The Shadow Value of Legal Status
--A Hedonic Analysis of the Earnings of U.S. Farm Workers[1]

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Abstract

The purpose of this study is to estimate the shadow price of the legal status of farm workers. A hedonic function in terms of farm work experience, gender, education level, language skill, and legal status is estimated with control variables for employer type, farm work type, as well as other geographical and time variables. The data is drawn from the National Agricultural Workers Survey (NAWS). The preliminary results show that while legal status did contribute significantly to the wage differences it is not the major factor. After taking account of the composition shift in demographic characteristics, the quality adjusted labor prices still doubled in the past two decades.

Key words: Farm worker, U.S. agriculture, undocumented labor, legal status, hedonic analysis
JEL codes: J31, J43

I. Introduction

The number of foreign-born workers has increased significantly over the past few decades in the U.S. labor market, especially for low-skilled farm works. To accommodate this situation, under the special agricultural worker legalization program of Immigration Reform and Control Act (IRCA), more than 1.1 million Mexicans have become legal immigrants (Wu, 2007). Although the intention of the 1986 IRCA was to encourage employers to hire a more legal workforce, evidence has shown that IRCA did not reduce the flow of new immigrants into the farm labor market in the transition period (Taylor and Thilmany, 1993). Wu (2007) also mentioned that "more than half of the immigrants working in the farm sector are unauthorized" in the 2007 issue of *Choices*. Martin and Calvin (2010) reinforce this issue and raise concern on the risk of spiking labor costs in the event of immigration enforcement or immigration reforms since unauthorized workers are usually paid less.

While researchers (Isé and Perloff, 1995, Rivera-Batiz, 1999 among others) are in agreement that there is a wage difference between authorized and unauthorized workers, it is not clear what the shadow value of the legal status is or to what extent employers are willing to pay for an authorized farm worker. Since the difference in earnings can be generated by the quality characteristics of the farm workers, we employ a hedonic framework to estimate the wage function and thus the shadow price of the legal status of farm workers. In the hedonic framework, a good or service is viewed as a bundle of characteristics that contribute to output or utility derived from its use. Accordingly, the price of the good or service represents the valuation of the characteristics "that are bundled in it", and each characteristic is valued by its implicit price (Rosen, 1974).

Therefore, the purpose of this study is three-fold. First, we estimate a hedonic model of U.S. farm workers' wages to determine how workers' characteristics, legal status, farm work types, employers, and other geographical and time factors may affect the farm worker's wage rate. Second, we estimate the shadow price of the legal status. Third, we estimate quality adjusted wage rates at the regional level to identify the patterns of wage differentiation across regions.

II. Methodology

Following Rosen (1974), we employ hedonic framework in estimating the wage function for U.S. farm workers. The labor input is viewed as a bundle of characteristics which contribute to the productivity derived from its use. The imputed prices of labor quality characteristics are the marginal prices valid at the sample means compared with actual average prices. A hedonic function in terms of years of farm work experience, gender, education attainment measured as schooling years, language skill, and legal status are estimated with controlled variables on employer type—hired or contracted, farm work type—such as tasks in fruit and nuts, horticulture, vegetables, or others, and other geographical and time variables. An econometric problem associated with the hedonic wage equation is that the probability of hired by contractor or directly by farmers may also be correlated with an error term in the wage equation. To correct for possible sample selection bias, we employ the hazard technique suggested by Heckman (1979).

Consider a hedonic wage function with a general form:

$$w_i = \boldsymbol{\beta}' \boldsymbol{x}_i + \boldsymbol{\gamma}' \boldsymbol{z}_i + \delta D_i + \varepsilon_i \quad (1)$$

where w_i represents a hedonic price of the labor input; $\boldsymbol{x}_i$ is a vector of quantities of the characteristics embodied in the labor service—including experience, age, gender, and education attainment, and language skill; $\boldsymbol{z}_j$ is a vector of features that may affect the level of wage rate, such as legal status and work type; and D_i is a binary variable representing the labor's selection of working as a hired labor or contract labor. We also add time and region dummies to control for the time- and geography-variant factors.

Employee type selection is one of the explanatory variables in equation (1). However, the decision to the employee type may also be endogenous and can be explained by other independent variables shown as equation (2).

$$D_i^* = \tau \boldsymbol{Z}_i + u_i; \quad (2)$$

where $\boldsymbol{Z}i$ is a vector of independent variables. $Di=1$ if $Di^*>0$, 0 otherwise.

