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# Efficiency Wages, Deferred Payments, and Direct Incentives in Agriculture

*Abstract*

Empirical evidence from agricultural labor markets is consistent with efficiency-wage theory and inconsistent with several alternative explanations. According to this theory, the higher wage or deferred payment (benefits) that direct-hire growers pay relative to that of farm labor contractors is an efficiency wage. Growers use this extra compensation to lower their monitoring expenses and reduce shirking by workers.

*Key words*: deferred payments, efficiency wage, incentives

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**Efficiency Wages, Deferred Payments, and Direct Incentives in Agriculture**

Employers may pay an efficiency wage — an unusually high wage — or use deferred benefit or wage payments to reduce the costs of monitoring workers (e.g., Lazear, Yellen, Shapiro and Stiglitz, and Newbery and Stiglitz). A high wage or deferred payment serves the same function as an employment bond, making the threat of losing a job greater so that less monitoring is required to prevent shirking or other bad behavior. We examine whether the basic predictions of this model are consistent with the data from a randomized national survey of agricultural workers.

If the efficiency-wage theory is correct, it may explain a number of puzzles about why the labor-management and compensation practices in agriculture differ from those in other labor markets. For example, it may explain why some employers pay unusually high wages and provide benefits, while others pay low wages without benefits. Efficiency wages also have strong implications for the effects of minimum wage laws. Rebitzer and Taylor show theoretically that minimum wage laws can increase employment in a market in which efficiency wages are used for much the same reason as in a monopsony market.

We are unaware of any existing empirical studies of efficiency wage theory in agriculture. The few empirical studies of efficiency wage theory in other sectors investigate labor markets in which only time-rate compensation is used and usually all workers are employed directly by the firm producing the final good.[1] In contrast in agriculture, one in eight workers nationally (and roughly one in four in the west, north east, and south east) is paid a piece rate and one in nine nationally (and nearly one in three in the west) is employed

by a farm labor contractor (FLC). Farm labor contractors provide growers with labor and, if desired, supervision and other services.

In many regions of the country, especially in California, growers use FLCs to provide labor and often to supervise these workers. FLCs tend to pay lower wages than direct-hire growers. We examine empirically whether the tradeoff between higher wages and monitoring costs can help explain differences in wages between FLCs and direct-hire employers.

We expect monitoring problems to differ across piece-rate and time-rate jobs. Typically, the primary concern of a supervisor is maintaining quality (especially when harvesting delicate crops) on piece-rate jobs and is increasing speed on time-rate jobs. Piece rates and other incentive payments may be used to ensure productivity in lieu of efficiency wages or monitoring.

We first discuss the underlying theories. Then we describe the data set. Next we report on a number of studies that test for efficiency wages and deferred wages. In the following section, we consider some alternative explanations. In our concluding section, we discuss why the use of efficiency wages has important policy implications.

**Preventing Shirking**

A major objective of any employer is to prevent shirking and maintain high levels of effort by employees. In repeated games (Newbery and Stiglitz), this problem may be less severe. However, typically agricultural employers hire workers for short-term, seasonal jobs. Only some employers try to employ the same workers again in future years. Consequently, these employers may try to prevent workers from shirking using productivity incentives such as piece rates, monitoring, or efficiency wages (or other forms of bonding).

*Piece Rates*

The direct approach to preventing shirking by providing productivity bonuses or piece-rate compensation is widely used in agriculture but is less common in other labor markets. Extensive prior research shows that workers who are paid by the piece rather than by the hour work much faster though possibly less carefully (which matters when harvesting delicate fruit). For example, Billikopf reports that employees paid by the piece prune a vineyard in only 19 hours of work per acre compared to 26 hours for employees paid by the hour. Foster and Rosenzweig find that agriculture workers (in the Philippines) who are self-employed or who are paid by the piece use up 10% more body mass net of calorie consumption — indicating that they put forth greater effort — than do time-rate workers.

*Monitoring*

Closely supervising workers can also maintain high levels of productivity. There are two problems with extensive monitoring. First, it is expensive. Second, research in other labor markets indicates that excessively close monitoring can backfire. Workers may perceive extensive or increased monitoring as an indication of distrust, which may cause them to reduce their work effort. Frey hypothesizes that this "crowding out of work effort" effect is likely to dominate when the relationship between supervisors and employees is personal (as one might expect in agriculture), while the "disciplining" effect is likely to dominate when the relationship is distant (as in a competitive market setting). A study by Barkema of 116 managers in medium-sized Dutch firms supports this view. Managers work effort was measured by their hours of work. The intensity of monitoring was measured by the regularity with which their performance is evaluated, the formality of the evaluation procedure, and the

degree to which the managers were evaluated by well-defined criteria. The effectiveness of monitoring depended on who was monitoring. When managers were monitored by the parent company (a relatively impersonal relationship), more monitoring lead to more effort. When managers were monitored by their firm's chief executive (a relatively personal relationship), monitoring lead to less effort.[2] And, when managers were monitored by a board of directors (an intermediate case), monitoring did not have a statistically significant effect.

Relatively little is known about which agricultural employers extensively supervise and which do not. Employers who can speak Spanish, for example, are more likely to directly supervise Spanish-speaking workers than those who do not, presumably because their monitoring and supervising costs are lower. Using a random sample of Fresno County growers, Isé et al. (1994, 1996) found that farmers who speak Spanish well are twice as likely to hire directly as to use FLCs, whereas those who do not speak Spanish at all are twice as likely to use FLCs (who speak Spanish) as to hire directly. Thus, we expect that employers who do not speak Spanish are more likely to hire managers or to use deferred payments (presumably because they cannot hire English-speaking employees).[3]

*Bonding, Deferred Payments, and Efficiency Wages*

Firms can use bonds, deferred payments, and efficiency wages to induce employees to work hard. Rigorous theoretical presentations are contained in Shapiro and Stiglitz and Stiglitz. Here, we briefly summarize the basic ideas.

