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Anita Alves Pena
Colorado State University

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Anita Alves Pena
Colorado State University
anita.pena@colostate.edu

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ABSTRACT

While a stated goal of minimum wage increases is to benefit low-income workers, some employers are not obligated to provide at least minimum wages to all employees. U.S. farm employers comprise one of these groups. Employees of large farms and H2-A workers (temporary nonimmigrant workers lawfully admitted to perform temporary or seasonal agricultural services) are protected by minimum wage legislation, while other migrant workers (especially those who are paid piece rate) are exempt. Furthermore, U.S. agriculture is characterized by a large percentage of illegal migrants, and workers who are illegal may or may not receive wages above minimum levels. This paper presents a case study, drawing from agriculture, that examines if and how minimum wage laws affect uncovered workers. Analysis examines wages and hours worked as functions of federal and state minimum wages using data from a nationally and regionally representative survey of employed farm workers. Results suggest wage increases for both covered and uncovered workers, greatest gains to those who are formally covered, and gains not being at the expense of hours worked.

JEL Classification Codes: I32, J33, Q12

Key Words: minimum wage exemptions, poverty, agriculture

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1 INTRODUCTION

The Fair Minimum Wage Act of 2007 provided for three scheduled increases in the federal minimum wage. Specifically, the minimum wage, which had been constant at $5.15 per hour since 1997, was increased to $5.85 in July 2007, to $6.55 in July 2008, and to $7.25 in July 2009. In addition to this federal minimum wage, many states (and some localities) have their own minimum wage laws. In the case of conflicts between levels, workers are entitled to the highest of the set of minimum wages offered to them. While a stated goal of minimum wage legislation is to benefit low-income working families, some employers of low-income workers are not obligated to provide minimum wages to all employees. Exemptions to the federal minimum wage currently apply under specific circumstances to workers with disabilities, full-time students, those under age 20 in their first 90 consecutive calendar days of employment, tipped employees, student learners, workers in seasonal and recreational establishments, salaried executive, administrative, professional and outside sales employees, and agricultural workers.[1]

Agriculture is one sector in which workers are often exempt from minimum wage provisions and for which distinctive individual-level data are available. U.S. farm employers are not obligated to provide minimum wages to all agricultural workers. Instead, employees of large farms and H2-A workers (temporary nonimmigrant workers lawfully admitted to perform temporary or seasonal agricultural services) are protected by minimum wage legislation, while

[1] U.S. Department of Labor, Wage and Hour Division.

other migrant workers are exempt. This is especially the case for certain piece rate paid workers.[2] Furthermore, U.S. agriculture is characterized by a large percentage of illegal migrants, and undocumented workers may not receive wages above minimum levels.[3]

Academic literature has focused on the employment effects of previous minimum wage increases on workers for whom these wages directly apply (e.g., Bhaskar and To 1999; Burkhauser, Couch, and Wittenburg 2000; Card and Krueger 1994, 2000; Neumark and Wascher 2000). In contrast, this paper examines less-studied secondary effects of minimum wage legislation, particularly those effects on workers who are not explicitly covered. A primary goal of this paper therefore is to document whether minimum wage changes affect wages, hours worked, employment levels, and distributions of workers across piece rate and time rate payment structures when workers are exempt.

The paper proceeds as follows. Section 2 describes previous literature on minimum wage legislation as well as institutional information pertaining to specificities of U.S. agricultural labor markets. Section 3 describes the agricultural worker data that forms the basis of the case study. Section 4 presents empirical strategies and results. Section 5 discusses policy implications, conclusions, and how results have applicability to broader policy discussions of minimum wages, poverty, immigration, and agricultural labor markets.

2 LITERATURE AND THEORETICAL CONSIDERATIONS

Literature on minimum wages primarily has focused on employment effects within the covered sector. According to mainstream economic models, increasing minimum wages should

[2] Agricultural wage contracts may be either time based (e.g., hourly) or productivity based (e.g., piece rate).

[3] Farm workers also are exempt from overtime provisions, and young workers employed on small farms with parental consent are exempt from child labor provisions.

have adverse effects on total employment. Some empirical work, however, has failed to confirm this pattern. Card and Krueger (1994), for example, find that minimum wages do not lead to decreases in employment for a case study of the fast food industry. This result has been debated in subsequent literature (e.g., Neumark and Wascher 2000; Card and Krueger 2000), and authors have argued that differences may be due to competition characteristics of establishments employing low-wage workers (e.g., Bhaskar and To 1999) or empirical judgments relating to the use of year effects as macroeconomic controls (e.g., Burkhauser, Couch, and Wittenburg 2000). Sabia (2009) exploits variation from recent minimum wage changes and estimates negative labor demand effects on teenagers using Current Population Survey data and alternative macroeconomic controls (such as whether the economy is in recession and the proportion of the population that is teenaged).

In literature on international economies, evidence regarding the presence or absence of employment effects also is mixed. Examples include Bell (1997), who finds negative employment effects in Colombia but neutral effects in Mexico, and Lemos (2004), who establishes negligible employment effects in Brazil associated with minimum wage changes. Lesser work has considered wage effects associated with minimum wages.[4]

2.1 Minimum Wages and the Uncovered Sector

Theoretically, and as monopsonistic labor market models stress, uncovered workers, in addition to covered workers, may receive a wage boost in response to minimum wage increases since the existence of a more generous outside option may put upward pressure on uncovered sector wage rates if workers are free to move between sectors. This also would be the case when regulations are complex and if employers are uncertain regarding the applicability of minimum

[4] Lemos (2004), however, does find compressed wage distributions.

wage laws to their workers. In these cases, decreases in income inequality and poverty are possible.

However, minimum wages also affect opportunity costs of working in industries such as agriculture by influencing pay and employment probabilities in nonexempt jobs. Minimum wage increases might force workers from the nonexempt sector to the lower wage exempt sector, and this migration may lead to lower wages in the uncovered sector. These dynamics are sometimes referred to as negative spillover effects to the uncovered sector following minimum wage increases and may be associated with increases in income inequality and poverty. The net result of these general equilibrium effects is theoretically ambiguous, and the question is an empirical one.

Mincer (1976) writes that "minimum wages generate socially wasteful labor mobility" (p. S87). Specifically, he argues that minimum wages lead to both inefficient allocations of people between the labor market and the nonmarket, and across covered and uncovered sectors within the market. His empirical analysis suggests that primary effects are the result of labor moving from covered to uncovered sectors after minimum wage increases, which puts downward pressure on uncovered wages that more than offsets changing option values. In complementary empirical work, Tauchen (1981) further examines effects of minimum wages across covered and uncovered U.S. labor market sectors. He estimates reduced-form wage and employment equations using aggregate data comparing the generally uncovered agricultural sector (prior to the Fair Labor Standards Act) to four low-wage, covered nondurable manufacturing industries, and finds that uncovered sector wage rates increase following minimum wage increases in regions characterized by small covered-sector demand elasticities, and that uncovered wage rates

fall in regions with large covered demand elasticities. This is consistent with Mincer's (1976) minimum-wage model.

2.2 Policy Context for U.S. Agricultural Labor Markets

The Fair Labor Standards Act (FLSA) of 1938 established federal rules regarding minimum wages, overtime pay provisions, and child labor standards. Until 1966 amendments to the act, agriculture was completely excluded. Since those amendments, most agricultural employees should be covered by minimum wages statutorily since they produce goods for interstate commerce. However, several exemptions specific to this sector result in many workers remaining uncovered in practice.[5] First, small farms that do not use 500 "man days" per year are exempt from paying minimum wages. Second, employers are not required to pay minimum wages to several groups of workers, including immediate family members, those principally engaged in livestock production, local piece rate paid hand harvest laborers, and nonlocal minors under 16 in piece rate hand harvesting alongside his or her parents.[6] These final categories are exploited in the empirical exercise. Furthermore, mis- and underreporting of wages by employers are common in agriculture, and compliance with minimum wage legislation may be limited, especially in the case of illegal immigrant workers sometimes paid in under the table transactions.[7] In addition to divisions based on piece rate or time rate pay basis, the empirical analysis also considers differential treatment by legal status group.

[5] Despite the 1966 amendments, 1969 increases to minimum wage applied to nonagricultural work only. In 1978, agricultural and nonagricultural wages were deemed subject to common standards.

[6] U.S. Department of Labor, Employment Standards Administration, Wage and Hour Division, Fact Sheet #12: Agricultural Employment under the Fair Labor Standards Act (FLSA).

[7] Employers hiring workers via a farm labor contractor may be more likely to comply with labor laws because both contracting parties (employer and farm labor contractor) may be liable in the case of audit and therefore an additional incentive mechanism is in place. In addition, farm labor contractors are required to register with the U.S. Department of Labor under the Migrant and Seasonal Agricultural Worker Protection Act, which restates wage requirements, and therefore information pertaining to compliance standards is arguably more widely disseminated to this group.

Early agricultural labor economics literature considered the effects of the FLSA and its amendments on equilibrium outcomes. Gardner (1972) and Lianos (1972), for example, find that initial extensions of minimum wages to agricultural workers under the FLSA led to significantly increased wages and decreased employment.[8] Specifically, Gardner (1972) regresses a farm wage index on prices of land and other inputs, manufacturing wages, product prices, a time trend, and minimum wage introductions. He finds that minimum wages that are applicable to agricultural labor markets are positively related to farm wages whereas the opposite is true for minimum wages that do not directly apply. Hired agricultural labor force sizes, on the other hand, are increasing in nonapplicable minimum wages and decreasing in applicable minimum wages. Lianos (1972), in independent research, comes to similar conclusions and stresses that welfare effects of minimum wages on hired farm workers are characterized by winners and losers with some workers remaining employed at higher wages and others losing employment. In more recent agricultural labor economics literature, Moretti and Perloff (2000) find that increases in the minimum wage raised wages for hourly workers in U.S. agriculture and decreased wages for piece rate workers on average during the 1989–1995 time period. The authors present a general equilibrium model illustrating how wage effects are uncertain under an assumption of incomplete enforcement of the minimum wage.

