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YOU GET WHAT YOU PAY FOR: TESTS OF EFFICIENCY WAGE THEORIES 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 efficiency wage theories. The data set incorporates numerous objective and subjective performance measures including turnover, effort, absences, satisfaction, and commitment. It also contains extremely good measures of establishment, worker, and job characteristics.

For almost all of the performance measures in both countries efficiency wage theories are supported; that is, workers receiving particularly high wages given their observable characteristics report that they are less likely to quit, more satisfied with their pay, and so forth. The between-establishment component of wages is a more reliable predictor of performance than the within-establishment component.

Keywords: Efficiency wages, Japan.

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I. Introduction

This paper tests efficiency wage theories using a unique data set containing information on over 8000 employees of nearly 100 manufacturing plants in the United States and Japan.

Efficiency wage theories posit that companies that pay above-market wages for workers of a given level of observable quality will have above-average productivity from these workers. These theories have received mixed but generally positive empirical support. This paper extends past work by (1) examining a broader range of performance measures; (2) controlling more carefully for on-the-job training and job characteristics; and (3) examining both U.S. and Japanese data.

The primary result of this paper is that the residual from an ordinary least squares wage equation (a measure of above-market wages) predicts which workers have low probability of quitting, high self-reported willingness to work hard, high satisfaction with their pay, and so forth. In all, the estimated performance effects from raising wages are positive for fifteen of 16 performance measures in the U.S. and for 11 of 12 measures in Japan. The pattern of the results is inconsistent with the hypothesis that the high wages merely measure human capital or compensating differences.

The basic results are robust both to variation in specification and to estimation technique. Alternative techniques include: fixed effects estimators that control for correlated errors within an establishment; ordered logit estimators that take into account the qualitative nature of most of the responses; and techniques that correct for the use of estimated regressors.

II. Literature Review

The efficiency wage hypothesis states that when productivity of observably similar workers depends upon wages, employers will set wages to minimize unit labor costs. Table 1 summarizes the main variants of efficiency wage theories and some of their key assumptions. Higher wages are hypothesized to increase effort, satisfaction, unmeasured human capital, worker cooperation with managerial goals, and the perceived fairness of wages. In addition, higher wages are hypothesized to reduce voluntary turnover, vacancy rates, strike rates, the threat of unionization, and general labor unrest.

Performance equations: The majority of empirical tests of efficiency wages have regressed performance measure against measures of relative wages. These studies are summarized in Table 2. Performance measures include quit rates, survey measures of satisfaction and of self-reported effort, physical productivity (e.g., number of items checked per hour by super-market cashiers), absences, total factor productivity as estimated from production functions, and so forth. The level of analysis includes individual, establishment, corporation, industry, or entire U.S. economy. Various additional controls are included in each study, while some include other measures of the cost of job loss such as the unemployment rate.

The most common measure of relative wages, and the one that is used here, is calculated by first running a wage equation with controls for demographic and human capital variables such as age, education, sex, and race. The residual of this equation is then used as a measure of relative wages--workers who have large residuals in the wage equation are paid

more highly that are workers with similar observable human capital and demographic characteristics. In this paper, this residual will be designated $RESID_1$.

Other measures of relative wages used by the studies in Table 2 include: the company's assessment of its relative wage; wages relative to the area, where the company's wage across establishments is held constant by a union contract; and wages for very detailed occupations relative to other employers in the industry and area.

The results summarized in Table 2 are largely supportive of efficiency wage theories--that is, most of the studies find high-wage employers have high performance. Four cautions are in order. First, the results are far from consistent. For example, Janet Spitz (1989) and Jonathan Leonard (1987) find no relation between high relative wages and productivity.

In addition, most of these tests agree with efficiency wage predictions concerning the sign of the performance-productivity relation, but find a rather small wage elasticity of performance. High wages could increase performance, but not be efficiency wages if the relationship is weak. The production function estimates (Levine 1987, Straka 1988, and Wadhwani and Wall 1988) estimate the magnitude of the wage elasticity of performance; they all find performance-enhancing effects of high wages approximately of the size predicted by efficiency wage theory.

Furthermore, all of these studies have had difficulty controlling for the level of human capital and for compensating differentials. It is possible that any wage difference is due to workers being paid a differential to compensate for having to work hard, or due to workers being paid more because the employer observes their human capital more accurately than does the econometrician.[1] On the other hand, the negative relation between relative wages and quits and the positive relation between relative wages and satisfaction found in several of the studies implies that companies are not merely rewarding workers for good skills or for bad working conditions (Akerlof, Rose, and Yellen, 1989; Freeman, 1980; Leonard, 1987). To the extent that relative wages are systematically biased upward by mismeasured human capital, the wage coefficients in a quit equation is biased downward.

Finally, the studies have been limited to data in the United States and the United Kingdom. Comparative research on other countries has so far been lacking. The research discussed below is able to address some of the limitations of past work; nevertheless, many questions remain.

Within-plant vs. between-plant relativities: Unlike most data sets used by economists, this data set contains information on many workers at the same establishment. Thus, it is possible to divide the total residual from the wage equation ($RESID_1$) into two components: how well a worker is compared to his or her plant, and how well a plant pays compared to the market. The decomposition technique is straightforward: in the wage equation each plant is permitted to have a separate intercept. The residual from this wage equation is referred to as $RESID_2$, while the estimated coefficients on the plant-specific fixed effects are referred to as FE_2.

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1. Efficiency wage differ from compensating difference theories because the high wage more than compensates for the additional effort.

There are important theoretical and empirical differences between the two components of the wage residual. To understand the predicted effects of $RESID_2$ and FE_2 on performance, consider a worker who has high $RESID_2$ and average FE_2. Such a worker is highly paid compared to her co-workers at her plant (given her observable human capital, demographic, and job characteristics). Since she works at a plant with average wages (i.e., FE_2 is average, by assumption), she is also highly paid compared to workers at other plants in the area with similar observable characteristics. On the other hand, a worker who has average $RESID_2$ and high FE_2 is highly paid compared to her external comparison groups, but receives average pay within her plant.

Measurement error is probably lower for the between-establishment component, since individual-specific errors are averaged out. For this reason, performance may be more responsive to the between-establishment component.

