous results, in Japan the average level of intention to quit (LOOKFOR_P) behaved as predicted by human capital theory (Table 6, column 5). Establishments with high levels of LOOKFOR_P (i.e., low levels of intention to search for another job) tended to have high returns to tenure (6.8, (2.5), *). As in the United States, both the positive and negative results were not substantially altered with different control variables or using an instrumental variable technique to correct for measurement error.

In short, there is little evidence that high returns to tenure lower turnover. Quit rates and absenteeism in the US are slightly higher in plants with high returns to tenure, while average levels of intentions to quit are slightly lower in Japan. The balance of positive and negative results sums to little support for human capital theory.

(The relation between high starting wages and low turnover in four of the five equations is consistent with efficiency wage models. Levine (1990b) employs this data set to perform a more extensive set of tests of efficiency wage models. The results are largely supportive of the hypothesis that high wages can lower costs by reducing turnover and by increasing commitment, effort, and morale.)

It is possible that the 1982 recession is biasing the measures of establishment-specific returns to tenure; unfortunately for human capital theory, the most plausible bias inflates the relation between high returns to tenure and a low quit rate. For example, if high unemployment leads to a two-tier wage system or to very depressed starting wages (which imply artificially high cross-sectional returns to tenure), that unemployment should also reduce the quit rate. This story suggests that the correlation between establishment-specific returns to tenure and quits is biased upward.

Does OJT reduce turnover? Human capital theory predicts that OJT (assuming it has any firm-specific component) reduces turnover by creating an incentive for employers and workers to maintain the value of their investment.

There is no evidence that quit rates are lower at establishments with high levels of OJT in either the United States or Japan (Table 7, columns 1 and 2). In both countries, the OJT measures are jointly insignificant in predicting the quit rate. (In Japan the coefficients are jointly significant at the 8% level in the quit rate equation, but the signs are mixed and increasing each of the three measures by one standard deviation leads to a total effect that is very small and not statistically significantly different from zero.)[6] Results were not substantially changed when controls for gender, age, and union were added.

The results are more favorable for human capital theory when the LOOKFOR regressions are run at the individual level (Table 8, columns 1 and 3). At the individual level, NEWLEARN is an important predictor of low intention to quit in both the US and Japan (coefficients = .076 (.011)** and .042 (.015)**). FORMAL is also significantly positive in the US (.057 (.018)**), but not in Japan (-.004 (.011)). These results are very similar when a complete set of establishment controls are added.

An alternative explanation for the positive relation between NEWLEARN and LOOKFOR comes from the literature on job design--most workers prefer enriched jobs where they are learning new

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6. While the F test rejects joint significance, in the US the correlation between FORMAL_P and LOOKFOR_P is .36 ($P < .02$), and between ORIENT and LOOKFOR_P is .26 ($P < .08$). The other correlations between OJT and LOOKFOR_P were smaller and not significant. In Japan a correlation of .29 between ORIENT and LOOKFOR_P was the only one significant at the 10% level.

things (e.g., Hackman and Oldham, 1980: 89).[7] The job design literature leads to the hypothesis that OJT helps predict turnover because of omitted variable bias: the omitted satisfaction measures are loading onto NEWLEARN.

The results in Table 8, columns 2 and 4 are consistent with the job design hypothesis. Adding three self-reported satisfaction measures (e.g., "I like my job," and "I would recommend this job to a friend") to the LOOKFOR regression lowers the coefficient on NWLEARN from .076 to .013 (n.s.) in the US, and from .042 to .018 (n.s.) in Japan. When the satisfaction measures are included, the OJT measures are no longer jointly significantly related to LOOKFOR ($F(4,2737) = 1.9$); ($F(3,1712) = .6$).[8]

These results can also be interpreted as consistent with a more general version of human capital theory that not only focuses on wage profiles but also emphasizes non-pecuniary aspects of the job. That is, workers who are highly trained receive better working conditions as a reward for their higher productivity. Such a reformulation moves empirical human capital theory away from its traditional emphasis on the relation between wages and training.

