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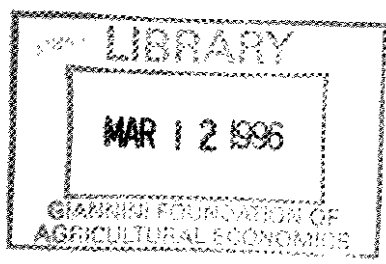
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THE EFFECTS OF WORK HISTORIES ON AGRICULTURAL WAGES

by

Emiko Hashida and Jeffrey M. Perloff



**California Agricultural Experiment Station
Giannini Foundation of Agricultural Economics
February 1996**

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The Effects of Work Histories on Agricultural Wages

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February 1996

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The Effects of Work Histories on Agricultural Wages

1. INTRODUCTION

Do farmworkers' work histories affect their current wages? Based on search theory, we argue that workers with a history of unemployment cannot afford to search as long as other workers and, as a result, obtain lower wages. Thus, an unemployed worker suffers from reduced income at the time of unemployment and lower wages in the future.

To the degree that work histories affect current wages, farmworkers may try to mold their work histories so as to increase their agricultural wages. For example, if specializing in farmwork raised their wages, they might turn down temporary nonfarmwork jobs. On the other hand, if obtaining nonagricultural employment allows them to hold out for higher paying farm jobs than otherwise, workers may benefit from seeking employment in both agricultural and nonagricultural sectors. Similarly, if learning English reduces a worker's probability of being unemployed, workers can reduce their unemployment and increase future wages in this manner.

In Section 2, we first present the standard search theory explanation of the relationship between the reservation wage and the length of unemployment spells. We then modify the theory to reflect the conditions in the agricultural labor market. We use this model to show how agricultural workers' wages are affected by their employment history. In Section 3, we use data from the National Agricultural Workers Survey (NAWS) to investigate how individual characteristics affect work history and whether work histories affect wages. We describe the data set in section 4. In Section 5, we use the estimates to simulate the effect of

individual characteristics on work histories and wages. We draw conclusions in the final section.

2. SEARCH THEORY

In a typical search-theory model, a worker searches for a job until the highest wage offered in a given period equals or exceeds the worker's reservation wage. Kasper (1967) and later authors contend that the reservation wage of unemployed workers falls over time.

In Mortensen's (1986) model, in which a worker has a single spell of unemployment, the worker lowers his or her reservation wage as the worker's resources for financing further job search is depleted. We will show that his result holds even when workers experience multiple spells of unemployment within a relatively short period of time, as is typical for agricultural workers.

2.1. Agricultural Wages and Unemployment History

Because most agricultural workers have limited liquid resources, their reservation wage drops quickly over time, and they are inclined to take one of the first offers they receive. Past unemployment that limits their cash reserves, exacerbates this effect. Thus, we expect reservation wages and hence actual agricultural wages to be lower for workers who have suffered substantial unemployment in the recent past.¹

¹ Using nonagricultural samples, Lancaster and Chesher (1984) and Hui (1991) found a negative relationship between the length of unemployment spells and reservation wages.

We will first describe Mortensen's model and then show how to modify it to allow for multiple spells of unemployment. We start with Mortensen's method for determining the reservation wage of a worker who lives forever and does not face a liquidity constraint. Suppose the worker receives job offers each period according to a Poisson process,

$$p(n, l) = \frac{e^{-\lambda l} (\lambda l)^n}{n!}, \quad (1)$$

where $p(n, l)$ is the probability that the worker receives $n = 1, 2, \dots$ offers during a period of length l . On average, the worker receives λl offers each period. We further assume that a job offer is fully characterized by the wage. Each wage offer is a random draw from the wage distribution $F(w)$. This wage distribution is fixed over time and is known to the worker. If a worker can choose among wage offers received within the same period, the worker considers only the best offer received in each period.

The worker's optimal strategy is to stop searching when the highest wage offered in a given period equals or exceeds the reservation wage, w^* . The reservation wage is the wage that equates the marginal cost and benefit of an additional period of search. Let $U(w)$ be the present value of accepting the best offer received, w , in a given period. The worker is assumed to work forever at this wage. $U(w)$ is a monotonically increasing function of w .

Using Bellman's principle (1957) of optimality, the value of searching during the next period, conditional on the worker's current information, is

$$V(\Omega) = (b - c)l + \gamma(l)E \{ \max [V(\Omega(t + l)), U(x)] \mid \Omega(t) = \Omega \}, \quad (2)$$

where $\Omega(t)$ is the worker's information at time t , $\gamma(l)$ is the discount factor that applies to a period of length l , x is the best wage offer made during the next period, b is the value of leisure per unit of time, and c is the search cost per unit of time.