2.3 Minimum Wages and Poverty

Beyond agriculture, literature pertaining to the effectiveness of minimum wages as antipoverty public policy instruments also is subject to controversy. Primary issues include establishing which particular worker groups realize wage increases subsequent to minimum

[8] Results are qualitatively similar to findings pertaining to the introduction of minimum wages in English and Welsh agriculture in 1917 (repealed in 1921 and reinstated in 1924). Gowers and Hatton (1997) find that wage rates within agriculture increased substantially, while employment fell with reduced poverty to workers retaining their jobs.

wage changes, as well as which may be transitioning to un- or underemployment as the result of policy change. In the monopsonistic model presented by Bhaskar and To (1999), an increase in the minimum wage may lead to an increase or a decrease in employment with resulting positive and negative welfare effects, respectively. Similar conclusions are drawn from Moretti and Perloff's (2000) general equilibrium model under incomplete labor market coverage of the minimum wage. In empirical work, such as Lianos (1972), Neumark and Wascher (2002) note that minimum wages may lead to redistributions among poor families (with some workers losing employment) as opposed to redistribution across income groups and therefore may have limited uses as antipoverty policy instruments. Neumark, Schweitzer, and Wascher (2005) find that the proportion of families with incomes below or near the poverty line is increasing with the minimum wage.

In contrast, international literature on relationships between minimum wages and income distributions has not lead to a consensus. Lustig and McLeod (1997), for example, find a pattern of generally inverse relationships between poverty and minimum wages across several developing countries. Neumark, Cunningham, and Siga (2006) find no evidence that minimum wages increase low family incomes in Brazil.

3 DATA

Primary data come from the U.S. Department of Labor's National Agricultural Workers Survey (NAWS). The NAWS is a nationally representative (and representative for 12 agricultural regions) survey of employed U.S. farm workers. NAWS is a rich source of data on illegal and legal agricultural immigrants, and their earnings in the United States. Workers have been sampled from work sites in three seasons per year since 1989. Of the 46,566 workers

represented in the 1989–2006 sample, 69 percent of the weighted sample reports Mexican origins, and 58 percent of these Mexican immigrant workers admit to being of illegal status. Of the overall sample (which includes U.S. born workers), 42 percent report being illegal.[9]

Table 1 presents summary statistics of wages, hours, weeks, demographic characteristics, and work attributes for NAWS workers in two main subcategories based on payment basis and one aggregate category. Hourly workers are those paid on a time-based schedule. Piece rate workers are paid according to their productivity. The "All Worker" category is tabulated over the full NAWS sample, which, in addition to piece rate and hourly workers, also includes small numbers of combination-pay workers (that receive some hourly and some piece rate compensation in their current employment situations) and salary workers. Combination and salary workers together comprise less than 5 percent of the data set.

Observable differences across payment structures are notable on several dimensions. In terms of demographic characteristics, hourly workers are much more likely to report being U.S. born than are piece rate workers. More than 21 percent of hourly workers are U.S. born in comparison to less than 7 percent of piece rate workers. On the other end of the legal status spectrum, almost 46 percent of hourly workers report being illegal compared with more than 57 percent of piece rate workers. Hourly workers are on average almost two years older than are piece rate workers and are more likely to be married and to have higher rates of educational achievement (measured via years of schooling), U.S. farm work experience, tenures with their

[9] Respondents are provided a pledge of confidentiality and $20 for their participation. The determination of legal status is twofold. Respondents are first asked a direct question about their immigration status followed by questions about the legalization program under which the legal status was obtained. The follow-up questions are used to double check the accuracy of the first pass response. Legal status information is missing for only approximately 1.5 percent of the total sample. In the 1989–2005 sample, 93 percent of those classified as undocumented self-identified this status.

current employers, and self-reported English language abilities.[10] Piece rate workers are more likely observed in fruit and vegetable picking operations, while hourly work is more common in field crops.

Piece rate workers are shown in Table 1 to realize higher wages per hour but work fewer hours per week on average and fewer weeks per year in agriculture. These patterns are documented in Pena (2010). Hourly equivalent wages are constructed for piece rate 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. Much of the general literature on piece rate versus time rate payment has focused on how compensation structure affects both worker sorting across firms, and on incentives and productivity. Of particular interest is the common empirical finding that piece rate earnings distributions are characterized by a higher mean (consistent with theoretical predictions of increased effort), but larger variance than time rate earnings distributions (e.g., Seiler 1984; Lazear 2000).[11]

Figure 1 illustrates mean wages received by NAWS workers by year and pay basis against federal minimum wage levels. While mean piece rate wages are higher, these wages also are more variable, and piece rate workers are more likely to report realized wages below established minimums.[12] Average workers under both schemes have wages above minimum levels, though piece rate wages are notably higher.[13]

[10] Relatively low reported family sizes may be related to the age distribution of the migrant farm work population.

[11] Earnings premiums can be decomposed into compensating wage differential for increased risk (and thus increased income variation under piece rate contracts), and into incentive-effort effects since piece rate workers would exude more effort if they were compensated for it.

[12] Probabilities that workers receive at least minimum wage also relate to differences in legal status. Immigrants, especially illegal immigrants, are observed as having both lower wages and as being more likely to be in piece rate paid positions than are U.S. born workers.

[13] This is notable given potential underreporting of wages in general in agriculture.

Consistent with the literature, the piece rate data series is shown to be more variable than average hourly wages. This pattern is attributable both to higher standard deviations and to smaller sample sizes. Pooled over the sample period, approximately 80 percent of NAWS workers are paid time rate (either hourly or salary) and 20 percent are paid piece rate or combination.

Although averages are greater than statutory minimum wages, coverage and enforcement is incomplete. Of overall NAWS workers, approximately 10 percent report being paid less than minimum wage. For hourly workers, this percentage is lower with 9 percent reporting wages below minimum. For piece rate workers, this percentage is higher with 16 percent reporting subminimum payment. Differences also are notable by legal status with 8 percent of legal compared with 12 percent of illegal workers receiving below minimum wages.

Figure 2 shows average hours per week for agricultural workers under the two payment schemes. The figure suggests a small upward trend in hours per week in the second half of the survey period as minimum wages increase. This is suggestive of the absence of a negative employment effect (since those who retain employment maintain hours); however, a caveat is that the size of the farm labor force (instead of the hours worked by individual laborers) may be more sensitive to minimum wage changes.

4 EMPIRICAL FRAMEWORK

The empirical part of this study begins by examining if federal and state minimum wage changes over the course of the data series have indeed affected agricultural wages of covered and uncovered workers. State analysis focuses on California, a large agricultural producer that incurred several minimum wage changes over the sample period. As the NAWS is representative

of farm workers nationally and for 12 regions, one of which corresponds to the state of California, other states (with the exception of Florida) cannot be analyzed separately while upholding the representativeness of the data. Figure 3 illustrates minimum wage changes nationally and for the state of California since the beginning of the NAWS sample period.

4.1 Relationships between Minimum Wages and Wages Received by Coverage

The basic regression examines realized wages as a function of minimum wage levels. The function is specified as a linear model of the general form:

$$w_i = \alpha \text{minwage}_i + X_i\beta + \epsilon_i \quad (1)$$

where the dependent variable w_i represents hourly equivalent wage rates for the primary task reported by the survey respondent. The variable minwage_i denotes the federal (and state respectively) minimum wage level during the year that the worker is surveyed. Extensions include interaction terms between this variable and whether coverage or exemption is predicted for a worker based on legal status and thus take the revised form:

$$w_i = \alpha \text{minwage}_i + \sum_{\text{legalstatus}_i}^{4} \phi_i \text{minwage}_i * \text{legalstatus}_i + X_i\beta + \epsilon_i \quad (2)$$

where legalstatus_i corresponds to a series of dummy variables indicating naturalized citizenship, Green Card holder, other work authorization, and illegal worker, respectively. In both regression cases, examining the statistical significance and economic magnitude of the parameter α is of particular interest.

Since piece rate workers are much less likely to be formally covered by minimum wages, piece rate pay structure is used as a proxy for the uncovered agricultural labor force and hourly pay for covered. Therefore, the treatment of uncovered and covered parts of U.S. agriculture is twofold. First, piece rate and time rate payment structures are treated individually to allow separate estimations for the two coverage levels. Second, within these regressions, legal status is entered both linearly alone and interacted with the treatment variable. The vector X_i includes whether a worker is an immigrant or is U.S. born, and if immigrant, whether a worker is a naturalized citizen, Green Card holder, has other work authorization, or is working illegally (and interaction terms between minimum wages and legal status dummies in extended versions of the analysis). This vector also includes general demographic and work characteristics, geographic region of observation, and survey year.[14]

If the assumption that piece rate status is a valid proxy for uncovered and hourly for covered employment, then the results in Table 2 suggest that the minimum wage has a positive effect on both covered and uncovered workers in U.S. agriculture. Columns (1) and (2) restrict the sample to piece rate workers, and columns (3) and (4) restrict to those reporting wages based on hours worked. Notably, the effect of minimum wage level on wages received is greater for hourly than for piece rate workers, and this difference is significant. Since the regression is specified in linear form, the coefficient α as estimated in Table 2 can be interpreted as indicating that a $1 increase in minimum wage is associated with approximately $0.98–$1.10 higher wages received for piece rate workers and with $1.40–$1.80 higher wages per hour for hourly positions.

