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Emiko Hashida [*]   Jeffrey M. Perloff [†]

[*]University of Califorina, Berkeley
[†]University of California, Berkeley and Giannini Foundation

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by

Emiko Hashida and Jeffrey M. Perloff
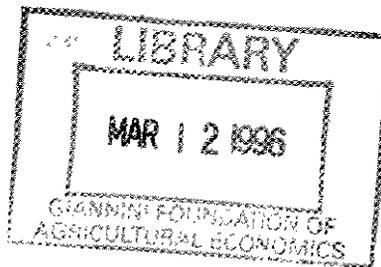
Duration of Agricultural Employment

Emiko Hashida*
and
Jeffrey M. Perloff**

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* Graduate student, University of California, Berkeley.
** Professor, University of California, Berkeley.

Contact:
Jeffrey M. Perloff (perloff@are.berkeley.edu, 510/642-9574)
Department of Agricultural and Resource Economics
207 Giannini Hall
University of California
Berkeley, California 94720

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Worker Characteristics and Employment Duration in Agriculture

Although many agricultural workers are only able to find sporadic, short-term, seasonal employment, some are able to find long-term employment or to find consecutive, short-term jobs. Until recently, determining which worker characteristic lead to steady employment was impossible because agricultural employment histories were unavailable. Using data from a recent, random sample of agricultural workers, the National Agricultural Workers Survey (NAWS), we estimate the probability that a worker will have a long-term job and the duration of shorter term jobs as functions of worker characteristics.

The findings of previous studies of employment duration of nonagricultural workers (e. g., Abraham and Farber, 1987; Blank, 1989; Lindeboom and Theeuwes, 1991) are not likely to apply to the agricultural sector. The composition of the agricultural labor force is vastly different from that of the nonagricultural labor force. For example, in no other major sector is the majority of the labor force Hispanic or immigrants. These characteristics, which are disadvantageous in other sectors, may not be detrimental in securing long-term jobs in agriculture. In other sectors, education has a substantial, positive effects on productivity and employment duration, whereas education is unlikely to affect productivity or duration in agricultural jobs.

Moreover, different technical problems are posed by our agricultural data set than is typical for other sectors. Because workers typically have frequent, short spells of employment, we need to deal with multiple spells — an issue that's rarely a problem in other sectors. In addition, because the NAWS uses stock sampling and its survey period is

relatively short, our sample has a variety of censoring problems. We use a technique designed to deal with censoring and other sample selection problems.

This method is presented in the first section. The second section describes the survey and our data set. The estimation results and simulations are analyzed in the third section. The last section contains conclusions.

THE MODEL

We start by discussing a standard duration model. Then we discuss stock sampling and selection problems in our data set and explain how we estimate the probability that a worker has certain work history. Finally, we discuss our modification of the standard duration model that deals with the stock sampling and selection problems.

A Standard Duration Model

A farmwork spell is a period of uninterrupted employment with a single agricultural employer. The duration of a farmwork spell, t, is a continuous, random variable. The hazard function, $h(t)$, is the rate at which spells are completed at duration T:

$$h(t) = \lim_{\Delta t \to 0^+} \frac{Pr(t \le T < t + \Delta t \mid T \ge t)}{\Delta t} = \frac{f(t)}{1 - F(t)}, \tag{1}$$

where $f(t)$ is the probability density function and $F(t)$ is the cumulative distribution function.

In farmwork, the hazard rate $h(t)$ is initially low, but increases until it reaches a peak as seasonal tasks are completed. After this maximum risk point, the hazard rate is likely to decrease because workers remain employed after the completion of seasonal tasks only if they

are assigned to nonseasonal tasks. We use a lognormal distribution, which has a hazard function of this form.

The duration of farmwork differs across workers due to differences in personal characteristics, legal status, geography and other variables. When log T is normally distributed, it can be expressed as a linear function of the covariates X (Kalbfleisch and Prentice, 1980):[1]

$$\log T = X\beta + \sigma W, \tag{2}$$

where $W \sim N(0, 1)$ and $\sigma^2 = \text{var}(\log T)$ is the variance of the log duration.

Types of Work Histories

If we observed the length of an employment spell for each worker and the observed spells were free of length bias, we could estimate Equation 2 directly. In the NAWS sample, however, workers may have no spells, no completed spell, or one or more completed spells. Further, some of the observed spells are length biased.

