Stanford
Center for International Development

Working Paper No. 377

Poverty, Legal Status and Pay Basis in U.S. Agriculture

by

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January 2009

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ABSTRACT

U.S. farmworkers are paid on a piecerate or timerate basis. This paper studies relationships between wage contracts, legal status, and poverty using a representative survey of employed farmworkers which includes detailed information on legal status, including whether a worker is illegal. Results indicate that while piecerate workers earn more per hour on average, they work fewer hours and face greater poverty risk than their timerate counterparts. Furthermore, foreign-born workers, especially those who are illegal, are overrepresented in piecerate positions, and national and regional analysis shows that the effect of piecerate pay on poverty is positive and correlated with being foreign-born.

Keywords: U.S. agriculture, wages, poverty.

JEL Classification No.: I32, J33, Q12

* I thank the West Coast Poverty Center at University of Washington for supporting this project through its Western Poverty and Policy Small Grants Program. I also thank Colleen Manchester, Gopi Shah Goda, Kevin Mumford, lunch lecture participants at the Stanford Center for International Development, conference participants at the 2008 Western Economic Association International Annual Meetings, especially my discussant P.C. Roger Cheng, and seminar participants at Colorado State University, the West Coast Poverty Center, and the University of Nebraska for helpful comments.

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> The migrant workers' year is a string of beads-a week of employment here, another there, uncertainly tied together with travel in search of work. Away from home for months at a time, many take their families with them. In a sense they work not for Employer A or Employer B; they work a crop. Lacking capital, they often unite loosely as crews, and travel in whatever vehicles the leader can provide. Where they work, many find indifferent housing...The migrant farm worker occupies the lowest level of any major group in the American economy. (p. 110, 1959 Farm Labor Fact Book, U.S. Department of Labor)

I. Introduction

This paper studies the relationship between poverty, legal status, and the wage payment methods available to farmworkers in the U.S., a group that is among the poorest in the country. Agricultural wage contracts are either time-based (e.g. hourly) or productivity-based (e.g. piecerate). Additional complexity in agricultural wage contracts comes from team structure and whether payment is based on individual or work crew productivity. This paper studies the relationship between wage contracts, being an immigrant, and poverty outcomes. Piecerate workers are shown to earn more per hour on average but to work fewer hours per week. Weeks worked in agriculture, however, are similar across payment structures. In contrast, piecerate workers report higher numbers of weeks outside of the U.S. annually and fewer weeks in nonfarm work than do timerate workers. These statistics together create questions regarding whether piecerate workers face more or less poverty risk than do their timerate counterparts. Analysis of reported annual family incomes suggests that piecerate workers are more likely to fall below U.S. poverty thresholds than are hourly workers and that immigrants, especially illegal immigrants, are more likely observed in piecerate positions all else equal.

The paper is organized as follows. Section II. examines literature on sorting and on incentives and productivity as related to piecerate and timerate contract structures. Section III. presents a theoretical framework of contract choice in which workers sort into payment schemes based on preference, effort, ability, and risk tolerance. Section IV. presents the national data source on agricultural workers exploited in this paper. Section V. quantifies the effect of piecerate pay

on wages and hours using these data. Section VI. presents regional results for the western U.S, areas where agricultural production is more highly concentrated in crops correlated with piecerate payment. Section VII. considers sensitivity to the definitions of piecerate and timerate. Specifically, the definition of piecerate is extended to include workers indicating combination piecerate and timerate pay, and the definition of timerate is extended to include salary workers in addition to those paid by the hour. Results are shown to be robust to these alternative specifications. Section VIII. discusses public policy implications and concludes. Specifically, if piecerate workers are more likely to be observed below the poverty threshold and if they are also more likely to be immigrants, a question for welfare economics is whether this is socially desirable. Discussion focuses on whether sorting can be viewed as optimal and whether piecerate payment is a choice on the part of the worker or the result of market failures.

II. Literature

Much of the literature on piecerate versus timerate payment has focused on how compensation structure affects both worker sorting across firms, and incentives and productivity.

Sorting

Lazear (1986) presents a theoretical model of sorting such that salary workers are of lower quality and more homogeneous than are their piecerate paid counterparts. Intuitively, higher quality workers would choose to be paid based on observable output in anticipation of higher productivity, whereas lower quality workers would prefer timerate work.

In the agricultural labor market literature, Rubin and Perloff (1993) model the decision by employees to work for piecerate in California. They estimate a structural probit model that controls for sample selectivity, finding that the earnings differential between piecerate and timerate workers is primarily a function of age, with prime age workers being less likely to engage in piecerate positions in comparison to those who are either younger or older workers.[1] The authors conclude that factors contributing to disutility of piecerate work (e.g. increased effort and income variability) outweigh benefits (e.g. increased expected pay) for prime age workers.

Foster and Rosenzweig (1996) examine possible reasons that generate the observed distributions

of piecerate and timerate workers using a sample of farming households in the Philippines. They consider comparative advantage, worker and employer preferences for piecerate or timerate, and informational asymmetries. The authors find that comparative advantage is a key determinant of sorting for their case study. Newman and Jarvis (2000) present complementary evidence to this. Specifically, they find that a theory of equalizing differences is consistent with observed wage variation in Chilean grape growing and argue that piecerate pay method allows heterogeneous workers to sort among employers.

Recent research has suggested sorting based on direct measures of preference. Green and Heywood (2008), for example, use the British Household Panel Survey to estimate relationships between compensation scheme and job satisfaction. They find that piecerate pay is associated with increased overall satisfaction and satisfaction with wage and hours specifically, but decreased satisfaction with the nature of the work.

Incentives and Productivity

The literature on incentives and productivity has focused on how effort translates into productivity. Using Bureau of Labor Statistics Industry Wage Surveys, Seiler (1984) establishes that piecerate earnings distributions within manufacturing are characterized by a higher mean (consistent with theoretical predictions of increased effort), but larger variance than timerate earnings distributions. This result holds both within firms and within manufacturing occupations. Seiler argues that piecerate workers receive an earnings premium and decomposes this premium into a compensating wage differential for increased risk, and thus increased income variation under piecerate, and into an incentive-effort effect since piecerate workers would exude more effort if they were compensated for it. Risky, ambitious workers therefore would differentiate themselves under piecerate pay. Seiler measures earnings as hourly wages and finds that piecerate workers were 40% more productive than timerate workers and were paid 20% higher hourly wages.

Related to incentive-effort effects, Foster and Rosenzweig (1994) show that timerate payment schemes and share-tenancy contracts reduce effort compared to piecerate payment schemes and on-farm employment for a small sample of Philippine farmers. The authors measure effort in part by calorie consumption. Oettinger (2001) finds that commission rates influence the effort choices (measured by daily dollar sales) of stadium vendors at major league baseball games.

Lazear (2000) presents a case study of Safelite Glass Corporation in Ohio that underwent a switch from timerate pay to piecerate pay after an ownership change. Lazear finds that this switch was associated with a 10% increase in pay and 44% increase in productivity.[2] Lazear measures earnings on a monthly basis.[3] He shows that this increase is the result of both productivity and sorting effects: both increases in current worker production and the hiring of new more productive workers was evident in his data. Similarly, Paarsch and Shearer (2000) find that piecerate workers are 22.6% more productive than are those paid timerate in a British Columbian tree-planting firm. However, this difference is only 14.3% after adjustment for decreases in quality associated with piecerate work. Shearer (2004), also using data from British Columbian tree-planting, finds that the average productivity gain from an experimental shift from timerate to piecerate would be around 20%.

Freeman and Kleiner (2005) find that piecerate compensation increases productivity in American shoe manufacturing. However, they find that this gain is at the expense of profitability. After their case study firm switched from piecerate to timerate compensation, productivity fell about six percent. However, this was offset by increased profits overall, indicating a negative relationship between profits and productivity.

Poverty

Overall, the literature suggests that sorting and positive wage differentials between piecerate and timerate work exist. However, there might be other differences such as in hours over a pay period or weeks worked per year which would result in lower total income for piecerate workers and therefore increased incidences of poverty. In addition, piecerate pay may be more prevalent in traditionally low wage occupations. Freeman and Kleiner (2005) note, using evidence from the Census of Manufacturing, that establishments with higher percentages of production workers are more likely to pay piecerate than are establishments with lower percentages of production workers.[4] In agriculture, harvest activity is highly correlated with piecerate payment. Seasonal workers are often migratory and may not have consistent work or pay in offseasons, thus contributing to poverty outcomes.