The worker continues to search if and only if $V(\Omega) > U(w)$. In other words, the worker will search next period if and only if the value of searching next period exceeds the present value of accepting the best offer this period. Because the best offers are random draws from a known wage distribution, the worker gains no new information over time, so that $\Omega(t+l) = \Omega(t)$. Thus, using Equation (1), Equation (2) can be rewritten as,

$$V = (b - c)l + \gamma(l) \left[\sum_{n=1}^{\infty} p(n, l) \int_0^{\infty} \max[V, U(x)] dG(x, n) + p(0, l)V \right], \quad (3)$$

where $G(w, n)$ is the probability that the best of n offers is less than or equal to w , where $n \geq$

1. Subtracting $\gamma(l)V$ from both sides, we obtain

$$(1 - \gamma(l))V = (b - c)l + \gamma(l) \left[\sum_{n=1}^{\infty} p(n, l) \int_0^{\infty} \max[0, U(x) - V] dG(x, n) \right]. \quad (4)$$

Using the properties of the Poisson distribution and the continuous time equivalent of the discount factor, $\gamma(l) = e^{-rl}$, we derive the continuous time version of Equation 4. Dividing both sides of Equation 4 by l and taking the limit as $l \rightarrow 0$, we obtain

$$rV = b - c + \lambda \int_0^{\infty} \max[0, U(x) - V] dF(x). \quad (5)$$

By definition of the optimal-stopping strategy, the reservation wage must satisfy

$$V = U(w^*). \quad (6)$$

Because the present value of accepting wage x is $U(x) = x/r$, we can rewrite Equation 6 as

$$rV = rU(w^*) = w^*. \quad (7)$$

Substituting Equation 7 into Equation 5, we obtain the equation that defines the reservation wage,

$$\frac{\lambda}{r} \int_{w^*}^{\infty} [x - w^*] dF(x) = c + w^* - b. \quad (8)$$

The left-hand side of Equation 8 is the marginal benefit of an additional period of search: the present value of the expected income gain from accepting an offer in the next period. The right-hand side is the marginal cost of an additional period of search: the sum of the out-of-pocket search cost c and the opportunity cost $w^* - b$.

If the worker can only finance a job search for K periods, the value of an additional period of search depends on how much search time is left, $\tau = K - t$, where Mortensen

defines t is the length of an unemployment spell to date. Instead of following Mortensen, we define t as the total length of time spent unemployed in a given length of time (say a season) or equivalently, the proportion of time spent unemployed in a given length of time.²

The reason we focus on the length of unemployment in a given period is that, in agricultural labor markets, most workers have many short-term jobs and experience frequent periods of unemployment. In the NAWS, 40 percent of the workers had two or more unemployment spells in the previous two years. With repeated spells, the total time unemployed is more important than the length of a single spell of unemployment in determining a worker's reserves and reservation wage. For example, if a worker has recently experienced a long unemployment spell or multiple unemployment spells, even if only a short time has elapsed in a given episode of unemployment, the worker may have little money in reserve.

The total amount of resources available for job searches is cK . Thus, the value of searching for an additional period, when there are τ periods left, is

$$V(\tau) = (b - c)l + \gamma(l) \left[\sum_{n=1}^{\infty} p(n, l) \int_0^{\infty} \max[V(\tau - l), U(x)] dG(x, n) + p(0, l) V(\tau - l) \right]. \quad (9)$$

² In order to reinterpret Mortensen's liquidity constraint model in terms of the proportion of time spent unemployed, we need only to divide the both sides of the time constraint equation by the length of the base period, which leaves the model unaffected.

Subtracting $\gamma(l)V(\tau - 1)$ from both sides and using algebra on the left-hand side, we find that

$$V(\tau) - V(\tau - l) + [1 - \gamma(l)]V(\tau - l) = (b - c)l + \gamma(l) \left[\sum_{n=1}^{\infty} p(n, l) \int_0^{\infty} \max[0, U(x) - V(\tau - l)] dG(x, n) \right]. \quad (10)$$

Dividing both sides by l and taking the limit as $l \rightarrow 0$, we obtain

$$\frac{dV(\tau)}{d\tau} = b - c - rV(\tau) + \lambda \int_0^{\infty} \max[0, U(x) - V(\tau)] dF(x). \quad (11)$$

From Equation 7, the reservation wage when τ periods of search time remain, $w(\tau)$, is

$$V(\tau) = U(w(\tau)) = \frac{w(\tau)}{r}. \quad (12)$$

Using Equations 8 and 12, we rewrite Equation 11 as

$$\frac{dw(\tau)}{d\tau} = r[w^* - w(\tau)] + \lambda \int_{w(\tau)}^{\infty} [x - w(\tau)] dF(x) - \lambda \int_{w^*}^{\infty} [x - w^*] dF(x). \quad (13)$$

The right-hand side of Equation 13 is non-negative for all $w(\tau) \leq w^*$. In order for a worker to participate in the labor market, w^* must be greater than or equal to b . As a result, we have that

$$w^* \geq w(\tau) \geq b, \quad (14)$$

and

$$\frac{dw(\tau)}{d\tau} \geq 0. \quad (15)$$

Because $V(0) = U(b) = b/r$ when there is no search time left, the reservation wage falls toward the value of leisure as the reserve to finance search is exhausted.

In the NAWS data set, workers do not report reservation wages. However, we can establish a relationship between a worker's reservation wage and expected wage as follows. Because the worker only accepts wage offers greater than the reservation wage, the worker's expected wage is

$$E(w) = \frac{1}{1 - F(w^*)} \int_{w^*}^{\infty} x dF(x), \quad (16)$$

so

$$\frac{dE(w)}{dw^*} = \frac{f(w^*)}{1 - F(w^*)} [E(w) - w^*] > 0. \quad (17)$$

Thus, the expected wage rises with the reservation wage. Thus, this theory shows that the greater the proportion of time spent unemployed, the lower the expected wage. We examine whether this relationship holds using in the NAWS data set.