VI. Conclusions and Further Research

Human capital theory is the foundation of contemporary neoclassical labor economics. While it has had numerous successes in predicting labor market phenomena, it has been less successful in the tests presented in this paper.

Contradicting human capital theory, there is no evidence in either the United States or in Japan that OJT measures explain past wage anomalies. In neither country do plants with high returns to tenure provide above-average levels of training. Furthermore, there is no evidence that high returns to tenure lower turnover or absenteeism--a test that does not rely upon the OJT measures. Finally, there is no evidence that plants with high levels of average OJT enjoy lower average turnover.

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7. In regressions not shown, NEWLEARN is a powerful predictor of workers' self-reported satisfaction.

8. It is likely that the coefficients on the attitude variables are biased upward by any "halo effect" that raises self-reports of both LOOKFOR and of satisfaction. Such a bias does not affect the coefficients or statistical significance of the OJT measures.

Consistent with human capital theory, at the individual level workers who report that they are learning on the job have lower intentions of quitting. This relationship appears to be primarily because of the relationship between NEWLEARN and satisfaction, a mechanism stressed in the job design and organizational behavior literatures. While this mechanism is consistent with human capital theory, it is quite different from the relation between training and the returns to tenure that have been emphasized by past researchers.

There are numerous explanations within the human capital framework concerning why the posited relations may not arise in this data set. It could be that most training is general, and that we should not expect turnover to be closely linked to OJT. If most training occurs in the first months at a plant, then tenure broken down by years is too coarse a measure for these tests.

The results in this paper leave many questions unresolved. Companies differ substantially in their returns to tenure; differences in the quantity of training is a plausible cause for differences in wage profiles. Nevertheless, OJT has little explanatory power at the plant level in predicting steep returns to tenure. This lack of correlation between returns to tenure and turnover are in contradiction to the findings of Mincer and Higuchi (1988).

The failure of the human capital model in both the US and Japan results reduces our confidence that the model can explain differences in training, wage growth, and tenure between the two countries. Mincer and Higuchi calculate that "as much as two-thirds of the differential in turnover between the two counties is explainable by the differences in the steepness of the profiles" and that factors proxying for OJT account for "up to 80% of the differences in the steepness of wage profiles" (1988: 97). Their results are not replicated here; that is, steepness of wage profiles do not predict turnover, and direct measures of OJT (as opposed to their proxies) do not correlate with the steepness of profiles.

Each data set has its advantages: for example, their sample is a national sample containing both non-manufacturing as well as manufacturing industries, but contains no direct measures of training. As usual, these conflicting results suggest that further research is needed.

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Table 1

Descriptive Statistics

	United States		Japan	
	Mean	Std. Dev.	Mean	Std. Dev.
Individual Level Variables:				
LHOURLY - log of hourly earnings	2.13	.30	n.a.	
LOGEARN - log of annual earnings, including bonus and family allowance	n.a.		9.33	.47
EDUCATION - 1=elem; 2=some H.S.; 3=H.S. grad; 4=some coll; 5=coll grad; 6=BA plus	3.24	.93	3.07	.96
AGE - age of worker	36.78	10.73	34.17	9.69
AGE^2 - AGE squared	1468.12	861.78	1261.18	699.00
AGE OVER 55 - 1 if AGE greater than 55; 0 else	.07		.07	
TENURE - years employed at plant	10.39	9.01	11.27	7.90
$TENURE^2$ - TENURE squared	190.11	301.01	189.30	235.05
NON-WHITE - 0 if white; 1 if other	.08		n.a.	
MALE MARRIED - 1 if male and married; 0 else	.58		.58	
MALE UNMARRIED - 1 if male and unmarried; 0 else	.18		.27	
FEMALE MARRIED - 1 if female and married; 0 else	.14		.07	
LINE WORKER - 1 if worker in line dept.; 0 else	.65		.52	
LINE SUPERVISOR - 1 if supervisor in line dept.; 0 else	.06		.14	
LINE MANAGER - 1 if manager in line dept.; 0 else	.01		.02	
TECHNICAL WORKER - 1 if worker in technical production; 0 else	.18		.11	
TECHNICAL SUPERVISOR - 1 if supervisor in technical production; 0 else	.03		.05	
TRAIN - time to train someone to do your job (0=few hrs;1=few days-wk;2=sev wks;3=2-5 mos;4=6 mos-1 yr;5=few yrs;6=5+yrs)	2.42	1.71	2.47	1.52
NEWLEARN - my job makes me keep learning new things (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)	3.53	1.21	3.53	1.13
FORMAL - importance of formal on the job training (0=never had; 1=not at all important; 2=a little; 3=somewhat; 4=very)	3.35	.91	2.38	1.36
INFORMAL - importance of informal on the job training (0=never had; 1=not at all important; 2=a little; 3=somewhat; 4=very)	3.51	.85	n.a.	
LOOKFOR - how likely are you to seek a job at another co. next year? (0=very likely; 1=somewhat likely; 2=not at all likely)	1.60	.68	1.57	.64

