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The effect of continuing education participation on outcomes of male and female agricultural workers in the USA

Anita Alves Pena*

Department of Economics, Colorado State University, Fort Collins, Colorado, USA

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Job training and employment assistance programs aim to assist migrant and seasonal farmworkers and their dependents locate steady employment and develop job skills. This study investigates effects of educational programs on wages, annual time allocations, and poverty of male and female farmworkers and their families using regression analysis in comparison to propensity score matching. Continuing education participation is found to be associated with higher wages, though variation across program types is large and magnitudes across genders matter. Program participation is positively related to work weeks, and negatively related to weeks abroad and to poverty incidence.

Keywords: adult education; farmworkers; gender; migrant education; returns to education; time allocations; poverty

JEL codes: I21; I32; J43

Introduction

The public workforce investment system is an intergovernmental network aimed at providing labor force-related business assistance. The system consists of state and local workforce investment boards, local One-Stop Career Centers that facilitate employer and employee matching and training programs, and activities targeting specific populations such as youth, Veterans, Native Americans, and farmworkers. Among these initiatives is the National Farmworker Jobs Program (NFJP), a job training and employment assistance program for migrant and seasonal farmworkers and their dependents.[1] The Economic Opportunity Act of 1964 established the NFJP, and the Workforce Investment Act of 1998 currently authorizes it (U.S. Department of Labor, Employment and Training Administration 2009b). The stated goals of this program include assisting migrant farmworkers increase their 'economic stability' by steadying agricultural employment and by helping in the development of skills that can be used in complementary occupations (e.g. during off-seasons).

Migrant farmworkers have historically been among the poorest members of the working class in the USA. In fact, the US Department of Labor, in its Farm Labor Fact Book concluded that, 'The migrant farmworker occupies the lowest level of any major group in the American economy' (1959, 110). Fifty years after this publication, descriptions of impoverished conditions for this largely immigrant population are still relevant. Few studies in agricultural labor economics, however, have focused on how educational programs targeting migrant and seasonal workers affect outcomes within

*Email: anita.pena@colostate.edu

this population. Understanding links between continuing education participation and worker outcomes for both immigrant and US-born workers contributes to the very limited academic literature on migrant education programs and is important for establishing benefits and costs for strategic planning exercises pertaining to future workforce investments related to those in the farm economy.

The aim of this research is to quantify the extent to which farmworker participation in continuing adult education programs, such as in the types of programs facilitated by NFJP, results in measurable improvements in various economic indicators. Analysis here draws from a large nationally representative survey of employed US farmworkers, and empirical methodology relies on regression analysis in contrast to propensity score matching. While impossible to completely eliminate the effect of differences between treatment and control subjects, the empirical methods act to minimize bias in nonexperimental settings relying on survey data. Key covariates include demographic and work-related characteristics of individual workers and regions and year of observation. The nationally and regionally representative data used here include direct information on legal status (including undocumented status), which are important controls that otherwise would be omitted in studies of highly immigrant (and often undocumented) populations such as this one. Identification of the effect of adult education on worker outcomes relies on the importance of these observable characteristics in the self-selection decision into continuing education program participation.

Results suggest that education participation is associated with higher wages all else equal, though variation of returns across individual programs is large and gender differentials are found in terms of magnitudes. Program participation is found to be positively related to annual weeks worked in agricultural and nonagricultural occupations and negatively related to weeks spent outside of the USA and to poverty. In addition to wage and poverty outcomes, annual time allocations of workers can shed light on the effectiveness of programs such as NFJP at achieving their goals of improving the 'economic stability' of agricultural employment. This relates to the permanence of the highly immigrant and highly mobile farm workforce and therefore is directly relevant to discussions of recent agricultural labor and immigration policy proposals.

The rest of this paper is organized as follows. The literature on private and social returns to education broadly is noted in the next section. This is followed by a detailed description of the available farmworker data that are used here, a discussion of each of the empirical methods, and a presentation of key results. This paper concludes with discussion of relevance to public policy and of limitations to this study.

The effects of education on earnings

The existence of a positive, causal effect of education on earnings is well established in general labor economics. Card (1999) summarizes this literature starting with Mincer's (1974) model in which earnings are decomposed into an additive function of schooling, work experience, and a quadratic in work experience to allow for nonlinearities. One finding that Card stresses in his overview is that the marginal returns to schooling for certain 'disadvantaged' subgroups (due, for example, to family background or abilities) are higher than average marginal returns to education in the overall population. This result suggests that larger effects of education program participation on earnings may be found for farmworkers than for other more advantaged groups.[2]

The literature in public economics also has modeled education as developing human capital and future earnings ability. In addition, public finance has studied the role of

education as a redistribution mechanism for increasing social equality (e.g. Fernandez and Rogerson 1996). Education has been shown to generate a number of favorable externalities (in addition to private benefits), including increased economic growth rates and civic involvement, positive peer effects, and decreases in crime. This suggests that social returns to education may outweigh private ones.[3] Furthermore, failures in financial markets may prevent current and potential students from borrowing fully against future earnings in order to obtain costly education. Together, these findings support the role of government programs such as NFJP and others.

The extent to which farmworker assistance programs effectively achieve stated goals is relatively unknown, and official measures used for judging annual NFJP performance are limited. Specifically, measures used for annual reporting include percentages of farmworkers entering and retaining employment and average earnings among participants.[4] While these performance measures are useful for summarizing participation and postprogram employment rates and earnings, all three are unconditional statistics that do not control for changes in average worker characteristics and economic conditions, or for self-selection into NFJP participation. Workers, for example, may self-select into adult education enrollment in response to changes in their personal circumstances. In the context of farmworker continuing education programs serving highly immigrant populations, shocks therefore may include changes in family structure such as the distribution of family members between the USA and a country of origin, or may relate to changing immigration status and/or enforcement intensities. Furthermore, the composition of the aggregate farm workforce may change over time and tabulations of participants versus nonparticipants may vary with economic conditions and business cycles.

In contrast to the current official measures of the success of programs such as NFJP, this project examines outcome differentials between adult education participants and nonparticipants (treatment and control groups) within agricultural labor markets using techniques from the econometrics of program evaluation (Heckman, LaLonde, and Smith 1999; Imbens 2004; Imbens and Wooldridge 2009) and comprehensive and nationally representative microeconomic data on farmworkers, their demographic characteristics, and education participation histories. Thus, in addition to contributing to an understudied academic research area within agricultural labor economics, this paper has practical significance by providing complementary evidence to what is currently reported for policy purposes.

Data

Data for this study come from the US Department of Labor's National Agricultural Workers Survey (NAWS), which is both a nationally and regionally representative survey of employed US farmworkers (for 12 agricultural regions with survey weights).[5] Survey respondents have been sampled from worksites in three seasons per year since 1989. The data are cross-sectional and are pooled for the analysis. This paper uses these data restricted to the 1993–2009 period as some detailed education participation questions are not asked in the earliest waves of the survey and the 2009 release is the most recent at the time of this writing. This restriction reduces the total sample size from 52,479 to 43,339 workers. The Department of Labor provides sample weights which are used throughout this paper. Incorporating these weights, 71.3% reports Mexican origins. Of the overall sample (which includes US-born workers), 48.8% indicates illegal US work status. Of Mexican immigrant workers, 64.7% indicates illegal status.[6]

US education participation in the NAWS

While participation in a NFJP-specific program is not directly identifiable in the data, NAWS includes data on whether workers have participated in English/ESL, citizenship, literacy, job training, general educational development (GED)/high school (HS) equivalency, college/university, adult basic education, Even Start, migrant education, or other classes while in the USA. Overall, 25.0% of farmworkers in the sample report having participated in at least one US education program. Table 1 shows participation rates by specific education program. More than 11% of farmworkers report participation in English or English as a Second Language (ESL) classes or school. The next most common education programs are HS equivalency (6.2%) and college or university classes (4.3%). Other education program participation rates are lower. Job training and migrant education categories are closest to specific opportunities offered through the NFJP, though overlap is likely to some extent in several categories.[7] Low participation rates overall across continuing education program categories are related to some extent to seasonality of work and participation in northward migrant streams as the agricultural season progresses. Only 15.9% of farmworker who report following the crop also report participation in any US education programs. This is in contrast to 27.2% of nonmigrant agricultural workers by this definition.

It can be hypothesized that optimal timing of educational investments may vary by gender due to differing family responsibilities, for example. Tabulations, therefore, are shown both for the overall sample, and for men and women separately, in Table 1. Notably, in terms of unconditional means, female farmworkers are more likely to participate in education programs overall (i.e. by the broadly defined 'any' category, for example). Specifically, almost 34% of women are program participants versus less than 23% of men. Women are also more likely to participate in *all* of the specific program categories. This indicates that allowing heterogeneous effects by gender may be important to the empirical analysis.