Workers interviewed in the NAWS report their work histories for the two-year period preceding the date at which they were randomly selected. Workers were chosen only if they were engaged in farmwork on the day of selection. That is, the NAWS uses stock sampling. The longer a worker is employed, the more likely that worker is to be selected when stock sampling is used. As a result, the length of employment in job in which they were found has an upward bias.

We can avoid this upward-bias problem for workers with multiple employment spells in the period before the interview if we drop the spell in which they were found: the sampling

spell. If, however, a worker's only observed spell is the sampling spell, dropping the sampling spell would leave us with no duration information for that worker. Exclusion of such workers would create a selection bias.

The NAWS workers can be divided into four categories ($j = 0, 1, 2, 3$) according to work histories. Category 0 contains those workers who continuously worked in farmwork for the two-year survey period. Workers in Category 1 did some farmwork but had no *complete* farmwork spell: a spell that began and ended during the two-year period. Category 2 workers had at least one complete farmwork spell, and frequently many. Workers in Category 3 did no farmwork during the two-year period.

In many previous duration studies, when multiple spells per worker are observed, researchers pick one spell per person or pool all the spells, simply discarding those observations that cannot be used for one reason or another. Were we to use either of these approaches, we would ignore workers in Categories 0, 1, and 3. If only one spell per person is used, most of the information about workers in Category 2 is lost. To avoid losing this information and possibly introducing biases, we employ a method that uses the available information about workers in all four categories.[2] In particular, we estimate the effects of worker characteristics on the average duration of spells, taking into account the possibility that those workers for whom we can compute the average duration may not be a representative sample.

A worker's job history category depends on individual choice, luck, and individual characteristics such as the worker's legal status. For example, one might expect that unauthorized workers are less able to find good long-term jobs, which are at a premium even for legal workers.

We use a multinomial logit model to estimate the probability that a worker with particular characteristics is in a given category. Let J_i be the category of individual i. Then the probability, P_{ij}, that individual i is in category j is

$$P_{ij} = \text{Prob}(J_i = j) = \frac{\exp(\gamma_j' Z_i)}{1 + \sum_{k=1}^{J} \exp(\gamma_k' Z_i)} \qquad j = 0, 1, 2, 3, \qquad (3)$$

where γ_0 is normalized to be zero and Z_i is a vector of exogenous characteristics of individual i.

A Conditional Duration Model

We only have usable duration information for workers in Category 2.[3] We want to estimate how the duration of Category 2 workers varies with personal characteristics conditional on the worker being in that category.

Instead of picking a single spell per worker, we measure the effects of the covariates on the average duration of spells. For this approach to make sense, there must be no temporal trends, no occurrence dependence, and no lagged duration dependence (see Lancaster, 1990, pp. 208-9). We assume that the log T_i are independently and identically distributed, where T_i is the duration of a single spell for worker i. If log T_i is distributed normally, then the average of log T_i is also distributed normally. If worker i experienced n_i complete spells, we can use Equation (2) to show that the average duration, $\overline{\log T_i} = \left(\sum_{n_i} \log T_i \right) / n_i$,

is

$$\overline{\log T_i} = \beta' X_i + \frac{\sigma}{\sqrt{n_i}} W_i , \tag{4}$$

where $W_i \sim N(0, 1)$ and X_i is a vector of exogenous characteristics of individual i. This duration equation can only be estimated for workers who had at least one complete farmwork spell ($J_i = 2$). If the error terms of selection Equation (3) and duration Equation (4) are correlated, estimating the duration equation using ordinary least squares will result in selection bias.

In order to correct for the possible selection bias, we use Lee's (1983) polychotomous extension of Heckman's two-stage sample-selection method. Using Lee's approach, the duration equation adjusted for selection bias is (for $j = 2$ and suppressing the i subscript)

$$\begin{aligned} \overline{\log T_2} &= \beta_2' X_2 + \rho_2 \frac{\sigma_2}{\sqrt{n_2}} \frac{\phi(H_2)}{\Phi(H_2)} + \eta_2, \\ &= \beta_2' X_2 + \frac{\theta_2}{\sqrt{n_2}} \lambda_2 + \eta_2, \end{aligned} \tag{5}$$

where $\phi(\cdot)$ and $\Phi(\cdot)$ are the density and cumulative distribution functions of the standard normal distribution, respectively; ρ_2 is the correlation between the errors; σ_2 is the standard deviation of the log duration for this group; H_2 is the inverse of Φ evaluated at Prob $[J_i = 2]$; $\lambda_2 = \phi(H_2)/\Phi(H_2)$ is the inverse Mills ratio; and the η_2 is an independently and identically distributed error term from a Gumbel distribution.