2.2. *Agricultural Wages and Agricultural Employment History*

Cross-section studies in nonagricultural industries usually find a positive relationship between the wage and the length of employment or tenure (Mortensen, 1988).³ Two explanations are commonly given for this relationship. First, as workers accumulate experi-

³ Studies in the nonagricultural sector range from findings of very strong positive correlation between job tenure and wage (Hersch and Reagan, 1990; Topel, 1990) to weak correlation (Abraham and Farber, 1987; Altonji and Shakotko, 1987) depending on the estimation techniques and the sample used.

ence in a particular job, they become more productive. Thus, if they are paid the value of their marginal product, their wages increase over time.

Second, many jobs require training designed to raise workers' productivity. Most of this training takes place when the worker is first employed. If the firm believes workers may quit before the firm captures the return on the training, employers make workers pay for part of the training costs through lower wages during the training period. Once the training is completed, however, workers' wages rise reflecting their higher productivity. Employers pay higher wages once the training is completed because they do not want to lose productive workers (Becker, 1964). Wages may continue to rise if additional experience increases productivity. For such jobs, wages rise with job tenure.

Agriculture employers employ few workers for long periods and rarely provide formal on-the-job training. Due to the seasonal nature of most agricultural work, it would be unprofitable to employ peak-season workers year round. Although there is an increased desire among agricultural employers in the post-IRCA years to retain workers, worker-retention rates are not high in agriculture. In the NAWS sample, only forty percent of workers returned to the same employer a year later (Gabbard, 1993).

Agricultural employers may not provide costly formal training because they know that the turnover rate is high (Becker, 1964). Most job training in agriculture is informal and takes the form of learning by doing. Workers gain on-the-job training and experience and increase productivity by working for a variety of farm employers over time, rather than working for only one employer. Thus, we expect to see a relationship between agricultural wages and the probability of being employed in agriculture rather than with the current job

tenure. If, however, workers retain their skills despite sporadic employment in farmwork or skill requirements are low, even this relationship may be a tenuous one.

2.3. Agricultural Wages and Previous Nonfarm Employment

Some hired agricultural workers use nonfarm employment to supplement their income and that the proportion of workers who do so has increased over time (Matta, 1984; Oliveira, 1990). Do farmworkers who have been able to obtain nonfarm employment enjoy more flexibility to seek higher paying agricultural jobs than those who did not find nonfarm employment? Both Matta (1984) and Oliveira (1990) report that more educated workers had a higher probability of working in nonfarmwork. In addition, Gabbard and Perloff (1995) find that hired agricultural workers who had confidence in finding nonfarmwork received higher agricultural wages than those who did not.

Gabbard and Perloff (1995) argue that workers who have confidence in finding jobs in the nonagricultural sector are likely to have higher reservation wages, and therefore higher agricultural wages, than others. There are two components to this argument. First, workers with greater search confidence — those with better education and English speaking ability — generally have higher reservation wages. Second, those workers who believe they can get jobs in the nonagricultural sector may have higher reservation wages than others because nonagricultural wages in general are higher than agricultural wages.

Our question differs from that in Gabbard and Perloff. We want to know if hired agricultural workers who actually worked in nonfarmwork receive higher agricultural wages than others. There are two reasons why such workers may not receive higher agricultural wages than other workers.

First, the wages in nonagricultural jobs available to hired farmworkers may not be higher than agricultural wages. In the NAWS data, the average hourly wage for nonfarm jobs held by farmworkers was only \$5.09 (in real 1989 dollars) compared to \$5.13 for farm jobs (Mines, Gabbard, and Samardick, 1993). Further, Mines et al. report that the nonfarm jobs — mostly in construction and service industries — taken by hired agricultural workers are just as seasonal and insecure as agricultural jobs. A worker with relatively low-wage nonfarm employment is less able to hold out for a good job than if that worker had earned a higher agricultural wage.

Second, farmworkers who take nonfarm jobs may not be the ones with greater search confidence in the nonagricultural sector. The workers who have confidence in finding nonagricultural jobs are more likely to be better educated and speak more English (Gabbard and Perloff, 1995). But, if available nonfarm jobs are not superior to farm jobs in wages or job security, there is no incentive for these "high-quality" workers to choose nonfarm jobs over farm jobs. Thus workers who have confidence in finding nonfarm jobs and those who actually take them may differ. For example, those who have search confidence are better educated and have superior English skills to those workers who actually take nonfarm jobs.

Workers may have engaged in nonfarmwork because they had better contacts (friends and relatives in nonfarmwork) or better information than other workers and not because they were more qualified. If so, there may be no qualitative difference between workers who worked in nonfarmwork and those who did not. Although both Matta (1984) and Oliveira (1990) find that educated workers had a higher probability of working in nonfarmwork, their December Current Population Survey data sets may not have been representative of all hired

agricultural workers. That data set is not likely to yield a representative sample of hired farmworkers because many immigrant workers return home for the winter season. Only about a quarter of the CPS samples are minority workers, while nearly 88 percent of the NAWS sample (from three seasons) are Hispanic workers.

If nonfarm jobs available to hired farmworkers pay no more than farm jobs, and if there is no qualitative difference between workers who take nonfarm jobs and those who do not, agricultural wages may not be positively related to the probability of working in the nonagricultural sector.

3. ESTIMATION MODEL

We now estimate the relationship between current agricultural wages and work histories and resources that allow workers to search. We then use this model to examine whether the observed agricultural wage is lower for workers with greater unemployment.

3.1. The Effects of Worker Characteristics on Work Histories

We estimate how various worker characteristics influence hired agricultural workers' work histories using the National Agricultural Workers Survey (NAWS). We then use the estimated coefficients to calculate fitted probabilities, which we use as instruments in the wage equation in the next section.