Summary statistics of demographic and work-related characteristics of participants and nonparticipants are presented in Table 2. On average and in addition to being more likely to be female, program participants are also different on other observable dimensions in comparison to nonparticipants. Particularly, participants are more likely to report greater years of education, work experience, and tenure with current employer,

Table 1. Farmworker US education participation rates, by program (percentage).

	Overall	Men	Women
English/ESL	11.22	10.69	13.16
Citizenship	1.76	1.68	2.02
Literacy	0.10	0.10	0.11
Job training	2.09	1.98	2.49
GED, high school equivalency	6.17	5.26	9.49
College or university	4.33	3.53	7.26
Adult basic education	0.59	0.54	0.80
Even start	0.04	0.02	0.10
Migrant education	0.27	0.20	0.54
Other education program	2.28	1.96	3.43
Any education program	25.02	22.61	33.85
Observations	43,287	35,249	8036

Notes: Author's calculations, NAWS, 1993–2009. Statistics are survey weighted.

Table 2. Mean demographic characteristics, by US education participation status.

	Overall		Men		Women	
	Particip.	Nonparticip.	Particip.	Nonparticip.	Particip.	Nonparticip.
Female (%)	28.99	18.76				
Age (years)	32.78	32.73	32.66	32.33	33.09	34.45
Education (years)	9.40	6.65	9.19	6.52	9.93	7.20
Has spouse in the USA (%)	45.28	33.47	42.06	27.60	53.17	58.87
Children in the USA (number)	0.91	0.65	0.80	0.50	1.17	1.32
Farm experience (years)	11.15	9.14	11.79	9.31	9.56	8.43
Tenure (years)	5.19	3.92	5.41	3.85	4.64	4.23
US-born (%)	41.28	15.55	38.36	13.14	48.43	25.97
Naturalized citizen (%)	7.39	2.78	7.49	3.02	7.14	1.74
Green card (%)	24.05	22.51	25.04	21.55	21.62	26.64
Other authorization (%)	2.31	1.27	2.03	1.25	3.02	1.32
Illegal (%)	24.97	57.90	27.08	61.03	19.79	44.33
Speaks English (%)	61.19	21.89	59.52	19.93	65.29	30.38
Reads English (%)	57.42	19.50	55.68	17.29	61.68	29.07
Mexican (%)	54.42	78.62	56.98	80.83	48.15	69.06
Central American (%)	2.17	3.33	2.23	3.24	2.01	3.73
Puerto Rico (%)	0.94	1.54	1.11	1.79	0.52	0.45
Field Crops (%)	16.60	16.93	20.42	19.05	7.23	7.74

(*Continued*.)

Table 2. (*Continued*.)

	Overall		Men		Women	
	Particip.	Nonparticip.	Particip.	Nonparticip.	Particip.	Nonparticip.
Fruit (%)	27.22	35.04	27.77	35.51	25.87	33.02
Horticulture (%)	23.79	14.29	19.04	12.36	35.45	22.64
Vegetables (%)	23.19	27.98	23.03	26.92	23.59	32.59
Misc. (%)	9.03	5.69	9.53	6.10	7.81	3.92
Preharvest (%)	18.28	20.29	16.81	19.82	21.87	22.32
Harvest (%)	21.81	33.16	23.63	34.92	17.35	25.53
Postharvest (%)	15.17	11.44	11.70	8.96	23.66	22.19
Semi-skill (%)	23.59	20.87	27.79	22.38	13.32	14.30
Supervisor (%)	0.27	0.13	0.28	0.14	0.24	0.09
Other task (%)	20.88	14.12	19.79	13.78	23.56	15.57
California (%)	24.17	35.71	25.01	35.43	22.12	36.93
East (%)	14.29	16.82	14.90	18.41	12.80	9.93
Southeast (%)	11.41	13.86	11.24	13.84	11.83	13.96
Midwest (%)	24.72	16.28	23.97	14.95	26.57	22.03
Southwest (%)	7.97	7.38	8.13	7.48	7.58	6.93
Northwest (%)	17.44	9.95	16.76	9.89	19.11	10.22
Observations	10,126	31,226	7728	26,026	2398	5200

Notes: Author's calculations, NAWS, 1993–2009. Statistics are survey weighted.

to be married with a spouse residing in the USA, and to have more children present in the USA.

Survey data distinguish naturalized citizens, Green Card holders, those with other work authorization (e.g. temporary visas), those who are illegally working within the USA, and those who are US-born. Education program participants are more likely to be US-born or legal immigrants (in each category) and to be of higher English language proficiency, while nonparticipants are more likely undocumented and have lower levels of self-reported English ability. Further patterns are evident by crop, task, and region of US farm work. Specifically, participants are less likely than nonparticipants to be working fruit and vegetable crops, to be harvest workers, and to be surveyed in California.[8] Differences are statistically significantly different at the 1% significance level in each category with the exceptions of Green Card holders (significant at the 5% level), field crops (significant at the 10% level), and southwest (not significant).

Important differences hold across genders. Particularly, female farmworkers are more likely to have a spouse present in the USA than are male farmworkers overall across participation statuses. However, female participants in education programs are less likely to have a spouse present in the USA than are female nonparticipants, but the opposite pattern is observed among male participants and nonparticipants. Female farmworkers are also more likely to report higher numbers of children present in the household, and this is magnified for female nonparticipants relative to participants in contrast to what is observed for males. This further suggests that family responsibility differences by gender are important to control for in empirical analysis and that family structure is important to the choice to participate in adult education programs. There are also some notable reversals in terms of means across some other variables by gender (e.g. Green Card holders, field crops, semi-skill, and eastern workers).

Economic outcome variables in the NAWS

Worker outcomes of interest include differentials in wages, annual weeks worked and spent abroad, and annual incomes between those reporting participation and nonparticipation in the various US educational program categories. Because a large fraction of agricultural workers are paid piece rates (i.e. wages based on output) instead of time rates (i.e. wages based on time input), hourly equivalent wages are constructed for piece rate workers based on survey questions indicating how much a worker (and his or her crew if applicable) was paid on average for each unit of output (e.g. box, bin, etc.) and how many units were produced in an average day, along with crew size information. These hourly equivalent piece rate wages are then comparable with hourly rates reported by other workers.[9] Figure 1 depicts farmworker wages in treatment and control groups, which are based on whether or not the worker reports participation in US education programs broadly defined to include several program types. Specifically, a worker is classified as a participant if he or she reports any of the education programs described in Table 1.[10]

Notably, real wages conditional on participation (adjusted to 2009 dollars to match the most recent data available[11]) take a U-shaped pattern in the early part of the series and are increasing thereafter. Figure 1 illustrates that the raw wage gap, unconditional on controls, between participants and nonparticipants ranges over the sample period from −$0.01 (1994) to $1.67 (2006) in real 2009 dollar terms. This difference thus is as great as 20%.

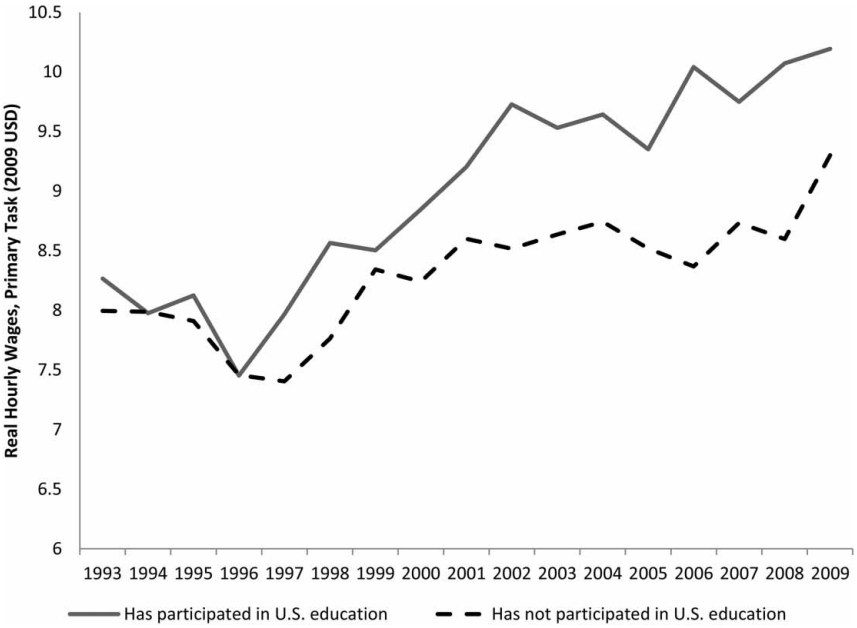

Figure 1. Average farmworker real wages, by US education participation.
Note: NAWS, 1993–2009.