The coefficients on interactions between the minimum wage level and legal status groups are generally statistically significant in the hourly wage regression specified in column (4). For naturalized citizens, the interaction is positive, and for those with work authorization and those

[14] Year effects may roughly control for the business cycle in addition to other variations and trends by year.

who report illegal status, interactions are negative. This may be an expected pattern among these groups within the covered sector.

Restricting the sample to California workers and matching California minimum wages instead of lower federal levels also shows a positive relationship between minimum wage levels and wages received in both piece rate and time rate positions.[15] These results are found in Appendix B.

Gindling and Terrell (2005) find patterns similar to those in Table 2 for formal and informal sectors in Costa Rica. Specifically, minimum wages lead to substantial increases in wages received by both workers in formal large urban and rural enterprises and in informal small urban and rural enterprises where minimum wage laws are unenforced. In contrast, the authors do not find a wage effect for the self-employed.

Table 3 repeats the exercises of Table 2 while restricting samples to those for whom minimum wage is most likely binding. This is important since minimum wages should affect those at current minimum levels and may or may not affect those at other wage levels, depending on the institutional circumstances. The first row reprints coefficients from the previous table for comparison. The second through fourth sets of estimates correspond to samples restricted to those workers in the sample earning within 150 percent, 125 percent, and 100 percent of the relevant federal minimum wage, respectively. Magnitudes of coefficients on the minimum wage variable generally decrease as the sample is further restricted. Comparing regressions including interaction terms to allow for differential effects across legal status groups (presented in columns (2) and (4) for piece rate and hourly workers, respectively), it is notable that the effect of the

[15] However, OLS may be biased if workers select to locate in California and this process relates to differential minimum wage characteristics at the state level.

minimum wage on piece rate workers becomes indistinguishable from zero, while the effect for hourly workers remains above $1 for $1 and significant.

A question may be why the effect of minimum wages on wage received is more than $1 for $1 in many cases. A caveat illustrated in Table 3 is that this is primarily true only for hourly workers. Secondly, this result diminishes as the sample is restricted to the most relevant workers for the exercise. Any remainder above $1 for $1 may be hypothesized to be the result of a combination of upward bias due to political pressure to increase wages, misinterpretation of minimum wage laws and their coverage, and measurement error related to state and federal minimum wage differentials.

4.2 Relationships between Minimum Wages and Hours Worked by Coverage

In addition to effects on wages received by those remaining in agriculture, minimum wage changes may be associated with changes in hours worked or in the distribution of workers across contract types. For hours, regressions parallel those presented above with the dependent variable being set to hours per week instead of wages. These results are presented in Tables 4 and 5. Coefficients on the minimum wage variable are generally positive though not statistically significant at conventional levels. The lack of a negative effect of hours is consistent with studies examining hours worked across industries. Zavodny (2000), for example, notes that minimum wage increases do not adversely affect hours among either the subsample of working teens in the United States or all U.S. teens.

Minimum wage levels, however, are associated with some notable differentials across legal status groups. Those with other work authorization in hourly work have statistically significantly lower hours per week on the order of three hours in comparison with the native

worker base category, while Green Card holders and illegal workers in piece rate positions have significantly higher hours per week.

4.3 Relationships between Minimum Wages and Probability of Coverage

To examine whether changes in minimum wages are associated with changes in the distribution of workers across contract types, consider:

$$\Pr(\text{piecerate}_i) = \gamma \text{minwage}_i + X_i\delta + \upsilon_i \quad (3)$$

where piecerate_i indicates that a worker is observed in a piece rate, as opposed to time rate, job. Results are presented as probit marginal effects in Table 6. In the baseline regression, the effect of minimum wages on the probability that a worker is in a piece rate paid position is insignificant. Regressions include year effects and therefore account for tendency toward less reliance on piece rate payment over time.

Estimates of the effects of minimum wages on the probability that a worker is in a piece rate paid position calculated for the 150 percent, 125 percent, and 100 percent of the relevant federal minimum wage subsamples are presented in Table 7. Significant effects in the positive direction (toward more likely being paid piece rate) are evident as the sample is restricted to those for whom minimum wages bind. This is important for refinement of modeling since the finding is consistent with workers selecting (or being selected) into piece rate paid positions for institutional and general equilibrium reasons.

4.4 Selection into Piece Rate Paid Positions

An additional consideration pertaining to dynamics before and after minimum wage increases is if and how the distribution of workers across piece rate and time rate payment basis

may change with policy. Figure 4 illustrates the fraction of farm workers under piece rate paid contracts over the sample period. The figure suggests an inverse relationship between piece rate contracts and minimum wage levels that is inconsistent with a story of workers leaving the covered sector after minimum wage increases and entering uncovered employment. The depiction, however, is unconditional and does not account for other trends and macroeconomic factors such as structural change pertaining to overall payment structure.[16]

Because whether a worker is employed in a piece rate or hourly paid position may be simultaneously determined with labor market outcomes such as wages and hours worked, endogeneity corrections are considered.[17] Modeling piece rate pay status as an endogenous binary treatment, piece rate status can be written as an unobserved latent variable:

$$\text{piecerate}_i^* = z_i\gamma + u_i \quad (4)$$

where the treatment decision rule is:

$$\text{piecerate}_i = \begin{cases} 1 \text{ if } \text{piecerate}_i^* > 0 \\ 0 \text{ otherwise} \end{cases}$$

This treatment is estimated as a probit model simultaneously with a wage equation and an hours equation, respectively.

[16] See Pena (2010) for further discussion on this dynamic in U.S. agriculture.

[17] Related to this is whether being paid piece rate is the result of a choice on the part of the worker, or alternately is the result of some kind of discrimination. Evidence on the prevalence and characteristics of farm labor contracting suggests that piece rate pay may not fully be a choice. Approximately 32 percent of piece rate workers, for example, report being employed by a farm labor contractor as opposed to directly by a grower, while only 16 percent of hourly workers report using farm labor contractors and wage gaps are evident between these two classes of workers. This suggests that individual workers may have more bargaining power when they represent themselves directly to a grower as opposed to via a third party.

The error term across equations is assumed to be bivariate normal with a covariance across the two equations, ρ, and variance of error of the primary equation of interest, σ. Transformations of the auxiliary parameters, ρ and σ, are estimated and reported for computational reasons. These transformed parameters along with the treatment effect of the minimum wage on wages and hours, respectively, and the effects of the minimum wage on the probability of piece rate pay from the second equation are presented in Tables 8 and 9, respectively. The presence of a spouse and number of children in the United States are used as exclusion restrictions in the probability of piece rate pay probit equation for the wage specifications.[18] This identification strategy is based on family structure characteristics being predictors of risk tolerance and piece rate pay being more variable than hourly pay theoretically and empirically, especially for agricultural product markets where production may at least partially depend on stochastic factors such as weather. Further discussion and reference appears in related work (Pena 2010).

For the full sample, the effect of minimum wage on wage is estimated at $1.56 and $1.72, respectively, for a $1 increase in the minimum wage with and without interaction terms allowing differential effects of minimum wage by legal status group. Magnitudes of these effects decrease as the sample is restricted toward those for whom the minimum wage is most binding. These patterns are qualitatively similar to results by simple OLS presented earlier in this paper. The effect of the minimum wage on the probability that a worker is in a piece rate paid position is negative for the full sample and positive for restricted subsamples based on the binding criteria. This is consistent with the pattern identified in Table 7. Notable, however, is that ρ is

[18] Identification is based on nonlinearity of the functional form in the cases where the outcome variable is hours.

insignificant across the specifications in Table 8. This indicates that we cannot reject the null hypothesis that error terms across equations are uncorrelated.

In Table 9, positive coefficients on minimum wage in all hours specifications are positive though in many cases insignificantly different from zero. This pattern, however, is consistent with wage increases in the agricultural sector associated with minimum wages not being at the expense of hours worked overall. In many cases, ρ is highly statistically significant, indicating an improvement over OLS and positive selection into piece rate positions.

5 DISCUSSION AND CONCLUSIONS

5.1 Can Minimum Wage Legislation Decrease Poverty Among Farm Workers?

Farm workers have historically been among the poorest members of the working class in the United States, and limited work in agricultural labor economics to date has focused on specific policy to combat poverty in this population. Over the survey period, the federal minimum wage increased from $3.35 to $5.15 per hour. Almost 13.5 percent of piece rate workers reported wages below federal minimum wage levels during this period compared with 2.4 percent of hourly workers. A question of interest that remains therefore is whether changes to wage payment methods, namely extending the minimum wage to all workers in agriculture, could serve as an instrument to decrease poverty among U.S. farm workers.

Results here suggest that realized wages increase along with minimum wages and that increases occur at a greater rate for covered than for uncovered workers. While this is not found to be at the expense of individual hours worked, negative employment effects cannot be ruled out without further analysis. Orrenius and Zavodny (2008) find that minimum wages have not resulted in negative employment effects for adult immigrants with less than high school

education.[19] If this is true for agriculture, an immigrant-intensive industry, then welfare gains from extending minimum wages may outweigh welfare losses. Since NAWS is nationally representative, survey weights can be applied to total counts to examine these differences. Decreases in total count (as well as separately in both piece rate [uncovered] and hourly [covered]) are evident as minimum wages increase in Figure 5. These decreases, however, correspond to the period when minimum wage was unchanging (between 1997 and 2007) and therefore are likely due to several factors unrelated to minimum wage legislation. U.S. agriculture as a sector is known to be following a negative macroeconomic time trend with diminishing employment levels in general, for example.