The NAWS collects a job history for the two years prior to the survey. Let P_{ij} be the proportion of time worker i spends during the two-year survey period in state $j = 0$ for farm employment, 1 for nonfarm employment, 2 for unemployment (or otherwise not working), or

3 if abroad.⁴ These proportions, P_{ij} , are assumed to be a logistic function of a vector of worker characteristics, X_i ,

$$p_{ij} = \text{Prob} (J_i = j) = \frac{\exp(\gamma_j' X_i)}{1 + \sum_{k=1}^3 \exp(\gamma_k' X_i)}, \quad (18)$$

where $j = 0, 1, 2, 3$ and γ_0 is normalized to equal zero.

The worker characteristics, X_i , include race (white, black, and other), ethnicity (Hispanic and other), place of birth (U. S., Mexico, and other), legal status (citizen, amnesty recipient, legal permanent resident, and unauthorized), knowledge of English, gender, age, age squared, family background (spouse, children, and whether the worker lives with spouse/children), years of education, farmwork experience in the United States, skill level, whether the worker has friends or relatives in nonfarmwork, whether the worker owns a house in the United States, the region in which the worker was located, and the cycle in which the worker was interviewed.

Race and ethnicity may affect the probability of being employed in the nonfarm sector due to racial or ethnic bias. In the farm sector, these variables are unlikely to affect the probability of being employed as most workers are minorities. If race and ethnicity do influence the probability of being hired in nonfarmwork, they may also affect the probability

⁴ The "unemployed/not working" category includes unemployment and not working due to family responsibilities, school requirements, moving, or illness or injury or because the individual is on vacation. We know the reason why an individual is not working in the most recent period (but not for the rest of the two-year history). Of the 1458 people in our sample, 1228 (86 percent) did not work because they had been laid off or fired.

of being unemployed because farmworkers typically seek nonfarm employment in the off-season.

Foreign-born workers are many times more likely to spend time abroad than those born in the United States. Legal status is likely to affect the probability of unemployment if unauthorized workers face greater difficulty in finding work than do legal workers. In addition, unauthorized workers suffer from much shorter farm employment spells than others (Hashida and Perloff, 1995). Shorter employment spells may also help to increase the percent of time unemployed.

Knowledge of English, though probably not a factor in finding farmwork, may increase the probability of finding nonfarmwork where English ability is likely to be more important than it is in farmwork. On the other hand, the type of nonfarmwork available to farmworkers may not require much English ability. Gender may influence the probability of being out of work. That female workers have shorter farm employment durations than men may be due to their heavier child-rearing and other family responsibilities. If so, the same responsibilities may force women to experience a higher probability of unemployment than men. Gender may also affect the probability of spending time abroad. Indeed, within our sample, virtually the only workers who shuttle between their home country and work sites in the United States are men (Mines, Gabbard, and Samardick, 1993).

As workers age, they may become more established in a region, which may raise their probability of finding nonfarmwork. On the other hand, older workers may experience a lower probability of working in agriculture as farmwork is more physically demanding than most nonfarmwork.

Additional farmwork experience should increase the probability of working in agriculture because experienced workers have better information and are more valuable to employers. Skill level, for the same reason, should raise the probability of working in agriculture.

Workers who live with their families are likely to have a lower probability of spending time abroad. This is because these workers are more established in the United States, and are less inclined to visit their relatives in their home countries or vacation abroad. Workers with families may be out of employment a smaller share of the time than other workers because they are under pressure to support their dependents.

Education may lead to a higher probability of nonfarm employment. Workers who have friends or relatives in nonfarmwork are likely to experience a higher probability of nonfarm employment. Immigrant workers who own a house in the United States are more likely to be established in the United States and are less likely to make periodic trips to their home country.

Geographical regions are expected to capture three different effects. First, workers in regions with long growing seasons are likely to experience a lower probability of unemployment than those in short growing-season regions. Second, individuals who live close to metropolitan areas are more likely to find nonfarmwork compared to those who do not. Thus, workers in the regions that contain metropolitan areas, such as the northeast, may have a higher probability of nonfarm employment than workers in predominantly rural regions such as the western plains. Finally, immigrant workers who live close to the Mexican border may return home more frequently than others.

3.2. *The Effects of Work Histories on Agricultural Wage*

We want to examine how work histories — the probabilities of farm employment, nonfarm employment, and unemployment — affect current agricultural wages. To do so, we must control for other geographic and demographic factors, the vector Z_i , that may affect agricultural wages. We estimate a wage equation where w_i , the natural logarithm of the current agricultural wage for worker i , is a function of the probabilities of having been in state $j = 0, 1, 2, 3$, and Z_i :

$$w_i = \alpha_j' P_{ij} + \beta' Z_i + u_i. \quad (19)$$

An implication of our search theory is that more recent unemployment lowers the expected current wage, holding the Z_i variables constant. The effect of more time in nonfarmwork is ambiguous. By working outside of agriculture instead of being unemployed, a worker has more cash reserves for job searches, which leads to higher wages. On the other hand, if employers prefer workers who specialize in agriculture, nonfarmwork experience could lower the wage.

At low levels of experience, we expect the wage to be increasing in experience. The NAWS variable, "years of farmwork experience," however, is an imperfect measure. Any year in which a worker spent more than 15 days in farmwork is counted as a year of farmwork experience. Nonetheless, as most of these workers spent considerable time in agriculture, this variable is probably a reasonable proxy. Older workers may be paid lower wages if productivity declines with age.