In terms of wages, there is a distinct breakpoint after which a wage gap between those participating and not participating in programs becomes evident.[12] There are several exogenous explanations of this pattern in dynamics. This breakpoint occurs in the mid-1990s and corresponds to several public policy changes including fundamental welfare reform (the Personal Responsibility and Work Opportunity Reconciliation Act), increases to minimum wages, legislative initiatives such as the Workforce Investment Act, and immigration-related reforms. This timeframe also corresponds to more positive macroeconomic conditions than in other parts of the series.

Figures 2 and 3 illustrate weeks worked per year in agriculture and outside of agriculture, respectively.[13] Like the wage plot, positive differences in agricultural work weeks between program participants and nonparticipants are evident in the latter half of the period (Figure 2). Positive differences are also seen for nonagricultural work weeks between participants and nonparticipants (Figure 3). Differences are also observable in terms of annual weeks spent abroad (not shown), with participants spending fewer weeks outside of the country on average than nonparticipants in each of the sample years. These figures together indicate significant differences in time allocation patterns that are important to the economic stability of workers and their employers, and for understanding attachment to the US labor force.

As a final illustration, Figure 4 shows the percentages of farmworkers with annual family incomes below US poverty thresholds. Workers are matched to relevant thresholds based on their reported family sizes and particular survey year, and therefore this figure is conditional on these factors only. Overall, poverty incidence among families whose household head participated in continuing education programs is less than that for families whose household head did not participate. This is suggestive of positive returns of education on a poverty dimension as well. This pattern generally

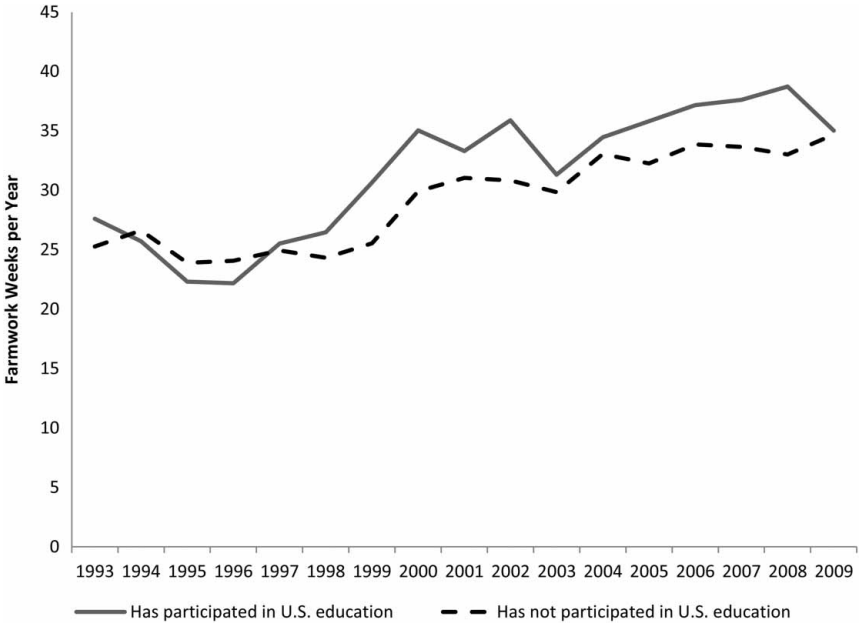

Figure 2. Average annual farm work weeks, by US education participation.
Note: NAWS, 1993–2009.

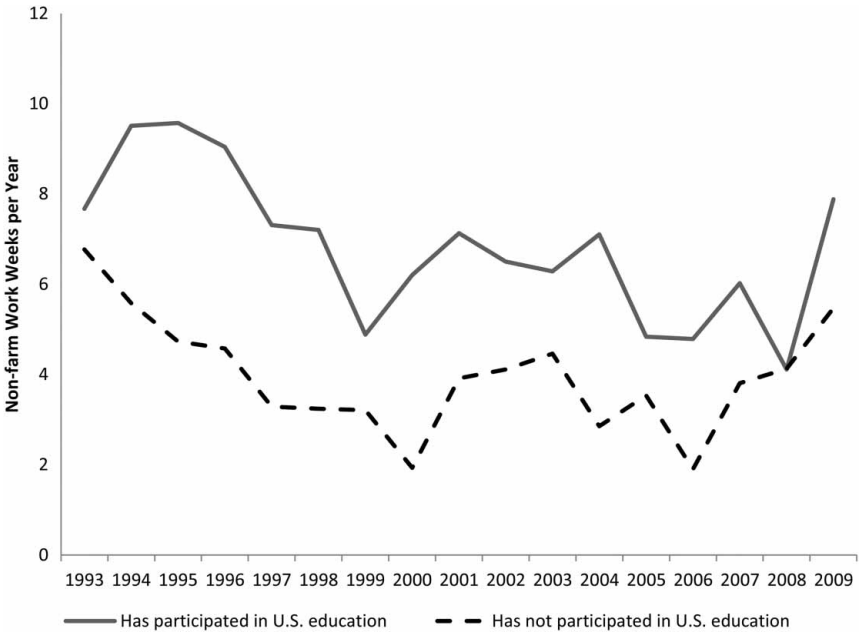

Figure 3. Average annual nonfarm work weeks, by US education participation.
Note: NAWS, 1993–2009.

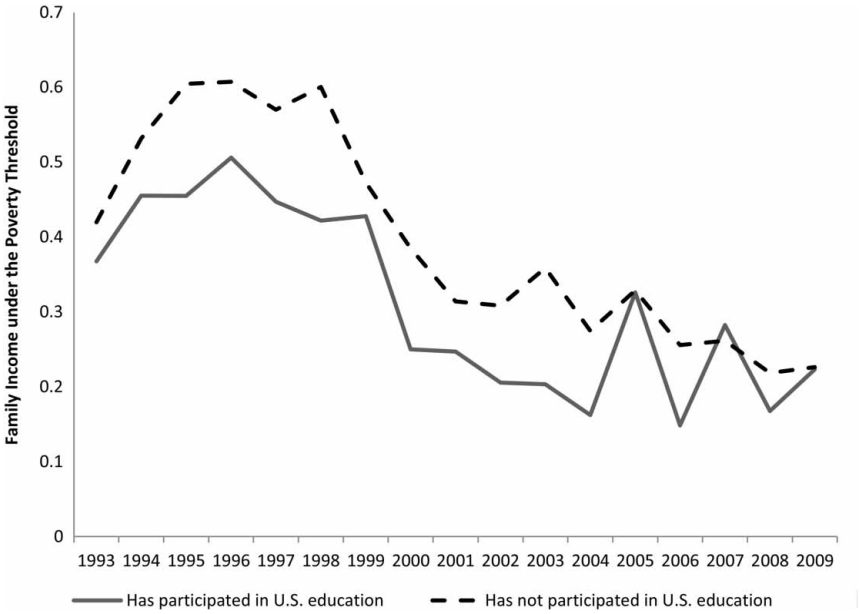

Figure 4. Family incomes below poverty thresholds, by US education participation.
Note: NAWS, 1993–2009.

persists across survey years though data (albeit noisy) toward the end of the series suggests that the gap may be closing.

Empirical framework

With the exception of family size in the poverty figure (Figure 4), the summary statistics presented do not account for differences in observable characteristics between workers who participate and those who do not.

In order to control for the differences noted in Table 2, the empirical analysis starts with regression estimation and follows with propensity score matching models[14] for comparison. Both parametric multivariate regression analysis and semi-parametric techniques such as propensity score matching (which is based on balancing observable characteristics in the data) are useful for addressing selection bias due to observable characteristic differentials. The wide range of available control variables (including indicators of workers' legal status categories) in the NAWS data allow for the minimization of selection on these dimensions.

The basic econometric framework takes the general form:

$$y_i = \alpha\ \text{participate}_i + X_i\beta + \varepsilon_i, \tag{1}$$

where the dependent variable y_i represents a series of outcome variables, including natural log of hourly equivalent wage rates ($\ln(w_i)$), weeks worked in and outside of agriculture ($farm\_weeks_i$ and $nonfarm\_weeks_i$) and weeks spent outside of the USA ($weeks\_abroad_i$), and the probability of falling below the poverty threshold ($P(poverty_i)$). For this final variable, weighted average poverty thresholds by size of family and year from the US Census Bureau are used to construct an indicator variable

equaling one if the worker and his or her family's income is under the poverty threshold and equaling zero otherwise.