A firm can induce workers to work hard by requiring them to post a performance bond that is forfeited if the firm fires the employee for shirking. Although agricultural firms

do not use bonds, we start with a model of bonds so that we can show that the methods firms actually use serve the same role as bonds.

Suppose that a worker places a value of $G$ on taking it easy on the job. If the only punishment that worker faces for shirking is dismissal (and the worker can quickly find employment elsewhere), the worker will shirk because the benefit, $G$, exceeds the (nonexistent) cost from being fired. Now suppose that the firm requires that a new employee must post a bond of $B$ dollars that will be forfeited to the firm if the worker is fired for shirking. The bond raises the cost of shirking. If, given the firm's level of monitoring, the probability that a worker is caught is $\theta$, a worker who shirks expects to lose $\theta B$. A risk-neutral worker chooses not to shirk if the certain gain from shirking, $G$, is less than the expected penalty, $\theta B$, from forfeiting the bond if caught: $G < \theta B$. By spending more on monitoring, the firm can raise $\theta$ and raise $\theta B$. However, by setting a higher bond $B$, the firm can deter shirking while spending less on monitoring.

Although performance bonds are used in a few labor markets (e.g., for couriers), they are not required in most labor markets, even those involving higher-paid workers than those in agriculture. Because agricultural workers have little income or wealth, requiring that they post a bond is obviously infeasible.

However, firms can effectively post bonds for their employees through the use of deferred payments. For example, suppose a firm pays new workers a low wage for some initial period of employment and then raises the wage. Over time, workers that are caught shirking are fired, so that only those who remain receive the higher wages. In another form of deferred wages, the firm provides bonuses or pensions to only workers who remain with the

firm for a substantial period of time. Both these types of deferred payments serve the same function as bonds: By raising the cost of being fired, the firm needs less monitoring to deter shirking.

To illustrate these ideas, we assume that workers care about the present value of their earnings stream over their lifetime. A firm may offer its workers one of two wage-payment schemes. In the first, the firm pays *w* per year for each year that the worker is employed by the firm. In the second arrangement, the starting wage is less than *w* but rises over the years to a wage exceeding *w*.

If employees can borrow against future earnings, those working for one company for their entire career are indifferent between any two wage-payment schemes with identical present values. The firm prefers deferred payments because employees work harder to avoid being fired and losing the high future earnings. If the employer and employee share the extra output from eliminating shirking in the form of higher profit and larger lifetime earnings, both the firm and workers prefer the deferred-payment scheme that lowers incentives to shirk.[4]

For the two payment streams to have the same present value, the deferred-payment scheme must start with very low wages. However, Krueger, in his study of efficiency wages in the fast food industry, argues that a minimum wage law effectively precludes firms from paying unusually low initial wages in a low-wage industry such as fast food restaurants or agriculture.[5]

If the present value of the deferred payments exceeds that from the constant wage stream, the deferred payments scheme has elements of an efficiency wage: an unusually high wage that a firm pays workers as an incentive to avoid shirking. If a worker fired for

shirking can immediately go to another firm and earn the same wage, the worker risks nothing by shirking. In contrast, a high wage payment raises the cost of getting fired, so it discourages shirking.[6]

We now briefly summarize the standard efficiency wage theory based on Yellen, Shapiro and Stiglitz, and Stiglitz. Suppose that a firm pays each worker an efficiency wage $w$, which is more than the going wage $\underline{w}$, which an employee will earn elsewhere after being fired for shirking. The less frequently the firm monitors workers, the greater must be the wage differential between $w$ and $\underline{w}$ to prevent shirking.

A worker decides whether to shirk by comparing the expected loss of earnings from getting fired to the value, $G$, that the worker places on shirking. A shirking worker expects to lose $\theta(w - \underline{w})$, where $\theta$ is the probability that a shirking worker is caught and fired and the term in parentheses is the lost earnings from being fired. A risk-neutral worker does not shirk if the expected loss from being fired is greater than or equal to the gain from shirking: $\theta(w - \underline{w}) \geq G$. Thus, the smallest amount by which $w$ can exceed $\underline{w}$ and prevent shirking is determined where this expression holds with equality, $\theta(w - \underline{w}) = G$, or $w - \underline{w} = G/\theta$. The extra earnings, $w - \underline{w}$, is the equivalent of a performance bond in discouraging bad behavior.

From the possible pairs of monitoring levels and efficiency wages that deter shirking, the firm picks the combination that minimizes its labor cost. The greater the firm's monitoring cost, the higher the wage paid by the firm to prevent shirking.

Research in other labor markets shows that higher pay or deferred pay may substitute effectively for direct monitoring and supervision of workers. For example, Rebitzer shows

that there is an explicit tradeoff between level of supervision and of wages in the petrochemical industry.

Krueger finds a tradeoff between higher or deferred wages versus monitoring by fast-food restaurants. Lack of adequate monitoring in fast-food restaurants leads to shirking, absenteeism, theft, and other problems. If the manager of a restaurant is the owner of the franchisee, the manager has strong profit motive to work hard and closely supervise employees. In contrast, at chain-owned restaurants, managers are employees who receive a fixed salary and do not receive bonuses based on performance or the restaurant's profit, so they are less likely to carefully monitor other employees. Because company-owned restaurants have a more severe monitoring problem than franchised restaurants, we expect them to be more likely to use financial incentives such as deterred wages or higher wages to prevent shirking. Krueger finds that company-owned restaurants pay more and have steeper tenure-earning profiles than do franchise restaurants.