Lack of negative employment effects in agriculture is consistent with findings by Gilbert, Phimister, and Theodossiou (2001) that positive distributional effects associated with minimum wages may be greater in rural as opposed to urban areas. Lustig and McLeod (1997) find cross-country evidence that minimum wages and poverty are inversely related for a number of developing countries. The authors indicate, however, that documenting this relationship does not establish that minimum wages are cost-effective as antipoverty public policy mechanisms.[20]

Overall, the paper contributes to understanding of the consequences of extending minimum wages to all U.S. farm workers. Results are relevant to discussions of the likely effects of new minimum wage increases (such as those legislated in the Fair Minimum Wage Act of 2007), especially in regard to industries where minimum wage coverage is incomplete. As noted, exemptions to the federal minimum wage extend beyond agriculture to, for example, workers

[19] Statistical evidence suggests that these workers may select to locate in areas with lower subnational minimum wages. The result also is consistent with Cadena's (2010) theoretical model that predicts that immigrants following an objective to maximize earnings select locations with stagnant minimum wages (over states with increasing minimums).

[20] Formby, Bishop, and Kim (2010) examine the cost-effectiveness of the Fair Minimum Wage Act of 2007 and conclude that an equal cost increase in EITC benefits would have been more cost-effective as a poverty reduction mechanism than the current legislation.

with disabilities, full-time students, youth in their first days of consecutive employment, tipped employees, and student learners. Furthermore, workers in certain seasonal and recreational establishments and executive, administrative, professional, and outside sales employees who are paid on a salary basis are exempt. Thus, farm workers are only one subgroup of U.S. workers for which minimum wages do not apply, and results therefore may be relevant to policy discussions beyond agricultural markets. A caveat, as noted in the literature, however, is that specific institutional and labor market characteristics (e.g., relative labor demand and supply elasticities across industries and sectors) may play important roles.

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APPENDIX A: DATA APPENDIX

The sampling procedure NAWS is based on four levels: 1) region, 2) crop reporting district, 3) county, and 4) employer with probabilities proportional to size at each level. NAWS uses 12 geographic regions based on USDA Quarterly Agricultural Labor Survey of farm employers. The 12 regions are defined in Table A.1.[21] USDA information is 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 districts, 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 farm worker 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.

[21] The public use NAWS sample is collapsed further to only six regions.

APPENDIX B: MINIMUM WAGES AND CALIFORNIA

In general, NAWS workers cannot be matched to particular state minimum wages since the survey is designed to be nationally and regionally representative for agricultural regions (not for each U.S. state individually) as indicated in Appendix A. California, however, comprises one of these regions. With the exception of the piece rate series, which is simply decreasing over time as in the national case, figures corresponding to the California sample and California state minimum wages are presented for comparison in Figures B-1 through B-3. Similar patterns to the national cases are evident. While California minimum wages are precisely matched to California workers (whereas federal minimum wages are matched to all workers in the main estimations of this paper), it should be noted that the distribution of workers across states also may respond to changes in minimum wages.

The effects of California state specific minimum wage levels on wages and hours, respectively, in the framework accounting for selection into piece rate paid jobs are presented in Tables B-1 and B-2. The sample is restricted to 150 percent and 125 percent of California minimum wages in the cases allowing for the binding nature of the wage rate. The 100 percent case is not presented because of small sample sizes for the California region case. Qualitative results are similar to the national results with the caveat that the more than $1 for $1 result is not found. This is suggestive evidence that the results presented in the main body of this paper are upwardly biased due to mismatch between the minimum wage variable and particular state and local requirements.

Figure B-4 documents how the fraction of the total U.S. farm worker population that is located in California has changed over time. This fraction is graphed against California minimum wages. While again this illustration is unconditional, it is notable that the fraction of total farm

workers located in California has increased alongside minimum wage levels over the survey period. This is in contrast to noted applications by Zavodny (2000) and Cadena (2010). The pattern, however, is noted for the particular industry of U.S. agriculture in the figure and can be due to a wide variety of general equilibrium dynamics.

Table 1 Summary Statistics by Wage Payment Method and Overall

	Piece rate	Hourly	All workers
Current wage (2006 USD)	9.33	7.29	7.82
Hours per week	35.35	41.68	40.66
Farmwork weeks per year	27.04	28.59	28.50
U.S. born (%)	6.67	21.22	18.91
Naturalized citizen (%)	2.15	4.48	4.12
Green Card (%)	23.68	23.25	23.76
Other authorization (%)	10.48	5.31	6.21
Illegal (%)	57.02	45.74	47.00
Female (%)	17.58	21.91	21.22
Age (years)	30.65	32.34	32.17
Has spouse in U.S. (%)	29.68	35.37	35.17
Children in U.S. (number)	0.76	0.72	0.75
Education (years)	6.13	7.20	7.04
U.S. farm experience (years)	8.08	9.20	9.17
Tenure (years)	2.94	3.96	3.87
Speaks English (%)	17.02	31.52	29.38
Reads English (%)	13.95	28.74	26.53
Mexican (%)	87.91	72.03	74.56
Other immigrant (%)	2.16	1.25	1.58
Field crops (%)	6.14	17.42	15.71
Fruit (%)	53.74	28.59	33.87
Horticulture (%)	0.80	18.83	15.12
Vegetables (%)	35.72	28.19	29.01
Miscellaneous crops (%)	3.50	6.79	6.13
Observations	6,322	31,365	39,726

SOURCE: NAWS, pooled cross sections.

Table 2 Effect of Federal Minimum Wage Level on Wage

	Piece rate		Hourly	
	(1)	(2)	(3)	(4)
minimum wage	0.973**	1.094*	1.445***	1.771***
	(0.359)	(0.467)	(0.0930)	(0.127)
minwage*naturalized		0.112		0.448***
		(0.737)		(0.0943)
minwage*green card		0.122		−0.123
		(0.595)		(0.0985)
minwage*other auth		−0.670		−0.231*
		(0.888)		(0.109)
minwage*illegal		0.0393		−0.343*
		(0.343)		(0.161)
naturalized citizen	0.342	−0.158	0.183	−1.894***
	(0.718)	(3.471)	(0.0911)	(0.440)
green card	0.419	−0.147	0.0816	0.702
	(0.455)	(2.790)	(0.0960)	(0.512)
other authorization	0.0951	2.855	−0.0141	1.059
	(0.456)	(3.687)	(0.0852)	(0.541)
illegal	−0.351	−0.526	−0.117	1.570
	(0.299)	(1.470)	(0.0765)	(0.790)
female	−0.849**	−0.840**	−0.274**	−0.273**
	(0.218)	(0.215)	(0.0900)	(0.0885)
age	−0.0129	−0.0131	0.00248	0.00227
	(0.0108)	(0.0108)	(0.00268)	(0.00258)
education	0.0626*	0.0624*	0.0380***	0.0381***
	(0.0257)	(0.0262)	(0.00832)	(0.00831)
farm experience	0.0400***	0.0401***	0.00648*	0.00622*
	(0.00807)	(0.00927)	(0.00295)	(0.00298)
tenure	0.0835*	0.0833*	0.0620***	0.0611***
	(0.0385)	(0.0388)	(0.00851)	(0.00839)
speaks English	0.183	0.201	0.235**	0.225**
	(0.274)	(0.302)	(0.0853)	(0.0785)
reads English	−0.238	−0.238	0.0446	0.0382
	(0.188)	(0.191)	(0.0857)	(0.0844)
from Mexico	0.221	0.219	−0.00183	−0.0440
	(0.280)	(0.258)	(0.0339)	(0.0379)
field crops	0.363	0.362	−0.324*	−0.337**
	(1.021)	(1.017)	(0.128)	(0.131)
fruit crops	−0.551	−0.550	−0.361**	−0.357**
	(0.574)	(0.576)	(0.106)	(0.103)
horticulture	1.455	1.448	0.0930	0.0840
	(1.073)	(1.076)	(0.0978)	(0.0950)
vegetables	0.380	0.382	−0.391**	−0.390**
	(0.300)	(0.288)	(0.103)	(0.106)
constant	4.498	3.839	−0.282	−1.499*
	(2.332)	(3.031)	(0.510)	(0.639)
Observations	6,558	6,558	31,839	31,839
R-squared	0.187	0.188	0.514	0.517

NOTE*:* Regressions also include task, region, and survey year dummies. Robust standard errors are in parentheses. Standard errors are clustered at the region level. *Statistically significant at the 0.10 level; **statistically significant at the 0.05 level; *** statistically significant at the 0.01 level.
SOURCE: NAWS, pooled cross sections.

Table 3 Effect of Federal Minimum Wage Level on Wage When Minimum Wage is Binding

	Piece rate		Hourly	
	(1)	(2)	(3)	(4)
Full sample	0.973**	1.094*	1.445***	1.771***
	(0.359)	(0.467)	(0.0930)	(0.127)
150% of minimum wage	1.005***	0.626*	1.350***	1.308***
	(0.0749)	(0.255)	(0.0265)	(0.0933)
125% of minimum wage	0.816***	0.273	1.231***	1.244***
	(0.177)	(0.349)	(0.0398)	(0.0374)
100% of minimum wage	0.801**	0.317	1.048***	1.063***
	(0.233)	(0.403)	(0.0159)	(0.0155)

NOTE*:* Regressions include full sets of regressors as in previous table. Robust standard errors in parentheses. Standard errors are clustered at the region level. *Statistically significant at the 0.10 level; **statistically significant at the 0.05 level; *** statistically significant at the 0.01 level.
SOURCE: NAWS, pooled cross sections.