The variable participate$_i$ denotes whether a worker reports participation in the continuing education program of interest, and the statistical and economic significance of the parameter α is of particular interest. While baseline regressions define participation based on the use of any US education program and therefore incorporate an aggregate participation variable, extensions relax this grouping and allow for heterogeneity across individual program categories from Table 1 by incorporating several participation variables. Relaxing the assumption that all adult education programs can be lumped together is important since some programs available to farmworkers target different demographic groups and have different educational purposes.

The vector X_i includes nativity, legal status, and general demographic and work-related characteristics such as gender, age, education, experience, tenure, family structure, crop, task, geographic region of observation, and survey year.[15] Estimations for log wages and for annual week allocation variables are conducted by OLS regression in the base specifications. Poverty estimations, for which the dependent variable is binary, are conducted using Probit regression (and therefore the estimation is nonlinear in contrast to Equation (1)). Since the available data are cross-sectional and pooled, each worker is observed only once and therefore these models should be interpreted as static.[16]

Propensity score matching

An alternate method to determine effects of participation is to match workers based on a measure of their observed characteristics (propensity score). Propensity score matching has become increasing popular in the recent empirical literature because it relies on fewer distributional assumptions than traditional parametric methods (Heckman, LaLonde, and Smith 1999; Dehejia and Wahba 2002). While the core assumptions of OLS and propensity score matching can be viewed as analogous since both methods are based on exploiting variation in observable characteristics (and thus on controlling for selection based on observables), matching methods are attractive because they relax other assumptions implicit in OLS relating to the specification of the model. An advantage of propensity score matching over OLS is that it allows for the researcher to control weighing and therefore the overlap between treatment and control subjects (Cobb-Clark and Crossley 2003).

Consider, for example, the propensity to participate as an unobserved latent variable:

$$\text{participate}_i^* = z_i\gamma + u_i, \tag{2}$$

where the treatment decision rule is $\text{participate}_i = \begin{cases} 1 \text{ if participate}_i^* > 0 \\ 0 \text{ otherwise} \end{cases}$.

By definition, the average treatment *on the treated* is as follows:

$$E(y_{i1} - y_{i0}|\text{participate}_i = 1) = E(y_{i1}|\text{participate}_i = 1) - E(y_{i0}|\text{participate}_i = 1), \tag{3}$$

where $E(y_{i1}|\text{participate}_i = 1)$ and $E(y_{i0}|\text{participate}_i = 1)$ are the actual and counterfactual average outcomes for the cases that participants did and did not receive treatment (i.e. did or did not participate). Estimation here, therefore, requires finding an estimate for the counterfactual average outcomes, $E(y_{i0}|\text{participate}_i = 1)$.[17]

The first step of the general propensity score technique is to estimate an equation similar to Equation (2). The propensity score is then the predicted value of the dependent variable (wages, weekly time allocations, and poverty are taken in turn). The second step is to examine the effect of US adult education participation on outcomes by matching treatment and control variables based on their propensity scores (here, calculated by Probit) and creating the counterfactuals. To construct these counterfactuals, matching is performed in this paper based on both individual neighborhood (observations that can be ranked close together) and based on smooth weighting (i.e. 'kernel matching' that is based on an assumed population distribution, here Gaussian). For the case of nearest-neighborhood matching, the estimation procedure takes treated observations individually and matches them (with replacement) to the control observations by minimizing differences in propensity scores. Differences are then calculated between values of outcome variables for the treatment and control observations which have been matched. These differences are then averaged over all matches. The kernel matching estimation procedure is similar with the exception that treatment observations are matched with a weighted average of the set of control observations based on the assumed population distribution as opposed to individual observations with similar propensity scores. The weights used here are inversely proportional to propensity score differentials across the treatment and control groups (Becker and Ichino 2002).

A primary assumption of propensity score matching is that of unconfoundedness. Unconfoundedness refers to a property that the conditional distribution of the outcome variable for participants is the same as the distribution of the outcome variable for nonparticipants given the other covariates. Unconfoundedness is, therefore, an assumption regarding statistical independence (Caliendo and Kopeinig 2008). An implication of this assumption is that treatment and control observations like propensity scores are thought to differ only in the error term from the propensity score equation. An advantage of this methodology, therefore, is that it should approximate a randomized controlled experiment without imposing the additional parametric assumptions of OLS.

Results

Results from the two methodologies are presented in turn.

OLS and Probit regression

OLS estimates of the effects of continuing education program participation on hourly and hourly equivalent farmworker wages in Equation (1) are presented in Table 3. The effect of participation, broadly defined to include any US education program, is found to be on the order of 2% by this empirical method (columns (1)–(3)). Coefficients in the wage equations follow intuition. Female farmworkers earn less all else equal than do male farmworkers. Those with more education, experience, and tenure with employer accrue wage premiums. Relative to US-born workers, those of legal status groups (naturalized citizens, those with Green Cards, those with other work authorization, and undocumented workers) receive lower wages controlling for demographic and job specific characteristics and wages are increasing in self-reported English language-speaking ability (though some of these patterns are not statistically significant at conventional levels for the smaller sample of women as a subgroup).

Table 3. Farmworker education program participation and log(wages).

	Overall (1)	Men (2)	Women (3)	Overall (4)	Men (5)	Women (6)
Participate (any)	0.0220***	0.0225***	0.0156*			
	(0.00511)	(0.00601)	(0.00907)			
English/ESL				0.0155**	0.0114*	0.0224*
				(0.00605)	(0.00688)	(0.0121)
Citizenship				0.0465***	0.0499***	0.0302
				(0.0152)	(0.0168)	(0.0327)
Job training				0.0228*	0.0388***	−0.0282
				(0.0123)	(0.0144)	(0.0224)
GED/HS				0.00260	0.00323	−0.00567
				(0.00894)	(0.0113)	(0.0137)
College/university				0.0828***	0.100***	0.0490***
				(0.0129)	(0.0172)	(0.0187)
Other US classes				−0.0167	−0.0159	−0.0176
				(0.0101)	(0.0123)	(0.0176)
Female	−0.0729***			−0.0727***		
	(0.00560)			(0.00559)		
Age	0.00846***	0.00861***	0.00793***	0.00809***	0.00839***	0.00743***
	(0.00109)	(0.00122)	(0.00230)	(0.00110)	(0.00123)	(0.00233)
Age squared	−0.000108***	−0.000112***	−9.65e−05***	−0.000105***	−0.000111***	−9.11e−05***
	(1.34e−05)	(1.50e−05)	(2.89e−05)	(1.35e−05)	(1.51e−05)	(2.93e−05)
Education	0.00734***	0.00706***	0.00724***	0.00662***	0.00635***	0.00647***
	(0.000839)	(0.000983)	(0.00139)	(0.000849)	(0.000991)	(0.00143)
Farm experience	0.00509***	0.00490***	0.00579***	0.00510***	0.00489***	0.00577***
	(0.000787)	(0.000957)	(0.00133)	(0.000786)	(0.000952)	(0.00134)
Experience squared	−0.000103***	−9.22e−05***	−0.000152***	−0.000102***	−9.01e−05***	−0.000150***
	(1.76e−05)	(2.05e−05)	(3.28e−05)	(1.76e−05)	(2.05e−05)	(3.27e−05)
Tenure	0.00819***	0.00804***	0.00821***	0.00816***	0.00800***	0.00810***
	(0.000501)	(0.000538)	(0.00123)	(0.000499)	(0.000536)	(0.00123)
US spouse	0.0448***	0.0586***	0.0144*	0.0451***	0.0593***	0.0139*

(*Continued*.)

Table 3. (*Continued*.)