Working in the opposite direction, equity theory (Adams, 1965) implies that within-establishment differentials should have more impact on performance than between-establishment differentials. For example, equity theory predicts that a 10% raise for a worker while holding constant all other wages in the plant is more valuable to the recipient than if everyone else in the plant also received a 10% wage increase (Blinder, 1988: 6,7). Equity theory predicts that workers who are paid the market wage, but paid below-average for their establishment, will be below average in pay satisfaction and above average in intention to quit.

Are relative wages measured correctly? One important problem with the performance equations described above is that relative wages are measured with error. To the extent that the error is random, the coefficient on $RESID_i$ is biased downward. To the extent that the error is correlated with human capital, the coefficients on productivity-related measures of performance are biased upward, while the coefficient on turnover is biased downward. For example, if half of the relative wage measure is actually picking up unmeasured general human capital, then the coefficients on intention to look for another job is biased down by roughly 50%.

If there is no measurement error by the worker or by the wage equation, then four predictions follow: (1) $RESID_2$ has similar effects on satisfaction with pay compared to others in the company (internal satisfaction), and on satisfaction with workers in other companies doing similar jobs (external satisfaction); (2) FE_2 has no effect on internal pay satisfaction; (3) $RESID_2$ and FE_2 have the same effect on external pay satisfaction; and (4) if wages are associated with the particular job the worker is doing, then $RESID_2$ is negatively related to a worker's willingness to move to another job within the company (since $RESID_2$ then measures the wages that must be foregone to move to another job within the company). If equity theory is correct and there is no measurement error, a fifth prediction is that $RESID_2$ should have a larger effect on overall pay satisfaction than does FE_2--a worker's satisfaction should increase more if she is the only recipient of a raise than if all workers in the plant receive that increase.

All of these predictions are modified in the presence of measurement error; because idiosyncratic errors average out for the plant effect, the relative size of $RESID_2$'s coefficient will decrease in the presence of measurement error. The tests below regress $RESID_2$ and FE_2 against the various pay satisfaction measures, and shed light on the relative importance of measurement error and of equity theory.

III. The Data

The data are from 1982-83 surveys of manufacturing establishments in the Indianapolis area in the U.S. and from the Kanagawa prefecture (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, organization were stratified by employment size and by industry, and randomly selected. 52 out of the 140 U.S. establishments that were contacted (37%) and 46 out of the 90 Japanese establishments (51%) provided usable data. (Lincoln and Kalleberg [1990] discuss the data in more detail.)

The survey questions and summary statistics are presented in Table 3. An important feature of the data set is the presence of numerous measures of job characteristics, including on-the-job training, autonomy, monitoring, and complexity. Descriptions of the wage equation data (wage measures, human capital and demographic controls, and job characteristics) are presented in the Appendix.

Performance Measures

Turnover: At the establishment level, the quit rate in the previous year is available. This variable was determined from the establishment's personnel records.

All other performance measures are responses from surveys filled out by employees. With the exception of the ABSENCES measure, the coding is always such that higher levels of the dependent variable corresponds with higher performance.

A measure of intention to quit, LOOK_FOR_JOB, is the response to the following question:

> "How likely is it that you will try hard to find a job with another company within the next year?" (2 = Not at all likely; 1 = Somewhat likely; 0 = Very likely)

Economists typically work with actual quit rates, not with intentions to quit. Reassuringly, numerous studies have found that similar intention to quit measures are quite accurate predictors of futures quits (see, e.g., Mobley, Horcer, and Hollingsworth [1976] and the studies cited there). Using this data set, Lincoln and Kalleberg also find that plants with higher levels of LOOK_FOR_JOB have higher voluntary turnover (1990).

A related performance measure (only available in the U.S. sample) is self-reported absences per month (ABSENCES). Efficiency wage theories imply that workers paid relatively high wages should have fewer days late and days absent per month. (Such self-reports of behaviors may be rather unreliable. Furthermore, efficiency wage theories give ambiguous predictions if the right to be absent is a benefit conferred on high-wage employees.)

Satisfaction measures: Five measures of overall job satisfaction are available in the data set. Typical questions are "All in all, how satisfied would you say you are with your job?" (JOB_SATISFACTION: 0 = "Not at all satisfied," 3 = "Very satisfied"); and "In general, how well would you say that your job measures up to the sort of job you wanted

when you took it?" (JOB_MEASURES_UP: 0 = "It is not at all what I wanted," 2 = "It is very much what I wanted.")

The summary statistics in Table 3 are consistent with past research: Japanese workers consistently report lower satisfaction than do U.S. workers (Lincoln and McBride, 1987). To some extent, differences in mean responses between countries may be due to differences in language, culture, and economic realities. The results below only study attitudinal differences within each country, minimizing the difficulties of cross-cultural comparisons.

In addition to measures of overall job satisfaction, in the US three questions measures pay satisfaction. PAY_INTERNAL measures pay satisfaction compared to the company in general. PAY_EXTERNAL measures pay satisfaction compared to those outside of the company performing the same job. PAY_SATISFACTION measures agreement that "Pay at this company is good."

Commitment measures: There are six measures of employee commitment to the company. Typical questions include "I am proud to work for this company," (PROUD_TO_WORK_HERE; 1 = "Strongly disagree," 5 = "Strongly agree") and "I feel little loyalty to this company" (NOT_LOYAL, same codes, but reverse-coded in regressions).

Similar measures of commitment have been found to correlate with high intent to remain at the firm, and with low rates of turnover, absenteeism, and tardiness. On the other hand, commitment does not predict effort levels (Mowday et al., 1982: 36-37).

Somewhat surprisingly, the mean levels of worker commitment and loyalty reported in Table 3 are very similar in the U.S. and Japan. As discussed in Lincoln and Kalleberg (1990), Japanese workers have higher commitment when taking into account their lower level of job satisfaction.

IV. Results

Wage equations: Table 4 presents the basic wage equations for the United States and for Japan. The log of annual earnings is regressed upon a standard list of demographic and human capital controls, as well as the job characteristics measures described above.

The results in columns (1) and (3) accord well with past research on wages in the United States and in Japan (esp. Kalleberg and Lincoln, 1988). Japanese workers receive higher returns to age.[2] On the other hand, U.S. wages show higher returns to education and to rank (i.e., being a manager or supervisor). The U.S. wage equation has lower explanatory power than does the Japanese (R^2 = 0.40 in U.S., 0.69 in Japan).