We estimate this model in four steps. First, we estimate the multinomial logit model by maximum likelihood to obtain $\hat{\gamma}_j$. Second, we compute the predicted probability $\hat{P}_j$ of being in each category using Equation (1), substituting $\hat{\gamma}_j$ for γ_j. Third, for individuals in

Category 2, we compute $H_2 = \Phi^{-1}(P_2)$ and then calculate the inverse Mills ratio $\lambda_2 = \phi(H_2)/\Phi(H_2)$. Fourth, we estimate Equation (5) for workers in Category 2, using the average duration of their completed spells prior to the interview, to obtain consistent estimates of β_2 and θ_2 by regressing $\overline{\log T_2}$ on X_2 and $\lambda_2 /\sqrt{n_2}$. The formula for the asymptotic covariance matrix is given in Greene (1991).

The explanatory variables include gender, age, education, legal status, farmwork experience in the United States, race (white, black, and other), ethnicity (Hispanic and other), knowledge of English, place of birth (United States, Mexico, or other), family background (spouse, children, and whether the worker lives with spouse and children), the geographical region in which a given worker was located at the beginning of the two-year survey period, skill levels, and when the worker was sampled.

We expect legal status to have a significant effect on employment duration in the post-IRCA years. Employers who knowingly hire unauthorized workers are liable to be fined. Consequently, unauthorized workers may be relegated to undesirable short-term employment for which employers are unable to recruit enough legal workers.

The effect of race and ethnicity on the duration of farm employment is unclear. Knowledge of English may increase employment duration if this ability translates into improved communication with employers and a better chance of finding desirable jobs. Place of birth captures the effect of cultural and other differences on the duration of farm employment.

Age, by itself, may have a negative effect on the duration of farm employment as many agricultural tasks are strenuous. At low levels of farm experience, additional experi-

ence raises productivity and hence should increase employment duration because employers want to retain productive workers. The effect of formal education is likely to be minimal. A difference in duration of farm employment due to gender may indicate sex discrimination by employers or may indicate choices by workers.

Family and household relations may influence employment duration in various ways. Workers who live with a spouse and children are likely to have a greater desire to obtain long-term employment. If such workers are more stable and reliable, employers will prefer employing them on a long-term basis. On the other hand, workers who live away from their spouse or children may not be able to hold long-term jobs because they want to regularly visit their families.

The geographical variables are included to control for the inter-regional differences in the growing season. Skill variables test the hypothesis that farm employers are likely to retain skilled than unskilled workers, so as to avoid the higher search costs in replacing them.

THE DATA

We use data from the National Agricultural Workers Survey (NAWS) from 1989 to 1991. The NAWS is a national random sample of agricultural workers conducted three times a year since 1988. We do not use data from the first year because the interview instrument changed substantially after that year. We use interviews from six cycles, where a cycle is a round of interviews that took place in a particular season in a given year. Although only seasonal agricultural services (SAS) workers are interviewed in the NAWS, SAS is defined broadly as most field work in perishable crop agriculture.[4] From the 4,718 interviews of Cycles 5 through 10, we use the 3,795 observations for which all relevant data are available.

A nationally representative cross-section of workers from 72 counties in 25 states

representing 12 distinct agricultural regions was sampled. For each of the interviewing

cycles, 30 counties were selected randomly as interview sites. The number of interviews

conducted during a given cycle is commensurate with the amount of SAS activity at that time

of the year. Interviews are conducted every four months — in January, May, and September

— to ensure as diverse a representation of workers as possible (Mines, Gabbard, and

Boccalandro, 1991).

Each worker was asked to provide a complete job history for the previous two years

as well as demographic, legal status, education, family and household information. The

NAWS breaks down each worker's employment history into spells. A spell is defined as the

period of uninterrupted employment with a single agricultural or nonagricultural employer, or

a single period of unemployment or time spent abroad (Mines, Gabbard, and Samardick).