Table 4 Effect of Federal Minimum Wage Level on Hours per Week

	Piece rate		Hourly	
	(1)	(2)	(3)	(4)
minimum wage	7.127	3.991	0.217	2.025
	(3.551)	(3.616)	(1.300)	(1.279)
minwage*naturalized		−2.659		−4.159
		(5.219)		(2.134)
minwage*green card		3.777**		−0.922
		(1.346)		(1.061)
minwage*other auth		0.344		−3.281***
		(3.020)		(0.654)
minwage*illegal		6.114**		−1.739
		(2.198)		(1.759)
naturalized citizen	8.118***	20.29	2.961	22.57
	(0.528)	(23.09)	(1.695)	(11.44)
green card	8.034**	−8.865	4.394**	8.614
	(2.153)	(5.896)	(1.211)	(6.060)
other authorization	9.490***	6.653	4.531**	19.06***
	(2.000)	(12.42)	(1.253)	(2.531)
illegal	6.289*	−21.57*	2.488*	10.75
	(2.678)	(9.495)	(1.100)	(8.385)
female	−3.151***	−3.083***	−5.087***	−5.041***
	(0.677)	(0.674)	(0.439)	(0.455)
age	−0.0263	−0.0267	−0.00591	−0.00652
	(0.0560)	(0.0547)	(0.00903)	(0.00957)
education	0.0476	0.0421	0.176*	0.169*
	(0.101)	(0.0998)	(0.0788)	(0.0751)
farm experience	−0.0766	−0.0687	0.0923**	0.0929**
	(0.0510)	(0.0491)	(0.0303)	(0.0319)
tenure	0.340***	0.344***	0.244**	0.245**
	(0.0338)	(0.0228)	(0.0646)	(0.0648)
spouse	1.814*	1.958*	0.653	0.707
	(0.861)	(0.795)	(0.617)	(0.580)
children	−0.714	−0.780*	0.124	0.126
	(0.387)	(0.369)	(0.200)	(0.204)
speaks English	1.213	1.335	0.342	0.373
	(1.192)	(1.224)	(0.820)	(0.837)
reads English	−2.073	−2.027*	−1.290	−1.242
	(1.085)	(1.005)	(0.842)	(0.874)
from Mexico	−4.228***	−4.344***	−0.109	0.0908
	(0.876)	(0.875)	(0.673)	(0.565)
field crops	−0.646	−0.654	1.907	1.908
	(2.268)	(2.175)	(1.550)	(1.498)
fruit crops	−1.275	−1.267	−2.380	−2.388
	(3.846)	(3.739)	(1.741)	(1.739)
horticulture	2.270	2.741	−0.0250	−0.0558
	(2.671)	(2.571)	(1.659)	(1.617)
vegetables	0.473	0.456	−1.927	−1.904
	(3.736)	(3.625)	(1.523)	(1.539)
constant	7.908	20.65	39.87***	30.98***
	(13.53)	(13.76)	(6.614)	(7.285)
Observations	7,078	7,078	31,510	31,510
R-squared	0.133	0.138	0.113	0.114

NOTE*:* Regressions also include task, region, and survey year dummies. Robust standard errors are in parentheses. Standard errors are clustered at the region level. *Statistically significant at the 0.10 level; **statistically significant at the 0.05 level; *** statistically significant at the 0.01 level.
SOURCE: NAWS, pooled cross sections.

Table 5 Effect of Federal Minimum Wage Level on Hours When Minimum Wage is Binding

	Piece rate		Hourly	
	(1)	(2)	(3)	(4)
Full sample	7.127	3.991	0.217	2.025
	(3.551)	(3.616)	(1.300)	(1.279)
150% of minimum wage	0.623	−6.028	0.277	2.107*
	(4.583)	(7.945)	(1.111)	(0.962)
125% of minimum wage	0.963	−10.14	2.869	4.754*
	(4.039)	(7.728)	(2.258)	(1.872)
100% of minimum wage	0.910	−3.783	0.939	1.442
	(7.561)	(12.48)	(1.932)	(2.674)

NOTE: Regressions include full sets of regressors as in previous table. Robust standard errors are in parentheses. *Statistically significant at the 0.10 level; **statistically significant at the 0.05 level; *** statistically significant at the 0.01 level.
SOURCE: NAWS, pooled cross sections.

Table 6 Effect of Federal Minimum Wage Levels on Pr(piece rate)

	(1)	(2)
minimum wage	−0.0439	−0.0375
	(0.0271)	(0.0338)
minwage*naturalized		0.00266
		(0.0297)
minwage*green card		0.0361
		(0.0300)
minwage*other auth		−0.0411*
		(0.0234)
minwage*illegal		−0.00658
		(0.0492)
naturalized citizen	−0.0444	−0.0527
	(0.0301)	(0.100)
green card	0.0380	−0.110
	(0.0267)	(0.0833)
other authorization	0.0451	0.311
	(0.0572)	(0.242)
illegal	0.0490*	0.0814
	(0.0279)	(0.233)
female	0.00304	0.00266
	(0.00913)	(0.00928)
age	−0.00120***	−0.00120***
	(0.000381)	(0.000391)
education	−0.00120	−0.00122
	(0.000871)	(0.000816)
farm experience	0.00152***	0.00140***
	(0.000416)	(0.000433)
tenure	−0.00243**	−0.00241**
	(0.000964)	(0.000945)
spouse	−0.00530	−0.00496
	(0.0138)	(0.0132)
children	0.00663**	0.00681**
	(0.00330)	(0.00336)
speaks English	−0.00500	−0.00367
	(0.0211)	(0.0212)
reads English	−0.00515	−0.00485
	(0.0295)	(0.0295)
from Mexico	0.0349**	0.0352**
	(0.0164)	(0.0154)
field crops	−0.0377	−0.0374
	(0.0300)	(0.0301)
fruit crops	0.120***	0.121***
	(0.0407)	(0.0416)
horticulture	−0.130***	−0.130***
	(0.0159)	(0.0152)
vegetables	0.0368	0.0380
	(0.0396)	(0.0408)
Observations	39,343	39,343

NOTE: Regressions also include task, region, and survey year dummies. Robust standard errors are in parentheses. Standard errors are clustered at the region level. Probit marginal effects reported. *Statistically significant at the 0.10 level; **statistically significant at the 0.05 level; ***statistically significant at the 0.01 level.
SOURCE: NAWS, pooled cross sections.

Table 7 Effect of Federal Minimum Wage Level on Pr(piece rate) When Minimum Wage is Binding

	(1)	(2)
Full sample	−0.0439	−0.0375
	(0.0271)	(0.0338)
150% of minimum wage	0.00214	0.0164
	(0.00979)	(0.0223)
125% of minimum wage	0.0435**	0.0625*
	(0.0201)	(0.0344)
100% of minimum wage	0.104	0.170**
	(0.0953)	(0.0824)

NOTE*:* Regressions include full sets of regressors as in previous table. Robust standard errors are in parentheses. Standard errors are clustered at the region level. *Statistically significant at the 0.10 level; **statistically significant at the 0.05 level; ***statistically significant at the 0.01 level.
SOURCE: NAWS, pooled cross sections.

Table 8 Effect of Federal Minimum Wage Level on Wage Accounting for Selection into Piece Rate

	(1)				(2)			
	wage	piece rate	ath(ρ)	ln(σ)	wage	piece rate	ath(ρ)	ln(σ)
Full sample	1.556***	−0.169	0.00101	0.536***	1.718***	−0.0966	0.00460	0.535***
	(0.107)	(0.128)	(0.0240)	(0.0687)	(0.158)	(0.197)	(0.0217)	(0.0687)
150% of minimum wage	1.341***	0.0190	−0.00914	−0.377***	1.275***	0.144	−0.0110	−0.377***
	(0.0261)	(0.0853)	(0.0329)	(0.0639)	(0.109)	(0.184)	(0.0298)	(0.0638)
125% of minimum wage	1.210***	0.377**	0.00924	−0.735***	1.192***	0.544**	0.00966	−0.736***
	(0.0316)	(0.171)	(0.0275)	(0.0438)	(0.0275)	(0.257)	(0.0256)	(0.0443)
100% of minimum wage	1.085***	0.594	−0.0118	−1.047***	1.057***	0.978**	−0.00553	−1.049***
	(0.136)	(0.550)	(0.0300)	(0.0570)	(0.141)	(0.466)	(0.0276)	(0.0568)

NOTE*:* Regressions include full sets of regressors as in earlier tables. Robust standard errors are in parentheses. Standard errors are clustered at the region level. *Statistically significant at the 0.10 level; **statistically significant at the 0.05 level; ***statistically significant at the 0.01 level.

SOURCE: NAWS, pooled cross sections.

Table 9 Effect of Federal Minimum Wage Level on Hours Accounting for Selection into Piece Rate

	(1)				(2)			
	hours	piece rate	ath(ρ)	ln(σ)	hours	piece rate	ath(ρ)	ln(σ)
Full sample	0.924	-0.256	0.174**	2.614***	2.193***	−0.241	0.176**	2.613***
	(0.635)	(0.165)	(0.0867)	(0.0658)	(0.729)	(0.169)	(0.0837)	(0.0654)
150% of minimum wage	0.192	0.000854	0.0312	2.616***	0.987	0.0215	0.0333	2.615***
	(0.928)	(0.115)	(0.158)	(0.0701)	(1.076)	(0.164)	(0.150)	(0.0700)
125% of minimum wage	3.592*	0.499***	0.125	2.655***	4.247*	0.535***	0.126	2.655***
	(2.054)	(0.160)	(0.211)	(0.0701)	(2.226)	(0.146)	(0.202)	(0.0698)
100% of minimum wage	1.965	0.527	0.444	2.713***	1.262	0.764*	0.444	2.711***
	(4.245)	(0.491)	(0.289)	(0.0468)	(5.179)	(0.443)	(0.279)	(0.0446)

NOTE: Regressions include full sets of regressors as in earlier tables. Robust standard errors are in parentheses. Standard errors are clustered at the region level. *Statistically significant at the 0.10 level; **statistically significant at the 0.05 level; ***statistically significant at the 0.01 level.
SOURCE: NAWS, pooled cross sections.