The race and ethnicity variables are included to capture possible effects of discrimination. The gender dummy captures possible differences in wages between men and women. Although most previous studies fail to find gender wage gaps for a given task category, women may be concentrated in tasks that pay low wages. The effects of family and household composition on wages are unknown. On the one hand, workers who live with their families face greater search constraints than those who do not. On the other hand, the stability of workers who live with their children may be appealing to employers, or employers may prefer to hire related workers.

The legal status dummies capture the return to being authorized to work in this country. Unauthorized workers could impose extra costs to employers in the form of fines and lost revenues if workers are apprehended (Taylor, 1992), though such fines are few and far between.

Wages should vary with tasks (harvest and nonharvest), crops (field crops, nuts and fruits, flowers and nursery products, vegetables, and speciality crops), and skills (unskilled, semi-skilled, and supervisors). The geographical variables control for regional differences in macroeconomic conditions such as the demand for labor and cost of living. The seasonal dummies control for seasonal variation in wages. One might expect higher wages during the peak agricultural season. However, a fundamental difference between the summer sample and the winter sample may yield the opposite result. Those who are found working in agriculture during winter are not a typical group of hired farmworkers since there is little agricultural demand for labor in winter. The winter sample must contain an unusually high proportion of long-term and skilled workers who may well be paid more than the average wage.

The English language ability variables capture the possible effects of superior language ability in finding and getting better farm jobs. The importance of English skills is expected to be minimal given the widespread use of Spanish, the native language of most immigrants, in the agricultural industry. Additional farmwork experience, on the other hand, is expected to increase wages since experience raises productivity at least initially. Education is not expected to have any effect on agricultural wages.

4. DATA

We use data from the U. S. Department of Labor's National Agricultural Workers Survey (NAWS) to estimate the effects of worker characteristics on work histories and the relationship between current agricultural wages and work histories. The probabilities of farmwork, nonfarmwork, unemployment, and time spent abroad are computed from the two-year job history collected from each worker in the sample. The wage data and the contemporaneous variables that affect wages correspond to the jobs that workers held after the two-year survey period.

The NAWS covers a nationally representative cross-section of workers from 72 counties in 25 states representing 12 distinct agricultural regions. Although only seasonal agricultural services (SAS) workers are interviewed in the NAWS, SAS is defined broadly as most field work in perishable crop agriculture.⁵ For each of the interviewing cycles, 30 counties were selected randomly as interview sites. The number of interviews conducted

⁵ 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.

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).

The initial NAWS interviews were in 1988. Since then, the survey instrument has been revised several times. In our analysis, we use the five interview cycles that took place between 1989 and 1991, during which the survey instrument was not changed. Of the 4,718 interviews conducted during the five cycles, we use the 2,357 observations for which all relevant data are available.

Table 1 lists the means and standard deviations for all workers, those who only worked on farms, those who worked on and off farms, those who had experienced unemployment, and those who spent some time abroad during the previous two years. The most common reasons for spending time abroad cited by farmworkers are to visit relatives (37 percent) and to vacation (24 percent). Only 1 percent cite unemployment as the reason to stay abroad (Rosenberg, Gabbard, Alderete, and Mines, 1993).

Of the 2,357 observations used in this study, 1,669 workers or 72 percent engaged only in farmwork when they were employed. Only 24 percent did both farmwork and nonfarmwork. A majority of workers, 62 percent, experienced unemployment while 49 percent spent time abroad.

A relatively small number of workers in the southeast and midwest experienced unemployment while a relatively large number of workers in the northwest experienced unemploy-

ment. Relatively more farmworkers in the midwest, western plains, and northwest did nonfarmwork. In contrast, relatively few workers in the west performed nonfarmwork.

White workers are 56 percent of sample, blacks are 2 percent of the sample, while the rest are native Americans, Asians, and Hispanics who did not indicate a race. Hispanics make up 92 percent of the sample. A relatively large number of them spent time abroad.

Mexican-born workers are 79 percent of the sample, those born in the United States are 10 percent, and the rest were born in other countries. Those workers born in the United States are more likely to have done nonfarmwork and less likely to have spent time abroad than Mexican-born workers.

Citizens are 12 percent of the sample, workers with amnesty are 55 percent, legal permanent resident (LPR) are 23 percent, and people who are unauthorized to work in the United States are 11 percent. A relatively large number of citizens did nonfarmwork while a relatively small number of LPR workers did so. The level of unemployment does not differ substantial across legal-status groups. Relatively few citizens and LPR workers spent time abroad while a relatively large number of amnesty workers did so.

Only 12 percent of workers say they speak English well and about the same number claim to write well. A relatively large number of workers with English skills performed nonfarmwork. However, they are no less likely than others to experience unemployment. They are much less likely than others to spend time abroad.

Female workers are 22 percent of the sample. A relatively large number of female workers experienced unemployment while relatively few of them engaged in nonfarmwork. They were much less likely than men to spend time abroad. Workers with families are no

more likely to do nonfarmwork and they are no less likely to experience unemployment than those without families. Workers who live with their families are less likely than others to spend time abroad. The skill level required for the most difficult task performed by a given worker during the two-year period determines the "skill level" (unskilled, semi-skilled, and supervisor).