Table 1 ((continued)

Descriptive Statistics

	United States		Japan	
	Mean	Std. Dev.	Mean	Std. Dev.
TRAIN BY TENURE - interaction (product) of TRAIN and TENURE	27.21	36.69	29.14	29.99
FORMAL BY TENURE - interaction (product) of FORMAL and TENURE	35.71	34.05	28.40	27.79
INFORMAL BY TENURE - interaction (product) of INFORMAL and TENURE	36.97	34.59	n.a.	
(TRAIN = 5) AND (TENURE >= 3) - 1 if time to train is few years and tenure greater than or equal 3; 0 else	.08		.08	
(TRAIN = 6) AND (TENURE >= 5) - 1 if time to train is 5+ years and tenure greater than or equal 5; 0 else	.04		.01	
JOB CHOICE - knowing what you do now, would you decide again to take this job? (0=would not; 1=would have second thoughts; 2=I'd take the same job)	1.60	.64	.86	.77
JOB SATISFACTION - how satisfied are you with your job? (0=not at all; 1=not too satisfied; 2=undecided; 3=somewhat; 4=very)	2.90	1.13	2.11	1.06
JOB RECOMMEND - would you recommend this job to a friend? (0=advise against this job; 1=have doubts; 2=recommend this job)	1.51	.69	.95	.68
Plant Level Variables:				
LOG PLANT SIZE - log of plant size	5.43	1.15	5.70	.93
UNION CONTRACT - 1 if plant is unionized; 0 else	.53		.71	
INDEPENDENT COMPANY - 1 if independent company; 0 if branch or subsidiary	.32		.35	
NEWLEARN_P - NEWLEARN averaged over all workers in a plant	3.61	.32	3.53	.35
TRAIN_P - TRAIN averaged over all workers in a plant	2.55	.64	2.51	.40
FORMAL_P - FORMAL averaged over all workers in a plant	3.32	.21	2.34	.38
INFORMAL_P - INFORMAL averaged over all workers in a plant	3.48	.18	n.a.	
ORIENT - 1 if plant has orientation programs for employees; 0 else	.72	.46	.88	.33
QUITS - quit rate (quits in previous year/plant employment)	.06	.06	.07	.04
LOOKFOR_P - LOOKFOR averaged over all workers in a plant	1.53	.24	1.53	.23
ABSENCES_P - ABSENCES (days absent per month) averaged over all workers in a plant	.56	.30	n.a.	

Note: Sample sizes are 2740 individuals and 47 plants in the U.S.; 1715 individuals and 34 plants in Japan. n.a = not available in dataset.

Table 2

The Determinants of Wages in the United States and Japan

Dependent variable is log hourly wage in the US;

log annual earnings (incl. bonus and family allowance) in Japan.

