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**Determinants of Occupational Changes of U.S. Migrant Farm Workers under
Recessionary Times**

Tianyuan Luo

Graduate Student

Department of Agricultural and Applied Economics, University of Georgia

305 Conner Hall, 147 Cedar St., Athens, GA 30602

706-224-7350, luoterry@uga.edu

Co-Author:

Dr. Cesar Escalante

Associate Professor

Department of Agricultural and Applied Economics, University of Georgia

315 Conner Hall, 147 Cedar St., Athens, GA 30602 706--542-0740, cescalan@uga.edu

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ABSTRACT

This paper studies the factors influence the labor decisions of agricultural labor in the U.S. and finds the distinction among the three types of agricultural workers. Undocumented farmers are unresponsive to wage changes while other farmers are not; enhanced education decreases the probability of exiting farm for foreign-born farmers.

Key Words: Agricultural labor force; Determinants; Farm exit; Education

Introduction

Agricultural labor shortage nowadays has been linked to the economic woes of farm businesses and has been considered as a threat to the economic stability of certain sectors in the U.S. economy. Many states have reported deterioration in agricultural profits due to difficulties experienced in sourcing and hiring farm workers. The economic repercussions of such farm labor shortage could be further aggravated by the fact that more and more domestic farmer workers moving out of agriculture, coupled with the enforcement of stricter immigration laws.

According to National Agricultural Workers Survey, we can divide the existing and prospective pool of agricultural workers in the U.S. into four groups: citizens, green card holders, unauthorized and others. By the mid-twentieth century, Americans have been increasingly evading farm work, and now there is less than 2% of the U.S. labor force that works in agriculture (Taylor et al., 2012). The native farmworker shrinkage induced a large flow of immigrants so as to meet the labor demand in agricultural production.

In the last decade, the agriculture of United States relied heavily on the low-wage foreign workers, who are mostly from Mexico. The share of domestic hired farm workers has fallen to the point where, by 2006, only 23% of workers were U.S.-born while the rest are immigrants

mainly coming from Mexico and half of those foreign workers were undocumented immigrants (Martin 2009). However, now that the labor pool is drying up, which would have serious consequences, such as the price of labor-intensive fruits and vegetables could possibly be the first to skyrocket (Devadoss and Luckstead 2008). After peaking in 2007 at 7 million, immigration from Mexico has fallen by 12.9% until the year of 2011 (Passel, Cohn and Gonzalez-barrera 2012). The unstable unemployment rate as well as the stricter immigration control decreased the population of migrant worker a lot. Since the 1980s, all kinds of national illegal migrant worker problems start to emerge. As a result, U.S. congress enacted the Immigration Reform and Control Act (IRCA) in 1986. Thereafter, the legislation of H-2A program was also established. After that, another crucial immigrant control regulation was carried out in 2005 when the U.S. government started to intensify the domestic surveillance.

Besides the socioeconomic factors stated above, the reallocation decisions made by the agricultural farmers are largely dependent on their individual characteristics, such as gender, family size as well as educational attainment. To tackle the current agricultural labor issues, we need to do more micro level studies and find the determinants of labor decisions from agricultural workers. Given the influence of those decisions on the agricultural development, even on the entire economy, it is of great importance to understand the factors that determine the reallocation of agricultural workers among sectors and the impediments which may hinder its mobility (Dries and Swinnen 2002).

The specific aim of this paper is to: identify the factors that would influence the decision of migrant workers to change occupations from the agricultural section to another industry, including the decision to become unemployed. And as pointed out by Devadoss and Luckstead (2011), the decreasing trend in immigrant population is largely due to worksite and border

enforcement and the recent U.S. economic recession. Together with such background, we will have more insight into the mechanism of how farmers make their occupational decisions.

Literature Review

The determinants that affect the farmers' or farm households' labor allocation decisions can be generally categorized into three kinds: individual- or household-specific characteristics; macroeconomic features as well as the policy or political factors. Farmers' labor decisions would be under a compound effect of all the three categorical factors. Existing studies suggested different determinants of labor allocation decisions according to the specific background.

