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US farm workers: What drives their job retention and work time allocation decisions?

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Abstract

This article investigates the time allocation choices of US workers between farm work and other job alternatives. Results indicate that green card farm workers tend to allocate fewer workweeks to farm employment than citizens and undocumented workers, in favour of better opportunities in the non-farm sector. There is evidence of an assimilation effect, whereby undocumented workers also tend to re-allocate their time from farm to non-farm employment as their residence tenure increases, even though they experience constrained mobility and visibility during periods of strict immigration control. In the context of employers' violations of the existing labour laws that currently protect even the rights of undocumented workers, such turnover decisions seem justified. The findings raise concerns about whether any governmental effort to legalise the immigration status of such workers would reduce farm job turnover rates and increase farm employment retention, so long as labour standards are not enforced. Moreover, external economic shocks could more easily induce citizen and green card farm workers to abandon farm employment, whereas undocumented workers tend to remain in their farm jobs during such difficult times.

JEL Codes: J61, J43, J21

Keywords

Agricultural labour markets, employee retention, farm work, immigration, labour rights violations, non-farm employment, time allocation, undocumented farm workers, unemployment, working hours

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Introduction

One of the pressing concerns faced by the US farm industry has been the sourcing and retention of reliable farm workers who can help sustain business operations year after year. The industry's high labour turnover rates can be attributed to several factors. Relative to the nature of manual work in the manufacturing, service and other non-farm industries, farm operations involve more physically strenuous labour under working conditions that usually pose serious health risks (Calvin and Martin, 2010; Escalante et al., 2016). Even with such work demands, farm workers do not receive commensurate compensation, as farm wages and benefits are hardly competitive with those offered by non-farm businesses (Emerson, 2007; Escalante et al., 2011; Kandel, 2008).

The farm labour turnover issue is further complicated by the industry's dependence on foreign labour inputs. There is a tacit understanding in the US farm industry of its reliance on undocumented immigrants to perform farm tasks usually relegated to unskilled farm workers. Martin (2016), for instance, claims that between 2007 and 2009, almost 30% of US crop workers were born in the country, while the remaining 70% were born elsewhere. Within the foreign-born category, about 55% were unlawfully residing in the US and thus did not have the proper legal employment authorisation. The stricter implementation of immigrant control policies in recent years resulted in the deportation of some, if not all, of the undocumented immigrants (Escalante et al., 2016; Martin, 2016).

The farm industry's concern about worker retention, however, goes beyond a fear of the forced eviction of undocumented foreign workers by state and federal immigration authorities. A more compelling issue revolves around the need to sustain the interest of prospective farm workers, regardless of legal status, in considering farm employment and remaining employed in the sector for longer periods of time than occur at present. This study examines whether farm workers of varied legal statuses could have different motivations for seeking and retaining farm employment. For instance, the predominance of undocumented workers in the farm industry, even under stricter immigration controls, could possibly be induced by economic necessity and the lack or absence of other employment alternatives. The study seeks confirmation of the claim that such constrained employment choice is reinforced by the reality that undocumented workers are usually deprived of the basic employment rights stipulated by existing labour laws, given their employers' gross violations in the form of unreasonably low wages, lack of benefits and unacceptable working conditions, among other factors, which cannot be reported to proper authorities (Garcia, 2012; Smith and Sugimori, 2015). Thus, it will not be surprising that when the same workers are granted proper work authorisation (perhaps through an amnesty grant) to expand their employment options, they will make use of their legitimised bargaining position and seek jobs that ensure more equitable and just working terms and arrangements.

This study is designed to provide empirical support to the argument that the farm labour decisions of potential farm workers are influenced by their legal status. The general categories of documented and undocumented farm workers will be used to discern the determinants of these workers' employment choices/options and the resulting labour supply pattern of the US farm workforce. Specific sub-categories for documented workers will be considered to address two separate issues. The employment time allocation

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decisions of green card holders, who are immigrants who have been automatically granted permanent residence status, will be compared with those made by undocumented workers. This may shed light on the extent to which farm employment decisions are influenced by job uncertainties, inequitable and unjust working conditions and the deportation risks faced by undocumented workers. In other words, the analysis seeks to determine the extent to which the elimination of such inequities in working conditions, as well as alleviation of risks and uncertainty through the granting of permanent residence status, would indeed translate into the abandonment of farm employment in favour of more promising, lucrative opportunities in other sectors.

The study's second goal is to evaluate the reliability of supply of different categories of workers during periods of economic downturns and recessions. Results of this analysis lead to the contention that citizens and green card holders have little commitment to working in the farm sector while it strives to keep afloat during difficult economic periods. During such volatile times, undocumented workers remain in their farm jobs as the industry strives to maintain its viability. These questions are of particular importance given recent announcements of tighter enforcement of immigration laws. Presumably, the supply of labour by undocumented workers will be reduced.

The value of undocumented farm labour

Stricter US federal and local immigration policies in recent years have established procedures for apprehending the employment of undocumented immigrants. Employment verification systems and monitored hiring procedures were defined, along with harsher sanctions (involving higher civil fines and criminal penalties) for violators among employers (Smith and Sugimori, 2015). However, even as immigration enforcement efforts have led to many arrests and deportations, the share of undocumented workers has dropped in only a few industries, such as production and construction (Passel, 2015). Undocumented workers are eight times more likely than local residents to work in the farm sector (Bump, 2015). The following sections explore possible explanations for this trend.

Farm employers' hiring predicament

The value of the labour inputs supplied by undocumented workers to the farm sector has been a widely debated issue. Some analysts argued that local immigration control efforts generally resulted in small negative impact on unemployment and farm wage rates (Martin, 2007; Pham and Van, 2010). Others have cited farmers' difficulties in sourcing and hiring domestic workers to replace the displaced undocumented workers. Local residents were usually unwilling to endure the demanding, strenuous farm work in the light of better pay and more favourable working conditions in other industries (Wells, 2012; Wozniacka, 2013). When domestic workers are hired, farmers had to contend with substantial reduction in farm labour productivity that was nowhere near the levels achieved by their former undocumented workers. Consequently, high quantities of crops were un-harvested, and this resulted in huge crop losses (McKissick and Kane, 2011; Preston, 2007).

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The cheaper farm labour input argument

On paper, existing US labour laws protect the rights afforded to all workers, including undocumented workers. The latter group are entitled to at least the minimum wage rate, overtime pay, compensation benefits for job-related injuries, and workplace safety and health protection (Bray, 2016; Contreras, 2015). However, these workers are often victims of violations of such labour laws. Employers' violations include abusive practices of providing very low wages (or sometimes even non-payment of wages), exposure to dangerous and hazardous working conditions and uncompensated workplace injuries, among others (Garcia, 2012; Smith and Sugimori, 2015). Given the immigration enforcement climate, the affected workers are forced to accept these inequities, especially when threatened by their employers that they could be turned over to immigration authorities for deportation.