	United States		Japan	
	1	2	3	4
EDUCATION	.046**	.033**	.034**	.031**
	(.005)	(.005)	(.008)	(.008)
AGE	.019**	.012**	.072**	.072**
	(.003)	(.003)	(.007)	(.007)
AGE^2	-.0002**	-.0001**	-.0007**	-.0007**
	(.00004)	(.00004)	(.00009)	(.00009)
AGE OVER 55			-.103	-.098
			(.063)	(.060)
TENURE	.009**	.012**	.020**	.018**
	(.002)	(.002)	(.003)	(.003)
TENURE^2	-.0002**	-.0002**	-.0003**	-.0002**
	(.00005)	(.00005)	(.00009)	(.00009)
NON-WHITE	-.037*	-.052**	n.a.	n.a.
	(.016)	(.014)		
MALE MARRIED	.196**	.152**	.287**	.281**
	(.016)	(.014)	(.029)	(.029)
MALE UNMARRIED	.136**	.112**	.187**	.194**
	(.018)	(.016)	(.025)	(.026)
FEMALE MARRIED	-.016	-.009	-.158**	-.207**
	(.019)	(.016)	(.038)	(.038)
LINE WORKER	-.310**	-.350**	-.314**	-.268**
	(.028)	(.024)	(.037)	(.036)
LINE SUPERVISOR	-.216**	-.217**	-.184**	-.169**
	(.032)	(.028)	(.037)	(.036)
LINE MANAGER	.153**	.132**	-.062	-.030
	(.044)	(.038)	(.053)	(.051)
TECHNICAL WORKER	-.296**	-.337**	-.246**	-.211**
	(.028)	(.025)	(.037)	(.036)
TECHNICAL SUPERVISOR	-.211**	-.202**	-.186**	-.157**
	(.035)	(.030)	(.038)	(.037)

Table 2 (continued)

The Determinants of Wages in the United States and Japan

	United States		Japan	
	1	2	3	4
UNION CONTRACT	.046**		.00009	
	(.014)		(.019)	
LOG PLANT SIZE	.051**		.066**	
	(.007)		(.008)	
INDEPENDENT COMPANY	-.063**		-.075**	
	(.014)		(.018)	
Industry Dummies	7	0	7	0
S.D. (Coeff. on industry dummies)	.081		.070	
F test	49.5**		11.7**	
Plant Dummies	0	47	0	34
S.D. (Coeff. on plant dummies)		.185		.137
F test		43.9**		13.7**
R^2	.515	.648	.718	.753
F test	125.2**	82.2**	165.5**	101.2**
N	2740	2740	1715	1715

Notes:

* = Statistically significantly different from 0 at the 5% level; ** = 1% level.

Standard errors are in parentheses.

Seven industry dummies and four overtime dummies (Japan only) are omitted from the table.

Omitted variable for Gender*Marital Status interaction is Female Unmarried.

Omitted variable for the Department*Rank interaction is Technical Manager.

n.a. = not available in dataset.

Table 3

Wage Determination and OJT

Dependent variable is log hourly wage in the US;

log annual earnings (incl. bonus and family allowance) in Japan.

	United States		Japan	
	1	2	3	4
EDUCATION	.042**	.029**	.032**	.030**
	(.005)	(.005)	(.008)	(.007)
AGE	.017**	.008**	.069**	.070**
	(.003)	(.003)	(.007)	(.007)
AGE^2	-.0002**	-.00008*	-.0007**	-.0007**
	(.00004)	(.00004)	(.00009)	(.00009)
AGE OVER 55			-.081	-.074
			(.063)	(.061)
TENURE	.005	.007**	.020**	.017**
	(.003)	(.003)	(.004)	(.004)
TENURE^2	-.0002**	-.0002**	-.0004**	-.0002*
	(.00005)	(.00005)	(.00009)	(.00009)
NON-WHITE	-.028	-.040**	n.a.	n.a.
	(.016)	(.014)		
MALE MARRIED	.169**	.127**	.268**	.264**
	(.016)	(.014)	(.029)	(.029)
MALE UNMARRIED	.118**	.097**	.173**	.183**
	(.018)	(.016)	(.026)	(.026)
FEMALE MARRIED	-.016	-.009	-.154**	-.201**
	(.018)	(.016)	(.038)	(.037)
LINE WORKER	-.269**	-.308**	-.277**	-.230**
	(.028)	(.024)	(.037)	(.037)
LINE SUPERVISOR	-.192**	-.195**	-.162**	-.146**
	(.031)	(.027)	(.037)	(.036)
LINE MANAGER	.163**	.140**	-.054	-.018
	(.043)	(.037)	(.053)	(.051)
TECHNICAL WORKER	-.277**	-.320**	-.223**	-.186**
	(.028)	(.024)	(.037)	(.036)
TECHNICAL SUPERVISOR	-.195**	-.191**	-.174**	-.144**
	(.034)	(.029)	(.038)	(.037)
UNION CONTRACT	.059**		.003	
	(.014)		(.019)	
LOG PLANT SIZE	.053**		.065**	
	(.006)		(.008)	
INDEPENDENT COMPANY	-.071**		-.078**	
	(.014)		(.018)	