Farmer's characteristics play a key role in personal occupational decision. Being in good health would be a premise to work in the agricultural sector. Older farm operators would pass the farm management to the successor or just leave farm due to the aging and poor health (Bentley and Saupe 1990; Gale 2003). However, on the other hand, many papers found that young farmers are actually more likely to leave the farm. In his questionnaire survey, Lowell Hill (1962) showed that the people who left the farm were fairly young, with the age distribution ranging from 30 to 55 and with a mean of 40 years old. Married farmers are also less likely to leave the farm, compared with their single counterparts (Bojnec and Dries 2005). Moreover, family concerns may have a larger effect. Breustedt and Glauben (2007) found that the regions where a relatively high number of family member work on the farm show lower exit rates, a finding that is supported by results in other studies (Pfeffer 1989; Stiglbauer and Weiss 2000; Glauben et al 2004). Kimhi and Bollman (1999) suggested that the larger farm size will provide farmers with a reasonable and sustainable income to raise the family, making it unnecessary to search for higher paid job outside agriculture. Also, the sentimentality factor is often given as an

explanation for the fixity of labor in agriculture (Hill 1962). The preference to work in the agriculture may have something to do with non-pecuniary benefits (Van Heck 2009) which implies that farmers may like the self-employed style job or treasure the independence and sense of responsibility associate with farm ownership, which can be called ownership motives (Key and Robert 2009; Tocco, Bailey and Davidson 2013).

Aside from demographic and structural factors, macroeconomic factors as well as policies should also be taken into consideration. Tweeten (1984) pointed out that technology, national economic growth and off farm income may determine farm number and size, hence the number of farmers working on the farm. If there are more off-farm job opportunities, farmers may be more inclined to leave agriculture. It has been shown that off-farm work opportunities increased the exit probability of Australian farmers (Weiss 1997 1999). The same effect was also validated in the U.S. labor market (Roe 1995). Moreover, Goetz and Debertin (2001) produced a two-side conclusion about the impact of off-farm employment on the agricultural exit rate. The attractiveness of off-farm employment mainly comes from the higher wage rate. Individuals make their migration decisions by observing inter-sector income differences. Higher incomes in other sectors outside agriculture will stimulate people to move out (Bojniec and Dries 2005). Tocco et al (2013) also showed that the higher the regional wage ratio between nonfarm and farm sector, the more employment will occur in nonfarm industries. Moreover, government intervention would either stimulate or discourage farmers' reallocation decisions. Goetz and Debertin (2002) found out that higher subsidy payments from the government lower the exit rate in European countries. However, due to the heterogeneity of the government policies and programs, the policies' influence may be not significant, which is supported by the result of some several studies (Barkley 1990; Breustedt and Glauben 2007). Regarding migrant workers,

the immigrant policies have direct impact on their reallocation choice. Obviously, legal-status reduces the mobility and prevents unauthorized migrant farmer from moving out agriculture (Taylor 1992). However, because of the limited ability of agriculture to retain new immigrant workers, illegal immigrants may leave the agriculture as they acquire more work experience and contacts with urban labor market (Kossoudji and Ranney 1986). Generally speaking, the tightening of the immigration control may make it difficult to find jobs in other industries and force the illegal farmers to stay on the farm. However, the impact is inconclusive.

Data and Empirical Methodology

Data

In this study, we use two types of data: individual characteristics and socioeconomic data. Individual characteristic data were obtained from the National Agricultural Workers Survey (NAWS). The whole dataset contains information from 52,479 in-person interviews with hired crop farm workers, which were done in 40 states from 1988 to 2009. The data have been classified under six big regions: East, Southeast, Midwest, Southwest, Northwest, and California. In this paper, we focus on the data from 2002 to 2009 that consist of 19,334 observations. The agricultural workers are further divided into three major groups according to their legal status, namely citizens, green card holders and illegal migrant workers. In this dataset, there are 5,219 individual interviews for citizens, 4,350 for green card holder interviews, and 9,765 interviews among unauthorized migrant workers.