Workers were interviewed during the winter, spring, or fall seasons. Regardless of when interviewed, the worker's history includes each season twice, so that the workers' histories are comparable. Wages, which are only recorded at the time of interview, differ by season. Moreover, workers who are sampled in winter includes a relatively large share of those workers who enjoy year-round farm employment. In contrast, the spring sample contains a higher proportion of workers who do farmwork only during the peak season. A relatively small number of the winter sample workers experienced unemployment, whereas a relatively large number of the spring sample workers did so.

The average hourly wage for all workers in the sample is \$6.30. There is little variation in wages among the different subsets of workers. Workers who specialized in farmwork earn slightly higher average wages than those who performed nonfarmwork. The average worker had 5.6 years of education. The average number of years of farmwork experience is 10.2 for the entire sample. Those who performed nonfarmwork have slightly less experience in farmwork (9.4 years) than workers who specialized in farmwork (10.9 years). Workers with a history of unemployment have as much experience in farmwork as others.

5. ESTIMATION

We first discuss estimates of how the probability of having a particular work history varies with geographic and other characteristics. Then, we estimate the relationship between work history and wages.

5.1. Multinomial Logit

The maximum-likelihood, multinomial-logit estimates in Table 2 show how the share of time spent in farmwork, nonfarmwork, unemployment, and abroad vary with geographic and demographic characteristics. The base category is farm employment. In the following, we discuss only variables for which we can reject the null-hypothesis that the coefficient is zero based on asymptotic t-tests using the 0.05 criterion.

Because of the nonlinearity of the multinomial logit equations, these coefficients are difficult to interpret directly. Instead, we calculate the marginal effects for a "typical" worker.⁶ For discrete variables, we calculate the change in a probability from switching a variable from zero to one, holding all other variables constant. The marginal effect of a continuous variable is the change in the probability that results from a one percent increase in

⁶ We define a typical worker as having the mean value of continuous variables and the most likely value for discrete variables. A typical worker is 33.4 years old, has 5.6 years of education, and has 10.2 years of farmwork experience in the United States. The worker is a white Hispanic male, who was born in Mexico, received amnesty, does not speak or read English well, and works in the west. He has a spouse and children but does not live with them. He is unskilled and harvests nuts and fruits on his current job. He was interviewed in the spring, does not own a house in the United States, and does not have relatives or friends in the nonagricultural sector.

the variable, holding others constant: $\partial P_j / \partial x = P_j (\hat{\gamma}_j - \bar{\gamma})$, where $j = 0, 1, 2,$ or 3 and $\bar{\gamma} = \sum_{j=0}^{j=3} P_j \hat{\gamma}_j$.

Farmwork experience in the United States, age, and luck determine the probability of engaging in nonfarmwork. At the sample mean of 33 years, a one percent increase in age raises the probability of doing nonfarmwork by one percent. On the other hand, at the sample mean of 10 years, a one percent increase in farmwork experience reduces the probability of nonfarmwork by 0.9 percent. Workers who have friends or relatives in nonfarmwork are 5 percent more likely to do nonfarmwork than others. Compared to those interviewed in the fall, individuals interviewed in the spring are 2 percent more likely to do nonfarmwork.

Compared to workers in the northeast, those in the western plains have a 17 percent greater chance, those in the northwest have a 18 percent greater chance, and those in the west have a 14 percent greater probability of unemployment. Women are 17 percent more likely to be unemployed than men. In addition, workers sampled in the spring are 5 percent more likely than those sampled in the fall to be unemployed. Amnesty workers, on the other hand, are 4 percent less likely than unauthorized workers to experience unemployment. It is interesting to note that neither citizens nor LPR workers are less likely to experience unemployment than unauthorized workers. Further, skill level, education, and English ability apparently have no effect on reducing one's probability of unemployment. Thus, workers cannot reduce their odds of being unemployed through education or obtaining skills.

As workers begin to establish themselves in the United States, they abstain from returning home for a while. But when their status becomes more solid, they spend more time in the home country. Evaluated at the sample mean of 10 years, a one percent increase in years of U. S. farmwork experience reduces the probability of staying abroad by 1.4 percent.

As U. S. farmwork experience rises above 25 years, however, workers increase the share of time they spend abroad.

Legal status also affects the probability of being abroad. Amnesty workers are 15 percent less likely than unauthorized workers to spend time abroad. LPR workers, who are generally more established in the United States than amnesty workers, are only 9 percent less likely than unauthorized workers to spend time abroad. Citizens, the most established legal status category, are not statistically significantly less likely than unauthorized workers to spend time abroad.

Women and workers who live with their spouses are 6 percent less likely than others to spend time abroad. Workers who own a house in the United States have a 5 percent lower probability of spending time abroad than others. In addition, workers in the southeast are 8 percent less likely than workers in the northeast to spend time abroad. On the other hand, workers born in Mexico are 5 percent more likely than others to stay abroad. Those sampled in the spring have a 2 percent greater chance of spending time abroad than those sampled in the fall.

5.2. Wage Equation

We want to consistently estimate the relationship between work histories and current agricultural wages. We can use ordinary least squares if the probabilities, P_{ij} , and the error term in the wage equation are uncorrelated.

If they are correlated, we can use an instrumental variables technique, where the instruments are the fitted probabilities obtained by substituting the estimated coefficients, $\hat{\gamma}_j$, from the multinomial-logit estimates into Equation 18.

We can test the null hypothesis that these probabilities and the wage equation's error term are uncorrelated using a Hausman test. Because the Hausman-test statistic, 7.69, is less than $\chi^2_{.05}(40)$, we fail to reject the null hypothesis of no correlation between the probabilities and the error term. As a result, we report the ordinary-least-squares estimates for the wage equation in Table 3.