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

SOURCE: NAWS.

Table B-1 Effect of Minimum Wage Level on Wage Accounting for Selection into Piece Rate–California

	(1)				(2)			
	wage	piece rate	ath(ρ)	ln(σ)	wage	piece rate	ath(ρ)	ln(σ)
Full sample	0.995***	0.286***	−0.00199	0.354***	1.068***	0.640***	0.000205	0.354***
	(0.0438)	(0.0794)	(0.0118)	(0.0263)	(0.0969)	(0.139)	(0.0118)	(0.0263)
150% of CA minimum wage	0.918***	0.282*	0.0197	−0.598***	0.913***	0.357*	0.0183	−0.599***
	(0.0213)	(0.150)	(0.0167)	(0.0160)	(0.0351)	(0.203)	(0.0167)	(0.0160)
125% of CA minimum wage	0.601***	0.924***	0.0192	−0.900***	0.666***	1.279***	0.0189	−0.901***
	(0.0925)	(0.226)	(0.0272)	(0.0214)	(0.101)	(0.363)	(0.0268)	(0.0214)

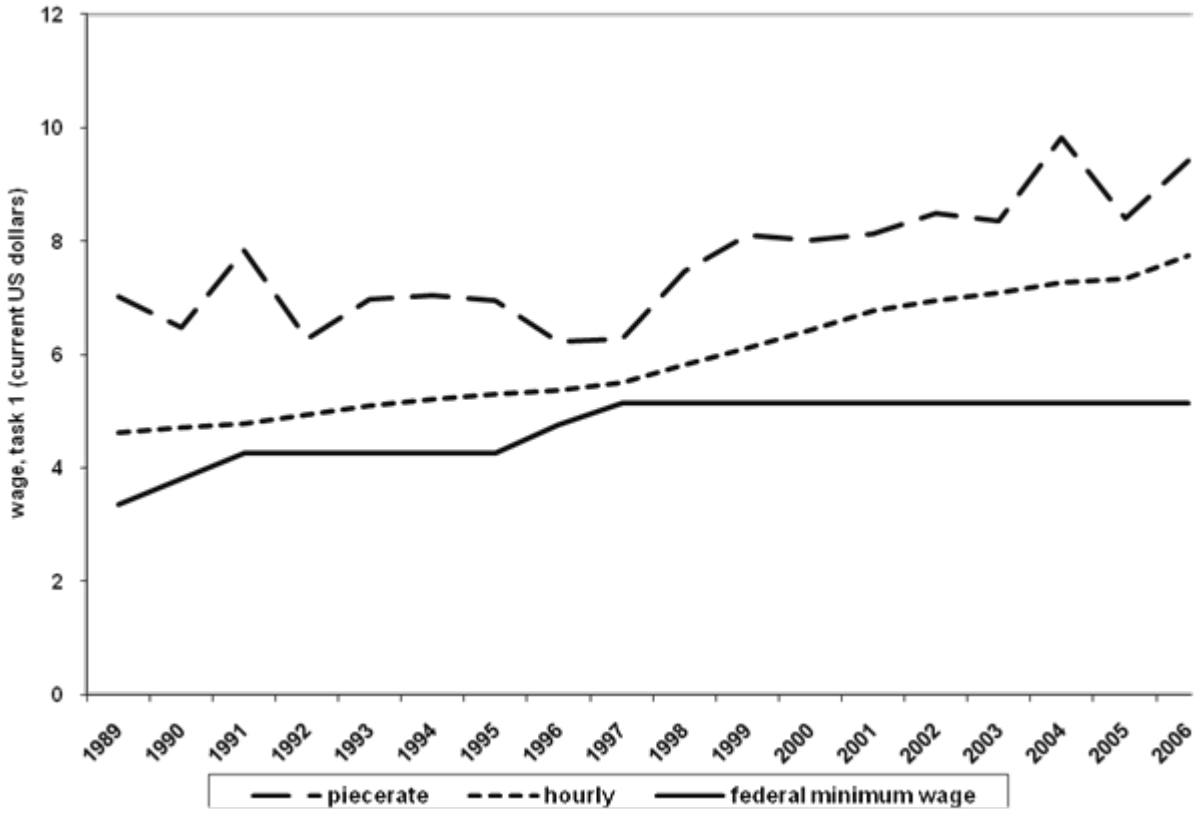
NOTE: Regressions include full sets of regressors as in earlier tables. Robust standard errors are in parentheses. *Statistically significant at the 0.10 level; **statistically significant at the 0.05 level; ***statistically significant at the 0.01 level.
SOURCE: NAWS, pooled cross sections.

Table B-2 Effect of Minimum Wage Level on Hours Accounting for Selection into Piece Rate–California

	(1)				(2)			
	hours	piece rate	ath(ρ)	ln(σ)	hours	piece rate	ath(ρ)	ln(σ)
Full sample	0.726	0.324***	0.653***	2.451***	0.687	0.606***	0.669***	2.453***
	(0.848)	(0.0894)	(0.0732)	(0.0196)	(1.159)	(0.153)	(0.0693)	(0.0192)
150% of minimum wage	−0.473	0.429**	0.508***	2.416***	−0.518	0.444*	0.546***	2.420***
	(1.047)	(0.182)	(0.118)	(0.0212)	(1.569)	(0.247)	(0.105)	(0.0205)
125% of minimum wage	2.997	0.990***	0.335**	2.374***	6.387**	1.201***	0.405***	2.379***
	(2.450)	(0.243)	(0.157)	(0.0247)	(2.967)	(0.413)	(0.147)	(0.0256)

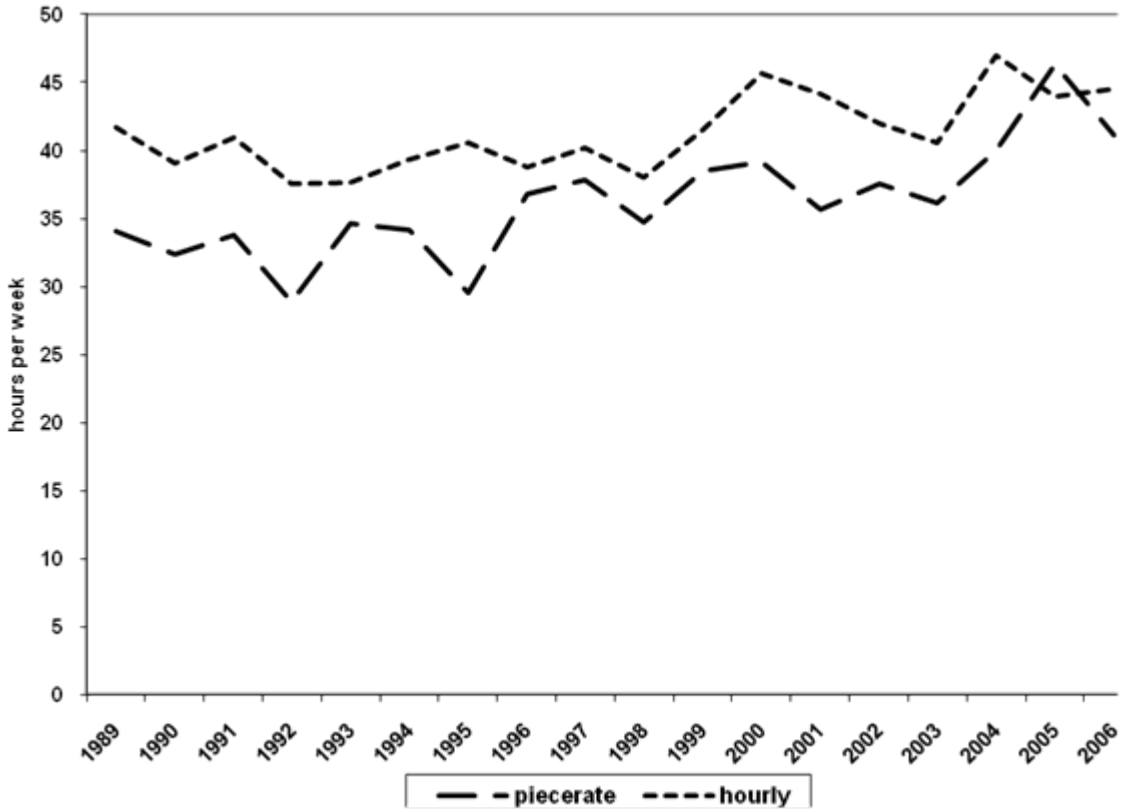
NOTE: Regressions include full sets of regressors as in earlier tables. Robust standard errors are in parentheses. *Statistically significant at the 0.10 level; **statistically significant at the 0.05 level; ***statistically significant at the 0.01 level.
SOURCE: NAWS, pooled cross sections.