*Farm Labor Contractors*

Because FLCs frequently provide monitoring services as well as labor, we may observe a different propensity to use deferred wages and other indirect approaches by employers who use FLCs. Unlike other sectors of the economy, labor contractors are extensively and increasingly used in agriculture in California and to a lesser extent in other areas of the country. Some FLCs provide only labor, but many also supervise the workers for the grower. *Farm Labor Contractors in California* reports on a large random survey of FLCs. This study finds that 53 percent of FLCs are responsible for setting performance standards of workers, 14 percent share this decision with growers, and the remaining third are not involved because

that is the grower's responsibility. Supervision of workers at the field or site is most often given by foremen and supervisors (64 percent) or the FLC (29 percent) though a few growers (4 percent) directly supervise.

Whether FLCs are better or worse supervisors than direct-hire growers is not known and may depend on specific circumstances. If the compensation scheme is such that the FLC has no vested interest in the productivity of the workers, the FLC may provide minimal supervision. On the other hand, with appropriate incentives, a FLC speaking the language of the workers, may be a better supervisor than a grower who speaks only English. Thus, we cannot predict whether efficiency or deferred payments are used more or less frequently for FLC employees rather than direct-hire employees.

**National Agricultural Worker Survey**

Before presenting our empirical tests of our hypotheses, we briefly describe our data set, which consists of 4,603 observations from the National Agricultural Worker Survey (NAWS) for 1992 to 1995. The Department of Labor commissioned the NAWS starting in 1988 in response to the Immigration Reform and Control Act of 1986, which required the Secretaries of Agriculture and Labor to assess annually the quantity and quality of agricultural workers in the United States.

The NAWS is an annual survey of a random sample of hired seasonal agricultural services (SAS) workers. Although only SAS workers are interviewed in the NAWS, SAS is defined broadly as most field work in perishable crop agriculture. SAS crops are the vast majority of nursery products, cash grains, field crops, as well as all fruits and vegetables, but

do not include the production of poultry, livestock, silage or other animal fodder (Mines, Gabbard, and Samardick).

A nationally representative cross-section of SAS workers from 72 counties in 25 states representing 12 distinct agricultural regions are sampled. For each of the interviewing cycles, 30 counties were selected randomly as interview sites. The number of interviews conducted during a given cycle is proportional to the share of SAS activity at that time of the year. Interviews are conducted every four months — in January ("winter" in our tables), May ("spring"), and October — to ensure as diverse a representation of workers as possible. Mines, Gabbard, and Boccalandro present complete details on the sampling procedure.

Table 1 presents summary statistics for the data set. The FLC dummy equals one if the worker is employed by a FLC and equals zero if the worker is directly employed by a farmer. The piece-rate dummy equals one if the worker receives any piece-rate compensation, even if the worker also receives some time-rate compensation.

The tenure variable is the number of years (rounded up to an integer) that an individual has worked with the current employer. Figure 1 shows that the distribution of tenure (truncated at 22 years where the frequency becomes essentially zero) is very skewed. The mean tenure is 4 years and the median is 2 years. Over a third (36%) of all workers are employed for one year or a shorter period. Over half (54%) are employed two years or fewer, and two-thirds (67%) are employed three years or fewer. The longest observed tenure in the sample is 38 years.

The mean value of tenure is 7.02 time-rate, direct-hire employees, 8.76 for time-rate, FLC workers, 6.59 for piece-rate, direct-hire workers, and 8.62 for piece-rate, FLC workers.

Because the tenure distributions are highly skewed, the means are much higher than the medians.

In addition to citizens, there are three other legal status categories. The base group in our regressions is immigrants lacking legal permission to work in this country. Some undocumented immigrants received amnesty under IRCA, so that they can become permanent residents or citizens and work legally in this country. The final category is other immigrants who can legally work in this country, most of whom are permanent residents.

**Empirical Specification**

Because workers may receive wages and benefits, we consider the impact of efficiency wages, deferred payments, and direct incentives on both wages and benefits using separate equations. To test the implications of the efficiency wage theory concerning deferred payments, efficiency wages, and direct incentives, we hypothesize that worker *i*'s hourly earnings, $w_i$ (hourly wage or piece-rate earnings per hour),[7] equation is

$$\ln w_i = \beta_1 T_i + \beta_2 FLC_i + \beta_3 (T_i \times FLC_i) + \beta_4 P_i + \beta_5 (T_i \text{ x } P_i) + \beta_6 (T_i \text{ x } P_i \times FLC_i) + \beta_7 X_i + \varepsilon_i$$

where $T_i$ is the years of tenure; $FLC_i$ is a dummy variable that equals one if the worker's employer is a farm labor contractor; $P_i$ is a dummy that equals one if the worker is paid by the piece; and $X_i$ is a vector of individual characteristics (race, ethnicity, gender, legal status, age, age$^2$, U.S. farmwork experience, years of schooling, and proficiency in speaking and reading English), year dummies, five regional dummies, and two seasonal dummies.

If deferred wages are paid, we would expected $\beta_1 > 0$. If only direct-hire growers pay an efficiency wage, then $\beta_2 < 0$. The sign of $\beta_3$ depends on whether farm labor contractors

provide more or less supervision than do direct-hire farmers. If piece-rate compensation provides an incentive to worker harder, then $\beta_4 > 0$. The signs of $\beta_5$ and $\beta_6$ can be either positive or negative.

Using ordinary least squares to estimate this equation is inappropriate if tenure and its interaction terms are correlated with the error term. For example, if only the best workers (whose abilities are unobserved) are offered long-term employment, we expect the wage error term and tenure to be correlated. However, we reject endogeneity (of both tenure and FLC status) below using Hausman tests.