The results are very similar in columns (2) and (4), when a complete set of plant dummies are added to the regressions. In the United States (but not in Japan) the coefficients

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2. An additional control was added in Japan for workers above the then-standard retirement age of 55. Many workers in Japan who retire from regular employment return to work, but receive a lower wage. The estimated coefficient is large (-9%) but not statistically significant.

on age, education and tenure are substantially smaller in the regression with plant dummies (column 2). This diminution is consistent with important sorting effects, where high-wage firms have a more experienced and better educated workforce. (In results not shown, the estimated coefficients were intermediate between columns 1 and 2 when establishment characteristics such as union status, establishment size and a set of industry controls were added.)

V. Regressions of Performance on Relative Pay

In this section the numerous performance measures (intention to quit, satisfaction, and so forth) are regressed against measures of above-market wages. All results were replicated with controls for demographic and human capital factors that are predicted to affect performance.

In Table 5, performance is regressed against $RESID_1$, the wage residual from Table 4, columns 1 and 3. $RESID_1$ is the relative wage measure controlling for standard demographic and human capital measures, occupation, and job characteristics. It is the correct measure of a worker's cost of job loss if the worker's alternate wage is equal to what a worker with similar observed characteristics receives in the labor market, and if average plant wage levels are uncorrelated with human capital. Alternative relative wage measures that relax these assumptions are discussed below.

The initial results are estimated with ordinary least squares (OLS). These results are much easier to interpret than are results estimated with ordered logit (the technique appropriate for categorical dependent variables). Because both techniques imply almost identical results, the standard OLS results are presented first. Ordered logit estimates, as well as estimates that address issues concerning the use of estimated regressors as independent variables, error components, and the mismeasurement of human capital are presented below.

Table 5 presents the core results of this paper. The most striking result is that in both countries virtually every coefficient is of the sign predicted by efficiency wage theories. For fifteen of 16 performance measures in the U.S. and for 11 of 12 measures in Japan, higher levels of $RESID_1$ are associated with higher levels of performance. Twelve of the 16 coefficients in the U.S. but only four of twelve in Japan are statistically significantly different from zero at the 5% level. (Since the attitudinal measures are not independent, the U.S. results are not as conclusive as they might appear.) Although $RESID_1$ is an estimated regressor, as discussed below, neither the coefficients nor the tests of significance are biased. (As discussed below, in the US the plant-level quit rate in the previous year is also negatively related to paying above-market wages, as predicted by efficiency wage theories.)

These results imply that in both the U.S. and Japan there appear to be good and bad jobs. Workers in some jobs receive above-market wages; furthermore, workers who are paid more are more satisfied, are more committed to their employer, have lower intention to look for another job, declare that they are willing to work harder than they need to, and so forth.

It is unlikely that these results are merely a result of unmeasured human capital, since the workers with high wages report lower intentions to quit. In past research, this correlation may plausibly have been due to the presence of unmeasured firm-specific human capital (that increases firm-specific wages and, thus, lower quit rates). The multiple measures of on-the-job training in Table 4 reduce the importance of this explanation.

While the estimated signs almost universally support efficiency wage theories, the size of the coefficients provides less than overwhelming support. In the U.S., the median coefficient is approximately 0.40; that is, a one standard deviation in the wage residual (a change of about 0.4 in the log wage) increases performance by about 0.16 of a standard deviation--equal to approximately 0.2 points on most of the questions with a 1 to 5 range in possible responses.[3]

Unsurprisingly, the largest coefficients are on the pay satisfaction questions (PAY_SATISFACTION, PAY_INTERNAL, and PAY_EXTERNAL), with coefficients greater than 0.90 (all three standard errors = 0.07 **). Coefficients are also relatively large on PROUD_TO_WORK_HERE (0.57 (0.07)**) and MISTAKE_TO_WORK_HERE (0.46 (0.07) **). Workers with high $RESID_1$ also reported that they were less likely to look for a new job (coefficient on LOOK_FOR_JOB = 0.36 (0.05) **). On the other hand, the coefficient on ABSENCES was of the wrong sign, very small, and not statistically significant (0.18 (0.10)).

The median coefficient in Japan is 0.14; only one third the U.S. figure. As in the U.S., PROUD_TO_WORK_HERE (0.24 (0.10)*) and MISTAKE_TO_WORK_HERE (0.29 (0.10) **) were relatively large, as was NOT_LOYAL (0.35 (0.10) **). Also as in the U.S., high-wage workers reported that there were less likely to look for a new job (LOOK_FOR_JOB = 0.19 (0.06) **).

In short, the efficiency wage theory prediction that high-wage workers will have higher performance are strongly supported in these data if we look at the sign (and in the US the significance) of the estimated coefficients; support is more modest the size of the coefficients. Support is stronger is the U.S. than in Japan. The following sections will examine alternative specifications and alternative measures of relative wages.

Within-plant vs. between-plant relativities: As noted above, there are important theoretical differences between the within-plant ($RESID_2$) and between-plant (FE_2) components of the wage residual. To summarize, measurement error is probably smaller between establishments, implying that FE_2 will have a greater effect on performance. On the other hand, equity theory implies that within-plant wage differences have greater effects than do between-plant differences.

The results of the performance regressions with separate coefficients for $RESID_2$ and FE_2 show a consistent pattern (Table 6).[4] In almost all cases, the coefficient on FE_2 is substantially larger than the coefficient on $RESID_2$. In the U.S., the coefficient on the plant fixed effects is of the expected sign as often as the total residual, but is larger for 12 of the 16 performance measures. In Japan, the coefficient on the plant fixed effects is of the expected sign for all twelve variables, is always of a larger magnitude than the total residual in Table 5, and is statistically significant for nine performance measures.

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3. The median coefficient is a meaningful measure, since most of the dependent variables have similar dispersion.

4. Results were unchanged when additional controls were added to the regressions.

The within-plant residual ($RESID_2$) was of the expected sign 12 of 16 times in the U.S., but only statistically significant 5 times. In Japan, the within-plant residual was never statistically significant.

These results provide no support for the predictions of equity theory. Because it is plausible that measurement error is more severe within establishments, the results are far from conclusive. Nevertheless, there is no evidence that people respond more strongly to internal relative pay differences than they do to external pay differences.

Are relative wages measured correctly? As noted above, regressing the estimated within- and between-plant relative wage measures against employee satisfaction with pay within- and between-plants can test the reliability of the relative wage measures. To repeat the results noted above, when there is no measurement error: (1) FE_2 has no effect on PAY_INTERNAL; (2) $RESID_2$ has similar effects on PAY_INTERNAL and PAY_EXTERNAL; and (3) $RESID_2$ and FE_2 have the same effect on PAY_EXTERNAL. (Recall that the pay satisfaction questions are only available in the U.S..)