Figure 1 Mean Wages Received by U.S. Agricultural Workers, 1989–2006



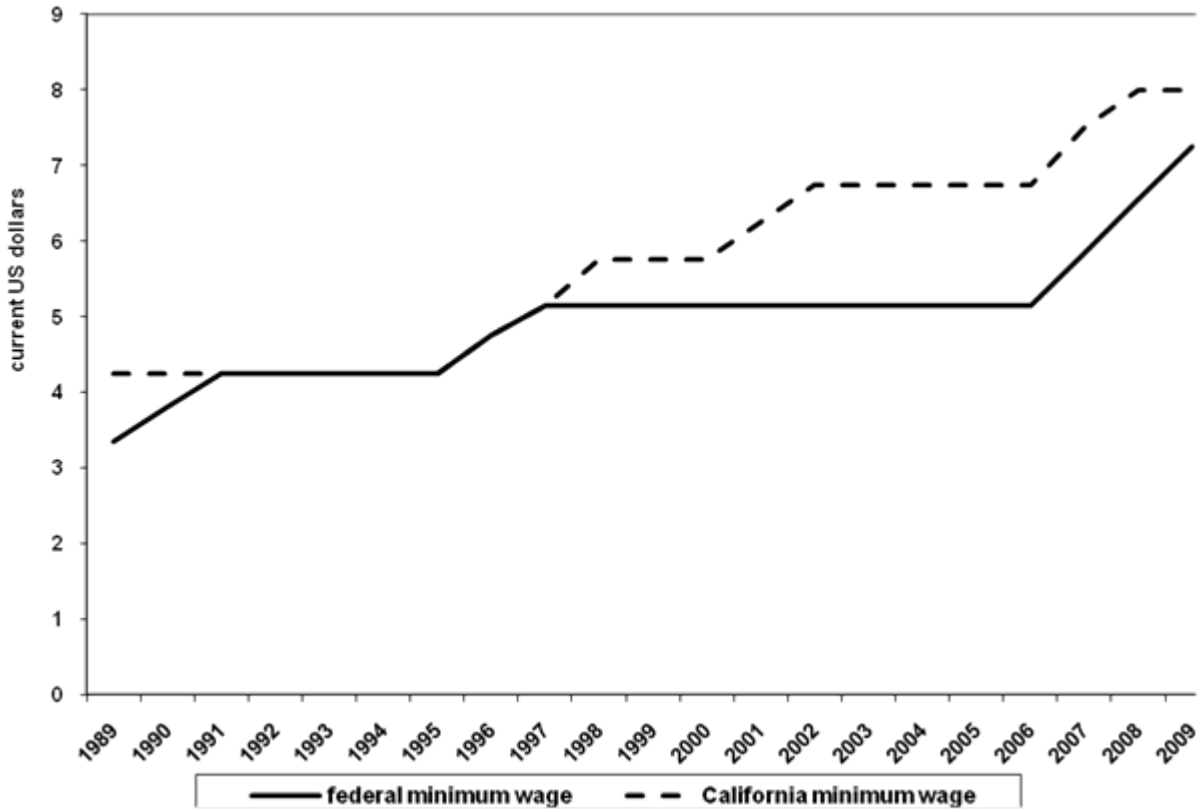
SOURCE: NAWS, pooled cross sections.

Figure 2 Mean Hours Worked by U.S. Agricultural Workers, 1989–2006



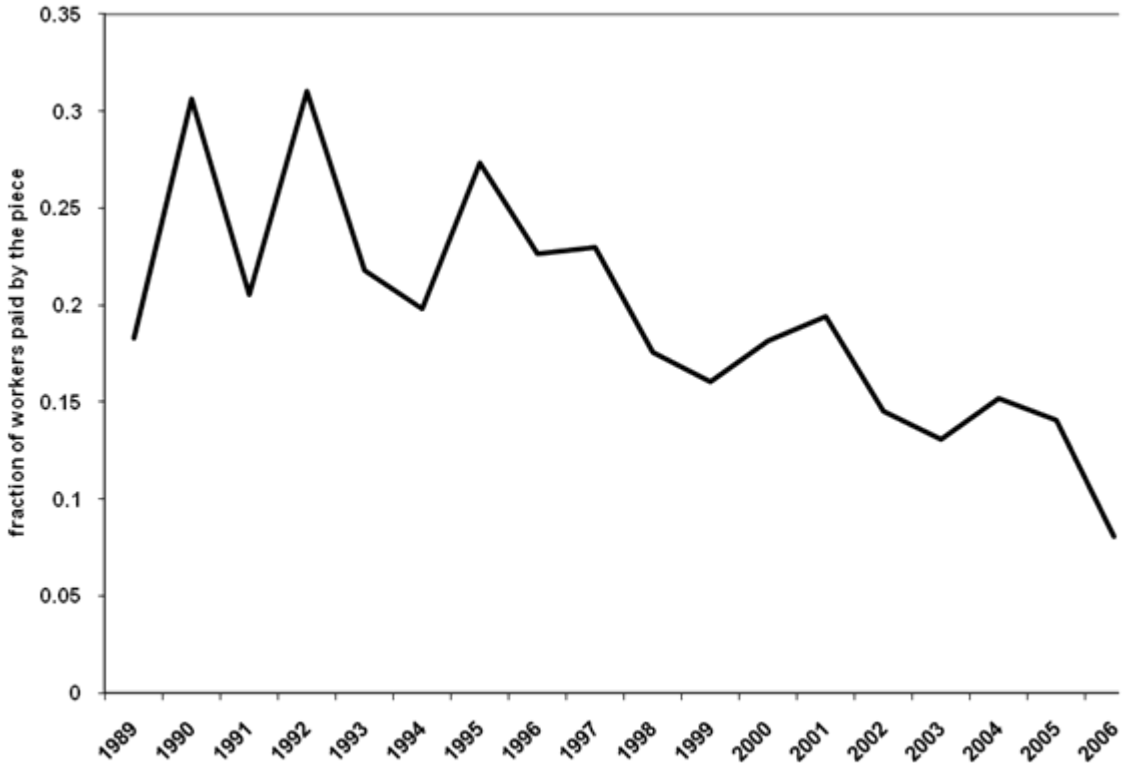
SOURCE: NAWS, pooled cross sections.

Figure 3 Minimum Wage for Covered, Nonexempt Workers, 1989–present



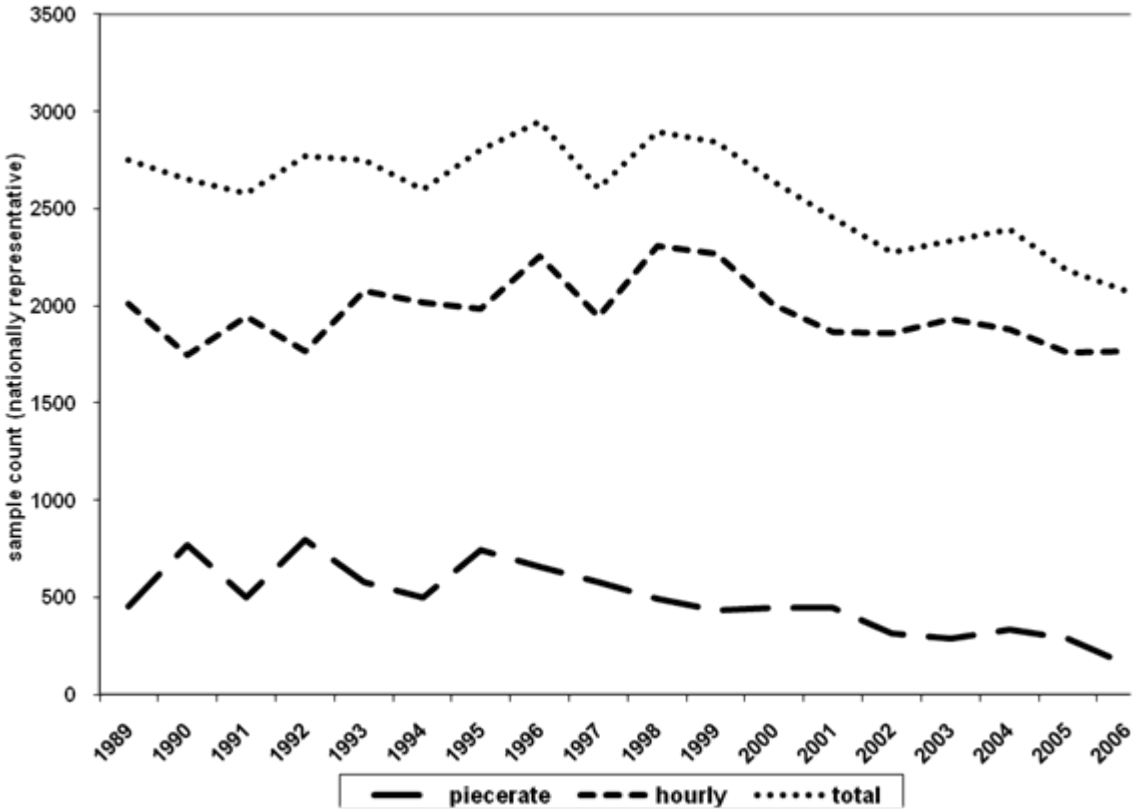
SOURCE: U.S. Department of Labor.