A strength of the NAWS is its detailed record of the legal status of the workers.[5]

Questions on legal status were included because the NAWS was commissioned by the Depart-

ment of Labor in response to a requirement in the Immigration Reform and Control Act

(IRCA) of 1986. IRCA was supposed to prevent new, unlawful immigration and to secure a

legal and stable work force for the agricultural sector by granting amnesty to formerly

undocumented immigrants.

We call this class of workers "amnesty" workers. They may legally work in the

United States and are eligible to become legal permanent residents ("green-card" holders). As

shown in Table 1, 51.7 percent of the sample are amnesty workers. The other legal status

categories are "citizen" (15.1 percent of the sample), "legal permanent resident" (21.6 percent)

and "unauthorized" (11.6 percent). The unauthorized category, which is the residual category in our estimates, includes immigrants who are not in the United States legally and those with visas that do not grant work authorization.

The average agricultural worker is relatively young (33.7 years), uneducated (5.8 years of education), and has 10.5 years of farming experience in the United States. The skill variables, unskilled and semi-skilled, are deduced from the most difficult task performed by a given worker in the two-year survey period. The residual skill group is supervising.

Whites are 53.5 percent of the sample and blacks are 3.5 percent. The residual race category consists of native Americans, Asians, and Hispanics who do not indicate they are white or black. Hispanics are 88 percent of the sample. Three-quarters of the workers were born in Mexico. Only 23.5 percent of the sample speak English to some extent.

The geographical regions are defined according to the length of the growing season. Because some states only hire a small number of agricultural workers, these were grouped together to form a single region, "North."[6] Washington and Oregon are combined in a second region, the "Northwest." California, Florida, and Texas, which have large agricultural workforces, are treated separately. Two-thirds of the workers in our sample are employed in California and Florida. The residual group for the geographical variables is the "South," which are the southern states other than Florida and Texas.

EMPIRICAL RESULTS

We first discuss the multinomial logit estimates of work history. Then we report the duration equations for workers with at least one completed spell. Finally, we present simulation results based on these estimates.

Work Histories

We estimate separate multinomial logit models of work histories for men and women. The likelihood ratio test statistic that male and female workers have identical coefficients on all of the explanatory variables is $115.04 > \chi^2_{0.99}(32)$, so we reject the null hypothesis that male and female equations are identical.

Tables 2 and 3 report the estimation results of male and female equations, respectively.[7] In both the male and female equations, the base group is Category 0: those people who continuously worked in farmwork for more than two years.

Although the male equation and the female equation correctly predict 80 percent and 81 percent of the categories, both equations overestimate the number of workers in Category 2 and underestimate the number of workers in each of the other categories. This result is typical of multinomial logit predictions for samples where the vast majority of observations are in one category, as in Category 2 in this sample.

Due to the nonlinearity of the multinomial logit equations, the coefficients are difficult to interpret directly. The marginal effect of a change in one of the explanatory variables, x, on the probability of being in a given work-history category is

$$\frac{\partial P_j}{\partial x} = P_j(\hat{\gamma}_j - \bar{\gamma}),$$

for $j = 0, 1, 2, 3$, where $\bar{\gamma} = \sum_{j=0}^{j=3} P_j \hat{\gamma}_j$. We evaluate the marginal effects at the sample means of the right-hand-side variables. For discrete variables, we define the "marginal effect"

as the difference between the probability where the variable equals one and the probability where the variable is zero.

We discuss in turn the marginal effects for males and then those for females. We only discuss coefficients that are statistically significantly different from zero based on asymptotic t-tests using the 0.05 criterion.

The probability of a man being in a particular category is not very sensitive to geography. Relative to working in the South (southern states other than Florida and Texas), working in Florida increases the probability of continuous farmwork (Category 0) by 4 percent and the probability of not having a completed spell within the two year period (Category 1) by 2 percent, reduces the chance of having at least one complete farmwork spell (Category 2) by 6 percent, and has no effect on the probability of not having worked in agriculture (Category 3). Working in the Northwest reduces the probability of continuous farmwork by 1 percent and that of not having a completed spell by 3 percent, while it increases the chance of having at least one complete farmwork spell by 3 percent and that of doing no farmwork by 1 percent.