III. Theoretical Framework

Piecerate versus Timerate Pay Basis

The theoretical framework draws on Lazear (2000). Let a worker's utility be specified as $U(I, E)$ where I is income and E is effort. Utility in increasing in income and decreasing in effort. Output, Y, is a function of effort, ability (A), and a stochastic component (τ), and is written as $Y = f(E, A, \tau)$. Risk tolerance is implicit in the utility function form. Output is increasing in all arguments.[5] Therefore, high ability workers with lower effort and lower ability workers with high effort could potentially produce an equivalent output level.[6]

Firms (farms) choose payment schemes based on benefit and cost calculations.[7] Benefits for hourly wages as opposed to piecerate might include advantages in terms of quality of output under an hourly compensation scheme in comparison with piecerate if piecerate workers rush to maximize number of units produced. Costs for hourly wages over piecerate might include lower output levels if piecerate workers exude more effort due to sorting and incentive effects and this translates into increased output.[8] Monitoring costs also are different under piecerate and timerate schemes. On one hand, timerate schemes may have lower monitoring costs since firms can devote fewer resources to tallying output. On the other hand, and in cases of nonproduction work specifically, monitoring costs may be higher under timerate since output may be harder to measure.

Assume here that each firm (farm) has established a payment structure to best fit its needs given its particular benefits and costs. Farms offering hourly wages pay an equilibrium wage rate W in exchange for a minimum output level Y_0.[9] (i.e. Workers producing below Y_0 will ultimately be fired.) Workers therefore must provide a minimum effort level in order to generate a required output level. Minimum effort is a function of ability and is denoted $E_0(A)$ and is implicitly defined by: $Y_0 = f(E_0(A), A, \tau)$. High ability workers may be hypothesized to have lower costs of effort.

Farms offering piecerate payment pay an equilibrium price per unit of output p. Income to piecerate workers therefore is calculated as pY, where Y is interpreted as an expected value in the worker's problem. Assuming both types of employment are readily available, agents sort into leisure (no wage income or effort), hourly work, or piecerate work according to ability level cutoffs and given their particular degrees of risk tolerance and personal preference as indicated by their utility functions.

Ability level cutoffs can be defined implicitly in terms of the parameters of the model. Workers with ability A would be observed in the piecerate position if:

$$U(pf(E^*(A), A, \tau), E^*(A)) > U(W, E_0(A)) \tag{1}$$

$$and$$

$$U(pf(E^*(A), A, \tau), E^*(A)) > U(0, 0) \tag{2}$$

where E^* denotes the optimal piecerate effort level chosen by a worker with ability A. Therefore, workers choosing piecerate have greater expected utilities of the piecerate position over the timerate position and also expect the utility associated with piecerate to be greater than the utility of choosing no employment and thus having $U(0, 0)$. Likewise, workers would be observed in the timerate employment if:

$$U(W, E_0(A)) > U(pf(E^*(A), A, \tau), E^*(A)) \tag{3}$$

$$and$$

$$U(W, E_0(A)) > U(0, 0) \tag{4}$$

Higher ability workers may derive more utility from piecerate than timerate positions given their lower effort costs to produce a given output level. Risk-loving workers, however, might choose piecerate work if they weigh higher mean income associated with piecerate work above higher variance. Risk preference is reflected in the functional form of an individual's utility function. Theoretically, $U(0, 0)$ can be positive or negative depending on individual attitudes toward work.[10]

Legal Status

Equilibrium parameters may vary by legal status group if, for example, illegal workers are offered lower wages than legal workers. Workers therefore sort into compensation schemes by solving:

$$\max[U(W^l, E_0(A)), U(p^l f(E^*(A), A, \tau), E^*(A)), U(0, 0)] \tag{5}$$

where the superscript l refers to the legal status group to which a worker belongs.[11] Thus, workers trade off more variable, higher expected payoff of piecerate work, where effort in endogenous, for lower variance payoff (or zero variance) of hourly work with enforced effort levels. The parameters of these tradeoffs may vary based on worker characteristics such as to which legal status group a worker belongs, and ability level cutoffs can be implicitly written as in the previous section.[12]

Poverty

If poverty is indicated by exogenously determined threshold values, workers would be defined as in poverty if:

$$W^l + p^l f(E^*(A), A) + N < T \tag{6}$$

where T is the relevant threshold value for the individual based on his or her family size, and N is additional annual income which may come from secondary employment during the year, wage earnings by family members, or nonwage income for other sources. Note that this framework easily includes combination pay workers in addition to those paid strictly on the basis of time or piece.

IV. Data

Data for this paper come from the U.S. Department of Labor's National Agricultural Workers Survey (NAWS). The NAWS is a nationally representative (and regionally representative for 12 agricultural regions) survey of employed U.S. farmworkers. The NAWS is a rich source of data on illegal and legal agricultural immigrants and their earnings. Workers have been sampled from work sites in three seasons per year since 1989. Of the 46,566 workers represented from 1989-2006, 73% report Mexican origins and 54% of these immigrant workers admit to being of illegal status. Of the overall sample (which includes U.S. born workers), 42% report being illegal.

In terms of pay structure distribution, approximately 80% of NAWS workers are paid timerate (either hourly or salary) and 20% are paid piecerate. Of those who are paid piecerate, 77% are paid for individual productivity and 23% are paid as part of a crew. Crews range in size from two to 150 members. Immigrants in the NAWS are more likely to be paid piecerate than are natives, and of immigrants, those of illegal status are more likely paid piecerate than are legal immigrants. More than 20% of Mexican workers, for example, and almost 24% of those from other countries

are paid piecerate, compared with less than seven percent of U.S. born farmworkers. In terms of legal status, 21% of illegal immigrants work piecerate compared to 19% of legal immigrants. One hypothesis is that illegal immigrant workers may select into this payment structure either due to a systematic difference in risk aversion or because of decreased bargaining power with employers because of their (lack of) citizenship status.

[Figure 1 about here]

[Table 1 about here]

Summary statistics by wage payment method are presented in Table 1.[13] Hourly workers are those paid on a time-based schedule. Piecerate workers on the other hand are paid according to their productivity. "Combo" workers receive some hourly compensation and some piecerate compensation in their current employment situation. This might take the form of a low hourly rate plus additional payment for high output. Salary workers are paid a contractual amount irregardless of specific hours worked or output produced. The columns in Table 1 indicate subsamples of the data by these payment method categories.

Of hourly workers, 21.6% report being U.S. born as do 7.4% of piecerate workers. After those who are U.S. born, the naturalized citizen group may be considered the next most permanent group in the data. The naturalized citizen variable displays an analogous pattern to that of U.S. born workers with higher percentages in hourly as opposed to piecerate positions. Specifically, 4.4% of hourly workers report being naturalized citizens compared with only two percent of piecerate workers. Similar percentages are evident for green card holders, and temporary legal status groups display the opposite pattern. Of hourly workers, 5.4% report other work authorization (e.g. temporary work permits) and 45.6% report being illegal. For piecerate workers, 10.2% and 57.1% of workers report other work authorization and being an illegal immigrant respectively.

Observable differences by country of birth, age, family structure, education and experience measures, English language abilities, and crop are also evident in the summary data. Hourly workers are less likely to be immigrant, are more likely to be older and to be married, tend to have more years of education, experience, and tenure and are more likely to speak and read English than piecerate workers.

Combination piecerate and timerate, and salary, categories have much smaller sample sizes than the hourly and piecerate subsamples. Approximately two percent of the overall sample reports

combination wages, and less than three percent of the overall sample reports being salaried. Because these two groups represent a limited group and a group demonstrating uncharacteristic attributes, the majority of the analysis is this paper omits these observations.[14] Sensitivity analysis that incorporates combination workers into the piecerate category and salary workers into the timerate category is presented at the end of the paper.

Figure 1 shows the unconditional fraction of agricultural workers by pay basis over time. The fraction of the overall agricultural workforce with hourly pay shows an increasing trend over the survey years, as does the salaried worker series. The fraction of workers receiving piecerate payment demonstrates a negative trend over time: this graph suggests about a 50% decrease in workers reporting piecerate over the sample period. While this trend is beyond the scope of this paper, it can be noted that the manufacturing industry experienced a similar decline in the percentage of workers paid piecerate since the 1970s (Seiler (1984)). In that case, the pattern was attributed to the entry of new establishments with different technologies replacing old piecerate firms. Freeman and Kleiner (2005) attribute declines in piecerate pay in shoe manufacturing to labor management policies associated with piecerate that increase productivity but decrease profitability. They find that piecerate firms have higher labor costs and lower survival rates than their timerate counterparts. Furthermore, as evident in Table 1, piecerate workers are more likely observed in fruits or vegetables than are their hourly paid counterparts, while the opposite is true for field crops and horticulture. Import substitution of fruits and vegetables over the sample period may contribute to the pattern.