Even as current laws have laid out costlier sanctions in hiring these workers, farm business owners may weigh the business risks in being reprimanded by authorities relative to the returns on cost savings realised from employing cheaper, yet more productive undocumented farm labour inputs. Ruark and Moinuddin (2011) report that the annual incomes of unauthorised workers are about USD5600 lower than their peer authorised workers. The disparity is even larger in certain sectors of the farm industry. Wage differentials between undocumented and documented workers in fruit, nut and vegetable farms have been estimated at 18%, in favour of the latter group of workers. The comparable differential in field crop and grain farms was reportedly 22% (Ruark and Moinuddin, 2011). Despite such disparities and the persistence of other inequitable hiring practices, undocumented workers tend to remain employed in farms, with the result that there is little incentive to employers to reduce the imbalance.

Data and variable measurement

This study's data were compiled from the National Agricultural Workers Survey (NAWS), which is the only nationally representative cross-sectional survey of hired agricultural labourers in the US. Use of data collected from 1993 to 2012 resulted in a sample size of 56,976 observations. The geographical affiliation of the respondents is categorised under six different regions: East, Southeast, Midwest, Southwest, Northwest and California.[1] The analysis focuses on the employment time allocation of farm workers categorised as citizens, green card holders and undocumented, accounting for 26%, 26% and 46%, respectively, of the total observations.

In order to investigate the employment time allocation decisions of US farm workers, a threefold classification of time allocation decisions is used, namely, farm employment weeks, non-farm employment weeks and unemployment (not working) weeks. In addition, for the sake of comparability of time allocation decisions among classes of hired farm workers, the number of employment weeks for each work alternative is divided by the total weeks of residence in the US to generate the share of employment time allocation decision for each legal status category.

Panel (A) in Table 1 shows the dependent variables capturing the time allocation decisions for farm workers. Figure 1 presents a graphical representation of such allocation decisions made by different legal categories of workers.

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Table 1. Summary statistics of dependent and independent variables.

Variable	Definition	Citizen		Green card holder		Undocumented	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	Panel (A): Dependent variables						
Farm work	Share of time allocated to farm works	0.712	0.307	0.792	0.239	0.830	0.231
Non-farm work	Share of time allocated to non-farm works	0.091	0.214	0.038	0.139	0.049	0.163
Not working	Share of time allocated to not working	0.198	0.258	0.170	0.209	0.120	0.181
	Panel (B): Independent variables						
Edu1_6[a]	If has 1–6 years of education = 1, otherwise = 0	0.134	0.341	0.641	0.480	0.585	0.493
Edu7_9	If has 7–9 years of education = 1, otherwise = 0	0.167	0.373	0.159	0.366	0.241	0.428
Edu10	If has more than 10 years of education = 1, otherwise = 0	0.686	0.464	0.128	0.334	0.115	0.319
Age	Age (years)	37.575	14.197	40.459	11.389	29.401	9.901
Years in US	Years of residence in the US (years)	25.559	10.409	19.116	9.404	6.767	7.007
Female	If female = 1, otherwise = 0	0.266	0.442	0.199	0.399	0.151	0.358
Married	If married = 1, otherwise = 0	0.525	0.499	0.785	0.411	0.521	0.500
Expected Ind_income	Level of expected individual income (categories)	7.853	2.420	7.332	2.147	5.251	2.011
Children: <6 years old	Number of children in a household who are less than 6 years old	0.204	0.546	0.324	0.640	0.240	0.577
Children: 6–13 years old	Number of children in a household who are between 6 and 13 years old	0.301	0.696	0.583	0.916	0.204	0.599
Children: 14–17 years old	Number of children in a household who are between 14 and 17 years old	0.155	0.445	0.274	0.573	0.061	0.290
Mexican	If a Mexican = 1, otherwise = 0	0.132	0.338	0.887	0.317	0.902	0.297

Table 1. (Continued)

Variable	Definition	Citizen		Green card holder		Undocumented	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Chicano	If a Chicano = 1, otherwise = 0	0.026	0.160	0.002	0.044	0.002	0.044
Other Hispanic	If other Hispanics = 1, otherwise = 0	0.024	0.153	0.026	0.160	0.064	0.244
Puerto Rican	If a Puerto Rican = 1, otherwise = 0	0.058	0.233	0.000	0.015	0.000	0.021
Not Hispanic or Latino	If not a Hispanic = 1, otherwise = 0	0.590	0.492	0.033	0.178	0.012	0.107
English speaking[b]	Level of English speaking proficiency (categories)	3.607	0.830	1.931	0.880	1.518	0.710
English reading	Level of English reading proficiency (categories)	3.551	0.905	1.732	0.871	1.364	0.653
Farm work experience	Years of working in agriculture (years)	15.734	12.814	16.964	9.444	6.179	5.999
Harvest[c]	If farm task is harvest = 1, otherwise = 0	0.178	0.382	0.290	0.454	0.352	0.478
Post-harvest	If farm task is post-harvest = 1, otherwise = 0	0.135	0.342	0.098	0.298	0.090	0.287
Semi-skilled	If farm task is semi-skilled = 1, otherwise = 0	0.253	0.435	0.313	0.464	0.209	0.407
Supervisor	If farm task is supervisor = 1, otherwise = 0	0.006	0.077	0.006	0.075	0.001	0.027
Other task	If farm task is other = 1, otherwise = 0	0.212	0.408	0.118	0.322	0.135	0.342
Fruit[d]	If the crop at work is fruit = 1, otherwise = 0	0.168	0.374	0.458	0.498	0.395	0.489
Horticulture	If the crop at work is horticulture = 1, otherwise = 0	0.244	0.430	0.123	0.328	0.167	0.373
Vegetable	If the crop at work is vegetable = 1, otherwise = 0	0.223	0.417	0.251	0.433	0.262	0.440
Other crop	If the crop at work is other crops = 1, otherwise = 0	0.080	0.271	0.049	0.216	0.054	0.226

[a]The baseline for education categorical variable is zero years of education.
[b]Speaking and Reading are categorical variables that measure how well a farm worker speaks and reads English; proficiency categories are defined as follows: 1 = Not at all; 2 = A little; 3 = Somewhat; and 4 = Well.
[c]The baseline for farm task categorical variable is pre-harvest task.
[d]The baseline for the crops at farm work categorical variable is field crop.