Unskilled male workers are 4 percent less likely than supervisors to get continuous farmwork, 4 percent less likely to have no completed spell, and 9 percent more likely to have at least one complete farmwork spell. Semi-skilled male workers show a similar pattern to unskilled workers: They are 3 percent less likely than supervisors to get continuous farmwork, 8 percent less likely to have no completed spell, 12 percent more likely to have at least one complete farmwork spell, and 1 percent less likely to do no farmwork.

Compared to male workers in other ethnic groups, Hispanic male workers are 12 percent less likely to be continuously employed, 5 percent less likely to have no complete spells, and 17 percent more likely to have at least one farmwork spell. Racial variables have almost no marginal effects.

Male amnesty workers are 1 percent more likely than unauthorized male workers to be continuously employed, 11 percent less likely not to have a completed spell, and 10 percent more likely to have at least one complete farmwork spell. Male workers who live with small children are 3 percent more likely to be continuously employed, 2 percent less likely to not have a completed spell, and 2 percent more likely to have at least one complete farmwork spell than those who do not live with their small children. On the other hand, those workers who have small children in general are 3 percent less likely to be continuously employed than workers who do not have small children.

Somewhat surprisingly, the female equation shows few statistically significant effects of having small children. The exception is that female workers who live with small children are more likely to be continuously employed. Female workers in California, Texas, and the North are less likely to be continuously employed than those in the South.

For female workers, more experience and being white make them more likely to be continuously employed, and that being born in Mexico has the opposite effect. Extra experience up to 21 years makes a female worker more likely to be continuously employed than not to have complete spells, and more experience up to 29 years increases the probability of continuous farm employment relative to that of no farmwork. Neither skill variables nor legal status variables are statistically significant for female workers.

Compared to the South, working in California reduces the probability of continuous farmwork by 4 percent, that of having at least one farmwork spell by 2 percent, while it increases the chance of having no complete spells by 6 percent. Female workers in Texas are 2 percent less likely to be continuously employed, 11 percent less likely to have at least one complete farmwork spell, 11 percent more likely to have no complete spells, and 3 percent more likely to have done no farmwork than their counterparts in the base group. Working in the North reduces the chance of continuous employment by 2 percent, that of having at least one complete farmwork spell by 11 percent, while it increases the chance of having no complete spells by 11 percent.

White female workers are 3 percent more likely to be continuously employed, 5 percent more likely to not have a completed spell, and 9 percent less likely to have at least one complete farmwork spell than nonwhites. Mexican-born female workers are 4 percent less likely to be continuously employed, 3 percent more likely to not have a complete spell, and 2 percent more likely to have at least one complete farmwork spell than those born in other countries outside the United States.

No single characteristic or any obvious combination of characteristics ensured that a worker was continuously employed during the two-year period (Category 0). Characteristics that raised the probability for males were living in Florida (which raised the probability by 4% compared to living in the base region of the rest of the South), being a supervisor (4% higher probability relative to unskilled workers and 3% higher relative to semi-skilled workers), being non-Hispanic (12%), living with young children (3%) or having no young children (3%). The corresponding characteristics for females were living in the South (4%

higher relative to California, 2% higher than in Texas, and 2% higher than in the North), experience, living with young children (1%) and being white (3%).

Duration Equations Adjusted for Selection Bias

Duration equations for male and female workers that include the inverse Mills ratio to adjusts for possible selection bias are reported in Table 4. The statistics in parentheses are asymptotic standard errors. Because the coefficients of the inverse Mills ratio in both the male and female equations have large asymptotic t-statistics, we reject the null hypothesis that there is no sample selection effect for both equations.

Age and experience have opposite, nonlinear effects on the average duration of farm employment for both male and female workers (although age is not statistically significant for female workers). Age reduces the average duration until male workers reach 38 years, while experience increases the average duration until male workers have worked for 25 years. Experience has a relatively greater effect on the average duration than age. For female workers, experience increases the average employment duration for the first 24 years. The amount of education has no effect on the average length of employment in farmwork.

Legal status has a major impact on the average duration of farm employment, particularly for male workers. Male amnesty workers enjoy 139 percent longer average farmwork spells than unauthorized workers, while male legal permanent resident workers and male citizens experience 107 percent and 125 percent longer average spells than unauthorized workers. Therefore, having legal work authorization significantly increases male workers' average duration of farm employment for short-term employees (those in Category 2).