If some of the independent variables are the same as the variables in the wage function, the selection problem will arise as

$$E[\delta\varepsilon] \neq 0. \quad (3)$$

The error terms in equations (1) and (2) can be assumed with a joint normal error distribution to account for the selection bias as follows:

$$\begin{bmatrix} \varepsilon \\ u \end{bmatrix} \text{iid} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma^2 & \rho \\ \rho & 1 \end{bmatrix} \right) \quad (4)$$

Expected wage rate by a contract labor can be expressed as
$$E[w_i/D_i=1] = \boldsymbol{\beta}' \boldsymbol{x}_i + \boldsymbol{\gamma}' \boldsymbol{z}_i + \delta + E[\varepsilon_i /D_i=1] = \boldsymbol{\beta}' \boldsymbol{x}_i + \boldsymbol{\gamma}' \boldsymbol{z}_i + \delta + \rho\sigma\lambda_i \quad (5)$$

where λ_i is the inverse Mills ratio. The parameters of the treatment-effects selection model are estimated using full maximum likelihood.

III. Data

The data on characteristics of farm workers is drawn from the Department of Labor, Employment and Training Administration's National Agricultural Workers Survey (NAWS), which is a national, random sample of seasonal agricultural service (SAS) workers. The preliminary data spans the period 1989 to 2011. The NAWS uses stratified multi-stage sampling to account for seasonal and regional fluctuations in the level of farm employment. The stratification includes three interviewing cycles per year and 12 geographic regions, resulting in 36 time-by-space strata. Sampling and post-sampling weights are used in the NAWS to adjust the relative value of each interview so that population estimates may be obtained from the sample. The interviews were conducted in 467 counties and 40 states between October 1, 1988 and September 30, 2011. Workers are sampled from 12 regions, and have been collapsed into six production regions—East, South East, Middle West, North West, South West, and California.

IV. Results

- **Table 1:**
  Most farm hired labors and contract labor services are hired by crop farm.

- **Table 2:**
  According to the descriptive statistics, workers hired by growers have a higher mean education attainment and farm work experiences. They are also more likely to be legal or authorized farm workers.

- **Table 3:**
  1. Higher education attainment, more farm work experiences, better English speaking skills, or work as a field crop or horticulture farm worker have significant and positive impacts on wage rate.
  2. Females earned significantly less (around 3%) compared with the male farm worker's wage rate.
  3. Legal status itself could increase farm wage rate by more than 3%.

- **Table 4:**
  1. Legal status, English skill, farm work experience have significant negative impacts on the employed status as hired by contractors.
  2. Tasks in fruit & nuts and vegetables area use significantly more contract workers compared to other tasks.

- **Figure 1:**
  1. After taking account of the quality composition shift effect, wage rates increased by more than 2.5 times from 1990 to 2010.
  2. In general, Southwest region has the lowest quality adjusted farm wage rate among all six regions.

Table 1 Farm worker expense by farm type

Employed type	Farm type	2001	2011
Contract labor expense	Crop farm	78%	84%
	Livestock farm	22%	16%
Hired labor cash wages	Crop farm	71%	79%
	Livestock farm	29%	21%

Data sources: USDA Agricultural Resource Management Survey. Hired labor cash wages do not include cash wages paid to operators.

Table 2 Descriptive statistics by employed type

variables	hired by grower			hired by contractor			variable description
	N	Mean	STD	N	Mean	STD	
legal status	37076	2.61	1.28	6142	3.09	1.10	1~4, 4: unauthorized
education attainment	37076	7.23	3.82	6142	6.14	3.40	schooling years
farm work experience	36846	11.51	10.29	6112	9.45	9.17	years
gender	37076	0.20	0.40	6142	0.21	0.41	1: female and 0: male

Notes: N is the number of observations, STD indicates standard deviation.

Table 3 Empirical results (I)--wage function

(Dependent variable: wage rate)

| variable	Semi-Log		Linear	
	coefficient	standard error	coefficient	standard error
constant	1.214	0.013	2.7018	0.0638
education (years)	0.007	0.001	0.0556	0.0045
farm work experience (years)	0.004	0.000	0.0350	0.0018
female	-0.037	0.004	-0.3048	0.0352
legal	0.036	0.004	0.2758	0.0335
task-fruit&nuts	-0.040	0.005	-0.4057	0.0382
task-horticulture	0.065	0.006	0.4883	0.0485
task-vegetables	-0.051	0.005	-0.4409	0.0394
English skill	0.023	0.002	0.2192	0.0165
supervisor	0.008	0.004	0.0668	0.0257
hired by contractor	0.191	0.017	1.8309	0.0327
other variables				
rho	-0.7385	0.0596	-0.9152	0.0069
sigma	0.1879	0.0027	1.5204	0.0223
lambda	-0.1388	0.0120	-1.3914	0.0256
n	38362		38362	
pseudolikelihood	=	-640	=	-73653
Wald chi2(135)	=	52003	=	33185