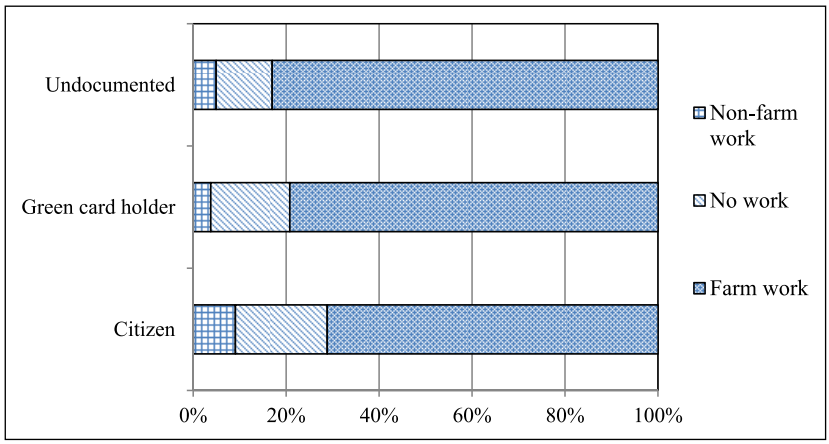

Figure 1. Hired farm workers' actual workweek allocations, by legal status (1993–2012).
Source: National Agricultural Workers Survey.

As can be gleaned from Figure 1, undocumented farm workers devoted the highest proportion of their employment time to farm work at approximately 83%, followed closely by green card holders at 79%. Citizen farm workers had the lowest allocation of time to farm work, but registered the most time spent in unemployment. Undocumented farm workers had the shortest period of unemployment. As for employment time allocated to non-farm work, citizens and green card holders recorded more time spent on non-farm jobs than undocumented farm workers.

In addition to the patterns noted in general allocation of employment time, Figure 2 presents the intertemporal trends and disparities of farm workers' time allocation between farm and non-farm jobs. The contrasting trends in the upper and lower plots (Figure 2) indicate the shifting of time allocation of farm workers between farm and non-farm sectors. Undocumented and green card holders in general had more stable labour time allocation trends over the years compared to citizens. Citizen farm workers registered a lower share of time devoted to farm work prior to 1998 (with the lowest point at 59.4% in 1995); thereafter, the share started increasing to levels comparable to those of green card holders (with the highest point at 82.1% in 2006).

Panel (B) in Table 1 lists the independent variables considered in this study. As suggested by Acquaye et al. (2003), there are substantial differences in agricultural input requirements and productivity growth rates among regions in the US such that labour demand and utilisation patterns across regions could vary as well. To control for this regional variation in labour use, this article applies regional fixed effects, in addition to the inclusion of time (year) fixed effect.

Education is usually regarded as an important factor in promoting non-farm employment and thus enhancing income diversification opportunities for rural and farm households (De Janvry and Sadoulet, 2001; Mishra and El-Osta, 2016; Yunez-Naude and Taylor, 2001). In this study's sampled data, citizen farm workers have higher average educational attainment levels as majority of these workers have had more than 10 years

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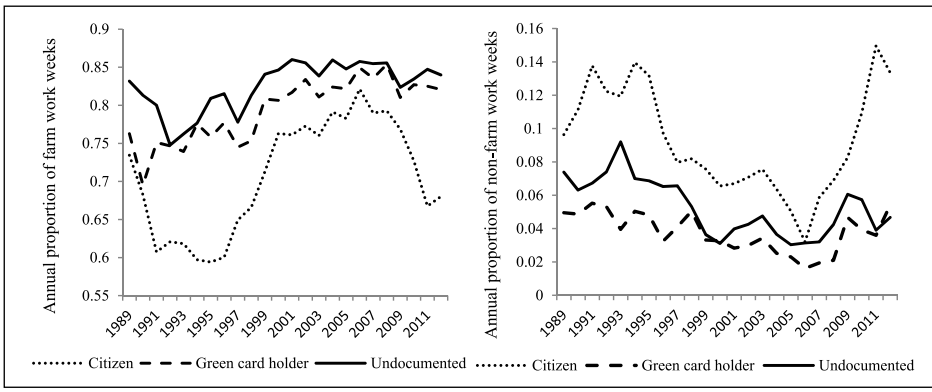

Figure 2. US farm workers' annual workweek allocation trends, by legal status.
Source: National Agricultural Workers Survey.

of education experience. Undocumented workers have significantly lower educational attainment and low English speaking and reading proficiency levels which, in turn, reduce their ability to compete for non-farm jobs.

The present analysis also considers the possible effects of other demographic and structural attributes on the time allocation decisions of farm workers. Ahituv and Kimhi (2006) find that older and female workers are less inclined to work on farms. Lien et al. (2010) suggest that younger and married individuals would exhibit a greater preference for off-farm employment. Notably, undocumented farm workers in our sample are predominantly male and generally 10 years younger than their documented peers.

The number of dependants among family members, such as children, has been found to reduce a farm household's exposure to off-farm activities (Bjørnsen and Biørn, 2010; Goodwin and Mishra, 2004; Lien et al., 2010). The responsibility of taking care of dependants does not necessarily affect the time allocation to and performance of farm work as both tasks can usually be done together in a well confined farm business and household setting (Lien et al., 2010).

As suggested by some studies, a variable measuring the number of years of residence in the US is also added here to capture the immigrant/foreign worker's cultural and social assimilation (Hamermesh and Trejo, 2013; Vargas, 2016). In this study's dataset, 88.7% of green card workers and 90.2% of undocumented farm workers are from Mexico. The predominance of a single source of foreign farm labour reduces the measurement error of characteristics across different immigration cohorts when analysing the overall population (Vargas, 2016).

Serra et al. (2005) indicate that more labour-intensive activities on farms could decrease the share of time allocated to non-farm sectors for farm households. For instance, fruit and vegetable farm workers would usually be required to devote more time at the work site than grain crop workers due to the labour-intensive nature of the former operations. Thus, work time allocation decisions even within the farm sector may also be differentiated according to the nature and type of farming enterprises.

In considering the income effect, the present analysis utilises expected (instead of actual) individual income owing to the suspicion that individual income may be

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modelled endogenously with the time allocation between farm and off-farm activities. It follows the approach proposed by El-Osta et al. (2004), which uses the predicted value for the possible endogenous variable to address endogeneity. In this article, expected individual income is constructed as a function of a series of factors based on previous models (Ahearn et al., 2013; Atamanov and Van den Berg, 2012; De Janvry and Sadoulet, 2001) and an exclusive covariate (country of origin). Adsera and Chiswick (2007) examine the impact of country of origin on labour market outcomes, including immigrants' work earnings, and find significantly large differences among immigrants originating from various countries. This study does not expect to find any country of origin effect on the time allocation decisions of farm workers, except through changes in individual incomes. In the sample used in this analysis, undocumented farm workers have statistically lower incomes than documented workers (Table 1).