Table 3 (continued)

Wage Determination and OJT

	United States		Japan	
	1	2	3	4
TRAIN[a]	.023**	.027**	.023**	.019**
	(.005)	(.004)	(.008)	(.008)
NEWLEARN[a]	.005	.008*	.004	-.0002
	(.004)	(.004)	(.006)	(.006)
FORMAL[a]	-.001	-.004	.005	.007
	(.0095)	(.008)	(.008)	(.008)
INFORMAL[a]	-.008	-.005	n.a.	n.a.
	(.010)	(.009)		
TRAIN BY TENURE[b,c]	-.0003	-.00009	-.0009	-.0003
	(.0003)	(.0003)	(.0006)	(.0005)
FORMAL BY TENURE[b,c]	.0008	.0006	.001*	.0009
	(.0007)	(.0006)	(.0007)	(.0006)
INFORMAL BY TENURE[b,c]	.0004	.0002	n.a.	n.a.
	(.0008)	(.0007)		
(TRAIN = 5) AND (TENURE >= 3)[c,d]	.083**	.041*	.013	.002
	(.019)	(.017)	(.027)	(.026)
(TRAIN = 6) AND (TENURE >= 5)[c,d]	.039**	.020	.060	.039
	(.029)	(.024)	(.055)	(.053)
Industry Dummies	7	0	7	0
S.D. (Coeff. on industry dummies)	.077		.070	
F test	46.9**		11.1**	
Plant Dummies	0	47	0	34
S.D. (Coeff. on plant dummies)		.188		.136
F test		47.4**		13.3**
F tests:				
a: TRAIN through INFORMAL	7.9**	14.2**	3.3**	2.4
b: TRAIN BY TENURE through INFORMAL BY TENURE	1.4	0.7	3.1*	1.1
c: TRAIN BY TENURE through (TRAIN=6) & (TENURE>=5)	4.5**	1.5	1.7	0.7
d: (TRAIN=5) & (TENURE>=3) and (TRAIN=6) & (TENURE>=5)	9.8**	2.9*	0.6	0.3
R^2	.537	.669	.724	.757
F test	98.1**	78.2**	133.6**	90.7**
N	2740	2740	1715	1715

Table 4

Estimating Plant-specific Returns to Tenure

Dependent variable is log hourly wage in the US;
log annual earnings (incl. bonus and family allowance) in Japan.

	United States	Japan
	1	2
Plant-specific starting wages (STARTW_P)	47	34
S.D. (Coeff. on STARTW_P)	.228	.150
F test	25.2**	4.6**
Plant-specific returns to tenure	47	34
Mean (Coeff. on returns to tenure)	.011	.011
S.D. (Coeff. on returns to tenure)	.017	.013
F test	4.7**	4.9**
R^2	.668	.765
F test	50.49**	64.9**
N	2740	1715

Note: Controls are the same as Table 2, except TENURE and $TENURE^2$ are omitted.

Table 5

OJT, Starting Wages and Returns to Tenure

Dependent variable in cols. 1 and 3 is the coefficient on plant-specific starting wages from Table 4.