Consistent with theory, the coefficient of FE_2 on PAY_EXTERNAL is 2.4 (0.09 **) is far larger than its coefficient on PAY_INTERNAL (0.97 (0.09 **)). At the same time, the latter coefficient is significantly different from the zero effect predicted by theory. (With no measurement error, establishment wage levels would not predict pay satisfaction compared to others in the company. If halo effects are large, then high wage plants will have high responses on all satisfaction questions.)

Again, roughly consistent with theory, $RESID_2$'s coefficient on PAY_INTERNAL is comparable in magnitude to its coefficient on PAY_EXTERNAL (0.59 (0.09) ** vs. 0.90 (0.09) **).

There is no support for the hypothesis that $RESID_2$ and FE_2 have the same effect on PAY_EXTERNAL. The coefficient on $RESID_2$ (0.59 (0.09) **) is less than a fourth as large as the coefficient on FE_2 (2.06 (0.09) **). This result implies that there is substantially greater measurement error (by the worker or the econometrician) of within-plant relativities than between-plant relativities.

The final hypothesis was that $RESID_2$ will be negatively related to TAKE_ANY_JOB if wages are associated with the particular job the worker is doing (since $RESID_2$ then measures the wages that must be foregone to move to another job within the company). In the U.S. the predicted negative relationship holds; workers with high RESID_2 were less likely to agree they would take any job to remain working with the company (-0.24 (0.11)**). In Japan, again consistent with the hypothesis that wages are unrelated to current tasks, the coefficient is tiny and insignificant (-0.02 (0.08)).

In sum, the results strongly support joint hypothesis that (1) workers are able with some accuracy to distinguish internal vs. external relative pay; and (2) their assessments are correlated with the residuals from the wage equations in Table 4. On the other hand, the failure of FE_2 coefficient on PAY_INTERNAL to equal zero, and very different effects that $RESID_2$ and FE_2 have on PAY_EXTERNAL implies that there is mismeasurement of relative wages by the wage regression, by the workers, or by both. More importantly, the results imply that the measurement error is substantially larger within than between establishments.

VI. Econometric issues

The results presented above have ignored several potentially important econometric issues. Fortunately, the results are not sensitive to alternative estimation techniques that address the statistical issues. Furthermore, the results are also robust to numerous modifications in the specification of the estimating equations.

Error components: The individual-level estimates reported above ignore correlations among measurement errors within a plant (e.g., common working conditions or training requirements). Such correlations do not bias the coefficient estimates, but typically lead to underestimates of standard errors.

Repeating the regressions at the plant level (i.e., aggregating observations within each plant) avoids these potentially biased standard errors. Such estimates are reported in Table 7.

As with the individual-level results, the signs are strongly supportive of efficiency wage theories: In the United States, 16 of the 17 variables have coefficient on FE_2 of the predicted sign. Probably because of the reduction in measurement error between plants, twelve of the 16 with the predicted sign the coefficients are statistically significant.[5] The median coefficient is 0.41, and the size pattern is similar to the between-plant coefficients in Table 6, column 2.

The coefficient on the quit rate at the plant in the previous year (QUITR_P) is large and significantly negative (-0.15 (0.05) **).

In Japan the results are almost as strong. Twelve of thirteen performance measures are of the predicted sign, seven statistically significantly so. The median coefficient is 0.60. In short, the between-establishment results with far fewer degrees of freedom are quite similar to the individual-level results.

Ordered logit: Most of the individual-level dependent variables are discrete responses to survey questions. Thus, the individual-level OLS results presented are heteroskedastic. (Heteroskedasticity is not a problem with the plant-level averages.) Moreover, the results reported above implicitly assume that scales are cardinal; that is, a move from 1 to 2 on a 5-point scale is equivalent to a move from 4 to 5.

Ordered logit estimation is the appropriate estimation technique in these circumstances. Ordered logit coefficients can be translated into changes in probability of each categorical response when a right-hand side variable (i.e., the wage residual) changes by one unit (written as dP/dX). Unfortunately, ordered logit results are cumbersome to report, since there is a separate dP/dX for each possible response.

Ordered logit estimation does not lead to any qualitative change in results. The estimated coefficients and dP/dX's are presented in Table 8 for some of the more important performance measures.

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5. Because the degrees of freedom declines to below 50, plant-level results are reported as statistically significant if the P value is less than 10%.

Using the complete set of performance measures, in both the United States and in Japan the sign and significance of the ordered logit coefficients on $RESID_1$ are almost identical to the OLS coefficients. The only exception is on JOB_SATISFACTION, which becomes statistically significantly positive at the 2% level. Thus, there is no evidence that the positive results reported in Table 5 are artifacts of the estimation procedure.

Estimated regressors: Estimated regressors can lead to potential difficulties, since the regressors are measured with error. Measurement error is responsible for two problems: biased coefficients and biased standard errors.

The coefficients on RESID_1 in Table 5 are unbiased (Pagan, 1984: 225). Intuitively, coefficients reported in Table 5 are identical to the coefficients that would be estimated if the wage had been included directly in the regression with the additional controls from the wage equation included in the performance equation. Furthermore, although the standard errors are typically biased upward, under the null hypothesis the tests of significance are asymptotically correct (Pagan, 1984: theorem 3.iii, p. 226).

The estimated coefficients on the plant effects in Tables 6 and 7, on the other hand, do suffer from a slight downward bias. Following the procedure outlined in William Dickens and Brian Ross (1984, p. 12), consistent estimators were computed. The procedure is analogous to correcting for errors in variables, with the estimated standard errors of the plant effects calculated in Table 4 serving as an estimate of the measurement error.[6] In results available from the author, when correcting for measurement error almost all of the estimated effects of the plant effects on performance in Table 6 increase slightly in magnitude, but the results were substantively unchanged.

The standard errors are typically biased downward for the estimates in Table 6, leading to artificially inflated tests of significance (Pagan, 1984: 226). Although no correction was made for the biased standard errors, the uniformity of results in Table 5 (when the significance levels of the tests are unbiased) makes it unlikely that measurement error substantially affects the results.