V. What is the relationship between wage contract structure and poverty?

The overall research question is what is the relationship between wage payment method and poverty, and whether this relationship is different for illegal immigrant workers than for legal immigrant and U.S. born workers.

What are the effects of compensation schemes on wages and hours?

Output-based pay rates are associated with greater variability than are time-based pay rates. Therefore, output-based pay and short-term poverty can be hypothesized to be interrelated. Negative

shocks in agricultural output due to weather events, for example, may affect piecerate workers more than timerate workers. Figures 2 and 3 illustrate hourly-equivalent wages and hours per week respectively for workers under hourly and piecerate compensation schemes over time. Hourly-equivalent wages are constructed for piecerate workers based on survey questions indicating how much a worker (and his or her crew if applicable) is paid on average for each unit of output (e.g. box, bin, etc.) and how many units are produced in an average day, along with crew size information.

As expected given the literature, average wages of piecerate workers are seen in Figure 2 to be systematically higher than those of hourly workers. Also consistent with the literature, piecerate wages display larger variance. Part of this variation is likely due to smaller sample sizes by year for piecerate workers than for timerate workers. However, variation in agricultural conditions such as weather phenomena are also likely contributors to piecerate wage variability. Hours per week, as illustrated in Figure 3, suggest another element of the story. In contrast to their higher average wages per hour, piecerate workers for most of the sample period report fewer hours per week than hourly workers do.

[Figures 2-4 about here]

Figure 4 presents farm weeks worked per year.[15] While a clear pattern between piecerate and timerate workers is not observable for farm weeks per year, summary statistics reveal that piecerate workers on average spend fewer weeks in nonfarm work per year and more weeks abroad. For example, piecerate workers report 8.1 nonwork weeks per year and 7.6 weeks abroad on average while timerate workers report 7.4 nonwork weeks and 5.9 weeks abroad.

Considering these pictures together, the relationship between total income and poverty outcomes between piecerate and hourly workers is uncertain. Since these patterns are unconditional and given that the literature stresses the role of sorting into compensation schemes, multivariate regression analysis is used for further examination. The basic regression strategy is as follows:

$$\ln w_i = X_i\beta + \delta piecerate_i + \epsilon_i \tag{7}$$

where the dependent variable lnw_i represents logarithmic hourly-equivalent wage rates. The effect of piecerate pay method on wages is represented by δ.

[Tables 2-3 about here]

Maximum likelihood treatment effects regressions control for selection into documented categories so that the coefficient on $piecerate_i$ is consistently estimated and does not capture part of the effect of the omitted or mismeasured variables. The theoretical framework suggests that ability, for example, may be one of these variables. Treatment effects regressions simultaneously estimate the probability of treatment (piecerate here, estimated by probit) and $\ln w_i$ as a function of piecerate (estimated by linear regression). This is equivalent to controlling for the non-zero expectation of the error in the outcome equation.[16]

Piecerate pay method is modeled as an endogenous binary treatment. Specifically, piecerate status is an unobserved latent variable:

$$piecerate_i^* = z_i\gamma + u_i \tag{8}$$

The treatment decision rule then is:

$$piecerate_i = \begin{cases} 1 & if \quad piecerate_i^* > 0 \\ 0 & otherwise \end{cases} \tag{9}$$

The error terms are assumed jointly normally distributed where ρ is the correlation between these terms.

The treatment effects regression for hourly-equivalent wages is presented in Table 2. Although exclusion restrictions are not necessary to estimate the model, they help with identification. Rubin and Perloff (1993) hypothesize that family structures are associated with selection into piecerate work since these structures may be correlated with risk tolerance. Family structure variables are used as exclusion restrictions in the wage regression. Since the existence of family members may affect a worker's total number of weekly hours, the hours regression is identified on nonlinearities from the probit functional form. The effect of piecerate compensation on the hourly-equivalent wage of agricultural workers in the sample is estimated to be 22.5%. The average hourly agricultural wage rate in 2006 was \$8.00, which implies a piecerate wage rate from the regression is \$9.80. For the 2006 sample, the actual piecerate wage was on average \$10.15.[17]

Legal status variables are relative to the omitted category of U.S. born workers. All four legal status group variables are statistically significant in the selection equation. Naturalized citizens

are estimated to be 17.8% less likely to be observed in piecerate positions in comparison to U.S. born workers (the omitted category). Green card holders, those with other work authorization, and illegal workers, on the other hand, are 20 to 26% more likely to be paid piecerate. These patterns are consistent with the summary statistics in Table 1. After controlling for selection into piecerate, naturalized citizenship, green card status, and other work authorization are all associated with higher wages relative to U.S. born workers (although these coefficients are statistically insignificant). Illegal workers receive 3.1% lower wages than other immigrant and U.S. born groups all else equal. Education, experience, and tenure variables are associated with higher wages as expected.

Total earnings is a function of both hourly-equivalent wages and hours worked. If piecerate workers receive higher hourly wages but work fewer hours, then their total earnings (and ultimate poverty outcomes) will be determined by a simultaneous determination of both of these variables. A parallel treatment effects regression for hours worked therefore is examined in Table 3. Piecerate workers are found to work 9.5 fewer hours per week than do their timerate counterparts controlling for selection and demographic, regional, and temporal differences. Average hours for timerate in 2006 was 45.8 per week implying piecerate hours of 36.4 per work as predicted by the model and 39.7 actually in the data for that year. The treatment effects framework accounts for positive selection in terms of hours per week for piecerate workers. This is evident from the statistically significant and positive estimated ρ parameter in Table 3.

[Table 4 about here]

Do some compensation structures expose workers to greater poverty risk?

Questions of poverty and general farmworker economic outcomes are not only functions of hourly wages and weekly hours, especially in the case of seasonal work. U.S. poverty threshold values vary by family size and year. Thresholds are matched to NAWS workers by reported family sizes and year of observation. Agricultural incomes are first imputed by multiplying hourly wages by hours worked and comparing weekly earnings to a weekly measure of the U.S. poverty threshold. The fraction of NAWS respondents with imputed agricultural income under the relevant poverty threshold for their particular family sizes over the sample period are presented in Figure 5. Overall, the figure suggests that piecerate workers are better off. A lower (yet substantial) fraction is below the poverty threshold in comparison to their timerate counterparts. This, however, might be misleading. The

imputed agricultural earnings measure here is based on reported wages per hour multiplied by hours per week and then multiplied by the number of weeks that the farmworker reported working in the previous year in order to compare to the poverty threshold (which is reported on an annual basis). Agricultural workers, however, are by nature seasonal, and poverty outcomes are based on total annual outcomes which may include, for example, nonagricultural work in off-seasons and other sources of income such as that of a spouse or from public aid program participation.

[Figures 5-6 about here]

In addition to hourly wages and hours per week, NAWS workers are asked to report annual family incomes and personal incomes. Of NAWS hourly workers, 35.9% report annual family incomes putting them below U.S. poverty thresholds for their relevant family sizes. This can be compared with 51.5% of piecerate paid workers, 43.3% of those reporting combination pay, and 17.8% of salary workers. The correlation between total personal annual income and total annual family income among NAWS workers is 71.4%. Figure 6 illustrates how the fraction of survey respondents with self-reported family incomes below the U.S. poverty threshold have changed over time. While both hourly and piecerate series show a downward trend, the fraction of piecerate workers reporting poverty status is systematically greater than the fraction of hourly workers reporting poverty. The difference is statistically significant in most years.

Probit regressions are estimated of the form:

$$\Pr(poverty_i) = w_i\phi + \lambda piecerate_i + \epsilon_i \tag{10}$$

where the dependent variable $\Pr(poverty_i)$ represents the probability that a worker's total annual family income is below the poverty threshold, the probability that personal income is below the poverty threshold, and the probability that imputed agricultural income is below the poverty line respectively. The effect of piecerate pay method on poverty is represented by λ. Results are presented in Table 4. Probit marginal effects indicate that a switch from timerate to piecerate has a positive 2.5% effect on the probability of reporting income below the poverty threshold when income is defined as self-reported family income. This difference is 1.4% (and statistically insignificant) when income is based on the personal income measure. If income is defined as the imputed measure based on wages and hours reported for the current agricultural job, the conditional

correlation between piecerate pay basis and the probability that a worker is below the poverty threshold is *negative* 17.2% indicating that piecerate workers are much *less* likely to be under the poverty threshold than are hourly workers when only agricultural income is included. This result points to the significance of the seasonal nature of agricultural employment and secondary incomes from a family member, additional employment, or other source. The preferred specification for judging poverty outcomes overall therefore is based on annual family income as opposed to the imputed agricultural income, as this is the most relevant comparison to the poverty thresholds.