Although the effects on female workers are not as pronounced, female amnesty workers and legal permanent resident workers enjoy 34 percent and 42 percent longer average employment spells than unauthorized workers. Female citizens do not have a statistically significant longer duration than unauthorized workers.

Workers in regions outside the South have shorter average employment spells. For males workers, working in regions other than the South reduces the average employment spells by 12 percent (California) to 44 percent (Texas). Female workers experience 19 percent (California) to 51 percent (Northwest) shorter average employment spells when not working in the South.

Skill variables are statistically significant only for male workers. Compared to supervisors, unskilled and semi-skilled workers have 49 percent and 79 percent longer average employment spells, respectively.[8]

Race and ethnicity have unconventional effects compared to the results found in nonagricultural sectors. Both white male and white female workers have shorter average employment spells than the residual category (Asians, native Americans, and unclassified Hispanics) by 13 percent and 24 percent respectively. On the other hand, male Hispanic workers have 93 percent longer average employment spells than non-Hispanics.

Place of birth and English skills affect the average duration of farm employment for male workers but not for female workers. Male workers who were born in the United States (in Mexico) have average farmwork spells that are 51 (30) percent shorter than those born in other countries. Male workers who speak some English have 13 percent shorter average employment spells than others. This result may indicate that language abilities increase

workers' intersectoral mobility. However, this effect is rather small and is not statistically significant for workers who speak English well.

Having small children reduces female workers' average duration of farm employment by 26 percent. However, living with their children increases the average employment duration by 30 percent. Similar observations have been made in relation to male workers' probability of continuously working in farmwork.

Simulations

In order to show the magnitude of the effects of various worker characteristics on employment duration, we use the estimated equations to compute expected employment duration for workers with different characteristics. We examine the effect of a change in one variable on the duration of a male worker and a female worker with typical male characteristics. These characteristics are listed in footnote *a* of Table 5. For qualitative variables, we assume that the "typical" characteristic is the most common one. For continuous variables, the "typical" characteristic is the average value.

A typical worker is almost certain to be in Category 2 and had at least one complete spell of agricultural employment during the two year period. A male worker with typical characteristics has a 2 percent probability of working continuously (Category 0), a 10 percent probability of having worked during the two-year period but not having a completed spell (Category 1), an 88 percent probability of having completed spells (Category 2), and a 0.2 percent probability of never having worked in agriculture during the two-year period (Category 3). The corresponding probabilities for a typical female worker are 0.2 percent, 6 percent, 93 percent, and 1 percent.

Moreover, no amount of change in a single variable would increase the probability in any other category so that it is larger than the probability of being in Category 2. Thus, in Table 5, we report the effect of a change in a variable on the expected employment duration conditional on being a Category 2 worker, but do not report the effect on the probability of being in each category.

In Table 5, for both male and female workers, we first evaluate the expected job duration at the typical male characteristics. We then change the value of one variable at a time holding the other variables at the typical male characteristics to determine the effect of a given characteristic on expected job duration. In the last row of the table, we evaluate the expected job duration for males and females with the typical female characteristics.

As reported in the first row of Table 5, a male worker with typical male characteristics can expect to have a much longer job duration than a female worker with the same characteristics. A male's expected job duration is 115 days, which is 72% longer than that of a female with the same characteristics, 67 days. As shown in the last row, however, the expected duration for men and women is virtually the same when both have the typical female characteristics. Thus, although females would work for fewer days than men if they had the same characteristics, casual observation may suggest that their employment durations are nearly comparable. In the remaining comparisons, we assume that both men and women have the typical male characteristics.

Unauthorized males and female workers are employed equally long, however, males with legal authorization to work have much longer expected durations than comparable females. For workers with typical male characteristics, an unauthorized male has an expected

job duration of 48 days and a comparable female has an expected job duration of 50 days. Having legal work authorization doubles the expected job duration of a typical unauthorized male worker while it would only increases the expected job duration of a comparable female by 34 to 42 percent.

Similarly, the effects of farmwork experience on expected employment duration are greater for male workers than for female workers. With no experience, a typical male worker and a female worker with typical male characteristics are expected to work on a job 68 days and 50 days, respectively. Expected job duration increases much more rapidly with experience and reaches a much higher maximum for a typical male worker than for his female counterpart. At 25 years of farmwork experience, where expected job duration approaches the maximum for both male and female workers, a typical male worker's expected job duration is more than twice the expected job duration of his female counterpart.