The conceptual and empirical framework

The model of farm and non-farm labour supply decisions of different classes of farm workers assumes the following utility function of individuals

$$U_i = U_i(W_i, A_i \mid X) \tag{1}$$

where $i = 0, 1, 2, \ldots$ represents the first to the Nth production sector. Given the characteristics of individuals X, utility is affected by such factors as the sectoral wage rate W_i and sectoral amenities A_i. In this article, farm workers maximise their utilities by choosing between farm and non-farm employment. If the utility that can be derived from farm sector is higher than non-farm sector, such as

$$\Delta U = U_{FARM} - U_{NONFARM} \tag{2}$$

when $\Delta U > 0$, farm workers will continue to work on the farm; when $\Delta U < 0$, farm workers will transfer to non-farm sectors.

This study identifies factors that may influence the farm workers' decisions on allocation of time (measured in terms of weeks and referred to in this article as 'workweek'[2]) for farm and non-farm employment alternatives. The allocation decisions of different classes of workers according to their legal stature will be scrutinised using different estimation techniques. The analysis employs fractional multinomial logit (FMLOGIT) estimation given the model's suitability to this study's proportional response dependent variable. A secondary modelling approach, a seemingly unrelated generalised linear modelling framework (SUR-GLM), is also employed to account for possible contemporaneous correlation among errors of the three estimating equations.

The time spent in the US within the last year before the interview for hired farm workers $j = 1, 2, \ldots J$ is divided into three categories: farm work, non-farm work and not working. The basic models are structured as follows

$$\frac{FARMWEEKS_{jtr}}{US\ WEEKS_{jtr}} = \alpha_1 + X'_{jtr}\gamma + \rho_t + \varphi_r + \varepsilon_{jtr} \tag{3}$$

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$$\frac{NONFARMWEEKS_{jtr}}{US\,WEEKS_{jtr}} = \alpha_2 + X'_{jtr}\mu + \rho_t + \varphi_r + \epsilon_{jtr} \tag{4}$$

$$\frac{NOWORKWEEKS_{jtr}}{US\,WEEKS_{jtr}} = \alpha_3 + X'_{jtr}\sigma + \rho_t + \varphi_r + e_{jtr} \tag{5}$$

where $FARMWEEKS_{jtr}$, $NONFARMWEEKS_{jtr}$ and $NOWORKWEEKS_{jtr}$ represent the number of farm work, non-farm work and not working weeks devoted by individual j in year t and region r, respectively. $US\ WEEKS_{jtr}$ is the total number of weeks an individual spends in the US, which is the sum of farm employment, non-farm employment and not working weeks. The observed shares on the left side of equations (3), (4) and (5) have two common characteristics: (a) they are bounded between 0 and 1, inclusive, and (b) the sum of all three share components for any farm worker should be 1. ρ_t is the year trend effect, while φ_r controls for regional fixed effects. The vector X'_{jtr} captures the demographic characteristics of farm workers as well as other covariates listed in Table 1.

The fractional regression model, introduced by Papke and Wooldridge (1996), expands the generalised linear model (GLM) and combines it with a quasi-likelihood maximisation econometric method to generate robust estimates and inferences for proportional responses. Moreover, in the application of the model to the analysis of the share of participation in 401(k) as dependent variable, Papke and Wooldridge (1996) show that such an estimation technique would produce fully robust and relatively efficient results.

The univariate version of the fractional regression model is used as starting point for developing the multivariate fractional regression model. Under the fractional logit model, the share/proportional value of time allotted to each activity can be specified by the following functional form whereby the expectation of the share time allocation S_{jtr} is conditional on a series of covariates and fixed effects

$$E\left(S_{jtr}|X_{jtr}\right) = G\left(X_{jtr}\beta\right) \tag{6}$$

where X_{jtr} are the covariates that would affect the time allocation decisions of farm workers. $G(\cdot)$ is the cumulative distribution function (cdf) that follows the logit cdf. To estimate the β parameters, the Bernoulli likelihood can be specified as follows and its log-likelihood can be maximised by using the quasi-maximum likelihood estimation methods

$$L_j = \left[G\left(X_{jtr}\beta\right)\right]^{S_{jtr}}\left[1 - G\left(X_{jtr}\beta\right)\right]^{1-S_{jtr}} \tag{7}$$

The quasi-maximum likelihood estimation will produce consistent estimates of β even if the Bernoulli likelihood is incorrectly specified as long as the link function is in the correct form (Hausman and Leonard, 1997). In addition, all GLM equations could be estimated in an equation system resembling a seemingly unrelated regression form in order to address the possible issue of correlated error terms associated with time allocation decisions for different activities.

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In addition to the fractional regression model that separately estimates the share of time allocated to three activities, an extended model that accommodates both the proportional responses and multiple correlated choices can also be used. In this model, $S_{jtr} \in [0,1]$, $\sum_{m=1}^{M} S_{jtrm} = 1$, where m represents the category on which the allocation share is calculated. Moreover, the probability of observing boundary solutions in outcomes (i.e. 0 and 1) is essential. Since all β cannot be estimated separately under multinomial quasi-likelihood methods (Mullahy, 2015), normalisation is used by setting the coefficient of Mth category to be zero. As a result, the expectation value of share dependent variable conditional on covariates can be constructed as the following form

$$E\left(S_{jtrn}|X\right) = \left[\frac{exp\left(X_{jtr}\beta_n\right)}{1+\sum_{m=1}^{M-1} exp\left(X_{jtr}\beta_m\right)}\right], \quad n = 1,2,\ldots,M-1 \tag{8}$$

and

$$E\left(S_{jtrM}|X\right) = \left[\frac{1}{1+\sum_{m=1}^{M-1} exp\left(X_{jtr}\beta_m\right)}\right] \tag{9}$$

The multinomial logit likelihood function is therefore defined as

$$L = \prod_{j=1}^{J}\prod_{m=1}^{M} E\left(S_{jtrm}|X_{jtr}\right)^{S_{jtrm}} \tag{10}$$

The parameter could be estimated by maximising the log-likelihood form of equation (10), and the multinomial logit quasi-maximum likelihood estimation will provide consistent estimates of β following the contention presented by Papke and Wooldridge (1996).

Empirical results

The results are reported under six model versions in Tables 2 and 3. Three versions of the estimating equations are labelled as Employment Decision models representing the workweek allocation options (farm work, non-farm work and unemployment) estimated using FMLOGIT and SUR-GLM methods. The other three versions correspond to Farm Worker Category models, estimated using FMLOGIT, that allow for the validation of variations in labour supply decisions among citizen, green card and undocumented workers.