A treatment effects regression for annual family income, modeling piecerate as an unobserved latent variable and parallel to the logwage regression in equation (7) is presented in Table 5. Piecerate workers are found to have 4.9% lower annual family incomes after accounting for negative selection. This difference, although consistent with the probit regression for poverty incidence based on annual family income that is presented in the previous table, is not statistically significant.

[Table 5 about here]

VI. Regional Results

California is the highest ranked agricultural producer among the U.S. states, and more than one-third of NAWS workers are sampled there, making a separate analysis of the state a worthwhile exercise. In addition, piecerate payment is most frequently observed in fruit and vegetable production. California is compared to both the national case and to the case of the northwestern U.S. (another region with significant fruit and vegetable production) for robustness and to examine further results.

[Table 6 about here]

Summary statistics at the regional level for California and the northwestern U.S. are presented in Table 6. In comparison to the national averages presented in Table 1, both Californian piecerate and timerate workers are more likely Mexican immigrant and are less likely to report English language ability. More than 90% of both Californian hourly and piecerate workers report that they are from Mexico, and less than 15% of each of these subsamples reports English language speaking ability. Other demographic characteristics, however, display similar patterns to the national case and to the northwestern case.

Effect of Piecerate Pay, Californian Agricultural Workers

For the California subsample, the effect of piecerate pay on wages, as evident in Table 7, is 18.6%, which is smaller but qualitatively similar to the estimated effect for agricultural workers nationally. The effect of piecerate pay on hours is shown to be a negative 16.7 hours in Table 8 for the California sample. This hours effect is much larger that the 9.5 hours nationally indicating that California workers in piecerate positions work significantly fewer hours than do their timerate counterparts all else equal. Simple tabulations for hours show statistically insignificant differences between the California case and the national one. Thus, the increased hours effect estimated here comes from selection.

[Tables 7-9 about here]

Poverty results are shown in Table 9. The effect of piecerate on poverty is positive and significant if family or personal income measures are used and negative if the imputed measure is used. Californian piecerate workers are 3.7% more likely to be in poverty than are timerate workers by the preferred specification.

Effect of Piecerate Pay, Northwestern Agricultural Workers

Northwest is defined as a combination of Pacific and Mountain I and II regions as defined in Table A-1 in the Data Appendix. Conclusions for the northwest region qualitatively mimic those for the rest of the country. The effects of piecerate on wages and hours are shown in Tables 10 and 11 respectively. A 28.3% wage differential and 7.4 hour differential in the directions indicated in the national sample are shown. Poverty results also are similar to the national ones in terms of magnitudes and directions, though not statistically significant at conventional levels for the preferred comparison to the poverty threshold.

[Tables 10-12 about here]

VII. Sensitivity to Varying Piecerate and Timerate Definitions

Until this point, workers reporting combination (both piecerate and timerate) and salary schemes, were dropped from the analysis. Although these groups represent only small fractions of the overall sample, sensitivity of the results to these definitions is examined here. Namely, the piecerate

pay definition is changed to reflect either those reporting piecerate or combination wages and the timerate definition is changed to include salary workers. With this modification, the effect of piecerate pay (or more specifically of piecerate or combination pay) on wages is 23.5% (compared with 22.5% as shown in Table 2 under the alternative assumption). The effect of piecerate pay on hours is 8.9 fewer hours (compared with 9.5 fewer hours in Table 3). Poverty results are also qualitatively similar. Piecerate workers are 2.2% more likely to be in poverty than are timerate workers when family income is used to compared with poverty thresholds and are 15.9% less likely to be in poverty using the imputed income definition. These results can be compared with 2.6% and negative 17.3% respectively in Table 4.

VIII. Conclusions

Wage and hour differences, in addition to those in the propensity to experience poverty are examined in this paper for piecerate and timerate workers in the U.S. agricultural workforce. Farmworkers nationally are found to receive approximately 22.5% higher hourly wages when they work for piecerate compensation as opposed to for hourly compensation. These workers, however, are also found to work 9.5 fewer hours per week. Earnings are a function of both wage rates and hours, and therefore these differences relate to the incidence of poverty in this population. Conditional correlations between piecerate pay and poverty are found to be positive for self-reported total income and negative when imputed agricultural income is used. This points to the importance of consistent employment for ultimate worker outcomes and also to the importance of differences in family structures, secondary incomes, and sorting into pay schemes.

Related to this is whether being paid piecerate is the result of a choice on the part of the worker, or alternately is the result of some kind of systematic discrimination. If the former is true, government intervention might be argued based on paternalistic grounds. If the latter is the case, government intervention might be argued to address a market failure. Orrenius and Zavodny (2008) find that immigrants are overrepresented in risky jobs across sectors and that over representation is related to differences in average characteristics, such as immigrants English ability and education.

Evidence on the prevalence and characteristics of farm labor contracting suggest that piecerate may not fully be a choice. For example, approximately 35% of piecerate workers report being

employed by a farm labor contractor as opposed to directly by a grower. Only 14% of timerate workers report using farm labor contractors. Pena (2008) finds that that wage gap between legal and illegal minimized when worker is directly hired suggesting that individual workers may have more bargaining power when they represent themselves directly to a grower as opposed to via a third party. If farm labor contractors sort immigrant workers into piecerate positions independent of their skills, then sorting may not be economically efficient and may result in adverse distributional outcomes. Continuing research will examine if and how public policy can be used to decrease uncertainty in employment contracts by hedging against low wage draws associated with financial hardship and poverty for some workers.

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Notes

[1]The predicted probability that a worker in their sample is paid piecerate decreases until about age 34 and then increases.

[2]Despite these productivity increases, the Safelite Company filed for bankruptcy in 2000 (Freeman and Kleiner (2005)).

[3]Rubin and Perloff (1993), in contrast, measure pay on a daily basis. Although these alternative time units yield similar conclusions regarding short-term wage income, long-term income and poverty may differ depending on time horizon, especially in the case of seasonal employment.

[4]Furthermore, piecerate pay may be associated with higher turnover. Lazear (2000), for example, finds that the move to piecerate pay in the Safelite Corporation was associated with an increase in turnover from 3.3% per month to 3.6% per month.

[5]Lazear (2000) does not include a stochastic parameter. However, output in industries such as agriculture may depend on variables such as rainfall that are unrelated to the worker. This motivates the inclusion of a stochastic variable here.

[6]Note that $\frac{\partial E}{\partial A} = -\frac{\frac{\partial f}{\partial A}}{\frac{\partial f}{\partial E}} < 0$.

[7]See Paarsch and Shearer (2000) for modeling of the firm's decision to offer piecerate or timerate compensation. Kurosaki (2006) presents a model of employer contract choice of piecerate or timerate including a hybrid, piecerate wages paid in kind.

[8]Theoretically, the minimum effort requirement under an hourly scheme could be higher than the effort chosen by piecerate workers.

[9]The timerate wage, W, can be easily decomposed into hourly wage times hours per year. The simpler notation is used here.

[10]The empirical analysis in this paper excludes nonworkers since this population is not represented in the survey sample.

[11]Alternatively, parameters could be indexed on the basis of being an immigrant or not, if it is believed this this is the more appropriate division. However, Pena (2008) documents hourly wage differentials between legal and illegal workers in U.S. agriculture.

[12]Note that if one payment scheme is more risky than the other in a way that is related to legal status (for example, if workers are more likely to be cheated under piecerate than timerate), then the model could be extended by including legal status superscripts on the utility function itself.

[13]Statistics and regressions are reported using sample weights.

[14]Salary workers, for example, are more likely to be U.S. born and in supervisory positions with higher wages per hour and hours per week than are hourly and piecerate workers.

[15]A trend of increased hours in both types of positions in the latter part of the series is evident in the figure. Anecdotal evidence suggests that farmworker shortages characterized these years. Changes in agricultural labor markets may have resulted in fewer workers working more hours.

[16]If it can be argued that piecerate payment can be predicted strictly on observable characteristics, then propensity score matching methods may be used to estimate the effects of piecerate pay on wages and hours respectively. Results from these methods are similar. However, if selection is at least partially based on unobservable characteristics such as ability, then propensity score matching has limited applicability.