We also examine whether worker *i* receives up to four benefits: paid holidays, an end-of-season bonus, a bonus based on the employer's profit, and an incentive bonus (a reward for hard work). Suppose that there is a latent variable for worker *i*, $Y^*_{ji}$, representing the propensity for this worker to receive a fringe *j*. The latent variables equations are of the same form as that of the wage equation:

$$Y^*_{ji} = \gamma_1 T_i + \gamma_2 FLC_i + \gamma_3 (T_i \times FLC_i) + \gamma_4 P_i + \gamma_5 (T_i \text{ x } P_i) + \gamma_6 (T_i \text{ x } P_i \times FLC_i) + \gamma_7 X_i + \varepsilon_i.$$

We observe that worker *i* receives the fringe *j* if $Y_{ji} = 1$, which occurs if $Y^*_{ji} > 0$. The paid holidays and the end-of-season bonus are clearly deferred payments. We expect these two to be positively related to tenure in general. We expect that the bonus based on the employer's profit, which should be relatively uncorrelated with an individual worker's productivity, to be unrelated to tenure. The incentive bonus should be unrelated or negatively related to tenure as it serves as a direct incentive and hence is a substitute for deferred payments. We estimate these equations using probit.

**Results**

Using the NAWS data, we tested whether the implications of the efficiency wage and deferred wage theories are consistent with wage and fringe benefits in agriculture. We first report a wage equation and then four fringe benefit equations.

*Wages*

We regress the logarithm of the wage on standard individual characteristics, job tenure, an FLC dummy, the interaction between tenure and FLC, a piece-rate compensation dummy, and an interaction between tenure and the piece-rate dummy. One might argue that tenure and its interaction variables are endogenous. Similarly, one might make the same endogeneity claim about FLC status and its interaction terms. To test for these possibilities, we conducted two Hausman tests, in which we compare an instrumental variable estimate to the ordinary least squares estimate. First, we consider that tenure (and its interactions) is endogenous.[8] The Hausman test statistic is 12.61 with a p-value of 0.84. Next, we test whether both tenure and FLC status (and their interactions) are endogenous. The test statistics is 16.82 and p-value is 0.93. Consequently, we report only the ordinary least squares estimates of the log wage equation in Table 2. The reported robust standard errors are estimated using White's method.

If wage earnings are deferred, wages should increase with tenure. The coefficients on the demographic variables that are usually included in wage equations have the expected signs. The equation shows that wages increase with tenure.[9] The F-statistic that the tenure variables are collectively different from zero is 21.9. The comparable F-statistic on the piece-rate terms is 219.2 and that on the FLC terms is 14.3. Thus, we reject all three null-hypotheses that the tenure, piece rate, and FLC terms are irrelevant. Figure 2 shows that the wage-

tenure profile is statistically significantly upward sloping for all four compensation-employment groups.

The wage-tenure profile for time-rate employees of direct-hire farmers lies strictly above that for time-rate, FLC employees. The difference in the slopes of these two curves is not statistically significantly different at the 0.05 level. Thus, consistent with our expectation, FLCs pay 7.5 ($\approx e^{-.0776} - 1$) percent less than do direct-hire growers. This differential may indicate that direct-hire growers pay an efficiency wage that is higher than the wage paid by FLCs, the employer of last resort.

If FLCs provide less (more) supervision of workers than do direct-hire farmers, efficiency wage theory predicts that the tenure-FLC dummy should have a positive (negative) coefficient. The coefficient is a small positive number that is not statistically significantly different from zero at the 0.05 level. Thus, the slope of the time-rate workers' wage-tenure curves for FLCs and direct-hire farmers are essentially identical. Because both curves have an upward slope, we may infer that both type of employers use deferred payment similarly to encourage productive work.

The piece-rate dummy has a positive coefficient as we expected: Piece-rate compensation provides an incentive for employees to work harder. The coefficient on the piece-rate dummy is 0.233, so piece-rate workers earn 26 percent more than time-rate employees. We expect the tenure-piece-rate interaction term to have a zero or negative coefficient for direct-hire employees. The coefficient is negative and statistically insignificant at the 0.05 level.

In contrast, the tenure-piece-rate-FLC interaction term is relatively large, positive, and statistically significantly different than zero. Indeed the steepest of the four wage-tenure

profiles is that of the piece-rate, FLC workers. Apparently FLCs are more likely to use heavily back-loaded deferred payments for piece-rate rather than time-rate employees. The piece-rate, FLC wage-tenure curve intersects the piece-rate, farmer wage-tenure curve from below at about five years. As the mean is 2.9 years and the median is 2 years for this group (and virtually none of them have more than 4 or 5 years or tenure), most piece-rate FLC employees earn less than comparable workers employed directly by farmers.

We repeated this analysis regressing log weekly earnings instead of log wages on the same right-hand-side variables. The results are similar. The coefficient on tenure is 0.0133 (compared to 0.00761 in the wage equation) with a standard error of 0.00186. Each extra year of tenure results in 1.3 percent higher weekly earnings. None of the interactions between tenure and the various dummies are statistically significantly different from zero. Thus the effect of extra tenure on earnings is the same for all four groups.

*Fringe Benefits*

We examine four fringe benefits by estimating probit equations.[10] Again, we tested for endogeneity and reject it using Hausman tests. For example, the p-values for the endogeneity of tenure test are 0.99, 0.99, 0.99, and 0.80 for the equations in Table 3 (in order).

Our results confirm our predictions. For both the deferred payment fringe benefits (paid holidays and end-of-season bonus), tenure has a statistically significant, positive coefficient. None of the interactions with tenure have statistically significant coefficients in the paid holidays equation, but the tenure-FLC coefficient is significantly positive. (FLCs are more likely to provide paid holidays than are direct-hire growers.)

As expected, none of the tenure variables in the employer's profit probit have a statistically significant coefficient. An incentive bonus is an alternative to deferred payments. In the incentive bonus probit equation, tenure has a statistically significant negative coefficient (and none of the interactions with tenure are statistically significant).