According to this wage equation, the agricultural wage is positively related to the probability of working on farms and negatively related to the probability of engaging in nonfarmwork. Neither of these relationships, however, is statistically significant at the 5 percent level.

As predicted, the more time the worker spent unemployed in the last two years, the lower that worker's current agricultural wage. We can reject the null-hypothesis that the coefficient on the share of time the worker was unemployed is not statistically significantly different from zero at the 5 percent level. A ten percentage point increase in the share of time unemployed leads to a 1 percent drop in the current agricultural wage. Thus, unemployment reduces farmworkers' income in two ways. Initially, unemployment reduces a worker's earnings by reducing the hours worked. Later, the worker may accept a relatively low-wage job because the worker lacks the resources to continue searching.

We tested whether the relationship between work histories and current agricultural wages are different between the winter and other seasons. For example, we examined whether the relationship between the probability of unemployment and current agricultural wages differs for the winter sample from the rest. To examine this question, we included an interactive variable that is the product of the winter dummy and the probability of unemploy-

ment. We then tested if the winter dummy and this interactive variable were jointly statistically significantly different from zero. All winter-probability combinations were tested. The test statistics ranged from 0.026 to 1.832 and all were smaller than the critical value $F_{.05}(2, 2311) = 3.00$. Therefore, we could not reject the null hypothesis that the relationship between work histories and current agricultural wages are the same for workers interviewed in all seasons.

Wages vary substantially geographically. Compared to workers in the northeast, workers in the southeast earn 16 percent lower wages while those in the western plains earn 19 percent lower wages.

Skill levels also have substantial effects on wages. Supervisors earn 29 percent higher wages than unskilled workers who perform tasks other than harvesting. Neither unskilled harvesters nor semi-skilled workers make statistically significantly different wages than unskilled non-harvesters. Type of crop also creates some variation in wages. Specialty crop workers earn considerably less than all other workers. Relative to specialty crop workers, those who work on field crops earn 13 percent higher wages while individuals who work on nuts and fruits earn 14 percent more. Flower and nursery product workers and vegetable workers also earn 15 percent and 14 percent higher wages than specialty crop workers, respectively.

Wages differ with legal status. Compared to unauthorized workers, citizens earn 14 percent higher wages, legal permanent residents earn 9 percent more, and amnesty workers earn 7 percent more. Season has no statistically significant effect on wages.

Education and English skills do not have statistically significant effects on wages. Farmwork experience is the only standard human capital measure that influences wages. Wages are increasing with experience up to 25 years and then decreasing.

Race and family-household composition are the only other demographic variables that affect the agricultural wages. White workers earn 5 percent lower wages than others. Married workers earn 9 percent lower wages than unmarried workers. Those who live with their spouses, however, earn 7 percent higher wages than other married workers.

5.3. Simulations

We use our estimated wage equation and work-history equations to calculate the expected wages and probabilities of working on farm, engaging in nonfarm employment, being unemployed, or being abroad for the typical worker, as shown in Table 4. Then we change one variable at a time to examine the effects of a change in various characteristics on wages and employment history.

The typical worker (defined above) earns \$5.66 in hourly wages. In the last two years, he spent 52 percent of his time in farmwork, 5 percent in nonfarmwork, 13 percent in unemployment, and 30 percent abroad.

Now we compare this typical worker to an otherwise identical worker with a different legal status. Although legal status substantially affects the probabilities of working on a farm and of staying abroad, it has little effect on the probabilities of being unemployed and of engaging in nonfarmwork. As expected, unauthorized workers with otherwise typical characteristics have the lowest probability of doing farmwork at 24 percent. The probability

of working on a farm is 36 percent for citizens, 45 percents for workers with LPR, and 52 percent for amnesty workers.

Although citizens are the most likely to do nonfarmwork (6 percent) and unauthorized workers are the least likely (3 percent), the difference between them is not statistically significant. Further, there is little variation in the probabilities of unemployment among different legal status groups. Despite having the lowest probability of doing farmwork, unauthorized workers' probability of unemployment, at 10 percent, is not statistically significantly worse than that for citizens and LPRs. Amnesty workers have a slightly higher probability of unemployment than unauthorized workers with otherwise typical characteristics at 13 percent.

A fall in the probability of doing farmwork due to a change in legal status is offset by a rise in the probability of being abroad. While the amnesty group, which has the highest probability of doing farmwork, spends only 30 percent of the time abroad, the unauthorized group, which has the lowest probability of doing farmwork, spends 64 percent of the time abroad. Citizens, who have the second lowest probability of doing farmwork, experience the second highest probability of staying abroad at 44 percent. The legal permanent residents who have the second highest probability of farmwork, experience the second lowest probability of staying abroad at 36 percent.

Surprisingly, unauthorized workers with otherwise typical characteristics experience a probability of unemployment no higher than others. It may be that unauthorized workers come to the United States for short-term employment and expect to return home when the initial contract expires without looking for further employment opportunities.

Amnesty workers are the group with the strongest attachment to U. S. farmwork, followed by LPRs, citizens, and unauthorized workers in descending order. This result underscores the importance of amnesty workers to U. S. agriculture. Not only are they the largest legal status group in the farmworker population, but they devote more time to farmwork than any other legal status group.