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Table 2. Marginal effects for the Employment Decision models (1993–2012).[a]

	Farm work		Non-farm work		Unemployment	
	FMLOGIT	SUR-GLM	FMLOGIT	SUR-GLM	FMLOGIT	SUR-GLM
	(1)	(2)	(3)	(4)	(5)	(6)
Citizen	0.056***	0.051***	−0.048***	−0.048***	−0.008	−0.007
	(0.015)	(0.014)	(0.014)	(0.014)	(0.011)	(0.011)
Undocumented	0.046***	0.044***	−0.009	−0.008	−0.037***	−0.037***
	(0.009)	(0.008)	(0.008)	(0.008)	(0.006)	(0.006)
Edu1_6[b]	−0.004	0	0.01	0.01	−0.006	−0.002
	(0.017)	(0.016)	(0.014)	(0.014)	(0.013)	(0.013)
Edu7_9	−0.007	−0.002	0.018	0.017	−0.011	−0.006
	(0.018)	(0.018)	(0.015)	(0.015)	(0.014)	(0.014)
Edu10	−0.028	−0.024	0.023	0.022	0.005	0.01
	(0.024)	(0.024)	(0.019)	(0.019)	(0.018)	(0.019)
Age	0.008***	0.009***	0.004**	0.004**	−0.012***	−0.011***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Age^2	−0.000***	−0.000***	−0.000**	−0.000**	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Years in US	−0.006***	−0.006***	0.003***	0.003***	0.003***	0.002***
	(0.001)	(0.001)	0.000	(0.001)	(0.001)	(0.001)
Female	−0.119***	−0.141***	−0.005	−0.008	0.124***	0.116***
	(0.031)	(0.031)	(0.024)	(0.024)	(0.024)	(0.025)
Married	0.005	0.007	−0.015	−0.015	0.01	0.013
	(0.013)	(0.013)	(0.010)	(0.010)	(0.010)	(0.010)
Children: <6 years old	−0.027*	−0.022	−0.003	−0.005	0.030**	0.034***
	(0.016)	(0.016)	(0.013)	(0.013)	(0.012)	(0.012)

(Continued)

Table 2. (Continued)

	Farm work		Non-farm work		Unemployment	
	FMLOGIT	SUR-GLM	FMLOGIT	SUR-GLM	FMLOGIT	SUR-GLM
	(1)	(2)	(3)	(4)	(5)	(6)
Children: 6–13 years old	−0.017*	−0.014	0.001	0.001	0.016**	0.018**
	(0.010)	(0.009)	(0.008)	(0.007)	(0.007)	(0.008)
Children: 14–17 years old	−0.009	−0.006	−0.004	−0.004	0.013	0.016*
	(0.013)	(0.012)	(0.012)	(0.012)	(0.009)	(0.009)
English speaking	−0.016	−0.011	0.009	0.009	0.007	0.012
	(0.019)	(0.019)	(0.014)	(0.014)	(0.014)	(0.015)
English reading	−0.013*	−0.011	0.004	0.004	0.008	0.008
	(0.007)	(0.007)	(0.005)	(0.005)	(0.005)	(0.005)
Farm work experience	0.010***	0.011***	−0.007***	−0.007***	−0.003	−0.002
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Harvest[c]	0.006	0.007	0.013*	0.013*	−0.020***	−0.019***
	(0.008)	(0.008)	(0.007)	(0.007)	(0.006)	(0.006)
Post-harvest	0.006	0.006	−0.001	−0.001	−0.006	−0.004
	(0.011)	(0.011)	(0.009)	(0.009)	(0.009)	(0.009)
Semi-skilled	0.017	0.022	−0.005	−0.006	−0.011	−0.007
	(0.018)	(0.017)	(0.014)	(0.014)	(0.014)	(0.014)
Supervisor	0.038	0.061	−0.006	−0.008	−0.032	−0.016
	(0.074)	(0.071)	(0.070)	(0.069)	(0.061)	(0.061)
Other task	0.009	0.016	−0.002	−0.003	−0.007	−0.002
	(0.019)	(0.020)	(0.015)	(0.015)	(0.015)	(0.015)

Table 2. (Continued)

	Farm work		Non-farm work		Unemployment	
	FMLOGIT	SUR-GLM	FMLOGIT	SUR-GLM	FMLOGIT	SUR-GLM
	(1)	(2)	(3)	(4)	(5)	(6)
Fruit[d]	−0.015	−0.005	−0.024**	−0.024**	0.040***	0.040***
	(0.013)	(0.013)	(0.010)	(0.010)	(0.011)	(0.011)
Horticulture	0.072***	0.088***	−0.035***	−0.036***	−0.036**	−0.030**
	(0.017)	(0.019)	(0.013)	(0.013)	(0.014)	(0.015)
Vegetable	0.016	0.029**	−0.041***	−0.040***	0.025***	0.025***
	(0.011)	(0.012)	(0.008)	(0.008)	(0.009)	(0.009)
Other crop	0.039**	0.060***	−0.043***	−0.045***	0.005	0.011
	(0.020)	(0.020)	(0.015)	(0.015)	(0.016)	(0.016)
Expected Ind_income	0.005	−0.003	0.007	0.009	−0.013	−0.019
	(0.025)	(0.024)	(0.019)	(0.018)	(0.019)	(0.020)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
R^2						
McFadden's R^2	0.411383	0.394248	0.411383	0.454587	0.411383	0.407107
χ^2	3581.14	2217.084	3581.14	1628.922	3581.14	2137.461

FMLOGIT: fractional multinomial logit; SUR-GLM: seemingly unrelated generalised linear modelling framework.

[a]Huber–White robust standard errors are reported in parentheses. Models are weighted by the sample weight provided by National Agricultural Workers Survey (NAWS): *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

[b]The baseline for education categorical variable is zero years of education.

[c]The baseline for farm task categorical variable is pre-harvest task.

[d]The baseline for the crops at farm work categorical variable is field crop.