Most of the control variables except age are statistically significant in some or all of the equations. Table 4 shows the marginal effects of a change in tenure on the probability that a worker receives a given bonus for each of our four groups of workers. The marginal effects are evaluated at the sample mean of the right-hand-side variables. These effects are extremely small (small fractions of a percentage point). For example, as tenure increases by 1 percent, the probability that a time-rate paying farmer provides paid holidays increases by 0.009 percentage point.

**Alternative Explanations**

Our results are consistent with efficiency wage theory. Are there alternative explanations for these phenomenon? We argue that three widely used candidate theories — on-the-job training, dual labor markets, and insurance — do not explain the observed phenomena in agricultural labor markets.

First, according to Becker-Mincer human capital theory, employer-financed firm-specific training (but not general training) could explain why the wage rises with tenure. Although this explanation may be important in other labor markets, it is implausible in agriculture. Farmers have no reason to provide firm-specific training (as opposed to general, occupational-skill training). Most farmers provide no training of any kind, and those that do spend a few days or weeks at most providing general skill training. As our tenure variable is

measured in years, such training (even if it were specific and not general) could not explain a wage increase over even the first two periods.

Second, the dual-labor-market theory holds that there are "good" and "bad" jobs, where the good jobs pay higher wages and provide better working conditions. The former requires more disciplined workers who are reliable and hard working unlike the latter. The existence of dual labor markets can explain two levels of wages. For example, direct-hire growers may provide the good employment wages and conditions and FLCs the bad wages and conditions. However, even if this explanation is correct, this theory fails to explain the presence of deferred wages and benefits, unlike the efficiency-wage theory.

The efficiency-wage story explains both a wage differential between types of employers and deferred wages and benefits. According to our efficiency-wage story, direct-hire growers pay higher wages than FLCs to serve as a bond to prevent shirking. That is, FLCs are employers of last resort who hire less-skilled or disciplined workers — the ones rejected by direct-hire growers — and pay them a relatively low "shirker's" wage. To degree that these premia are inadequate to deter shirking, farmers may also use deferred payments.

Third, an insurance theory could explain wage differentials but probably not deferred payments. According to this theory, FLCs pay a lower wage than farmers because they provide insurance in the form of more steady or longer-term employment. To test this hypothesis, we regressed the logarithm of tenure on the same right-hand-side variables as in the previous analyses (other than those involving tenure), as Table 5 shows. The coefficient on the FLC variable is -0.193, so FLC employees have 18 percent less tenure than do those who work for farmers (about three-quarters of a year at the mean). Similarly, piece-rate

workers average 9 percent less tenure than do time-rate employees holding other characteristics constant. Further, when we regress hours worked per week on the same right-hand side variables, the coefficient on the FLC term is -0.145 (Table 5), so FLC employees also work fewer hours. Thus, we reject the alternative theory that FLC can pay a lower wage because they provide more hours per week or longer-term employment.

**Conclusions**

We find empirical regularities that are consistent with efficiency wage theory and inconsistent with three competing theories. Thus we have failed to reject the hypothesis that the higher wages that direct-hire growers pay relative to those of farm labor contractors are efficiency wages. According to this theory, employers may use deferred payments (wages or fringes) to provide an incentive for workers to avoid being fired due to shirking, thereby allowing employers to lower their monitor expenses.

Future research may be able to test this and other efficiency-wage theory implications directly. A direct test would be to show that efficiency wages and deferred payments increase productivity (as has been shown for piece rates).

It is important to know if efficiency wage theory holds in agriculture as it would have important implications for various policies such as requiring that growers provide certain benefits and minimum wages. Because agricultural workers are among the lowest paid workers in the United States, state and federal governments regularly debate laws to assist and protect agricultural workers including mandating certain benefits (vacation and other bonuses, health insurance, unemployment insurance); regulating employer-provided housing, tools, travel, and sanitation; and setting special provisions in minimum wage laws.

Some economists and growers question the wisdom of requiring benefits and regulating on the grounds that doing so will lower wages — a tradeoff that is predicted by the traditional compensating wage differential theory. One response to this argument is that the compensating wage differential theory apparently does not hold in this market. There is substantial evidence (e.g., Hashida) that agricultural employers who provide superior benefits also tend to pay high wages. Efficiency wage theory explains some of these (apparently non-compensating) wage effects. Similarly, as Rebitzer and Taylor show, whether minimum wage laws increase or decrease employment in a market depends on whether efficiency wages are used.

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**Table 1: Means**

| | *Mean (Standard Error)* |
|---|---|
| *Binary Variables* | |
| Farm Labor Contractor (FLC) Employee | 0.09 |
| Paid a Piece Rate | 0.12 |
| White | 0.61 |
| Hispanic | 0.77 |
| Female | 0.21 |
| Citizen | 0.33 |
| Amnesty | 0.35 |
| Other Legal Immigrant | 0.25 |
| Speaks English Well | 0.26 |
| Reads English Well | 0.32 |
| Spring | 0.24 |
| Summer | 0.46 |
| West | 0.34 |
| South East | 0.08 |
| North West | 0.06 |
| Western Plains | 0.19 |
| Midwest | 0.11 |
| Paid Holidays | 0.16 |
| End-of-Season Bonus | 0.42 |
| Bonus based on Employer's Profit | 0.19 |
| Incentive Bonus | 0.15 |
| | |
| *Continuous Variables* | |
| Wage ($) | 5.76 (1.90) |
| Tenure (years) | 3.96 (4.55) |
| Age (years) | 35.94 (11.75) |
| $Age^2$ | 1429.61 (946.84) |
| U.S. Farmwork Experience (years) | 12.54 (9.45) |
| U.S. Farmwork $Experience^2$ | 246.43 (372.64) |
| Education (grade) | 7.48 (3.91) |

*Data*: NAWS 1992-1995, 4,603 observations.