Halo effect: There is substantial evidence that surveys are often subject to a halo effect, where, for example, a positive opinion concerning one aspect of a job can influence the responses to questions concerning other aspects (Cooper, 1981). In the presence of a halo effect, survey measures of the various performance measures will be more highly correlated

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6. The procedure calculates:

$$b_{D\&R} = [I - (X'X)^{-1}S]^{-1} \cdot b_{ols},$$

where $b_{D\&R}$ is the consistent estimate using the Dickens and Ross (1984) procedure, b_{ols} is the ordinary least squares coefficient estimated in Table 5 (along with the other coefficient estimates of the X's), and X is a matrix with all of the individual-level controls listed in Table 4 as well as the estimated plant effects from Table 4 columns 2 and 4. S is a matrix with zeroes everywhere but the lower right corner; that element contains the square of the mean estimated standard error on the plant effects (from Table 4).

than are the true underlying variables. Thus, the estimated coefficients should not be considered as independent tests of efficiency wage theories.

In this data set, there are only modest correlations among the various attitudes measures. The median correlation among the performance measures is a modest 0.31 in the United States, and 0.32 in Japan. Thus, it does not appear that a halo effect is dominating the data.

Sensitivity analyses: Numerous alternative specifications were run in order to check the robustness of the reported results. Restricting the sample to men only; restricting the sample to non-union establishments; and so forth did not change the results qualitatively.

When establishment characteristics (seven industry dummies, log of establishment employment, a dummy representing whether the plant is an independent company, and union status), were added to the wage equations, the coefficients on the resulting residuals were not substantially different from those reported above.

The results were almost unchanged if the job characteristics (on-the-job training, autonomy, complexity, and monitoring) were dropped from the wage equation. Thus, past research that has not been able to control for as well for human capital and working conditions does not appear to be substantially biased.

VI. Conclusions and Further Work

This paper utilizes a rich data set on workers and their employers in the U.S. and Japan to test several predictions of efficiency wage theories. The data set incorporates numerous objective and subjective performance measures of turnover, effort, absences, satisfaction, and commitment, as well as extremely good measures of worker and job characteristics.

In both the U.S. and Japan, for almost all of the performance measures efficiency wage theories are supported. Contrary to the predictions of human capital/compensating differences theory, there are good and bad jobs. In good jobs, workers receive high wages given their human capital and demographic characteristics; they also report that they are less likely to quit, are more satisfied with their pay, are willing to work harder than they have to, have higher commitment to the firm, and so forth. Not all of the estimated effects are statistically significant, and most of the estimated effects are small in magnitude. In the United States and more emphatically in Japan, between-plant relative wages had larger effects on performance than did within-plant relativities.

In spite of the impressive agreement on the direction of the effects, it remains to be seen if the effects are large enough to justify paying above-market wages. Further research linking wages, individual performance measures and corporate performance measures (as in the production function studies listed in Table 2) will be necessary to understand the importance of efficiency wage effects.

Appendix: Description of the Data

The establishments were spread among seven manufacturing industries: printing, electronics, chemicals, metals, food, machinery, and transportation. Within each establishment, a structured interview was conducted with top management personnel and arrangements were made to administer a questionnaire to a sample of full-time, non-temporary employees. Variable names, descriptions and summary statistics are in Table 3.

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 various family-based bonuses. In all Japanese wage equations a set of four dummy variables are included that control for the average number of overtime hours worked per month.

Standard controls: The data set contains a set of standard demographic and human capital controls that are included in all regressions (unless noted below). These include: age, education, gender interacted with marital status, tenure and its square, and race (in the U.S.). Three occupational levels (worker, supervisor, manager) are interacted with staff vs. line.

Several results are notable in the table of summary statistics (Table 3). Mean tenure is as high in the United States as in Japan. This does not imply that lifetime employment is more common in the U.S., since the average Japanese in the sample is four years younger. To the contrary, it reflects the prevalence of layoffs in Indiana manufacturing in the recession year of 1982.

Job Characteristics: In addition to standard demographic and human capital controls, the data set has extremely good measures of job characteristics. No past study of efficiency wage theories has been able to control as completely for worker and job characteristics.

Four broad categories of job characteristics are used in this study: on-the-job training, autonomy, complexity, and supervision. All job characteristics were derived from questionnaires filled out by the workers themselves. Most questions were five-point Likert scales, with one implying agreement with a statement, and five implying disagreement. (In the results presented below, job characteristic measures are entered as continuous variables. No results changed when they were entered as a complete set of dummy variables, one for each possible response level.)

On-the-job training measures include: 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).

Three measures of autonomy are used as controls. Typical questions include: "My job gives me freedom as to how I do my work" (FREEDOM: 1 = "Strongly disagree," 5 = "Strongly agree"). There were 3 measures of complexity; for example "There is a lot of variety in the kinds of things that I do" (VARIETY: same codes). Finally, 3 questions

measure monitoring; for example, "My supervisor has a great deal of say over what I do" (SPRSAY: same codes).

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Table 1

Summary of Efficiency Wage Theories

Benefit of Paying high wages	Key assumptions	Reference
Increase effort.	Effort is costly to monitor; incomplete bonding.	Shapiro and Stiglitz, 1984
Reduce turnover.	Turnover is costly; incomplete bonding.	Salop, 1979
Reduces hiring costs.	Vacancies are costly to fill.	Lang, 1986
Increase the average level of unobservable human capital.	Workers with high unobserved human capital have high reservation wages.	Weiss, 1980
Increase the likelihood that workers will perceive their wages as fair.	Workers can punish firms that are perceived as unfair by quitting or by providing by low effort.	Akerlof, 1984
Forestall union formation or labor strife.		Dickens, 1986
Increase the cost of and reduce the gains from strikes.		
Lower the rate of absenteeism and tardiness.	Incomplete bonding, income effects not too big.	
Lead to the "quiet life" for managers.	Managers do not maximize profits; high wage workers are more pleasant subordinates.	Hicks, 1935
Increase worker cooperation with new hires.	Workers choose level of cooperation or harassment of new hires.	Lindbeck and Snower, 1988