Note: field crop work is excluded from the estimation

Table 4 Empirical results (II)--selection equation
(Dependent variable: dummy variable equals one if worker is hired by contractors)

| | Semi-Log | | Linear | |
variable	coefficient	standard error	coefficient	standard error
legal	-0.1128	0.0307	-0.0827	0.0273
English skill	-0.1898	0.0152	-0.1866	0.0132
task-fruit&nuts	0.3321	0.0304	0.3187	0.0261
task-horticulture	-0.8556	0.0832	-0.6264	0.0539
task-vegetables	0.3487	0.0316	0.3326	0.0285
education (years)	-0.2130	0.0176	-0.1833	0.0153
farm work experience (years)	-0.1379	0.0110	-0.1362	0.0089
female	0.0324	0.0335	0.0651	0.0281

Figure 1 Quality adjusted wages for U.S. farm worker by region
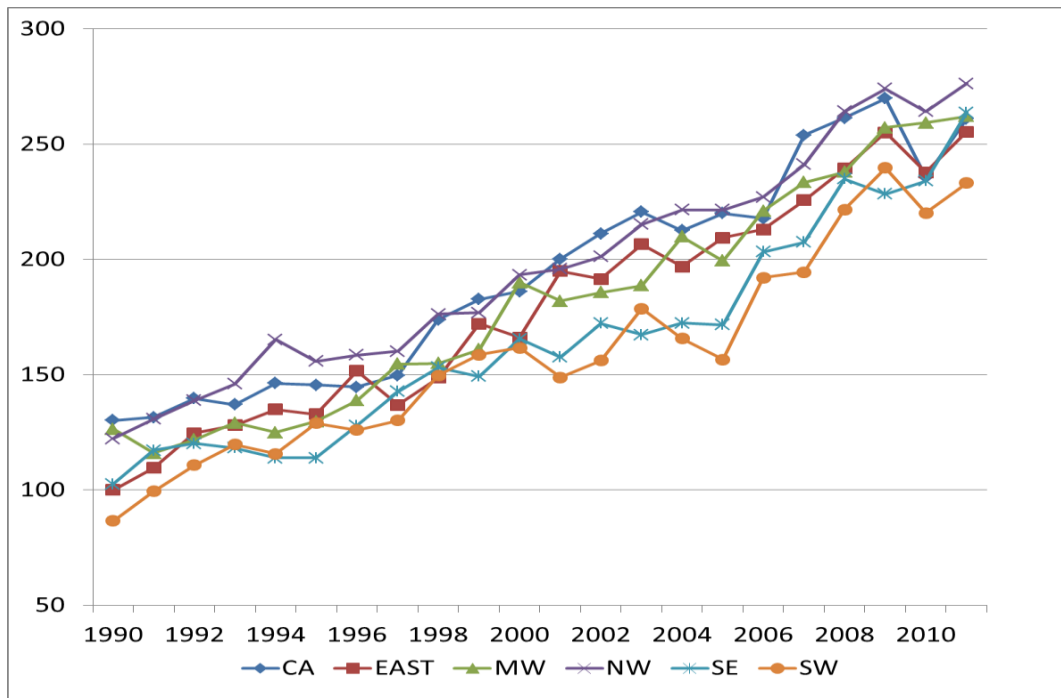
Sources: by authors.
Notes: CA: California; East: includes states ME, NH, VT, NY, MA, CT, PA, NJ, DE, MD, WV, VA, KY, TN, and NC; MW: Midwest, includes states ND, SD, NE, KS, MN, IA, and MO; NW: Northwest, includes states WA, OR, ID, MT, NV,WY, CO, and UT; SE: Southeast, includes states AR, LA, MS, AL, GA, FL, and SC; SW: Southwest, includes states AZ, NM, TX, and OK.

V. Concluding Remarks

This paper uses new preliminary data to provide more current evidence on the farm workers' wage determinants with a focus on the workers' legal status. The preliminary results show that while legal status did contribute significantly to the wage differences it is not the major factor. Also, after taking account of the composition shift in demographic characteristics, the quality adjusted labor prices still doubled in the past two decades. This study will provide more information on the shadow value of workers' authorized legal status based on a hedonic framework. This information could be applied to further analysis in identifying the impact of immigrant reform or regulations on farm production cost as well as the labor market. The results may generate considerable interest and discussion given that the U.S. farm production has relied on both authorized and unauthorized workers in the last few decades.

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