**Table 2: Log Wage Regression**

| *Variable* | *Coefficient* | *Robust (White) Standard Error* |
|---|---|---|
| Constant | 1.542* | 0.038 |
| Tenure | 0.0076* | 0.001 |
| FLC | -0.078* | 0.014 |
| Tenure*FLC | 0.0028 | 0.003 |
| Piece Rate (PR) | 0.233* | 0.017 |
| Tenure*PR | -0.0023 | 0.003 |
| Tenure*FLC*PR | 0.0096 | 0.007 |
| White | 0.025* | 0.008 |
| Hispanic | -0.053* | 0.012 |
| Female | -0.049* | 0.009 |
| Citizen | 0.014 | 0.015 |
| Amnesty | 0.017 | 0.011 |
| Other Legal Immigrant | 0.030* | 0.012 |
| Age | 0.0073* | 0.002 |
| $Age^2$ | -0.00010* | 0.00002 |
| U.S. Farm Experience | 0.0046* | 0.001 |
| U.S. Farm $Experience^2$ | -0.00010* | 0.00003 |
| Education | 0.0045* | 0.001 |
| Speak English Well | 0.021 | 0.016 |
| Read English Well | 0.0030 | 0.018 |
| 1992 | 0.041 | 0.076 |
| 1993 | -0.099* | 0.010 |
| 1994 | -0.042* | 0.009 |
| Spring | -0.025* | 0.010 |
| Summer | 0.0042 | 0.009 |
| West | 0.0058 | 0.011 |
| South East | -0.100* | 0.015 |
| North West | 0.126* | 0.015 |
| Western Plains | -0.017 | 0.014 |
| Midwest | -0.0098 | 0.012 |

$R^2 = 0.23$

*Data*: NAWS 1992-1995, 4,603 observations.

* We can reject the null-hypothesis that the coefficient equals zero at the 0.05 level.

**Table 3: Probit**

| | Paid Holidays | End-of-Season Bonus | Bonus based on Employer's Profit | Incentive Bonus |
|---|---|---|---|---|
| Constant | -1.1706* | 0.3008 | -1.3713* | -2.2813* |
| Tenure | 0.0243* | 0.0177* | -0.0096 | -0.0244* |
| FLC | 0.7152* | -1.0995* | -0.9002** | 1.1496* |
| Tenure × FLC | -0.0207 | 0.0838* | 0.0269 | 0.0114 |
| Piece Rate (PR) | -0.1393 | 0.0786 | 0.2788 | 0.2624 |
| Tenure × PR | -0.0951 | -0.0203 | 0.0147 | 0.0241 |
| Tenure × FLC × PR | 0.1079 | -0.2458 | -0.1231 | -0.0010 |
| White | 0.0413 | -0.3461* | 0.5865* | 0.1233 |
| Hispanic | -0.5305* | 0.8844* | -0.2378 | -0.4188* |
| Female | 0.1774 | 0.0913 | -1.0391* | 0.1315 |
| Citizen | -0.1626 | 0.1138 | 0.0758 | 0.2241 |
| Amnesty | -0.4090* | 0.0521 | 0.6368* | -0.1868 |
| Other Legal Immigrant | -0.3263 | -0.3612* | 0.3803 | 0.3394 |
| Age | 0.0327 | -0.0225 | -0.0004 | 0.0341 |
| $Age^2$ | -0.0005 | 0.0004 | 0.00003 | -0.0005 |
| U.S. Farmwork Experience | -0.0206 | 0.0109 | 0.0574* | -0.0045 |
| U.S. Farmwork $Experience^2$ | 0.0007** | -0.0005 | -0.0017* | 0.0005 |
| Education | -0.0199 | 0.0019 | -0.0016 | 0.0062 |
| Speaks English Well | 0.0897 | -0.0091 | -0.1747 | 0.0200 |
| Reads English Well | 0.0047 | 0.0819 | 0.3259 | -0.3795 |
| 1992 | -3.2564 | 3.0379 | 6.0520 | -2.4196 |
| 1993 | -0.3440* | -0.2988* | -0.2274 | 0.4637* |
| 1994 | -0.3733* | -0.1925 | -0.6292* | 0.8195* |
| Spring | 0.1010 | -0.5792* | -0.1549 | 0.3420* |
| Summer | -0.3487 | -0.5876* | 0.2493 | 0.3518* |
| West | 0.3468 | 0.1828 | -0.9230* | 0.0322 |
| South East | 1.3095 | -0.4353* | -0.1817 | -0.2046 |
| North West | 1.1309 | -0.2856 | -0.4544** | -0.5693 |
| Western Plains | 1.0363 | -1.0820* | 1.1501* | -0.8068* |
| Midwest | 1.0331 | 0.0936 | -1.7463* | 0.2657 |
| *Percentage Correctly Predicted* | 88 | 72 | 90 | 85 |

| | *Predicted* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Actual* | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 0 | 1,025 | 18 | 540 | 164 | 952 | 42 | 1,006 | 20 |
| 1 | 134 | 46 | 177 | 342 | 76 | 153 | 168 | 29 |

*Data*: NAWS 1992-1995, 1,223 observations.

* We can reject the null-hypothesis that the coefficient equals zero at the 0.05 level on the basis of a t-test.
** We can reject the null-hypothesis that the coefficient equals zero at the 0.10 level on the basis of a t-test.