[17]The estimated ρ parameter in Table 2 suggests negative selection into piecerate work. This is consistent with a story that piecerate is positively correlated with some omitted or unobserved factor (such as preference for short-term work or low commitment to the job) that is negatively related to wages. This selection, however, is not statistically significant. Also note that being in a piecerate paid crew is an insignificant predictor of wages and of hours in this framework.

A Data Appendix

The sampling procedure of the National Agricultural Workers Survey is based on four levels: region, crop reporting district, county, and employer with probabilities proportional to size at each level. Specifically, NAWS uses 12 geographic regions based on USDA Quarterly Agricultural Labor Survey of farm employers. The 12 regions are defined in the table below. USDA information is also used for cyclical allocation (based on the relative proportions of workers each cycle). There are 47 crop reporting districts (aggregates of counties with similar agricultural characteristics) from which sampling locations are selected. Within crop reporting district, counties are selected randomly without replacement with probabilities proportional to the county's farm labor expenses. Employer lists are from the Bureau of Labor Statistics Agricultural Soil and Conservation Service and are updated with information from county extension agencies, local employment agencies, grower organizations, and farmworker service programs. Employers are selected using probabilities proportional to the square root of the seasonal farm workforce. Once permission to interview is obtained, the maximum number of interviews per grower is determined with probabilities proportional to square root size. The number of interviews per site of a particular grower is also determined by a proportional distribution to total number of crop workers. Workers are selected and approached randomly when arriving for work, at lunch, or when leaving and interviews are scheduled for times away from work site at locations chosen by the workers.

[Table A-1 about here]

Table 1: Summary Statistics by Wage Payment Method

	Hourly	Piecerate	Combo	Salary
U.S. Born (%)	21.60	7.41	8.59	56.16
Naturalized Citizen (%)	4.44	1.97	5.29	5.95
Green Card (%)	23.02	23.30	41.10	20.87
Other Authorization (%)	5.37	10.19	6.14	3.33
Illegal (%)	45.56	57.13	38.87	13.69
Female (%)	21.95	17.24	36.20	11.92
Age (years)	32.31	30.49	32.57	38.29
Has Spouse (%)	35.45	29.37	44.58	63.77
Children (number)	0.73	0.74	1.07	1.27
Education (years)	7.21	6.18	6.82	9.42
Farm Experience (years)	9.17	8.06	9.30	17.19
Tenure (years)	3.95	2.91	3.69	8.85
Speaks English (%)	31.84	17.59	21.06	70.97
Reads English (%)	29.08	14.80	19.70	65.77
Mexican (%)	71.74	87.16	80.87	39.99
Other Immigrant (%)	1.24	2.43	8.23	1.78
Field Crops (%)	17.42	7.11	3.97	48.45
Fruit (%)	28.50	51.76	74.76	10.57
Horticulture (%)	18.66	0.81	1.50	15.52
Vegetables (%)	28.26	36.59	17.01	17.71
Misc Crops (%)	6.93	3.63	2.75	7.36

Table 2: Effect of Piecerate Pay Basis on (log) Hourly-equivalent Wage

	(1) logwage	(2) piecerate	(3) atanh ρ	(4) $\ln\sigma$
piecerate	0.225***			
	(0.010)			
naturalized citizen	0.0120	-0.178**		
	(0.011)	(0.090)		
green card	0.0179	0.195**		
	(0.011)	(0.085)		
other authorization	0.0188	0.209**		
	(0.015)	(0.10)		
illegal	-0.0306***	0.255***		
	(0.012)	(0.089)		
female	-0.0546***	0.0263		
	(0.0059)	(0.040)		
age	-0.0000963	-0.00531***		
	(0.00025)	(0.0018)		
education	0.00630***	-0.00587		
	(0.00078)	(0.0051)		
farm experience	0.00178***	0.00711***		
	(0.00034)	(0.0023)		
tenure	0.00833***	-0.0133***		
	(0.00050)	(0.0034)		
spouse		-0.0335		
		(0.040)		
children		0.0361**		
		(0.015)		
speaks English	0.0282**	-0.0209		
	(0.012)	(0.064)		
reads English	0.000684	-0.0315		
	(0.012)	(0.067)		
from Mexico	0.00957	0.162***		
	(0.0081)	(0.063)		
field crops	-0.0435***	-0.220***		
	(0.0081)	(0.071)		
fruit crops	-0.0687***	0.569***		
	(0.0086)	(0.060)		
horticulture	0.0252***	-0.912***		
	(0.0076)	(0.095)		
vegetables	-0.0444***	0.158***		
	(0.0079)	(0.061)		
preharvest	-0.0450***	0.144*		
	(0.0059)	(0.081)		
harvest	-0.0140**	1.436***		
	(0.0063)	(0.069)		
postharvest	-0.00929	0.553***		
	(0.0074)	(0.083)		
semiskill	-0.0326***	0.634***		
	(0.0062)	(0.072)		
supervisor	0.216***	0.366		
	(0.036)	(0.27)		
Constant	1.542***	-2.411***	-0.0128	-1.494***
	(0.021)	(0.16)	(0.013)	(0.015)
Observations	38362	38362	38362	38362

Notes: Marginal effects reported. Regressions also include survey year and region dummies. Robust standard errors in parentheses. Ancillary parameters are the inverse hyperbolic tangent of ρ and $\ln\sigma$. Statistically significant at: the * 0.10 level; ** 0.05 level; *** 0.01 level.

Table 3: Effect of Piecerate Pay Basis on Hours per Week

	(1) hours	(2) piecerate	(3) atanh ρ	(4) $\ln\sigma$
piecerate	-9.446***			
	(1.21)			
naturalized citizen	3.261***	-0.259***		
	(0.78)	(0.087)		
green card	5.135***	0.161**		
	(0.68)	(0.082)		
other authorization	5.702***	0.194*		
	(0.86)	(0.10)		
illegal	3.336***	0.214**		
	(0.70)	(0.086)		
female	-4.725***	0.00860		
	(0.33)	(0.039)		
age	-0.00964	-0.00543***		
	(0.016)	(0.0017)		
education	0.153***	-0.00598		
	(0.045)	(0.0050)		
farm experience	0.0637***	0.00677***		
	(0.022)	(0.0022)		
tenure	0.261***	-0.0107***		
	(0.028)	(0.0033)		
spouse	0.989***	-0.0259		
	(0.34)	(0.037)		
children	-0.145	0.0381***		
	(0.13)	(0.014)		
speaks English	0.678	-0.0208		
	(0.58)	(0.063)		
reads English	-1.476**	-0.0415		
	(0.61)	(0.067)		
from Mexico	-0.547	0.198***		
	(0.52)	(0.060)		
field crops	1.608**	-0.203***		
	(0.63)	(0.067)		
fruit crops	-1.750***	0.517***		
	(0.57)	(0.057)		
horticulture	-0.197	-0.956***		
	(0.59)	(0.089)		
vegetables	-1.231**	0.171***		
	(0.56)	(0.058)		
preharvest	-2.157***	0.132*		
	(0.48)	(0.076)		
harvest	1.613***	1.413***		
	(0.59)	(0.065)		
postharvest	0.825	0.519***		
	(0.54)	(0.078)		
semiskill	1.920***	0.554***		
	(0.48)	(0.067)		
supervisor	2.035	0.395		
	(1.61)	(0.25)		
Constant	39.39***	-2.229***	0.174***	2.614***
	(1.46)	(0.15)	(0.049)	(0.0083)
Observations	38588	38588	38588	38588

Notes: Marginal effects reported. Regressions also include survey year and region dummies. Robust standard errors in parentheses. Ancillary parameters are the inverse hyperbolic tangent of ρ and $\ln\sigma$. Statistically significant at: the * 0.10 level; ** 0.05 level; *** 0.01 level.