Table 3. Fractional multinomial logit (FMLOGIT) marginal effects for the Farm Worker Category models (1993–2012).[a]

	Citizen			Green card holder			Undocumented		
	Farm work	Non-farm work	Not working	Farm work	Non-farm work	Not working	Farm work	Non-farm work	Not working
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Edu1_6[b]	−0.129***	0.077	0.051	−0.048	0.057**	−0.009	−0.001	−0.004	0.006
	(0.050)	(0.060)	(0.041)	(0.030)	(0.026)	(0.022)	(0.041)	(0.033)	(0.025)
Edu7_9	−0.094*	0.063	0.032	−0.060*	0.063**	−0.003	−0.003	0.004	−0.002
	(0.051)	(0.060)	(0.042)	(0.033)	(0.028)	(0.024)	(0.042)	(0.033)	(0.026)
Edu10	−0.110**	0.1	0.01	−0.119***	0.080**	0.039	−0.014	0.012	0.002
	(0.053)	(0.063)	(0.044)	(0.042)	(0.035)	(0.029)	(0.062)	(0.049)	(0.039)
Age	0.015***	0.016***	−0.032***	0.009***	0.011***	−0.020***	0.007**	0.001	−0.008***
	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)
Age^2	−0.000***	−0.000***	0.000***	−0.000***	−0.000***	0.000***	−0.000***	0	0.000***
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Years in US				−0.003***	0.001	0.002***	−0.008***	0.005***	0.003***
				(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Female	0.015	−0.031	0.016	−0.037	−0.112***	0.149***	−0.095	0.012	0.083
	(0.037)	(0.038)	(0.032)	(0.048)	(0.034)	(0.032)	(0.097)	(0.076)	(0.060)
Married	0.015	0.018	−0.032*	−0.013	0.011	0.002	−0.002	−0.023	0.024
	(0.018)	(0.018)	(0.018)	(0.020)	(0.015)	(0.014)	(0.035)	(0.027)	(0.022)
Children: <6 years old	−0.040**	0.011	0.029	−0.060**	0.042**	0.018	−0.036	−0.012	0.048
	(0.020)	(0.019)	(0.018)	(0.024)	(0.017)	(0.016)	(0.048)	(0.038)	(0.029)

Table 3. (Continued)

	Citizen			Green card holder			Undocumented		
	Farm work	Non-farm work	Not working	Farm work	Non-farm work	Not working	Farm work	Non-farm work	Not working
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Children: 6–13 years old	−0.039***	0.003	0.035***	−0.048***	0.030***	0.018*	−0.017	−0.009	0.026
	(0.013)	(0.014)	(0.012)	(0.014)	(0.010)	(0.010)	(0.028)	(0.022)	(0.017)
Children: 14–17 years old	−0.031*	−0.017	0.048***	−0.047***	0.025*	0.022*	−0.016	0	0.016
	(0.018)	(0.020)	(0.018)	(0.018)	(0.013)	(0.012)	(0.036)	(0.031)	(0.022)
English speaking	−0.130***	0.060**	0.070***	−0.068**	0.071***	−0.003	−0.025	−0.006	0.031
	(0.026)	(0.029)	(0.023)	(0.029)	(0.021)	(0.020)	(0.057)	(0.044)	(0.035)
English reading	0.019	−0.01	−0.009	−0.021*	0.016*	0.005	−0.013	0.003	0.01
	(0.019)	(0.022)	(0.015)	(0.011)	(0.009)	(0.009)	(0.013)	(0.010)	(0.009)
Farm work experience	−0.001	−0.003	0.004	−0.001	0.003	−0.002	0.012	−0.011*	−0.001
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.008)	(0.006)	(0.005)
Harvest[c]	−0.022	0.012	0.011	−0.02	0.005	0.015	0.013	0.023***	−0.036***
	(0.018)	(0.018)	(0.018)	(0.014)	(0.012)	(0.011)	(0.010)	(0.009)	(0.007)
Post-harvest	−0.073***	0.051**	0.022	−0.054***	0.028*	0.026*	0.02	−0.008	−0.012
	(0.020)	(0.020)	(0.018)	(0.019)	(0.016)	(0.014)	(0.022)	(0.018)	(0.015)
Semi-skilled	−0.018	0.002	0.016	−0.021	0.044**	−0.023	−0.004	−0.012	0.016
	(0.025)	(0.027)	(0.023)	(0.027)	(0.020)	(0.020)	(0.052)	(0.041)	(0.032)
Supervisor	−0.063	−0.105	0.168**	−0.077	0.225***	−0.148*	0.643***	−0.859***	0.217*
	(0.114)	(0.130)	(0.081)	(0.098)	(0.079)	(0.083)	(0.191)	(0.145)	(0.124)
Other task	0.011	0	−0.011	−0.032	0.042*	−0.01	−0.005	−0.01	0.016
	(0.026)	(0.027)	(0.024)	(0.030)	(0.023)	(0.023)	(0.051)	(0.040)	(0.031)

(Continued)

Table 3. (Continued)

	Citizen			Green card holder			Undocumented		
	Farm work	Non-farm work	Not working	Farm work	Non-farm work	Not working	Farm work	Non-farm work	Not working
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Fruit[d]	0.053**	−0.022	−0.031	0.008	−0.051***	0.044**	−0.01	−0.02	0.03
	(0.022)	(0.025)	(0.023)	(0.021)	(0.014)	(0.018)	(0.031)	(0.024)	(0.020)
Horticulture	0.03	−0.019	−0.011	0.066**	0.022	−0.088***	0.056	−0.054*	−0.002
	(0.023)	(0.022)	(0.022)	(0.030)	(0.021)	(0.024)	(0.041)	(0.032)	(0.026)
Vegetable	0.015	−0.013	−0.002	0.039**	−0.058***	0.019	0.018	−0.038**	0.019
	(0.018)	(0.017)	(0.018)	(0.020)	(0.013)	(0.017)	(0.024)	(0.018)	(0.015)
Other crop	−0.065**	0.032	0.033	0.028	0.022	−0.050**	0.028	−0.064*	0.036
	(0.028)	(0.025)	(0.024)	(0.032)	(0.023)	(0.025)	(0.049)	(0.038)	(0.031)
Expected Ind_income	0.077***	−0.024	−0.053**	0.083**	−0.079***	−0.004	0.012	0.029	−0.041
	(0.027)	(0.028)	(0.024)	(0.037)	(0.026)	(0.025)	(0.077)	(0.060)	(0.048)
N	10,148	10,148	10,148	11,391	11,391	11,391	21,459	21,459	21,459
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
McFadden's R^2		0.215			0.134			0.110	
χ^2		2069.837			1872.424			2786.399	

[a]Huber–White robust standard errors are reported in parentheses. Models are weighted by the sample weight provided by National Agricultural Workers Survey (NAWS): *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

[b]The baseline for education categorical variable is zero years of education.

[c]The baseline for farm task categorical variable is pre-harvest task.

[d]The baseline for the crops at farm work categorical variable is field crop.