	Overall (1)	Men (2)	Women (3)	Overall (4)	Men (5)	Women (6)
	(0.00500)	(0.00656)	(0.00802)	(0.00499)	(0.00650)	(0.00801)
US children	0.00292	0.000663	0.00300	0.00331	0.000849	0.00360
	(0.00249)	(0.00344)	(0.00326)	(0.00249)	(0.00342)	(0.00326)
Naturalized citizen	−0.0354***	−0.0365***	0.00779	−0.0326***	−0.0312**	0.00640
	(0.0118)	(0.0127)	(0.0352)	(0.0121)	(0.0130)	(0.0367)
Green card	−0.0697***	−0.0659***	−0.0541	−0.0571***	−0.0489***	−0.0513
	(0.0136)	(0.0151)	(0.0346)	(0.0138)	(0.0153)	(0.0358)
Other authorization	−0.109***	−0.0900***	−0.131***	−0.0935***	−0.0721***	−0.124***
	(0.0174)	(0.0202)	(0.0390)	(0.0176)	(0.0205)	(0.0406)
Illegal	−0.0796***	−0.0738***	−0.0667*	−0.0669***	−0.0568***	−0.0633*
	(0.0151)	(0.0171)	(0.0359)	(0.0153)	(0.0171)	(0.0371)
Speaks English	0.0196*	0.0257**	0.000381	0.0217**	0.0268**	0.00463
	(0.0108)	(0.0122)	(0.0205)	(0.0108)	(0.0122)	(0.0207)
Reads English	0.00786	0.0104	−0.00435	0.00947	0.0123	−0.00231
	(0.0112)	(0.0126)	(0.0222)	(0.0111)	(0.0126)	(0.0226)
From Mexico	0.0637***	0.0692***	0.0159	0.0565***	0.0607***	0.0117
	(0.0121)	(0.0127)	(0.0344)	(0.0122)	(0.0128)	(0.0357)
From Central America	0.0929***	0.0913***	0.0650	0.0852***	0.0830***	0.0587
	(0.0148)	(0.0160)	(0.0396)	(0.0150)	(0.0160)	(0.0408)
Observations	40,217	32,817	7400	40,217	32,817	7400
R^2	0.436	0.434	0.464	0.438	0.437	0.466

Notes: Author's calculations using survey weights, NAWS, 1993–2009. Robust standard errors in parentheses. Crop, task, region, and year dummies and a constant term are included.
*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

The magnitude of the OLS estimates of wage differentials between continuing education program participants and nonparticipants is worth comparing to that indicated in Figure 1. There, it was noted that wage differences ranged roughly from 0% to 20% across these categories depending on the year of observation. By OLS, it is found that controls (including year effects) reduce this difference to about one and a half percent for women to two and a quarter percent for men. Thus, despite the statistical significance of these results, the economic magnitude of the effects of educational programs for the population of US farmworkers appears small when observable factors are taken into account.

Regression results presented in columns (4)–(6) of Table 3 allow for heterogeneous correlations between wages and specific program categories. Positive and significant wage effects of participation are concentrated among English language, citizenship, job training, and college and university level study with notable variation across these categories. College or university courses are found to be associated with 5% to 10% higher wages, followed by citizenship classes (approximately 5%) and job training (2–4%). Therefore, the effects of some individual programs are found to be larger than what is observed using the any participation variable.

Some returns are found to be gender specific with women receiving lower returns on any participation than men. For example, using the any participation variable, men are observed to receive 2.3% higher wages when they participate in comparison to a return of only 1.6% for women (columns (2)–(3)). When participation is separated by type of program (columns (5)–(6)), only English/ESL training and college/university participation carries a statistically significant return for women. In the case of English language classes, women earn higher returns than men all else equal (2.2% versus 1.1%). For college and university, men earn the higher returns (10.0% versus 4.9%). Returns for citizenship and job training activity that are observed for the overall sample and for men are not likewise seen for women in this sample.

Results for the effects of continuing education program participation on weeks worked within and outside of agriculture and on weeks spent outside of the USA are presented in Table 4. Panel A gives results from regressions where education participation is defined broadly as participation in any type of program. Panel B presents the disaggregated results by specific continuing education program. In both cases, results are allowed to differ across men and women, and these results are presented in comparison to those for the overall sample.

Due to the seasonal nature of many agricultural tasks, there is a natural limit to increases in agricultural work weeks on an annual basis and therefore limits to improvements in the NFJP goal of ‘economic stability’ for workers measured via this time allocation variable alone. Farm work, therefore, is contrasted to nonfarm work and to time spent abroad. Education program participation across genders is found to be associated with approximately one more week in agricultural employment per year as well as an additional 1.3 weeks in nonfarm work overall. These weeks are offset by the approximate 2.7 fewer weeks spent abroad among participants over nonparticipants, and therefore the results can be interpreted in terms of time allocation substitution across these categories. These results suggest that continuing education programs do act to increase permanence in the USA and presence in farm work (thus helping to stabilize seasonal supply and minimize farm labor shortages). These factors are relevant to immigration policy debates given the highly immigrant composition of the farm labor force.

Variation, however, is notable across programs, and only English and ESL classes are consistent with this general pattern of statistical significance over all week

Table 4. Farmworker education program participation and annual week allocations.

	Farm			Nonfarm			Abroad		
	Overall (1)	Men (2)	Women (3)	Overall (4)	Men (5)	Women (6)	Overall (7)	Men (8)	Women (9)
Panel A									
Participate (any)	1.008***	1.451***	−0.459	1.346***	0.958***	2.169***	−2.708***	−3.076***	−1.402***
	(0.344)	(0.384)	(0.702)	(0.332)	(0.368)	(0.669)	(0.224)	(0.258)	(0.334)
Observations	41,346	33,749	7597	41,352	33,754	7598	41,352	33,754	7598
R^2	0.281	0.293	0.273	0.124	0.125	0.155	0.323	0.319	0.252
Panel B									
English/ESL	1.915***	2.358***	0.549	0.818**	0.698*	0.969	−2.997***	−3.542***	−1.180*
	(0.424)	(0.451)	(0.931)	(0.373)	(0.409)	(0.771)	(0.334)	(0.336)	(0.651)
Citizenship	−1.112	−1.718*	−0.930	1.775**	2.247**	0.581	0.200	0.0847	0.801
	(0.806)	(0.935)	(1.595)	(0.792)	(0.924)	(1.207)	(0.589)	(0.670)	(1.067)
Job training	1.513	1.033	1.704	0.644	0.665	0.237	−0.399	−0.0556	−0.643
	(0.933)	(1.070)	(2.022)	(0.807)	(0.903)	(1.585)	(0.355)	(0.443)	(0.459)
GED/HS	0.974	1.624**	0.0392	0.205	−0.445	1.647	−1.657***	−1.706***	−1.315***
	(0.593)	(0.680)	(1.113)	(0.623)	(0.681)	(1.230)	(0.319)	(0.401)	(0.418)
College/university	0.366	0.649	−0.948	1.168	0.436	2.453*	−0.535	−0.566	−0.406
	(0.863)	(1.027)	(1.528)	(0.865)	(1.036)	(1.470)	(0.388)	(0.502)	(0.431)
Other US classes	−1.381*	−1.289	−1.668	0.838	0.494	1.398	−2.270***	−2.294***	−2.078***
	(0.788)	(0.879)	(1.559)	(0.836)	(0.918)	(1.578)	(0.512)	(0.686)	(0.476)
Observations	41,346	33,749	7597	41,352	33,754	7598	41,352	33,754	7598
R^2	0.282	0.294	0.274	0.123	0.126	0.153	0.322	0.319	0.253

Notes: Author's calculations using survey weights, NAWS, 1993–2009. Robust standard errors in parentheses. Regressors as in other specifications included.
*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

allocation categories, thus suggesting that this category is driving the overall results. This indicates that employment returns are more concentrated than are returns associated with wages among certain program types and there are particular payoffs along this dimension associated with English language training. It is also important to note, however, that annual time allocation measures may reflect differences in choices made by individuals that are not related to education participation. As a result, the poorer fit by the goodness-of-fit R^2 statistics in Table 4 in comparison to Table 3, for example, is expected. Only about 27–29% of the variation in farm weeks is explained in Table 4 (and even less for nonfarm weeks per year) in comparison to 43–47% of the variation in wages in the models presented in Table 3.

When disaggregating by gender, it becomes clear that the farm weeks increase is experienced differentially with men increasing weeks worked in this category and women not seeing any statistically significant gains. US continuing education participation, however, is associated with increases in the number of *nonfarm* weeks worked by women, and this is experienced to a greater extent by women than by men. Participant women spend more than two additional weeks in nonfarm jobs, whereas men spend less than one additional week in this category of employment. This suggests that continuing education leads to increased work weeks overall across genders, though this is distributionally different across farm and nonfarm categories. Panel B suggests that the pattern for women in driven by college or university classes specifically.

Responses to educational participation in weeks spent abroad are also variable across gender with men more likely to experience larger magnitude declines in weeks out of the country (3.1 weeks versus 1.4 weeks, respectively, overall). This is also evident in several of the specific education program categories, particularly in terms of English/ESL, GED/HS equivalency, and the miscellaneous 'other US classes' category. This suggests that male attachment to the USA (and the US workforce) is heightened with continuing education participation, but this occurs to a lesser extent for women. This could be due to different starting values in terms of this type of attachment or in terms of previous participation in US continuing education programs. Neither of these factors, however, is directly observable in these data.