Table 2

Research Relating Performance to Relative Wages and the Cost of Job Loss

Researchers	Data Set	Performance Measures	Efficiency Wage Measure	Support?
Microeconomic Performance Equations				
Akerlof, Rose, and Yellen, 1989	NLS	Satisfaction, quits	Wage - HC	Yes
Bielby and Bielby, 1988	Quality of Employment Survey	Self-reported effort	Wage - HC	Yes
Cappelli, 1988	Airlines*	Satisfaction	Union wage-industry wage	Yes
Cappelli and Chauvin, 1989	Auto plants*	Disciplinary dismissals	Wage-area wage, unemployment	Yes
Freeman, 1980	CPS, NLS, PSID	Quits	Wage - HC	Yes
Holzer, 1989	Equal Employment Opportunity Pilot Project	Turnover, vacancy rates, training costs, performance ratings, perceived ease of hiring	Wage - HC	Yes

Table 2 (continued)

Research Relating Performance to Relative Wages and the Cost of Job Loss

Researchers	Data Set	Performance Measures	Efficiency Wage Measure	Support?
Krueger and Summers, 1988	CPS	Quits, tenure	Wage - HC	Yes
Leonard, 1987	Electronics firms*	Sales per worker, (quits)	Wage - occ wage	No (Yes)
Pfeffer and Davis-Blake, 1988	College administrators	Turnover	Wages - occ wage	Yes
Pfeffer and Langton, 1988	University faculty	Satisfaction	Wage - HC	Yes
Spitz, 1989	Supermarket workers*	Items checked per minute, quits	Union wage - area wage	No
Micro-level Production Function Studies				
Levine, 1990	PIMS lines of business*	Total factor productivity growth	Wage growth relative to competitors	Yes
Straka, 1989	4-digit SIC	Total factor productivity growth	Real wage growth	Yes
Wadhwani and Wall, 1988	U.K. financial data	Total factor productivity growth	Wage growth, unemployment	Yes

Table 2 (continued)

Research Relating Performance to Relative Wages and the Cost of Job Loss

Researchers	Data Set	Performance Measures	Efficiency Wage Measure	Support?
Macroeconomic Performance Equations				
Rebitzer, 1988	3-digit SIC	Total factor productivity growth, unit costs	Unemployment	Yes
Schor, 1989	PUL index* in U.K. mfg.	Worker output as a percent of engineering norm	Unemployment, (wage - UI)	Yes (No)
Weisskopf, Bowles, and Gordon, 1983;	US economy	Total factor productivity	Unemployment, wage - UI	Yes

Notes

Support column is Yes (No) if the findings support (do not support) a positive relation between wages and performance. The Yes or No in this column applies to all performance and cost-of-job-loss measures, unless otherwise noted.

*: Proprietary data.

UI ≡ unemployment insurance and other social welfare benefits
NLS ≡ National Longitudinal Survey
CPS ≡ Current Population Survey
PSID ≡ Panel Study on Income Dynamics

Occ wage ≡ wage controlling for detailed occupation.

Wage - HC ≡ Current wage - wage predicted for a worker with similar demographic and human capital measures such as age, education, race, and gender.

All data are US unless otherwise noted.

Table 3

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	2.42	1.71	2.47	1.52
(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)				
NEWLEARN - my job makes me keep learning new things	3.53	1.21	3.53	1.13
(1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)				
FORMAL - importance of formal on the job training	3.35	.91	2.38	1.36
(0=never had; 1=not at all important; 2=a little; 3=somewhat; 4=very)				
INFORMAL - importance of informal on the job training	3.51	.85	n.a.	
(0=never had; 1=not at all important; 2=a little; 3=somewhat; 4=very)				

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 3 (continued)

Descriptive Statistics

	United States		Japan	
	Mean	Std. Dev.	Mean	Std. Dev.
HISKILL - my job requires a high degree of skill (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)	3.54	1.12	3.28	1.05
REPEAT - my job makes me do things over and over (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)[a]	2.19	1.05	2.56	1.24
VARIETY - there is a lot of variety in the kinds of things I do (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)	3.65	1.18	2.95	1.20
FREEDOM - my job gives me freedom in how I do my work (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)	3.55	1.02	3.00	1.16
NDECIDE - my job does not let me participate in decisions that affect me (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)[a]	3.11	1.11	3.21	1.08
SPEED - my job lets me decide the speed at which I work (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)	3.28	1.14	3.24	1.21
SPRSAY - my supervisor has a lot of say over my work (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)	3.78	1.03	3.77	.95
SPRALNE - my supervisor lets me alone unless I ask for help (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)[a]	2.12	.92	3.24	1.05
SPREL - my supervisor's role in deciding what I do (0=I decides what and how; 1=sup. decides what, I decide how; 2=sup. decides both)	1.04	.59	1.07	.66
LOOK_FOR_JOB - 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
JOB_SATISFACTION - how satisfied are you with your job? (0=not at all; 1=not too satisfied; 2=somewhat; 3=very)	2.90	1.13	2.11	1.06
RECOMMEND_TO_A_FRIEND - 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

[a]: Item has been reverse coded (1 = strongly agree) so that higher values correspond to higher values of complexity, autonomy and monitoring.

Table 3 (continued)

Descriptive Statistics

	United States		Japan	
	Mean	Std. Dev.	Mean	Std. Dev.
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
MISTAKE_TO_WORK_HERE - deciding to work for this company was a mistake. (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)[b]	2.01	.88	2.47	1.07
JOB_MEASURES_UP - how well does job measure up to what you wanted? (0=not at all what I wanted; 1=not completely what I wanted; 2=what I wanted)	1.16	.66	.42	.59
TAKE_ANY_JOB - I'd take almost any job to keep working for this company. (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)	3.12	1.12	3.06	1.13
LIKE_VALUES_HERE - my values and the company's values are similar. (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)	3.10	1.06	2.66	.94
STAY_HERE - I would turn down another job to stay with this company. (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)	2.65	1.16	2.66	1.08
WILL_WORK_HARDER - I'm willing to work harder than I have to for this company. (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)	3.90	.86	3.43	.98
PROUD_TO_WORK_HERE - I'm proud to work for this company. (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)	3.65	.94	3.49	1.01
NOT_LOYAL - I feel no loyalty to this company. (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)[b]	3.48	1.10	3.42	1.02
ABSENCES - number of days absent last month.	.68	1.29	n.a	
PAY_SATISFACTION - my job pays well. (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)	3.42	1.05	n.a	
PAY_INTERNAL - I'm satisfied with my pay relative to others at this company. (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)	1.85	.92	n.a	
PAY_EXTERNAL - I'm satisfied with my pay relative to outsiders with the same job. (1=strongly disagree; 2=disagree; 3=undecided; 4=agree 5=strongly agree)	1.66	1.01	n.a	

[b]: Item has been reverse coded (1 = strongly agree) so that higher values correspond to attitudes desired by the employer. For ABSENCES and QUITR_P, no rescaling was done; higher values are behaviors undesired by the employer.