Table 4: Effect of Piecerate on Probability of Income Below the Poverty Threshold

	(1) poverty (family income)	(2) poverty (personal income)	(3) poverty (imputed income)
piecerate	0.0246**	0.0142	-0.172***
	(0.012)	(0.013)	(0.011)
naturalized citizen	0.0707**	0.0265	-0.00150
	(0.029)	(0.031)	(0.023)
green card	0.0137	-0.00608	-0.0678***
	(0.026)	(0.027)	(0.023)
other authorization	0.130***	0.0540	-0.142***
	(0.033)	(0.036)	(0.031)
illegal	0.0250	-0.0773***	-0.0482**
	(0.027)	(0.027)	(0.023)
female	-0.00000415	0.134***	0.133***
	(0.013)	(0.013)	(0.0096)
age	-0.000583	-0.00201***	0.000855**
	(0.00051)	(0.00051)	(0.00043)
spouse	-0.00477***	-0.00473***	-0.00151
	(0.0015)	(0.0016)	(0.0013)
children	0.00129*	0.00174**	-0.00508***
	(0.00071)	(0.00073)	(0.00066)
education	-0.0112***	-0.0103***	-0.0180***
	(0.0011)	(0.0011)	(0.0011)
farm experience	-0.0854***	0.103***	0.0158
	(0.013)	(0.016)	(0.011)
tenure	0.117***	0.115***	0.0952***
	(0.0054)	(0.011)	(0.0047)
speaks English	-0.0288	-0.0262	-0.0102
	(0.023)	(0.022)	(0.018)
reads English	-0.0301	-0.0126	-0.0201
	(0.023)	(0.023)	(0.020)
from Mexico	-0.00796	-0.00214	0.0112
	(0.019)	(0.019)	(0.017)
field crops	0.0473**	-0.000894	0.0773***
	(0.020)	(0.021)	(0.016)
fruit crops	0.0870***	0.0813***	0.105***
	(0.018)	(0.019)	(0.015)
horticulture	-0.0327	-0.0197	-0.0440**
	(0.020)	(0.021)	(0.018)
vegetables	0.0558***	0.0244	0.0609***
	(0.018)	(0.019)	(0.015)
preharvest	0.0261	0.0284*	0.0450***
	(0.017)	(0.016)	(0.013)
harvest	0.0444***	0.0419**	0.0182
	(0.016)	(0.016)	(0.014)
postharvest	-0.0123	0.00244	0.00533
	(0.019)	(0.021)	(0.017)
semiskill	-0.00565	-0.00554	-0.0341**
	(0.016)	(0.016)	(0.014)
supervisor	-0.192***	-0.319***	-0.202***
	(0.052)	(0.048)	(0.066)
Observations	39343	39343	39343

Notes: Probit marginal effects reported. Regressions also include survey year and region dummies. Robust standard errors in parentheses. Statistically significant at: the * 0.10 level; ** 0.05 level; *** 0.01 level.

Table 5: Effect of Piecerate Pay Basis on Log Family Income

	(1) log(family income)	(2) piecerate	(3) atanh ρ	(4) $\ln\sigma$
piecerate	-0.0485			
	(0.076)			
naturalized citizen	-0.213***	-0.174**		
	(0.059)	(0.087)		
green card	0.00958	0.245***		
	(0.057)	(0.083)		
other authorization	-0.0177	0.240**		
	(0.071)	(0.10)		
illegal	-0.282***	0.316***		
	(0.061)	(0.085)		
female	-0.00498	0.0112		
	(0.025)	(0.039)		
age	-0.000207	-0.00631***		
	(0.0010)	(0.0018)		
spouse	0.0168***	-0.00382		
	(0.0031)	(0.0053)		
children	0.00795***	0.00763***		
	(0.0013)	(0.0023)		
education	0.0219***	-0.0103***		
	(0.0015)	(0.0034)		
farm experience	0.571***	-0.0402		
	(0.023)	(0.038)		
tenure	0.0207**	0.0392***		
	(0.0098)	(0.014)		
speaks English	0.125***	0.00205		
	(0.040)	(0.066)		
reads English	0.0674	-0.0440		
	(0.045)	(0.070)		
from Mexico	0.0209	0.122*		
	(0.038)	(0.063)		
field crops	-0.273***	-0.277***		
	(0.043)	(0.074)		
fruit crops	-0.236***	0.519***		
	(0.041)	(0.060)		
horticulture	-0.00787	-0.862***		
	(0.045)	(0.093)		
vegetables	-0.230***	0.209***		
	(0.041)	(0.061)		
preharvest	-0.0956***	0.103		
	(0.033)	(0.079)		
harvest	-0.119***	1.364***		
	(0.039)	(0.069)		
postharvest	0.0434	0.453***		
	(0.037)	(0.083)		
semiskill	0.0412	0.518***		
	(0.034)	(0.071)		
supervisor	0.233**	0.293		
	(0.11)	(0.25)		
Constant	8.671***	-2.166***	-0.0318	-0.134***
	(0.11)	(0.16)	(0.044)	(0.012)
Observations	33765	33765	33765	33765

Notes: Marginal effects reported. Regressions also include survey year and region dummies. Robust standard errors in parentheses. Ancillary parameters are the inverse hyperbolic tangent of ρ and $\ln\sigma$. Statistically significant at: the * 0.10 level; ** 0.05 level; *** 0.01 level.

Table 6: Summary Statistics by Wage Payment Method, California and Northwest

	California		Northwest	
	Hourly	Piecerate	Hourly	Piecerate
U.S. Born (%)	3.91	1.90	19.90	8.25
Naturalized Citizen (%)	3.18	1.87	3.16	3.65
Green Card (%)	35.00	34.50	21.80	24.20
Other Authorization (%)	6.22	10.40	6.40	11.10
Illegal (%)	51.70	51.30	48.80	52.70
Female (%)	19.80	17.80	21.80	26.50
Age (years)	32.33	32.11	32.28	30.61
Has Spouse (%)	37.70	36.70	41.30	41.70
Children (number)	0.81	0.81	0.93	1.25
Education (years)	6.22	5.90	7.17	6.22
Farm Experience (years)	9.67	9.60	9.81	8.85
Tenure (years)	3.91	3.33	4.24	3.03
Speaks English (%)	13.30	10.90	34.80	22.00
Reads English (%)	11.50	9.10	29.20	19.40
Mexican (%)	92.60	93.80	78.80	89.80
Other Immigrant (%)	1.88	2.20	0.44	0.27
Field Crops (%)	6.08	0.30	11.10	1.96
Fruit (%)	57.10	74.40	43.30	67.20
Horticulture (%)	6.32	0.40	12.50	0.22
Vegetables (%)	28.70	23.40	23.10	26.60
Misc Crops (%)	1.86	1.50	9.63	3.96

Table 7: Effect of Piecerate Pay Basis on Logwage, California

	(1)	(2)	(3)	(4)
	logwage	piecerate	atanh ρ	$\ln \sigma$
piecerate	0.186***			
	(0.011)			
naturalized citizen	0.0468**	0.0997		
	(0.021)	(0.19)		
green card	0.00463	0.208		
	(0.017)	(0.17)		
other authorization	-0.00220	0.469**		
	(0.022)	(0.18)		
illegal	-0.0437**	0.289*		
	(0.018)	(0.18)		
female	-0.0479***	0.0529		
	(0.0060)	(0.058)		
age	-0.00216***	-0.00209		
	(0.00043)	(0.0029)		
education	0.00382***	-0.00736		
	(0.00083)	(0.0073)		
farm experience	0.00323***	0.00652*		
	(0.00051)	(0.0038)		
tenure	0.00934***	-0.0205***		
	(0.00073)	(0.0055)		
spouse		0.0681		
		(0.055)		
children		0.00997		
		(0.018)		
from Mexico	-0.0231*	-0.0769		
	(0.012)	(0.11)		
Constant	1.668***	-3.092***	-0.00960	-1.700***
	(0.027)	(0.30)	(0.014)	(0.017)
Observations	13576	13576	13576	13576

Notes: Marginal effects reported. Regressions also include language ability, crop, task, and survey year dummies. Robust standard errors in parentheses. Ancillary parameters are the inverse hyperbolic tangent of ρ and $\ln \sigma$. Statistically significant at: the * 0.10 level; ** 0.05 level; *** 0.01 level.

Table 8: Effect of Piecerate Pay Basis on Hours, California

	(1) hours	(2) piecerate	(3) atanh ρ	(4) $\ln \sigma$
piecerate	-16.74***			
	(1.15)			
naturalized citizen	1.184	0.0129		
	(1.47)	(0.20)		
green card	2.044	0.102		
	(1.27)	(0.17)		
other authorization	3.575**	0.439**		
	(1.46)	(0.19)		
illegal	0.476	0.183		
	(1.31)	(0.17)		
female	-4.741***	-0.0144		
	(0.46)	(0.053)		
age	-0.0215	0.00133		
	(0.023)	(0.0029)		
education	0.1000*	-0.00819		
	(0.054)	(0.0069)		
farm experience	0.0231	0.00420		
	(0.031)	(0.0038)		
tenure	0.346***	-0.0141***		
	(0.038)	(0.0053)		
spouse	1.064***	0.0856*		
	(0.41)	(0.050)		
children	0.0295	0.00857		
	(0.14)	(0.017)		
from Mexico	-0.141	-0.0591		
	(0.91)	(0.11)		
Constant	44.28***	-2.914***	0.653***	2.451***
	(2.32)	(0.30)	(0.073)	(0.020)
Observations	13546	13546	13546	13546

Notes: Marginal effects reported. Regressions also include language ability, crop, task, and survey year dummies. Robust standard errors in parentheses. Ancillary parameters are the inverse hyperbolic tangent of ρ and $\ln \sigma$. Statistically significant at: the * 0.10 level; ** 0.05 level; *** 0.01 level.