The effect of US continuing education participation on poverty status is modeled as a final outcome variable of interest in Table 5. For poverty, continuing education participants are found 3.5 percentage points less likely to be below the US poverty thresholds for their family sizes all else equal. Similarly, to effects on wages, the estimated effect, when controls are included, is muted in comparison to that suggested in Figure 4.

This effect is especially notable (order of 14 percentage points across genders), however, for those who participate in citizenship classes and second English and ESL classes (almost 6 percentage points) within the US relative to nonparticipants.[18] While these results carry over for the subgroup of men, statistically significant decreases in poverty at the household level for women engaged in US farm work are not evident overall (column (3)), but are evident for the English/ESL category (column (6)) though to a lesser magnitude than what is observed for men. Significant *increases* in family poverty are seen for job training for women, which is notable given that wage differences in Table 3 are statistically insignificantly different from zero for this category for women as are annual week allocations in Table 4. Differences, therefore, may be due to weekly hours worked (as opposed to weeks worked) by female education program participants, or may be related to the smaller sample size for women

Table 5. Farmworker education program participation and *P*(poverty).

	Overall (1)	Men (2)	Women (3)	Overall (4)	Men (5)	Women (6)
Participate (any)	−0.0353***	−0.0403***	−0.0341			
	(0.0130)	(0.0143)	(0.0247)			
English/ESL				−0.0559***	−0.0622***	−0.0582*
				(0.0156)	(0.0148)	(0.0352)
Citizenship				−0.144***	−0.175***	−0.0450
				(0.0279)	(0.0303)	(0.0588)
Job training				0.0167	−0.0345	0.142**
				(0.0313)	(0.0358)	(0.0642)
GED/HS				0.00861	0.00659	0.00614
				(0.0227)	(0.0280)	(0.0390)
College/university				0.0452	0.0849	−0.0202
				(0.0410)	(0.0541)	(0.0485)
Other US classes				0.0218	0.0366	−0.0243
				(0.0301)	(0.0362)	(0.0544)
Female	−0.00262			−0.00287		
	(0.0147)			(0.0147)		
Age	−0.0240***	−0.0158***	−0.0421***	−0.0235***	−0.0149***	−0.0427***
	(0.00268)	(0.00289)	(0.00676)	(0.00270)	(0.00290)	(0.00677)
Age squared	0.000285***	0.000204***	0.000460***	0.000280***	0.000193***	0.000469***
	(3.29e−05)	(3.46e−05)	(8.98e−05)	(3.28e−05)	(3.46e−05)	(8.97e−05)
Education	−0.00871***	−0.00742***	−0.0152***	−0.00939***	−0.00821***	−0.0152***
	(0.00203)	(0.00226)	(0.00403)	(0.00208)	(0.00231)	(0.00409)
Farm experience	−0.0159***	−0.0205***	−0.00885**	−0.0159***	−0.0204***	−0.00876**
	(0.00201)	(0.00245)	(0.00385)	(0.00201)	(0.00245)	(0.00386)
Experience squared	0.000339***	0.000399***	0.000278***	0.000340***	0.000402***	0.000274***
	(4.35e−05)	(5.09e−05)	(9.69e−05)	(4.34e−05)	(5.08e−05)	(9.67e−05)
Tenure	−0.0142***	−0.0142***	−0.0161***	−0.0141***	−0.0141***	−0.0159***
	(0.00121)	(0.00132)	(0.00286)	(0.00121)	(0.00132)	(0.00286)
US spouse	−0.193***	−0.130***	−0.340***	−0.191***	−0.126***	−0.339***
	(0.0127)	(0.0144)	(0.0223)	(0.0127)	(0.0143)	(0.0223)

(*Continued*.)

Table 5. (*Continued*.)

	Overall (1)	Men (2)	Women (3)	Overall (4)	Men (5)	Women (6)
US children	0.140***	0.138***	0.135***	0.140***	0.138***	0.135***
	(0.00561)	(0.00685)	(0.00926)	(0.00566)	(0.00696)	(0.00928)
Naturalized citizen	0.126***	0.101***	0.111	0.160***	0.144***	0.120
	(0.0323)	(0.0364)	(0.0739)	(0.0329)	(0.0373)	(0.0755)
Green card	0.0791**	0.0348	0.121	0.0811**	0.0390	0.124
	(0.0377)	(0.0423)	(0.0785)	(0.0382)	(0.0432)	(0.0799)
Other authorization	0.0752	0.0552	0.0182	0.0810	0.0668	0.0257
	(0.0565)	(0.0595)	(0.127)	(0.0569)	(0.0604)	(0.128)
Illegal	0.140***	0.101**	0.178**	0.144***	0.110**	0.180**
	(0.0389)	(0.0443)	(0.0810)	(0.0394)	(0.0445)	(0.0828)
Speaks English	−0.0443*	−0.0825***	0.0974	−0.0427	−0.0795***	0.0945
	(0.0261)	(0.0214)	(0.0771)	(0.0268)	(0.0215)	(0.0789)
Reads English	−0.0363	−0.0208	−0.127*	−0.0414	−0.0253	−0.132*
	(0.0274)	(0.0249)	(0.0730)	(0.0276)	(0.0250)	(0.0729)
From Mexico	−0.118***	−0.112***	−0.0897	−0.0951***	−0.0840**	−0.0762
	(0.0333)	(0.0375)	(0.0722)	(0.0338)	(0.0380)	(0.0736)
From Central America	−0.157***	−0.151***	−0.176***	−0.138***	−0.129***	−0.165**
	(0.0365)	(0.0419)	(0.0681)	(0.0385)	(0.0444)	(0.0710)
Observations	34,980	28,393	6587	34,980	28,393	6587

Notes: Author's calculations using survey weights, NAWS, 1993–2009. Robust standard errors are given within parentheses. Crop, task, region, and year dummies are included. Probit marginal effects reported.
*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

relative to men when disaggregated by continuing education program type, among other explanations.

Propensity score matching

To build intuition regarding attributes that are important for matching, Table 6 presents estimates of Probit marginal effects of various demographic and labor market characteristics on the probability that a worker participates in education program categories indicated by survey responses. Estimation results indicate that female gender, education, and years of previous farm work experience are positive, significant predictors of continuing education program participation. Age, on the other hand, is of statistical significance in the negative direction overall and for men as a subgroup.

Indicators of legal status also are of statistical and economic significance. Being US-born is the excluded category in Table 6. Marginal effects indicate that undocumented workers overall are 20.2 percentage points less likely to participate in US education programs all else equal. This is notable, but expected, since undocumented workers are excluded from participation by some program rules. NFJP assistance, for example, is contingent on being a US citizen, a lawfully admitted permanent resident, or a person with other employment authorization. English language ability and Mexican or Central American origin also are highly and positively correlated with adult education participation, as is the number of children in the household (though this is statistically indistinguishable from zero for women in the sample). These differentials may relate to targeting initiatives associated with available programs.

Matching is based on the covariates in Table 6 over the common support (i.e. matched observations are within sufficient levels of covariates to maintain positive probabilities of being in either participant or nonparticipant groups based on the continuing education programs of study). Propensity score matching requires that the propensity score equation be properly specified, and therefore to satisfy a series of balancing tests, to ensure minimal differences for each covariate used across treatment and control categories.[19]

Propensity score estimates for the five outcome variables of interest are presented in Table 7. Results follow general patterns identified by the regression techniques, though magnitudes of effects vary. The treatment effect of participation on wages, for example, is found to be 3.1% by the nearest-neighbor match technique and 3.6% by kernel matching respectively for the overall sample, and was similar for men as a subgroup. For women, wage differences were lower (around 2%) and were not statistically different from zero across participants and nonparticipants by the nearest-neighbor match technique (but were statistically significant by kernel matching). The propensity score estimation method is based on matching observable characteristics and therefore weighing treatment versus control observations, which differs from OLS and Probit regression, and therefore some differences in results are expected.

Results in Table 7 for annual farm work weeks, nonfarm work weeks, and weeks spent abroad also are consistent with results from the other methodologies with generally positive differences in work week categories and negative significant differences for weeks spent abroad though some magnitudes vary. There is suggestive evidence that female participants spend *fewer* weeks in farm work than their nonparticipant

Table 6. Determinants of farmworker education program participation (dependent variable: participation in any US classes or school).