Employment decision models' results

The estimated marginal effects for the three employment decision models are reported in Table 2. Of special interest in these results are the estimates obtained for the legal status variables that could reflect the disparities of time allocation trends among citizens, green card holders and undocumented farm workers. In the farm work model, the FMLOGIT and SUR-GLM results indicate that citizen farm workers' workweek allocation for farm employment was 5.1%–5.6% higher than the allocation decision of green card holders. Undocumented farm workers also exhibited a relatively higher propensity to work in the farm sector than green card farm workers by devoting an incremental 4.4%–4.6% of work time. In the non-farm work model, significant disparity in time allocation was obtained for citizen farm workers vis-à-vis the excluded category (green card holders): these workers allocated 4.8% less time than the latter group of workers.

The green card holders' apparent preference for non-farm employment may be motivated by economic reasons as the farm sector usually lags behind other sectors in offering competitive compensation rates. Immigrants who have recently obtained permanent residence status may consciously take advantage of their newly acquired greater flexibility in exploring more financially rewarding employment options outside the farm sector. Undocumented immigrants, however, face strict constraints on their mobility, visibility and employment options. As a result, these workers would persist in performing more taxing, strenuous farm work for relatively lower wages and, at times, even under poor working conditions.

The unemployment model results provide further validation of such contentions. Undocumented farm workers tend to spend 3.7% less hours not working than green card holders. These workers seem to be more compelled to remain employed for economic reasons, perhaps even when their current employment conditions (such as farm work) are not ideal.

Among demographic and structural variables, results indicate that older farm workers usually were more drawn to farm work, although the share of their farm work time diminished in their more advanced ages. Results also indicate that female farm workers tended to allocate 11.9% less time to farm work and 12.4% more time to unemployment than their male counterparts. These trends are consistent with persistent societal roles (especially in more remote rural areas) whereby female household members are usually expected to be more responsible for performing household chores and child care that could indeed diminish their availability for farm work.

The farm work experience variable has been found to significantly affect the share of work time devoted to farm and off-farm employment. This suggests that as farm workers gain more years of farm work experience, they tend to increase the amount of time devoted to agriculture at the expense of a declining allocation to non-farm work time.

This study also validates the influence of the nature and type of crop enterprise operations on employment time allocations. Specifically, horticulture farm workers were found to devote 7.2% more time to farm work and 3.5% less time to non-farm work than field crop farm workers. Those who worked in farms growing vegetables and other crops also allotted less work time to non-farm jobs compared to those in field crop farms. Overall, these results indicate that capital-intensive crops, such as field crops, that naturally have less demand for manual labour, employ workers who use the work time when they are not

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required on farms to seek jobs in the non-farm sector. On the contrary, the higher premium on manual labour (in terms of higher wages) in the production of such labour-intensive crops as vegetables and horticultural products would usually result in the employment of workers who tend to allocate more time to farm work than off-farm employment.

Farm worker category models' results

According to the marginal effects summarised in Table 3, certain demographic and structural factors have varied effects on the different worker categories. In the green card worker model, workweek allocation to non-farm jobs increases with higher educational attainment and English language proficiency levels. These variables, however, do not have any significant effect in the undocumented worker model. The age variable produced a consistently significant positive effect on farm work time allocation across all three worker category models. Such age effect, however, diminishes as the workers' chronological age advances.

Previous studies on the role of assimilation in the time allocation decision trends of immigrants reinforce the importance of this factor owing to its implications for welfare promotion and the economic integration of the immigrant population. Following Vargas (2016), this study uses the years of residence in the US as an indicator of the immigrant farm workers' assimilation into the society. The findings in Table 3 suggest that, for both green card and undocumented farm workers, a longer US residence tenure leads to a reduction in the share of time spent in farm work. Notably, undocumented farm workers with longer tenure also increase their workweek allocation to non-farm employment. It seems that longer residence tenure that translates to a higher level of social assimilation could increase the undocumented workers' confidence and initiative in seeking non-farm employment, even under continuing stricter immigration controls.

Figure 3 shows the change in the workers' predicted share of time allocated to farm and non-farm activities arising from the impact of the length of residence in the US. The trend for green card farm workers indicates a slowly increasing trend whereby the workers' longer residence resulted in a higher predicted proportion of weeks devoted to non-farm work. Correspondingly, there was a slowly decreasing trend in predicted farm workweek allocation rates for green card holders as they accumulated residence tenure in the US. Notably, the slopes of the undocumented workers' predicted time allocation rates in both plots are much steeper than those observed for green card farm workers. Undocumented farm workers experienced larger changes in their predicted proportions of time allocations for farm and non-farm work as they stayed longer in the US. As shown in Figure 3, undocumented workers initially allocated a higher share of time to farm work compared to green card workers. However, as the years of residence in the US increased, these workers' farm workweek allocation decreased from 80% to 40% (in contrast to the green card workers' rates dropping to 66% at the end of the time horizon). Undocumented workers' non-farm workweek allocation rates after about 40 years of residence were predicted at about 40%, which is substantially higher than the comparable rate for green card holders at only 10%.

Next, we scrutinise the influence of economic fluctuations on the time allocation pattern of farm workers. The natural resilience of agriculture in weathering economic volatility

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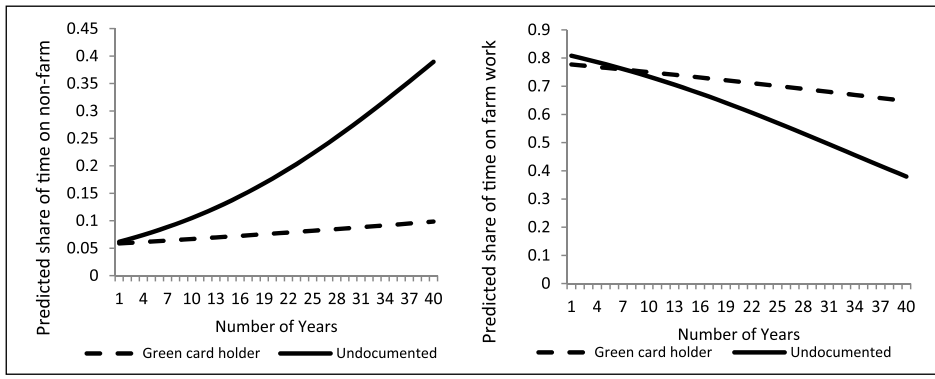

Figure 3. Predicted workweek allocations per year, by length of US residence.
Source: National Agricultural Workers Survey.

kept the sector growing at a decent rate during the 2008 financial crisis: it fared better during the period relative to non-farm industries (Council of Economic Advisers, 2013). It is of great interest to examine whether the share of time allocated to farm work by farm workers would stay the same or even increase in response to the economic shocks during the recessionary period. The conjecture is that the proportion of time allotted to farms could increase as other non-farm sectors confront relatively more economically difficult and stressful conditions. Figure 4 shows how the predicted value of proportion of farm and non-farm employment weeks of farm workers varies over the sample years.