The effects of skill on expected job duration are rather limited for male workers and are not statistically significant for female workers. A typical male worker can only expect to increase his job duration by 19 days if he upgrades his skill level from unskilled to semi-skilled. Supervisors have a shorter expected job duration than unskilled workers conditional on being in Category 2. This difference may be because supervisors are only required for certain production processes. This result must be interpreted with caution given the small number of supervisors.

Having small children and living with them have statistically significant effects only for female workers. A female worker, evaluated at typical male characteristics, with small children has a considerably shorter expected job duration than one who does not have small

children. On the other hand, the expected job duration of a female worker who lives with small children is comparable to that of her childless counterpart.

CONCLUSIONS

We estimated the average duration of employment, adjusting for possible sample selection bias, of workers with at least one complete spell of agricultural employment over a two year period. Had we used a conventional duration analyses, where some observations are discarded because of technical difficulties, the estimation duration equation would have reflected sample selection bias. We draw the following conclusions from this study:

(1)   We find that the standard measures of individual characteristics provide little help in predicting which workers will have long-term (2+ years) of agricultural employment. Long-term employment may be due to luck or to unobserved characteristics such as willingness to work hard and reliability. This limited ability to predict the work history of workers is not as serious as it otherwise would be because 79 percent of all workers had at least one completed spell of agricultural employment within a two year period, and most had several.

(2)   Legal status affects the duration of farm employment substantially. The duration of farm employment for male documented workers is double that of comparable unauthorized male workers. Similarly, the duration for female documented workers is 30 to 40 percent higher than for comparable unauthorized workers.

(3)   Age and experience have opposite nonlinear effects on the duration of farm employment for men. Experience increases the average employment duration for the first 25 years for men and 24 years for women. Average employment duration of men

decreases until they reach 38 years of age. No statistically significant effect of age on duration was detected for females.

(4)   Education and English skills matter very little. This result contrasts with findings for nonagricultural sectors (e. g., Abraham and Farber, 1987), where education tends to increase employment duration.

(5)   Race and ethnicity have unconventional effects on the duration of farm employment. Both white male and white female workers have shorter employment duration than the residual group. Male Hispanic workers, on the other hand, have average employment spells that are almost twice as long as that of non-Hispanics.

(6)   Females with the same characteristics as the typical male worker have considerably shorter periods of employment. Because the characteristics of females differ, however, the actual difference in employment duration between men and women is smaller than that comparison suggests. Factors such as experience and legal work authorization that considerably lengthen male workers' employment duration have much less of an effect for females.

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Footnotes

1. Many classes of distributions — the exponential, Weibull, lognormal, loglogistic, and gamma distributions— can be expressed in linear form.

2. An alternative approach would be to use the Cox partial-likelihood method, which allows inclusion of such polar cases as right- and left-censored spells. That method, however, is severely biased if there are many ties in exit times. Our sample has many ties.

3. Although right-censored data is routinely used in conventional duration studies, we cannot use them when they include stock-sampled jobs because of the unknown upward bias.

4. SAS crops are the vast majority of nursery products, cash grains, field crops, as well as all fruits and vegetables. SAS do not include production of poultry, livestock, silage or other animal fodder (Mines, Gabbard, and Samardick). For simplicity, we refer to SAS work as farmwork and SAS workers as farmworkers.

5. The legal status is self-reported. However, the workers were assured that any irregularity would be kept strictly confidential. A series of questions was used to cross-check the answers given for internal consistency. Some workers may have claimed to be properly documented because they had forged documents. If, however, employers treat workers with forged documents the same as legally documented workers, as is widely reported by cooperative extension farm advisors and others, these workers do not differ from those with legal documents for practical purposes.

6. The "North" region includes Colorado, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Massachusetts, Michigan, Nebraska, Nevada, New Jersey, New York, Ohio, Pennsylvania, Utah, Vermont, Virginia, West Virginia and Wisconsin.

7. Because there are no blacks in some categories for female workers, this variable is dropped from the female equation.

8. As noted in Table 4, the statistical significance of this result is based on estimates of the standard error using the ordinary least squares formula.