	Overall (1)	Men (2)	Women (3)
Female	0.0476***		
	(0.0107)		
Age	−0.00659***	−0.00688***	−0.00289
	(0.00187)	(0.00195)	(0.00478)
Age squared	5.39e−05**	6.74e−05***	−1.81e−05
	(2.35e−05)	(2.43e−05)	(6.02e−05)
Education	0.0221***	0.0191***	0.0335***
	(0.00129)	(0.00131)	(0.00343)
Farm experience	0.00893***	0.00862***	0.00862**
	(0.00136)	(0.00148)	(0.00347)
Experience squared	−0.000161***	−0.000181***	−6.82e−05
	(3.12e−05)	(3.27e−05)	(9.15e−05)
Tenure	0.000391	0.000940	−0.00136
	(0.000748)	(0.000734)	(0.00227)
US spouse	−0.000839	0.00861	−0.0429**
	(0.00964)	(0.0103)	(0.0213)
US children	0.0113***	0.0124***	0.00261
	(0.00362)	(0.00379)	(0.00788)
Naturalized citizen	0.0862**	0.0598*	0.173*
	(0.0339)	(0.0341)	(0.0959)
Green card	−0.0930***	−0.0839***	−0.144**
	(0.0289)	(0.0302)	(0.0731)
Other authorization	−0.0267	−0.0345	−0.0259
	(0.0404)	(0.0392)	(0.105)
Illegal	−0.202***	−0.191***	−0.244***
	(0.0358)	(0.0403)	(0.0730)
Speaks English	0.129***	0.108***	0.204***
	(0.0191)	(0.0174)	(0.0555)
Reads English	0.107***	0.121***	0.0304
	(0.0202)	(0.0199)	(0.0555)
From Mexico	0.181***	0.152***	0.300***
	(0.0251)	(0.0258)	(0.0689)
From Central America	0.348***	0.325***	0.405***
	(0.0558)	(0.0639)	(0.0989)
Observations	41,352	33,754	7598

Notes: Author's calculations using survey weights, NAWS, 1993–2009. Robust standard errors in parentheses. Crop, task, region, and year dummies are included. Probit marginal effects reported.
*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

female counterparts, though this relationship is only statistically significant for one of the matching techniques. (It also was insignificant by OLS.)

Overall, participation is found to be associated with 1.2 (women) to 1.5 (men) fewer weeks abroad by propensity score matching in comparison to 1.4 and 3.1 weeks, respectively, by OLS. As differences in farm and nonfarm weeks are found to be muted by propensity score matching relative to OLS, the results, therefore, are suggestive of some bias in the OLS results that is related to functional form. Magnitudes of results for the poverty outcome overall are similar across OLS and propensity score specifications, however.

Table 7. Propensity score treatment effects of farmworker education program participation on worker outcomes.

	Log(wages)	Farm weeks	Nonfarm weeks	Weeks abroad	*P*(poverty)
Panel A: Overall					
Nearest-neighbor	0.031***	0.442	0.725***	−1.380***	−0.037***
	(0.006)	(0.271)	(0.171)	(0.167)	(0.009)
Kernel match	0.036***	0.612***	0.882***	−1.765***	−0.040***
	(0.004)	(0.222)	(0.152)	(0.087)	(0.006)
Panel B: Men					
Nearest-neighbor	0.031***	0.502*	0.738***	−1.454***	−0.028***
	(0.007)	(0.300)	(0.188)	(0.201)	(0.010)
Kernel match	0.038***	0.948***	0.586***	−1.936***	−0.045***
	(0.005)	(0.219)	(0.162)	(0.109)	(0.006)
Panel C: Women					
Nearest-neighbor	0.017	−0.457	1.394***	−1.176***	−0.031
	(0.011)	(0.620)	(0.402)	(0.309)	(0.019)
Kernel match	0.020**	−1.034**	1.835***	−0.949***	−0.026*
	(0.009)	(0.420)	(0.328)	(0.152)	(0.016)

Notes: Author's calculations using survey weights, NAWS, 1993–2009. Analytical standard errors are given within parentheses for the nearest-neighbor match method. Bootstrapped standard errors (50 repetitions) for the kernel match method.
*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

Discussion and conclusions

Evidence as to the effectiveness of US continuing education programs for increasing farmworker wages and propensities to secure agricultural and nonagricultural work and for avoiding poverty is limited to date. Hourly wage gains from participation are found here to be greatest when education participation is restricted to college and university, citizenship, and job training categories. This is notable given the presence of programs such as NFJP that aim to assist migrant farmworkers by steadying agricultural employment and by helping in the development of general skills that can be used in complementary occupations.

Propensity score matching results, which control for selection into participation on observable dimensions, suggest that US continuing education program participants earn approximately 3% higher wages all else equal and have roughly four percentage point lower propensities to fall below poverty thresholds in comparison to nonparticipants. This is in contrast to roughly 2% differentials in wages by OLS and approximately three and a half percentage point differences for probabilities of being in poverty by Probit analysis (methods which also allow for selection on observable characteristics but are less flexible in terms of specification). Significant differences in annual time allocations across participants and nonparticipant categories also are noted across estimation methodologies with evidence of participant workers spending more time in both farm and nonfarm employment and less time abroad in comparison to nonparticipants. Results of this paper overall, therefore, are consistent with farmworker educational opportunities increasing base wages and bettering employment options. Thus, this research provides evidence complementary to current program performance measures, which also note positive associations between continuing education program participation and worker outcomes.

Another important result is that gender matters. Specifically, statistically significant wage increases with participation overall are observed to be lesser for female farmworkers than for males. Annual weeks in farm work are similarly not increased for women but nonfarm employment weeks are (and this is to a greater magnitude than for men). In the absence of data on intensity of participation however, it is impossible to rule out (or confirm) that the intensive margin of participation varies across genders (i.e. whether or not certain genders participate in continuing education programs to different extents thereby relating to the results). Therefore, in the end, there are several possibilities as to the mechanism behind these patterns including, but not exclusive to, labor market discrimination.

This paper contributes to the understudied area of continuing education participation among migrant and seasonal workers. Still, several caveats remain. First, although nationally and regionally representative, the data used here correspond solely to employed US farmworkers, meaning that workers who participate in continuing education programs and then exit the agricultural labor market (or who exit during the course of participation) are not included in the survey. The extent of substitution from agricultural to nonagricultural work or to other pursuits therefore is muted in the empirical exercise.[20] By similar reasoning, effects of participation on wages and poverty propensities also are lower bounds. Furthermore, as alluded to above, the effect of US continuing education participation may vary from the intensive to the extensive margin. Given the binary nature of survey questions pertaining to education programs, it is impossible given current survey data to examine effects of extent and duration of participation by individual workers (and likewise effects of milestones such as certificates and diplomas which may introduce nonlinearities).

Another important shortcoming relates to the cross-sectional nature of the data. Although controls include basic demographic, job-related, nativity, and legal status characteristics, a compelling measure of prior earnings or wages is absent. If education participants are more or less likely to have prior labor market success than those who do not participate and controls for work-related characteristics are insufficient to capture true labor market success, impact estimates will suffer bias. Identification of the effect of continuing education participation in this paper, therefore, relies on the adequacy of controls for tenure, work experience, English language ability, legal status and other personal demographic characteristics, and for crop and task types, region, and year of current employment to capture relationships to prior wages. While regression and propensity score matching do offer advantages over unconditional statistical tabulations of group means, for example, selection into training programs on remaining unmeasured factors may bias both sets of presented estimates. Controlling for unobservables, in addition to observables, is an important area for future extension as expanded data collection and new empirical methodologies emerge.

Finally, this paper documents potential benefits of offering continuing education programs to US farmworkers. These benefits, however, accrue to workers and their families in the form of higher wages and reduced poverty outcomes. They also accrue to employers in the form of increased permanence of an often highly immigrant and highly mobile workforce (here measured in terms of an increase in weeks spent in US farm work and a reduction in weeks spent abroad). The results, therefore, indicate positive economic surplus to workers and growers, and relate to discussions of recent agricultural labor and immigration policy proposals which have concerned the stability of the domestic agricultural labor market in terms of supply and demand.[21] While this paper provides some evidence supporting the achievement of stated goals of the NFJP, whether or not the

benefits described here, when measured in terms of economic surplus, exceed the costs of the program is beyond this paper's scope. The Department of Labor (2009a) reports that for program year 2005, for example, $71.2 million was awarded through competitive grants. This is an area warranting further research and economic policy analysis.