Figure 4 Fraction of Farm Workers under Piece Rate Paid Contracts, 1989–2006



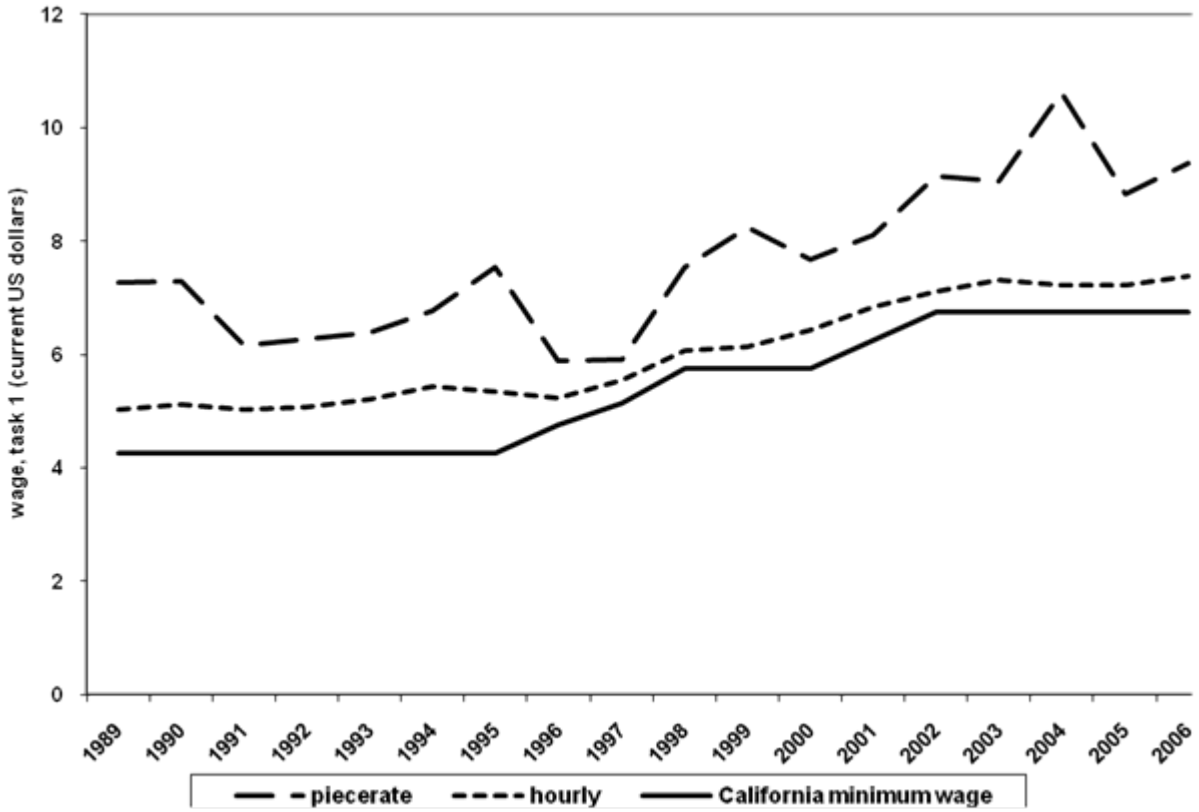
SOURCE: NAWS, pooled cross sections.

Figure 5 Survey Count of U.S. Agricultural Workers, 1989–2006



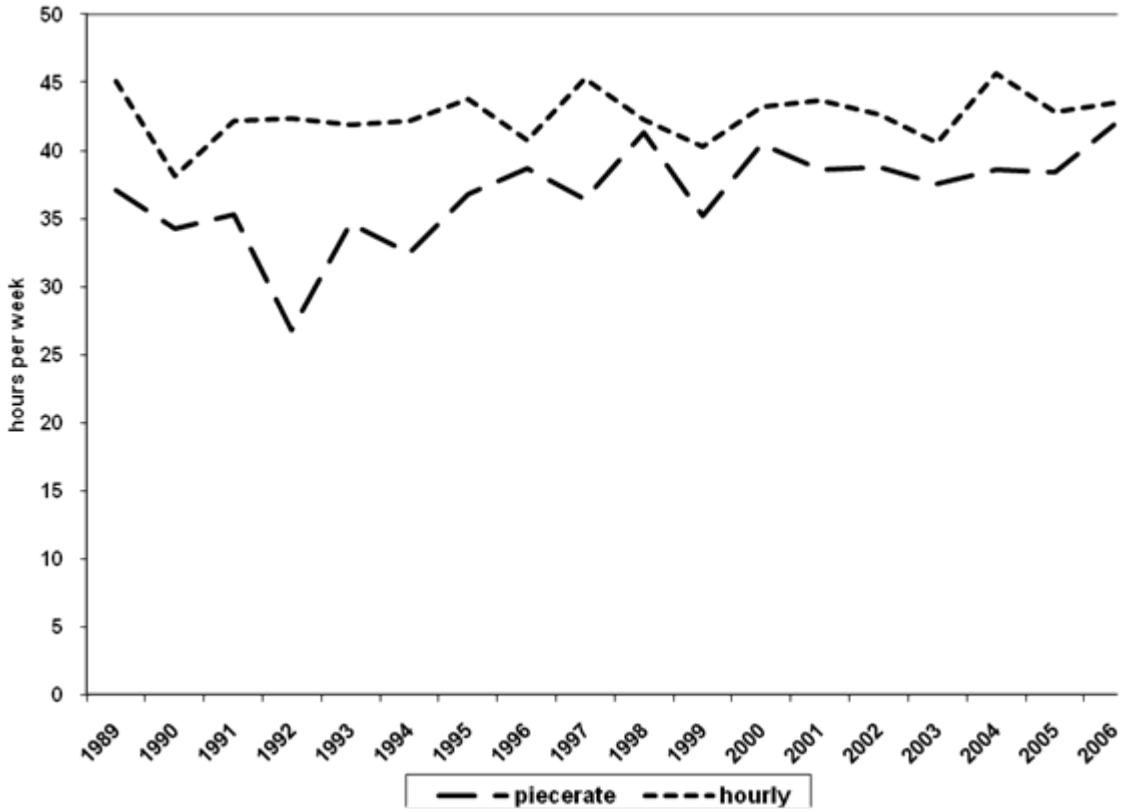
SOURCE: NAWS, pooled cross sections.

Figure B-1 Mean Wages Received by U.S. Agricultural Workers, 1989–2006: California



SOURCE: NAWS, pooled cross sections.

Figure B-2 Mean Hours Worked by U.S. Agricultural Workers, 1989–2006: California

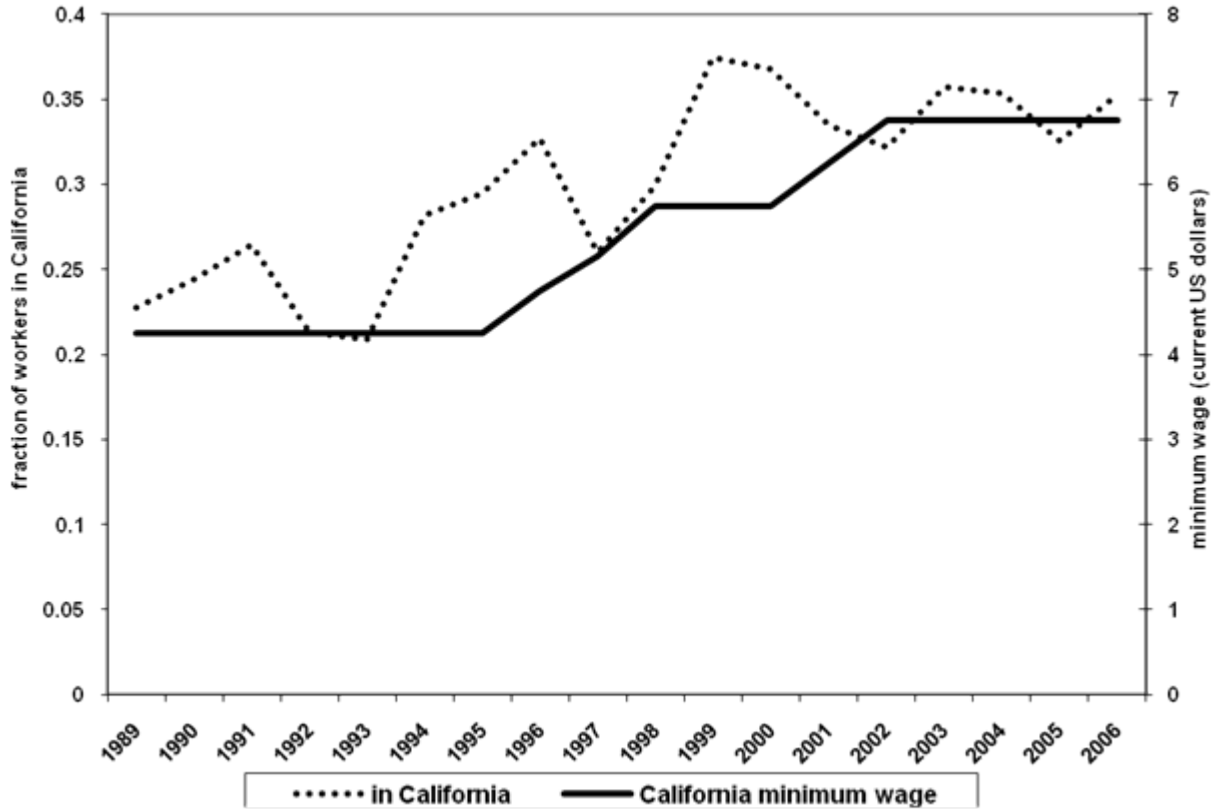


SOURCE: NAWS, pooled cross sections.

Figure B-3 Survey Count of U.S. Agricultural Workers, 1989¬–2006: California

SOURCE: NAWS, pooled cross sections.

Figure B-4 Fraction of Farm Workers Located in California, 1989–2006



SOURCE: NAWS, pooled cross sections.