Table 3 (continued)

Descriptive Statistics

	United States		Japan	
	Mean	Std. Dev.	Mean	Std. Dev.
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	
LOOK_FOR_JOB_P All "_P" variables are plant-wide averages of individual variables	1.53	.24	1.53	.23
JOB_CHOICE_P	1.59	.17	.84	.19
JOB_SATISFACTION_P	2.93	.29	2.09	.28
RECOMMEND_TO_A_FRIEND_P	1.47	.25	.93	.18
MISTAKE_TO_WORK_HERE_P	2.06	.28	2.53	.36
JOB_MEASURES_UP_P	1.19	.13	.42	.13
TAKE_ANY_JOB_P	3.00	.35	3.00	.36
LIKE_VALUES_HERE_P	3.09	.30	2.63	.27
STAY_HERE_P	2.57	.35	2.62	.32
WILL_WORK_HARDER_P	3.93	.22	3.42	.29
PROUD_TO_WORK_HERE_P	3.60	.36	3.43	.35
NOT_LOYAL_P	3.50	.25	3.38	.31
ABSENCES_P	.56	.30	n.a.	
QUITR_P - quit rate (quits in previous year/plant employment)	.06	.06	.07	.04
PAY_SATISFACTION_P	3.27	.53	n.a.	
PAY_INTERNAL_P	1.80	.27	n.a.	
PAY_EXTERNAL_P	1.49	.45	n.a.	

Table 4

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	.050**	.026**	.029**	.027**
	(.006)	(.005)	(.008)	(.008)
AGE	.032**	.007*	.063**	.069**
	(.004)	(.003)	(.007)	(.007)
AGE^2	-.0004**	-.00008*	-.0007**	-.0007**
	(.00005)	(.00004)	(.00009)	(.00009)
AGE OVER 55			-.094	-.083
			(.07)	(.06)
TENURE	.021**	.01**	.027**	.018**
	(.002)	(.0017)	(.0034)	(.003)
$TENURE^2$	-.0004**	-.0002**	-.0004**	-.0002*
	(.00006)	(.00005)	(.00009)	(.00009)
NON-WHITE	-.016	-.039**	n.a	n.a
	(.018)	(.014)		
MALE MARRIED	.217**	.122**	.252**	.262**
	(.0177)	(.014)	(.031)	(.029)
MALE UNMARRIED	.154**	.092**	.147**	.180**
	(.0199)	(.015)	(.026)	(.026)
FEMALE MARRIED	-.039	-.01	-.179**	-.199**
	(.021)	(.015)	(.039)	(.038)
LINE WORKER	-.188**	-.290**	-.221**	-.225**
	(.032)	(.024)	(.039)	(.037)
LINE SUPERVISOR	-.163**	-.188**	-.131**	-.146**
	(.036)	(.027)	(.039)	(.036)
LINE MANAGER	.153**	.136**	-.076	-.016
	(.049)	(.037)	(.055)	(.051)
TECHNICAL WORKER	-.171**	-.304**	-.213**	-.189**
	(.032)	(.025)	(.038)	(.036)
TECHNICAL SUPERVISOR	-.145**	-.191**	-.170**	-.146**
	(.039)	(.03)	(.04)	(.037)

Table 4 (continued)

The Determinants of Wages in the United States and Japan

	United States		Japan	
	1	2	3	4
TRAIN	.013**	.025**	.009	.016**
	(.004)	(.003)	(.005)	(.004)
NEWLEARN	.010	.006	-.002	-.002
	(.006)	(.004)	(.007)	(.006)
FORMAL	.003	.003	.022**	.016**
	(.007)	(.006)	(.005)	(.005)
INFORMAL	.004	-.002	n.a.	
	(.008)	(.006)		
HISKILL	.011	.010*	-.006	-.0014
	(.006)	(.005)	(.007)	(.006)
REPEAT	.011*	.013**	.013*	.006
	(.005)	(.004)	(.006)	(.006)
VARIETY	-.012*	-.003	.005	-.0003
	(.005)	(.004)	(.007)	(.006)
FREEDOM	-.0003	.003	.006	.008
	(.005)	(.004)	(.007)	(.006)
NDECIDE	-.012*	-.010**	.006	.0008
	(.005)	(.004)	(.006)	(.006)
SPEED	-.003	.0009	.00006	-.0001
	(.005)	(.004)	(.006)	(.005)
SPRSAY	-.003	-.006	.009	-.0003
	(.005)	(.004)	(.007)	(.006)
SPRALNE	-.001	.0005	.013*	.004
	(.006)	(.004)	(.006)	(.006)
SPREL	-.044**	-.030**	-.011	-.011
	(.01)	(.007)	(.011)	(.01)
Plant Dummies	0	47	0	34
S.D. (Coeff. on plant dummies)		.19		.14
F test		48.6**		13.1**
R^2	.40	.67	.69	.75
F test	67.2**	75.6**	132.1**	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 5

Individual-Level Performance Equations in the United States and Japan

(Independent variable is *RESID_1*)

	United States	Japan
Dependent variable:		
LOOK_FOR_JOB	.36**	.19**
	(.05)	(.06)
JOB_SATISFACTION	.13	.02
	(.09)	(.10)
RECOMMEND_TO_A_FRIEND	.34**	.04
	(.05)	(.06)
JOB_CHOICE[c]	.09	.03
	(.05)	(.07)
MISTAKE_TO_WORK_HERE[c]	.46**	.29**
	(.07)	(.10)
JOB_MEASURES_UP[c]	.14**	-.03
	(.05)	(.06)
TAKE_ANY_JOB[c]	.40**	.13
	(.09)	(.11)
LIKE_VALUES_HERE[c]	.40**	.15
	(.08)	(.09)
STAY_HERE[c]	.44**	.16
	(.09)	(.10)
WILL_WORK_HARDER	.25**	.13
	(.07)	(.09)
PROUD_TO_WORK_HERE[c]	.57**	.24*
	(.07)	(.10)
NOT_LOYAL[c]	.08	.35**
	(.08)	(.10)
ABSENCES	.18	n.a.
	(.10)	
PAY_SATISFACTION[c]	1.58**	n.a.
	(.07)	
PAY_INTERNAL[c]	.94**	n.a.
	(.07)	
PAY_EXTERNAL[c]	1.35**	n.a.
	(.07)	

Note: The wage residual RESID_1 was calculated with controls on age, education, tenure, race, gender by *marital status* interactions, and *department* by *rank* interactions (from Table 4, columns 1 and 3).