**Table 4: Marginal Effects**
(The derivative of the probability function with respect to tenure at sample means)

| | *Time Rate* | | *Piece Rate* | |
|---|---|---|---|---|
| | *Farmer* | *FLC* | *Farmer* | *FLC* |
| Paid Holidays | 0.009 | 0.001 | -0.028 | 0.006 |
| End-of-Season Bonus | 0.007 | 0.040 | -0.001 | -0.065 |
| Bonus based on Employer's Profit | -0.003 | 0.006 | 0.002 | -0.036 |
| Incentive Bonus | -0.009 | -0.005 | -0.000 | 0.004 |

**Table 5: Log Tenure and Weekly Hours Regressions**

| | *Tenure* | | *Weekly Hours* | |
|---|---|---|---|---|
| | *Coefficient* | *Standard Error* | *Coefficient* | *Standard Error* |
| Constant | -0.445* | 0.107 | 3.561* | 0.071 |
| FLC | -0.193* | 0.028 | -0.145* | 0.019 |
| Piece Rate | -0.096* | 0.024 | -0.190* | 0.016 |
| White | 0.032 | 0.023 | 0.002 | 0.015 |
| Hispanic | -0.031 | 0.037 | 0.025 | 0.025 |
| Female | 0.044 | 0.026 | -0.124* | 0.018 |
| Citizen | 0.237* | 0.044 | 0.058* | 0.029 |
| Amnesty | 0.224* | 0.030 | 0.061* | 0.020 |
| Other Legal Immigrant | 0.242* | 0.035 | 0.032 | 0.023 |
| Age | 0.022* | 0.005 | 0.006* | 0.003 |
| $Age^2$ | -0.0002* | 0.00006 | -0.00008* | 0.00004 |
| U.S. Farm Experience | 0.066* | 0.003 | 0.004 | 0.002 |
| U.S. Farm $Experience^2$ | -0.0009* | 0.00007 | -0.00006 | 0.00004 |
| Education | 0.013* | 0.003 | 0.006* | 0.002 |
| Speaks English Well | 0.012 | 0.040 | -0.007 | 0.026 |
| Reads English Well | -0.061 | 0.049 | -0.008 | 0.032 |
| 1992 | 0.381 | 0.218 | -0.303* | 0.150 |
| 1993 | -0.016 | 0.028 | -0.055* | 0.019 |
| 1994 | 0.103* | 0.028 | -0.069* | 0.019 |
| Spring | 0.111* | 0.029 | -0.159* | 0.019 |
| Summer | 0.069* | 0.025 | -0.043* | 0.016 |
| West | 0.216* | 0.034 | 0.105* | 0.023 |
| South East | 0.116* | 0.038 | -0.002 | 0.025 |
| Northwest | 0.115* | 0.041 | -0.007 | 0.027 |
| Western Plains | 0.050 | 0.039 | 0.021 | 0.026 |
| Midwest | -0.089* | 0.035 | -0.157* | 0.023 |
| $R^2$ | 0.37 | | 0.09 | |

**Figure 1**: **Tenure Distribution**

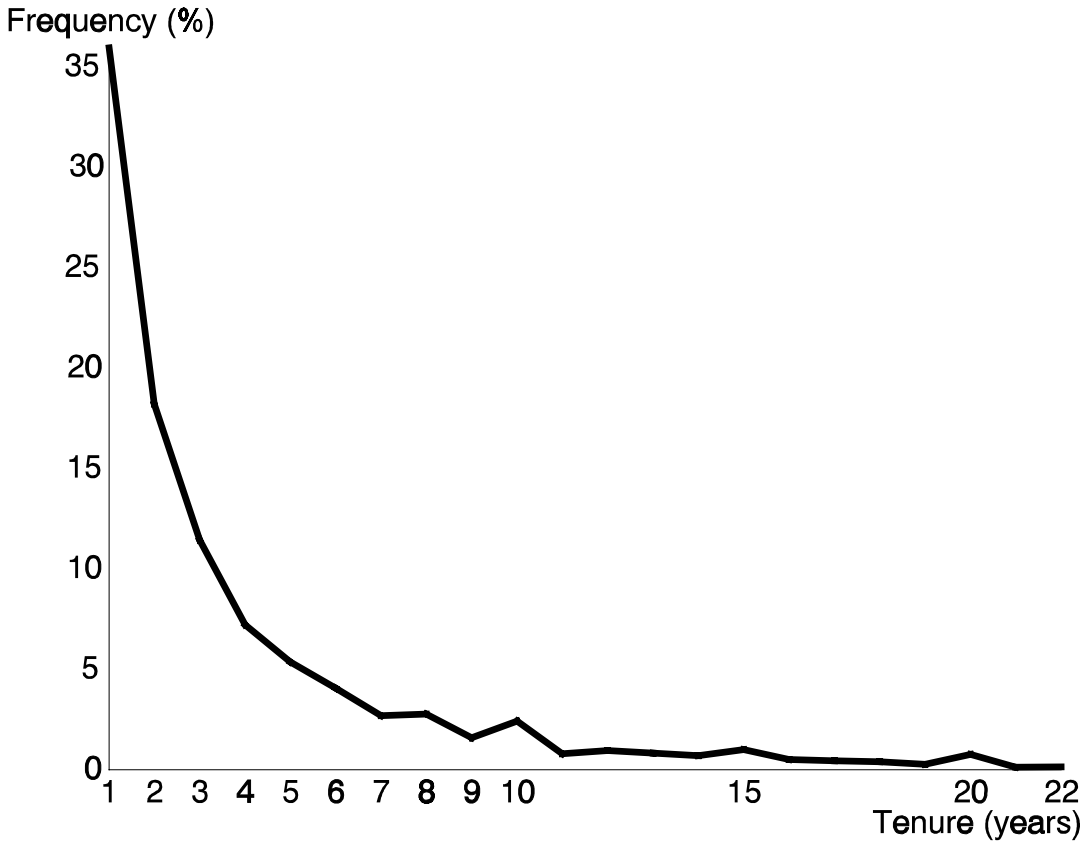
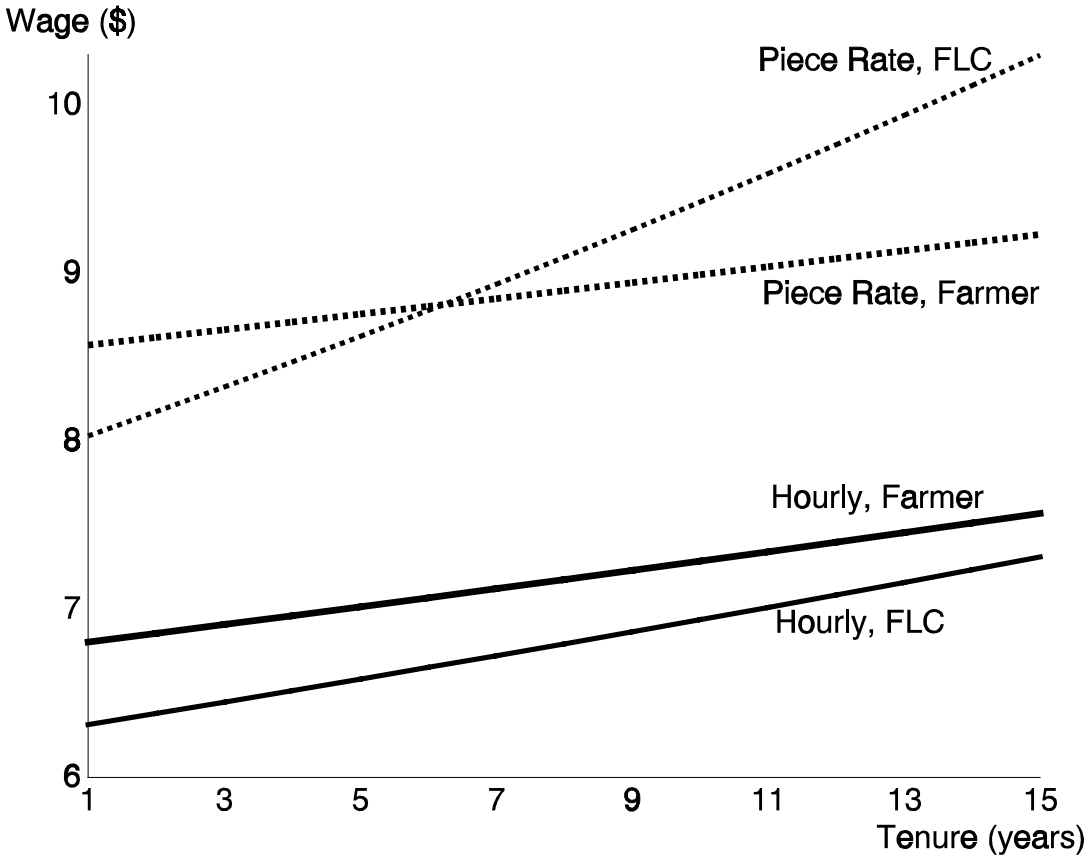