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Notes

1. Complementary to this, the US Department of Education offers vocational rehabilitation, defined to include evaluation, counseling, mental and physical rehabilitation, training, work adjustment, job placement, and postemployment services to disabled farmworkers through its Migrant and Seasonal Worker Program. The Department of Education also administers a Migrant Education Program, which offers support services aimed to facilitate primary and secondary education of migrant children. State and local government and privately funded programs also exist in some areas.
2. In contrast, Chiswick (1988) finds that groups with higher education levels also have higher rates of return.
3. In their survey of social returns to education, Lange and Topel (2006) argue that many empirical studies of education externalities have suffered from statistical imprecision. While evidence is generally consistent with the absence of externalities in the negative direction, the authors note that precise estimation of positive externality magnitudes is an area warranting continued research.
4. Employment entry is calculated as the number of adult participants who are employed in the first quarter following exit (training completion or other departure from the program) divided by the number who exit during that quarter. Employment retention is the number employed in both the second and third quarters after exit divided by the number who exit during the quarter. Finally, average earnings are total earnings in the second and third quarters divided by the number who exit during the quarter.
5. The NAWS sampling procedure is based on four levels: region, crop reporting district, county, and employer with probabilities proportional to size at each level. NAWS uses 12 geographic regions based on USDA Quarterly Agricultural Labor Survey of farm employers. The public-use NAWS sample used here is collapsed to six regions. Additional information and public access data are available from http://www.doleta.gov/agworker/naws.cfm.
6. Approximately 1% declined to answer legal status questions. Respondents are given a pledge of confidentiality and a nominal financial incentive. Furthermore, the NAWS has a long (and visible) history within farming communities. Still, illegal work status statistics should be considered lower bounds and it is important to note that some errors in variables bias may be introduced, thus attenuating coefficients on these variables toward zero.
7. US education participation questions at the farmworker level are asked generically. It is possible that timing of participation varies over workers and that characteristics such as family structure are determined subsequent to participation for some workers. Participation rates based on household member participation in programs within the last two years,

instead of individual participation at any time, are correlated with farmworker participation (not shown).

8. Six agricultural regions are identifiable in the public use data. The state of California stands alone as one of these six. Other regions are groupings of adjacent states with shared agricultural labor market characteristics.
9. The hourly equivalent wage for piece rate workers used here is the same as that used for reporting purposes by the US Department of Labor. It is not known if and to what extent this construction introduces measurement error.
10. Specific programs are studied separately in regression analysis in addition to this aggregate classification.
11. The Consumer Price Index for urban wage earners and clerical workers (CPI-W) for size class D (under 50,000 people) is used for these adjustments as this best approximates a rural worker CPI.
12. A similar breakpoint is observed for job tenure, defined in terms of how many years a worker has worked with his or her current employer. Since farmworker wages may be an increasing function of tenure, tenure may be a mechanism explaining the wage differences illustrated in Figure 1. Following this reasoning, tenure is modeled in the conditional analysis as an explanatory variable though it is possible that the relationship is bidirectional as higher wages may increase tenure. Answers to survey questions pertaining to tenure with current employer may represent either continuous or annual employment, and therefore increases in tenure may or may not correspond to increases in actual total work time with any given employer though do indicate the extent to which parties have had long-term relationships.
13. The three weeks categories may or may not add to 52 as some workers may be unemployed for some weeks.
14. Smith and Todd (2005) argue that difference-in-differences matching estimators are a preferred technique in the presence of temporally invariant bias. These types of models, however, are not possible given the lack of longitudinal data on participants and nonparticipants. Further discussion accompanies the introduction of this model after the presentation of the ordinary least squares (OLS) results.
15. Although summary statistics are presented in Table 2, dummy variables for Puerto Rican and for supervisor are excluded from the main analysis due to their very small sample sizes.
16. Previous values of outcome variables, for example, are not available for inclusion as regressors for the purpose of decreasing bias in the estimation of returns to continuing education participation, and individual fixed effects are similarly impossible to use to control for individual heterogeneity given the data structure. Even in the presence of very good control variables, therefore, a difference between the treated and untreated (in that one group actually chose to enroll and one did not) is possible. This remains a limitation of the analysis.
17. If individuals who choose to participate in educational activities are different from those who do not participate in unmeasured ways associated with outcome variables, however, there will be bias in both the OLS estimates as well as those obtained using propensity matching because of a violation of the unconfoundedness assumption.
18. A caveat is that results should be interpreted in light of the binational nature of much of the US farm work population. Border commuters and international shuttlers, for example, spend significant annual time both in source and receiving countries. US poverty thresholds are based on US cost of living scales, and therefore may improperly reflect annual outcomes for many workers in this population. Thus, workers who spend significant time elsewhere may be more likely to report total annual income below US thresholds yet may be less likely to be living in impoverished conditions given differences in exchange rates and living costs. If US poverty thresholds are inappropriate for this population, then results may be incomplete even in the presence of selection corrections. This warrants adjustments to poverty measurement for border crossing populations (Pena 2013).
19. Matching is achieved here based on the covariates in Table 6. Since not all are statistically significant, standard errors associated with propensity score estimates may be inflated (Caliendo and Kopeinig 2008). Dehejia and Wahba (2002), however, show that omitting variables may substantially bias results in propensity score matching, and a goal here is to maintain comparability with the OLS regressors and results in Tables 3–5.

20. Since the survey is only administered to current farmworkers, the nonfarm work week measures refer to other activity by these workers during the past year.
21. An example is H.R. 3017, the Agricultural Labor Market Reform Act of 2011 (http://www.govtrack.us/congress/bills/112/hr3017).

References

Becker, S. O., and A. Ichino. 2002. "Estimation of Average Treatment Effects Based on Propensity Scores." *The STATA Journal* 2 (4): 358–377.

Caliendo, M., and S. Kopeinig. 2008. "Some Practical Guidance for the Implementation of Propensity Score Matching." *Journal of Economic Surveys* 22 (1): 31–72.

Card, D. 1999. "The Causal Effect of Education on Earnings." Chap. 30 In *Handbook of Labor Economics*, *Vol. 3A*, edited by O. Ashenfelter and D. Card, 1801–1863. Amsterdam: Elsevier Science B.V.

Chiswick, Barry R. 1988. "Differences in Education and Earnings across Racial and Ethnic Groups: Tastes, Discrimination, and Investments in Child Quality." *The Quarterly Journal of Economics* 103 (3): 571–597.

Cobb-Clarke, D. A., and T. Crossley. 2003. "Econometrics for Evaluations: An Introduction to Recent Developments." *Economic Record* 79 (247): 491–511.

Dehejia, R., and S. Wahba. 2002. "Propensity Score-Matching Methods for Nonexperimental Causal Studies." *The Review of Economics and Statistics* 84 (1): 151–161.

Fernandez, R., and R. Rogerson. 1996. "Income Distribution, Communities and the Quality of Public Education." *Quarterly Journal of Economics* 111 (1): 135–164.

Heckman, J., R. LaLonde, and J. Smith. 1999. "The Economics and Econometrics of Active Labor Market Programs." Chap. 31 In *Handbook of Labor Economics*, *Vol. 3A*, edited by O. Ashenfelter and D. Card, 1865–2097. Amsterdam: Elsevier Science B.V.

Imbens, G. W. 2004. "Nonparametric Estimation of Average Treatment Effects Under Exogeneity: A Review." *The Review of Economics and Statistics* 86 (1): 4–29.

Imbens, G. W., and J. M. Wooldridge. 2009. "Recent Developments in the Econometrics of Program Evaluation." *Journal of Economic Literature* 47 (1): 5–86.

Lange, F., and R. Topel. 2006. "The Social Value of Education and Human Capital." Chapter 8. In *Handbook of the Economics of Education*. Vol, 1, edited by E. Hanushek and F. Welsh, 459–509. Amsterdam: Elsevier Science B.V.

Mincer, J. 1974. *Schooling, Experience and Earnings*. New York: National Bureau of Economic Research.

Pena, A. A. 2013. "Poverty Measurement for a Binational Population." *Migration Letters* 10 (2): 254–269.

Smith, J. A., and P. E. Todd. 2005. "Does Matching Overcome LaLonde's Critique of Non-Experimental Estimators?" *Journal of Econometrics* 125 (1–2): 305–353.

U.S. Department of Labor, Employment and Training Administration. 1959. *Farm Labor Fact Book*.

U.S. Department of Labor, Employment and Training Administration. 2009a. "National Farmworker Jobs Program Overview." http://www.doleta.gov/MSFW/html/facts.cfm

U.S. Department of Labor, Employment and Training Administration. 2009b. "Summary of Workforce Development Provisions of the Workforce Investment Act of 1998 (P.L. 105–220)." http://www.doleta.gov/USWORKFORCE/WIA/summarywia.htm