Despite their devotion to farmwork, amnesty workers do not earn the highest wages among legal-status groups. Agricultural wages rise as their legal status becomes more permanent. Citizens earn the highest wages at \$6.02, followed by LPRs at \$5.74, amnesty workers at \$5.66, and unauthorized workers at \$5.27.

The greatest gender differences concern the probabilities of unemployment and that of staying abroad. Where female workers experience a 32 percent probability of unemployment, comparable male workers only have a 13 percent chance of unemployment. Women only have a 17 percent chance of staying abroad, whereas men have a 30 percent chance of doing so. Women have a 48 percent probability of working on a farm compared to men at 52 percent. Men are not statistically significantly more likely to do nonfarmwork than women. Women's wages are not statistically significantly different from men's.

Household composition influences the probability of staying abroad more than it influences any other probability. Workers who live with their spouses have the lowest probability of staying abroad at 18 percent. Those who are not married have the second lowest probability of doing so at 25 percent. Workers with spouses are the most likely to stay abroad at 30 percent, presumably because some of the married workers leave their spouses in their home countries.

Workers who live with their spouses spend 57 percent of their time in farmwork while unmarried workers spend 54 percent of their time in farmwork. Married workers in general spend 52 percent of their time in farmwork. Workers who live with their spouses are also the most likely to experience unemployment at 17 percent. Unmarried workers are next at 15 percent. Married workers in general are the least likely to experience unemployment at 13 percent. Family/household composition has no statistically significant effect on the probability of doing nonfarmwork. Unmarried workers earn the highest wages at \$6.23, while workers who live with their spouses and married workers in general earn \$6.05 and \$5.66, respectively.

The effects of farmwork experience on various probabilities are the greatest during the first 10 years. During this period, the typical worker's probability of doing farmwork increases from 30 percent to 56 percent, while the probability of staying abroad plummets from 53 percent to 26 percent. The probability of doing nonfarmwork also drops from 9 percent to 4 percent in this period. During the second 10 years, the probability of farmwork continues to climb, but at a much slower pace, from 56 percent to 67 percent. The drop in the probability of staying abroad also continues at a slower rate from 26 percent to 16 percent. The probability of nonfarmwork declines from 4 percent to 2 percent in the second 10 years. After the first 20 years, farmwork experience has almost no effect on any of the probabilities. Farmwork experience has no statistically significant effect on the probability of unemployment.

There seem to be at least two reasons for farmworkers' demonstrated ability to rapidly increase the probability of farmwork in the first 10 years of their careers. First, additional

experience during the first few years is likely to raise productivity, which makes workers more desirable to employers. Second, during the first few years of their U. S. farm experience, farmworkers gain knowledge of the job market and develop contacts. Thus, farmworkers with more experience are better equipped to find additional agricultural jobs.

Farmwork experience raises wages for the first 25 years. Workers with no experience earn only \$5.06 while those with 25 years of experience earn \$6.05, a wage gain of almost 20 percent.

Among the three work history variables in the wage equation, only the probability of unemployment has a statistically significant effect on current agricultural wages. We increase the probability of unemployment from 0 percent to 100 percent in increments of 20, and evaluate what happens to current agricultural wages. We assume that workers perform farmwork when they are not unemployed. The probability of unemployment and current agricultural wages have an almost linear negative relationship. As the probability of unemployment drops from 100 to 80 percent, wages rise from \$5.07 to \$5.21 — a 15¢ per hour or 2.76 percent increase. The next 20 percent decline in unemployment brings an additional 15¢ per hour rise in wages. Thereafter, each 20 percent reduction in unemployment results in a 16¢ increase in wages. To take an extreme example, a typical worker who spent the previous two years in farmwork earns 15 percent more in wages than a worker who was unemployed the entire two years with otherwise identical (typical) characteristics.

6. CONCLUSIONS

Based on a search-theoretic model, we examined the relationship between agricultural wages and work histories. We draw six main conclusions:

1) A past history of unemployment negatively affects current agricultural wages possibly because workers search for shorter periods. Thus, increased unemployment hurts workers for two reasons. First, they suffer the immediate loss of income. Second, because their funds are low, apparently they cannot search for as long as they otherwise would, and take lower-wage jobs in the current period. A typical worker was unemployed 13 percent of the previous two years. An additional ten percentage points of unemployment lowers that worker's wage by slightly over one percent.

2) Workers cannot reduce their odds of being unemployed through education, learning English, or obtaining skills. A typical female worker experienced two and a half times more unemployment than a similar male worker.

3) Farmwork experience in the United States, age, connections and luck determine the probability of engaging in nonfarmwork. The amount of time spent in nonfarmwork does not have a clear-cut effect on current agricultural wages.

4) The percentage of time spent in farmwork during the previous two years differed substantially by legal status. A typical worker with amnesty spent 52 percent of his time in farmwork compared to 45 percent for a legal permanent resident, 36 percent for a citizen, and 24 percent for an unauthorized worker. Regardless of legal status, workers are unable to raise current agricultural wages by increasing the amount of time spent in farmwork.

5) As workers begin to establish themselves in the United States, they abstain from returning home for a while. But when their status becomes more solid, they spend more time in the home country.

6) Because the seasonal nature of agricultural work makes it impossible for most hired farmworkers to find year-round employment and nonfarm employment does not adversely affect workers' agricultural wages, agricultural workers benefit from taking nonfarm jobs in the off-season. Further research is required to determine whether individual or government interventions can ease the transition between farm and temporary nonfarm jobs and to confirm whether such programs would actually encourage workers to remain in farmwork when available.

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