**Figure 2: Deferred Payments**



## Footnotes

1. The one exception of which we are aware is Rebitzer (1995), which examines the petrochemical industry where some maintenance workers are hired directly by an employer or whose services are obtained through a contract with another firm.

2. A possible alternative explanation is that "familiarity breeds contempt." With the evidence provided, this explanation cannot be empirically distinguished from Barkema's.

3. Similarly, smaller-scale employers are more likely to directly monitor workers than larger ones. Isé et al. (1994, 1996) find that larger farms, which need more workers, rely more heavily on farm labor contractors: the direct-hire growers in their Fresno County sample have smaller farms: 328 acres on average compared to 407 acres for those that use farm labor contractors. Unfortunately, our current data set does not contain extensive information on the characteristic of employers so that we cannot examine these effects directly.

4. If workers cannot borrow against the future or have a higher discount rate than the market, such deferred payments schemes may not work.

5. Moretti and Perloff observe that some agricultural workers are not covered by existing minimum wage laws and others are paid less than the law specifies.

6. There are other explanations for why efficiency wages lead to higher productivity. Some economists claim that, in less-developed countries, employers pay an efficiency wage — more than they need to hire workers — to ensure that workers can afford to eat well enough that they can work hard. Other economists (e.g., Akerlof) and management experts contend that the higher wage acts like a gift, making workers feel beholden or loyal to the firm, so that less (or no) monitoring is needed. The problems that arise if unemployment results is discussed in several articles (e.g., Shapiro and Stiglitz).

7. Piece-rate hourly earnings are obtained by dividing self-reported information on earnings by the self-reported number of hours worked in the relevant time period (daily, weekly or monthly). According to the firm that collects this information, earnings are likely to be accurate, as most workers appear to know the size of their last pay check precisely. The number of hours worked may contain some measurement error. However, workers who are paid on a weekly basis have to answer two slightly different questions on the NAWS survey about the hours they work. The correlation of the two reported number of hours worked is 0.93 for piece-rate workers and 0.94 for hourly workers. Thus, the measurement error is not likely to differ much by method of payment and may be relatively small.

8. For instruments, we chose characteristics of the worker or employer that affect seniority but that are arguably orthogonal to the wage equation residual: whether the worker is married, was born in Mexico, was born in Central America, entered the united States before the age of 13, lives with an extended family, has small children in the household, has parents

who are farmworkers, the number of days spent abroad in the last year, and whether the employer keeps in contact with workers after the season ends.

9. Because the tenure measure is censored (the length of employment is rounded up to integer value of years), the coefficient on the tenure variables are likely to be biased downward, which works against the efficiency wage hypothesis.

10. Because many workers failed to provide information about fringes, the sample size for the probits (1,223) is substantially smaller than for the regression analysis (4,603).