Dependent variable in cols. 2 and 4 is the coefficient on plant-specific returns to tenure from Table 4.

	United States		Japan	
	STARTW_P	Returns to tenure	STARTW_P	Returns to tenure
	1	2	3	4
NEWLEARN_P	-.109	.010	.134	-.018*
	(.112)	(.008)	(.104)	(.008)
TRAIN_P	.126*	-.010*	-.115	.0006
	(.060)	(.004)	(.085)	(.007)
FORMAL_P	-.138	-.015	.012	.011
	(.251)	(.018)	(.083)	(.007)
INFORMAL_P	.208	-.020	n.a.	n.a.
	(.296)	(.021)		
ORIENT	.171*	-.010*	-.050	.010
	(.075)	(.005)	(.088)	(.007)
R^2	.21	.32	.10	.29
F test	2.2†	3.8**	.8	2.9*
F test (without ORIENT)	1.6	3.6*	1.0	2.9*
N	46	46	34	34

Note: Independent variables (except ORIENT) are plant-wide averages of individual responses.

† = Statistically significantly different from 0 at the 10% level.

Table 6

Do High Returns to Tenure Reduce Turnover?

	United States			Japan	
	QUITS	LOOKFOR_P	ABSENCES_P	QUITS	LOOKFOR_P
	1	2	3	4	5
Plant-specific starting wages	-.087†	.416*	.389	-.066	.681**
	(.051)	(.187)	(.247)	(.050)	(.251)
Plant-specific returns to tenure	1.026	-2.199	8.921**	.043	6.747*
	(.861)	(2.448)	(3.236)	(.575)	(2.862)
R^2	.21	.26	.15	.06	.24
F test	5.0**	7.6**	3.9*	1.0	4.9**
N	41	46	46	34	34

Note: Dependent variables are plant-wide averages of individual responses. ABSENCES_P not available for Japan.

Coefficients on plant-specific starting wages and returns to tenure created in Table 4.

Table 7

Does OJT Reduce Turnover - Plant Level?

Dependent variable is QUITS (Quits in previous year/plant employment).

	United States	Japan
NEWLEARN_P	-.055	-.079**
	(.034)	(.026)
TRAIN_P	.014	.033
	(.018)	(.021)
FORMAL_P	-.029	.034
	(.075)	(.021)
INFORMAL_P	.011	n.a.
	(.090)	
ORIENT	-.033	-.011
	(.023)	(.022)
R^2	.15	.26
F test	1.2	2.4†
N	41	34

Note: Independent variables (except ORIENT) are plant-wide averages of individual responses.
Controls for age, sex and union status do not change the results for standardized coefficients (see text).

† = Statistically significantly different from 0 at the 10% level.

Table 8

Does OJT Reduce Turnover - Individual Level?

Dependent variable is LOOKFOR.

	United States		Japan	
	1	2	3	4
NEWLEARN	.076**	.013	.042**	.018
	(.011)	(.011)[a]	(.015)	(.015)[b]
TRAIN	-.014	-.008	.003	-.00005
	(.008)	(.008)[a]	(.011)	(.010)[b]
FORMAL	.057**	.015	-.004	-.008
	(.018)	(.017)[a]	(.011)	(.011)[b]
INFORMAL	.020	.017	n.a.	n.a.
	(.018)	(.017)		
JOB CHOICE		.094**		.101**
		(.024)		(.023)
JOB SATISFACTION		.123**		.061**
		(.013)		(.016)
JOB RECOMMEND		.125**		.055*
		(.021)		(.025)
R^2	.17	.27	.14	.18
F test	20.6**	33.3**	10.8**	13.1**
N	2740	2740	1715	1715

Note: Additional controls as in Table 2, col. 1 and 3.
[a]: In the US, the F test on NEWLEARN, TRAIN, FORMAL and INFORMAL is F(4,2737) = 1.9 (n.s.); [b]: In Japan, F(3,1712) = .6 (n.s.)