The trends shown in Figure 4 indicate that the predicted value of the farm workweek proportion could be affected by economic fluctuation. Contrary to our expectation, the proportion of farm workweeks decreased and proportion of non-farm workweeks increased at the onset of the financial crisis for both citizens and green card holders. During the global recession that started in 2008, green card farm workers showed the largest decrease in the proportion of farm workweeks, of approximately 22% from 2008 to 2009. Citizen farm workers also exhibited a downward trend in farm workweek share but the magnitude of the decrease was smaller. Meanwhile, green card farm workers also showed a large increase in the share of time allocated to non-farm work, followed by citizen farm workers. These results suggest that citizen and green card farm workers may be more responsive to economic shocks, exhibiting more adaptive work decisions for the sake of survival and recovery under changing economic conditions. On the contrary, undocumented workers showed more stable and consistent patterns of supplying agricultural labour even during period of economic fluctuation. Such behaviour would then be beneficial in helping maintain a decent rate of business growth in the farm sector, even when the rest of the economy tends to falter under more volatile economic conditions.

Conclusion

This study has provided important empirical evidence on the determinants of employment decisions of farm workers under different legal immigration statuses. In general, there seems to be a diminished interest in working in agriculture among workers with

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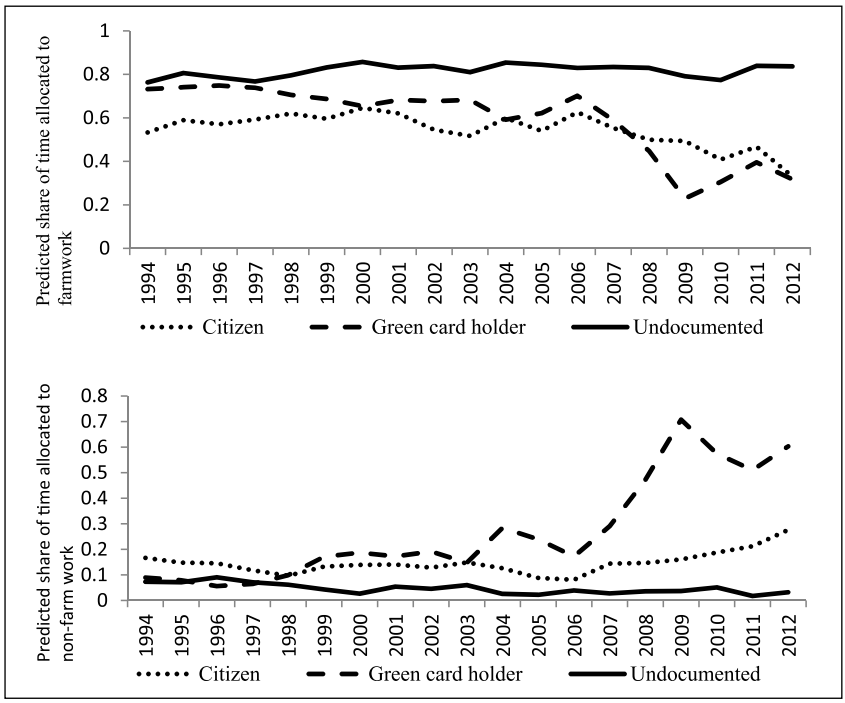

Figure 4. Predicted annual workweek allocations, US farm workers.
Source: National Agricultural Workers Survey.

flexible employment options. Specifically, the predicted value of the proportion of weeks per year devoted to farm work indicates that green card holders tend to devote the lowest proportion of workweeks to agricultural employment among all three farm worker categories. In contrast, undocumented workers have registered a higher rate of allocation of workweeks to farm work.

Moreover, evidence from this study suggests that citizen and green card farm workers tend to be more responsive to fluctuations in general economic activity. Under unfavourable economic conditions, citizens and green card holders devote fewer weeks to agricultural industries than undocumented farm workers, who are much less responsive to economic shocks as they tend to stick to their status quo labour allocation pattern during such difficult times.

The findings suggest that the usual contention that the farm sector subsists primarily on foreign workers should be made with caution and qualification. Such reliance holds only among farm workers whose undocumented status restricts their social visibility, mobility and job choices, and there is evidence that these workers will be prepared to terminate their tenure as farm employees if they do not fear deportation. Beyond this study's clear finding that permanent residence status may induce transitions from farm to non-farm employment, the significant assimilation effects suggested by the data capturing the lengths of farm work experience and residence in the US have further implications. These

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results suggest that assimilation to their social environments can increase these workers' initiative and confidence in taking the risk of social visibility, even under stricter immigration control, so that they consider leaving their farm jobs – with all their inequities and unacceptable working arrangements – in the hope of finding better opportunities in the non-farm sector. Of course, even outside the farm industry, their illegal status could still remain a liability in seeking or calling for better treatment by prospective employers.

Within the farm sector, the problems of attracting and retaining workers, regardless of legal status, remain important concerns. In the absence of a more comprehensive dataset that traces the historical immigration path of foreigners granted permanent residence status (isolating those that previously held valid, unexpired visas from amnesty grantees and other illegal residents with undocumented status), this study's findings on the farm work allocation behaviour noted among green card holders could lend some support to the legal status argument in farm workweek allocation behaviour. These results can therefore imply that efforts to legalise the immigration status of undocumented aliens (such as the recent presidential amnesty grant in 2014) could possibly lead to a diminishing supply of labour for the farm sector. More effective policies aimed at maintaining an adequate and stable supply of farm labour should therefore take into account the need for tempering the effects of immigration status legalisation with more employment retention efforts directed towards specific categories of farm workers. Moreover, government policies should aim to minimise or eradicate wage disparities between farm and non-farm workers. Meanwhile, more aggressive and effective monitoring of employers' compliance with existing labour policies should be pursued for the sake of maintaining more principled, healthier and safer work environments. Ultimately, however, within the farm industry, the strenuous and taxing nature of farm tasks will need to be minimised through encouragement of changes in production practices and mechanisation initiatives that would radically change the nature of farm work. Only through such strategies will it be possible to attract a wider pool of potential farm workers, regardless of immigration status, and retain them in the industry in periods of both economic difficulty and prosperity.

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Notes

1. We follow the geographical division methodology used in National Agricultural Workers Survey (NAWS) where California is used as a separate regional group.
2. Workweek is the total amount of hours or days spent working on a job in 1 week. In this article, a 'workweek' will be regarded as a full-time 5-day employment during the week.

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