For all measures except ABSENCES, responses are coded so that higher values correspond to attitudes desired by the employer.

Sample size is 2740 in the United States, 1715 in Japan, except for variables marked with [c], which have a sample size of 2619 in the United States, 1702 in Japan.

Table 6

Individual-Level Performance Equations in the United States and Japan

(Independent variables are RESID_2 and FE_2)

	United States		Japan	
	RESID_2	FE_2	RESID_2	FE_2
Dependent variable:				
LOOK_FOR_JOB	.14*	.71**	.02	.98**
	(.07)	(.07)	(.07)	(.12)
JOB_SATISFACTION	.03	.05	-.04	.26
	(.12)	(.11)	(.11)	(.20)
RECOMEND_TO_A_FRIEND	.10	.50**	-.04	.46**
	(.07)	(.07)	(.07)	(.13)
JOB_CHOICE[c]	.01	.00001	-.02	.23
	(.07)	(.06)	(.08)	(.15)
MISTAKE_TO_WORK_HERE[c]	.01	.86**	.01	1.50**
	(.09)	(.09)	(.11)	(.20)
JOB_MEASURES_UP[c]	.10	.03	-.04	.01
	(.07)	(.07)	(.06)	(.11)
TAKE_ANY_JOB[c]	-.24*	1.14**	-.02	.83**
	(.11)	(.11)	(.12)	(.22)
LIKE_VALUES_HERE[c]	.04	.57**	.02	.82**
	(.11)	(.11)	(.10)	(.18)
STAY_HERE[c]	-.11	1.20**	-.09	1.10**
	(.12)	(.12)	(.11)	(.20)
WILL_WORK_HARDER	.004	.43**	.08	.43*
	(.09)	(.09)	(.10)	(.19)
PROUD_TO_WORK_HERE[c]	-.06	1.12**	-.11	1.81**
	(.10)	(.09)	(.10)	(.19)
NOT_LOYAL[c]	-.19	.32**	.13	1.41**
	(.11)	(.11)	(.11)	(.19)
ABSENCES	-.002	.18	n.a.	
	(.13)	(.13)		
PAY_SATISFACTION[c]	.74**	2.41**	n.a.	
	(.10)	(.09)		
PAY_INTERNAL[c]	.90**	.97**	n.a.	
	(.09)	(.09)		
PAY_EXTERNAL[c]	.59**	2.06**	n.a.	
	(.09)	(.09)		

Note: The wage residual RESID_2 was calculated with controls on age, education, tenure, race, gender by marital status interactions, and department by rank interactions and a complete set of establishment fixed effects (Table 4, columns 2 and 4). The estimated coefficients on these fixed effects are included as FE_2.

For all measures except ABSENCES, responses are coded so that higher values correspond to attitudes desired by the employer.

Sample size is 2740 in the United States, 1715 in Japan, except for variables marked with [c], which have a sample size of 2619 in the United States, 1702 in Japan.

Table 7

Plant-Level Performance Equations

Independent variable is FE_2 (Fixed effects from Table 4, columns 2 and 4).

	United States	Japan
Dependent variable:		
LOOK_FOR_JOB_P	.59**	.89**
	(.19)	(.25)
JOB_SATISFACTION_P	.02	.36
	(.24)	(.36)
RECOMMEND_TO_A_FRIEND_P	.31	.38
	(.21)	(.23)
JOB_CHOICE_P	.12	.36
	(.13)	(.24)
MISTAKE_TO_WORK_HERE_P	-.61**	-1.41**
	(.20)	(.40)
JOB_MEASURES_UP_P	.02	-.01
	(.10)	(.17)
TAKE_ANY_JOB_P	.69*	.90†
	(.26)	(.45)
LIKE_VALUES_HERE_P	.41†	.60†
	(.23)	(.34)
STAY_HERE_P	.87**	.83*
	(.24)	(.40)
ABSENCES_P	.13	n.a.
	(.26)	
WILL_WORK_HARDER_P	.31†	.24
	(.17)	(.38)
PROUD_TO_WORK_HERE_P	.94**	1.54**
	(.24)	(.37)
NOT_LOYAL_P	-.04	1.13**
	(.20)	(.35)
PAY_SATISFACTION_P	2.10**	n.a.
	(.27)	
PAY_INTERNAL_P	.82**	n.a.
	(.17)	
PAY_EXTERNAL_P	1.51**	n.a.
	(.28)	
QUITR_P	-.15**	-.07
	(.05)	(.05)
N	47	34

Independent variables (except QUITR_P) are plant-wide averages of individual responses.

Results were not substantially changed when regressions were repeated with controls for union status, plant size and industry. QUITR_P is unchanged with additional controls for average tenure and percent female.

For all measures except ABSENCES_P and QUITR_P, responses are coded so that higher values correspond to attitudes desired by the employer.

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

Table 8

Ordered Logit Estimates

(Independent variable is RESID_1)

	Lowest	Next Lowest	Middle	Next highest	Highest	Logit Coeff.
U.S.						
LOOK_FOR_JOB	-.28	n.a	.00	n.a	.28	1.26**
						(.15)
JOB_SATISFACTION	-.08	.003	n.a	.04	.037	.34*
						(.14)
WILL_WORK_HARDER	-.11	.03	.06	.012	.008	.46**
						(.14)
PROUD_TO_WORK_HERE	-.47	-.20	.04	.515	-.115	3.36**
						(.13)
PAY_SATISFACTION	-.26	.01	.16	.097	.007	1.17**
						(.14)
JAPAN						
LOOK_FOR_JOB	-.15	n.a	.05	n.a	.10	.61**
						(.18)
JOB_SATISFACTION	-.01	.01	n.a	.00	.00	.025
						(.18)
WILL_WORK_HARDER	-.07	.02	.03	.015	.005	.29
						(.17)
PROUD_TO_WORK_HERE	-.11	.03	.05	.03	.00	.45**
						(.16)

The first five columns show the dp/dx; the change in probability of reporting that response as the RESID_1 measure increase by one unit. (Thus, all rows total zero).