Table 9: Effect of Piecerate on Probability of Income Below the Poverty Threshold, California

	(1) poverty (family income)	(2) poverty (personal income)	(3) poverty (imputed income)
piecerate	0.0370**	0.0512***	-0.162***
	(0.017)	(0.018)	(0.017)
naturalized citizen	-0.163***	-0.145***	-0.0882
	(0.044)	(0.056)	(0.057)
green card	-0.0821*	-0.0425	-0.0649
	(0.048)	(0.053)	(0.046)
other authorization	0.0490	0.0575	-0.183***
	(0.059)	(0.061)	(0.059)
illegal	-0.0436	-0.0766	-0.0406
	(0.052)	(0.056)	(0.046)
female	0.0146	0.214***	0.182***
	(0.019)	(0.019)	(0.014)
age	0.000423	-0.000342	0.00244***
	(0.00095)	(0.00099)	(0.00081)
education	-0.00349	-0.00213	-0.00279
	(0.0023)	(0.0024)	(0.0021)
farm experience	0.000783	0.00226*	-0.00659***
	(0.0013)	(0.0013)	(0.0012)
tenure	-0.0165***	-0.0154***	-0.0234***
	(0.0019)	(0.0018)	(0.0017)
spouse	-0.0731***	0.164***	0.0246
	(0.017)	(0.018)	(0.018)
children	0.130***	0.152***	0.122***
	(0.0066)	(0.0084)	(0.0085)
from Mexico	0.00889	-0.00494	-0.00859
	(0.035)	(0.038)	(0.030)
Observations	13748	13748	13748

Notes: Probit marginal effects reported. Regressions also include language ability, crop, task, and survey year dummies. Robust standard errors in parentheses. Statistically significant at: the * 0.10 level; ** 0.05 level; *** 0.01 level.

Table 10: Effect of Piecerate Pay Basis on Logwage, Northwest

	(1) logwage	(2) piecerate	(3) atanh ρ	(4) $\ln \sigma$
piecerate	0.283***			
	(0.026)			
naturalized citizen	0.116**	0.0946		
	(0.047)	(0.35)		
green card	0.0548	-0.124		
	(0.035)	(0.32)		
other authorization	-0.00755	-0.530		
	(0.045)	(0.33)		
illegal	-0.0124	-0.264		
	(0.035)	(0.32)		
female	-0.0565***	0.116		
	(0.015)	(0.100)		
age	0.00142**	-0.00500		
	(0.00059)	(0.0045)		
education	0.00862***	-0.0105		
	(0.0019)	(0.013)		
farm experience	0.00121	-0.00484		
	(0.00094)	(0.0068)		
tenure	0.00836***	-0.0103		
	(0.0015)	(0.010)		
spouse		0.110		
		(0.093)		
children		0.0409		
		(0.027)		
from Mexico	-0.0203	0.429		
	(0.027)	(0.29)		
Constant	1.614***	-0.477	-0.0349	-1.435***
	(0.050)	(0.39)	(0.036)	(0.032)
Observations	4979	4979	4979	4979

Notes: Marginal effects reported. Regressions also include language ability, crop, task, and survey year dummies. Robust standard errors in parentheses. Ancillary parameters are the inverse hyperbolic tangent of ρ and $\ln \sigma$. Statistically significant at: the * 0.10 level; ** 0.05 level; *** 0.01 level.

Table 11: Effect of Piecerate Pay Basis on Hours, Northwest

	(1) hours	(2) piecerate	(3) atanh ρ	(4) $\ln \sigma$
piecerate	-7.438***			
	(2.23)			
naturalized citizen	2.350	0.0356		
	(2.23)	(0.33)		
green card	2.291	-0.110		
	(1.98)	(0.31)		
other authorization	4.408*	-0.532*		
	(2.26)	(0.32)		
illegal	1.832	-0.288		
	(1.97)	(0.30)		
female	-3.314***	0.128		
	(0.85)	(0.094)		
age	-0.0111	-0.00470		
	(0.031)	(0.0041)		
education	-0.149	-0.00976		
	(0.10)	(0.013)		
farm experience	-0.0939**	-0.00628		
	(0.046)	(0.0064)		
tenure	0.231***	-0.00671		
	(0.059)	(0.0096)		
spouse	1.683**	0.118		
	(0.77)	(0.086)		
children	-1.103***	0.0308		
	(0.33)	(0.025)		
from Mexico	-0.704	0.463*		
	(1.70)	(0.28)		
Constant	46.09***	-0.370	0.0883	2.613***
	(3.14)	(0.38)	(0.082)	(0.018)
Observations	4989	4989	4989	4989

Notes: Marginal effects reported. Regressions also include language ability, crop, task, and survey year dummies. Robust standard errors in parentheses. Ancillary parameters are the inverse hyperbolic tangent of ρ and $\ln \sigma$. Statistically significant at: the * 0.10 level; ** 0.05 level; *** 0.01 level.

Table 12: Effect of Piecerate on Probability of Income Below the Poverty Threshold, Northwest

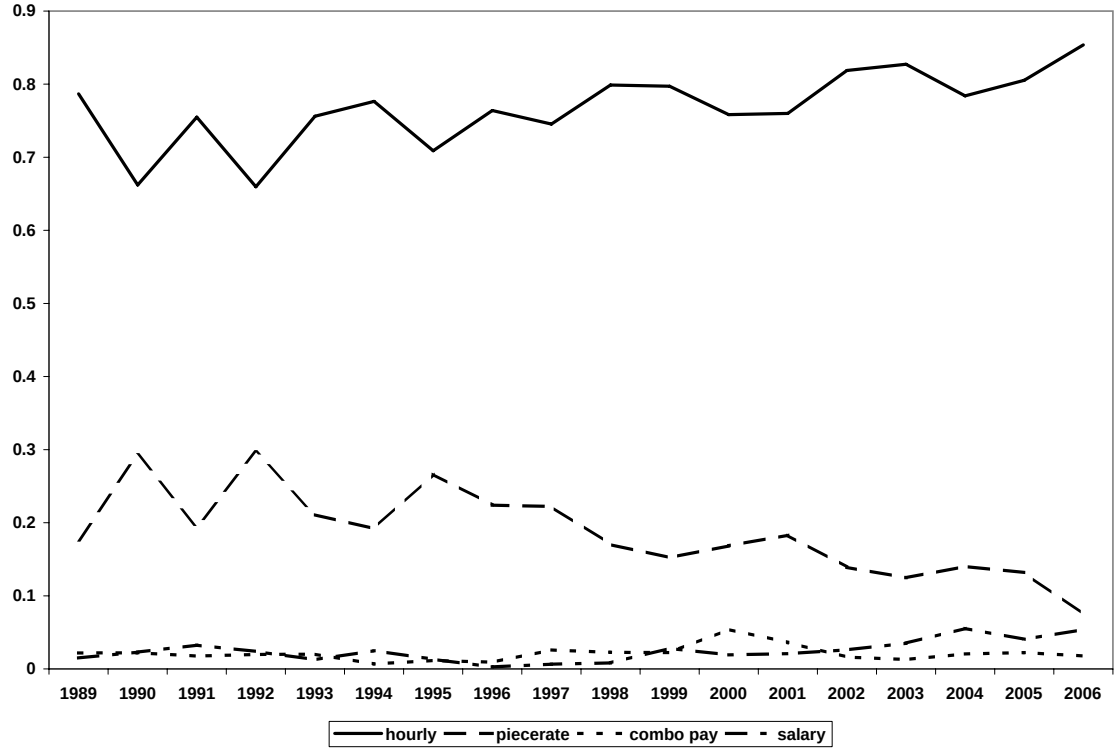
	(1) poverty (family income)	(2) poverty (personal income)	(3) poverty (imputed income)
piecerate	0.0485	0.0680**	-0.0677**
	(0.032)	(0.032)	(0.031)
naturalized citizen	-0.0946	-0.268*	0.0525
	(0.10)	(0.14)	(0.093)
green card	0.0255	-0.177	0.0448
	(0.100)	(0.12)	(0.085)
other authorization	0.175*	-0.0407	0.00896
	(0.10)	(0.13)	(0.092)
illegal	0.0685	-0.204*	0.0311
	(0.099)	(0.12)	(0.087)
female	-0.00253	0.133***	0.130***
	(0.029)	(0.029)	(0.025)
age	-0.00120	-0.00427***	-0.000999
	(0.0012)	(0.0013)	(0.0012)
education	-0.00691*	-0.00922**	0.00133
	(0.0035)	(0.0036)	(0.0033)
farm experience	0.000733	0.00465**	-0.00295*
	(0.0019)	(0.0019)	(0.0017)
tenure	-0.0141***	-0.0123***	-0.0207***
	(0.0029)	(0.0026)	(0.0027)
spouse	-0.0690**	0.0772***	0.00660
	(0.028)	(0.028)	(0.026)
children	0.120***	0.138***	0.105***
	(0.0100)	(0.012)	(0.010)
from Mexico	-0.0517	0.104	-0.0528
	(0.092)	(0.12)	(0.073)
Observations	5128	5128	5128

Notes: Probit marginal effects reported. Regressions also include language ability, crop, task, and survey year dummies. Robust standard errors in parentheses. Statistically significant at: the * 0.10 level; ** 0.05 level; *** 0.01 level.

Table A-1: NAWS Agricultural Regions

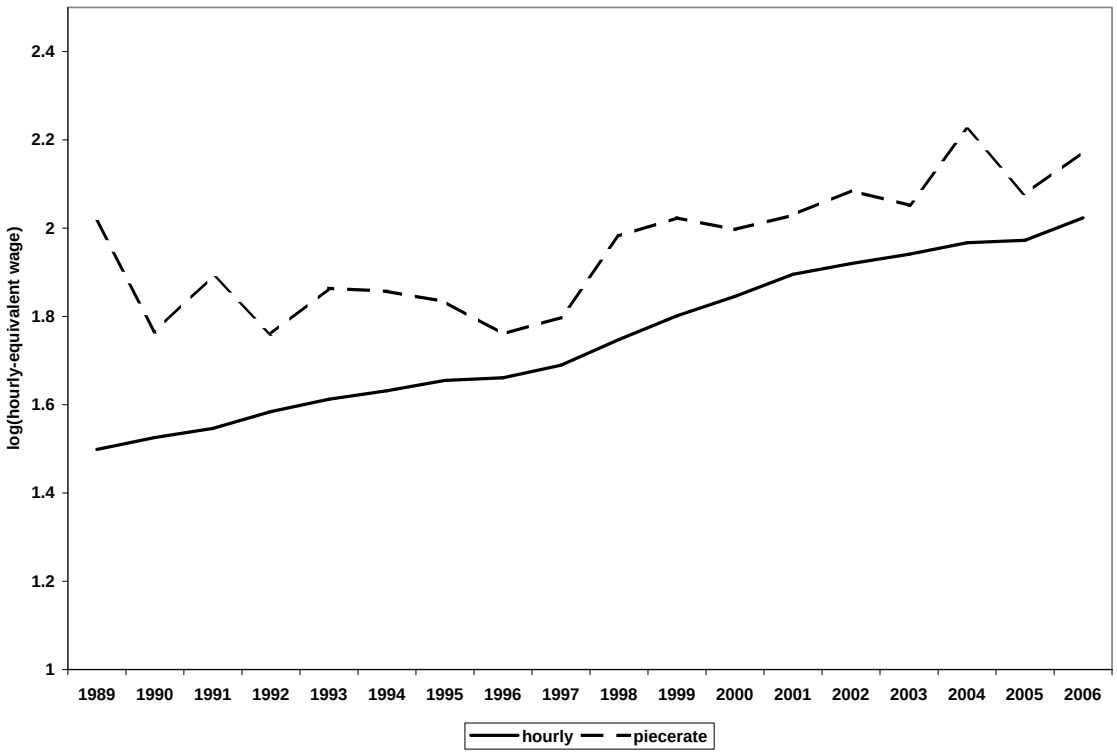
Region	States
California	CA
Southern Plains	TX, OK
Florida	FL
Mountain III	AZ, NM
Appalachia I, II	NC, VA, KY, TN, WV
Cornbelt Northern Plains	IL, IN, OH, IA, MO, KS, NE, ND, SD
Delta Southeast	AR, LA, MS, AL, GA, SC
Lake	MI, MN, WI
Mountain I, II	ID, MT, WY, CO, NV, UT
Northeast I	CT, ME, MA, NH, NY, RI, VT
Northeast II	DE, MD, NJ, PA
Pacific	OR, WA

Figure 1: Fraction of Agricultural Workers by Pay Basis



SOURCE– National Agricultural Workers Survey, pooled cross sections 1989-2006.

Figure 2: Hourly-equivalent Wage by Pay Basis



SOURCE– National Agricultural Workers Survey, pooled cross sections 1989-2006.

Figure 3: Hours per Week by Pay Basis

SOURCE– National Agricultural Workers Survey, pooled cross sections 1989-2006.

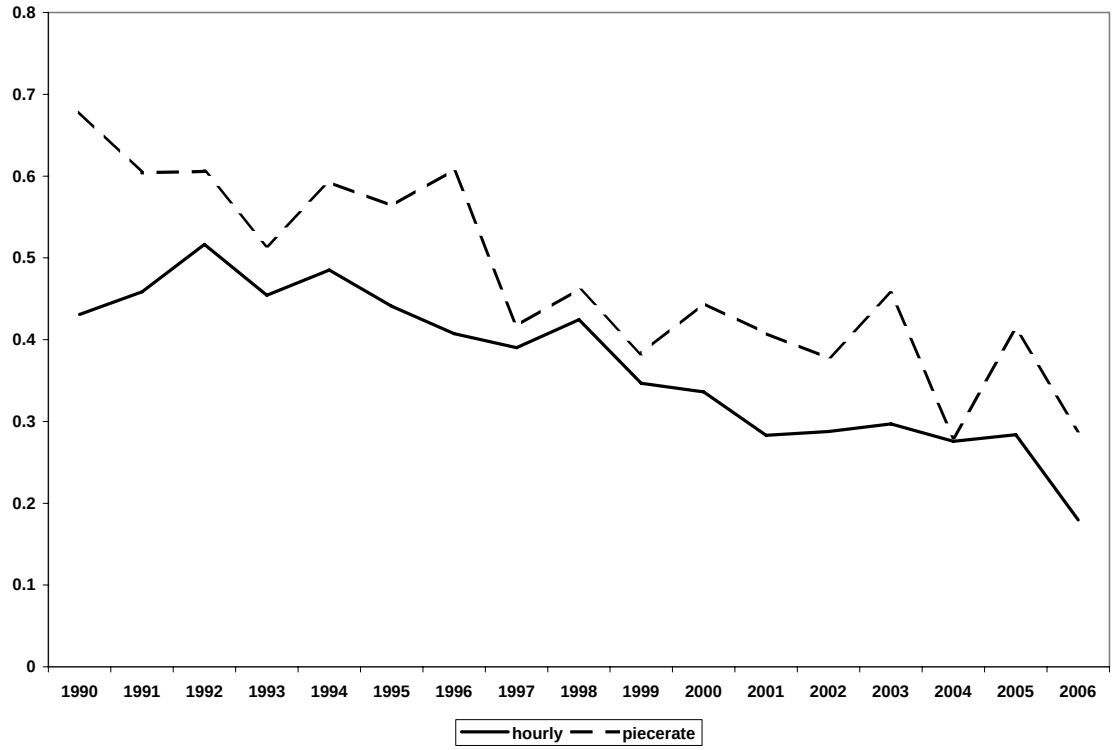
Figure 4: Farm Weeks per Year by Pay Basis

SOURCE– National Agricultural Workers Survey, pooled cross sections 1989-2006.

Figure 5: Fraction of Workers with Imputed Agricultural Income Under U.S. Poverty Threshold

SOURCE– National Agricultural Workers Survey, pooled cross sections 1989-2006.

Figure 6: Fraction of Workers with Self-Reported Family Incomes Under U.S. Poverty Threshold



SOURCE– National Agricultural Workers Survey, pooled cross sections 1989-2006.