This analysis will also use some macro-socioeconomic indices to illustrate the influence of the society and environment on agricultural workers' occupational decisions. The wage ratio is the quotient between the non-agricultural and agricultural sectors. In this article, we use the ratio

Table 1. Descriptive statistics on determinants used for regression

Variable	Description	Citizen		Green Card Holder		Unauthorized	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
age14to23	Age14 to 23=1; 0 otherwise	0.175704	0.380605	0.04046	0.197058	0.284076	0.450996
age24to33	Age24 to 33=1; 0 otherwise	0.170531	0.376134	0.124598	0.3303	0.406759	0.491254
age34to43	Age34 to 43=1; 0 otherwise	0.220924	0.414909	0.345977	0.47574	0.198771	0.399096
age44to53	Age44 to 53=1; 0 otherwise	0.244491	0.429826	0.303678	0.459898	0.083052	0.275975
gender	Male=1; female=0	0.225714	0.418092	0.193333	0.394958	0.162519	0.368945
numyrsw	Years of farm work	18.96417	14.42759	21.05885	9.410431	6.815259	6.606056
wagetask1	Wage	9.227791	3.186964	8.492666	2.540959	7.571592	2.037439
numkid	Number of children	0.758574	1.197433	1.405287	1.523215	0.619867	1.159404
wageratio	Wage ratio between ag and nonag	1.35183	0.520161	1.783704	0.607531	1.680106	0.620967
agcontri	Contribution of agriculture to regional GDP	3.999266	5.561923	10.25478	8.309918	8.755507	8.247356
popdensity	Population density	156.9956	102.744	157.5975	86.87155	168.3965	91.87468
regunemprate	Regional unemployment rate	5.722315	1.369392	6.096624	1.577291	6.086146	1.655167
east	East=1; 0 otherwise	0.217666	0.412699	0.054023	0.226089	0.122683	0.32809
southeast	Southeast=1; 0 otherwise	0.230312	0.421073	0.096322	0.295066	0.179416	0.38372
midwest	Midwest=1; 0 otherwise	0.251964	0.434182	0.090575	0.287036	0.09022	0.286512
southwest	Southwest=1; 0 otherwise	0.074919	0.263285	0.103678	0.304878	0.044649	0.206543
northwest	Northwest=1; 0 otherwise	0.09657	0.2954	0.151724	0.358795	0.144086	0.351195
single	Single=1; 0 otherwise	0.38973	0.487736	0.131954	0.33848	0.405632	0.491039
yrseeduc	Years of education	10.82909	3.128387	5.628046	3.629361	6.303635	3.18163
a17a	Number of family people have nonfarm job	0.375934	0.889487	0.214253	0.699229	0.248848	0.760917
conteduc	Received continued education=1; 0 otherwise	0.420901	0.541546	0.282069	0.462158	0.142843	0.354585

between composite wages of farming, fishing and forestry occupation and wages from the construction and extraction occupation. As a competing sector in the labor market, the constructing and extraction sector actually attracted a large amount of agricultural workers. This industry’s high capacity and low skill requirement make it a preferred choice. We extract the data for sector wages from the Occupational Employment Statistics of Bureau of Labor Statistics. Population density is calculated as the quotient between number of people and the area they occupied, both of which are from the U.S. Census Bureau. Moreover, the regional unemployment rate data are collected from Bureau of Labor Statistics. Table 1 provides a summary of these variables’ descriptive statistics.

Model

We divide an agricultural worker’s occupational decision into two stages, the first stage is to choose whether to stay or leave the farm; the second stage is designed solely for farm workers who chose to leave the farm and looks at whether they would choose to transfer to nonagricultural jobs or become unemployed.

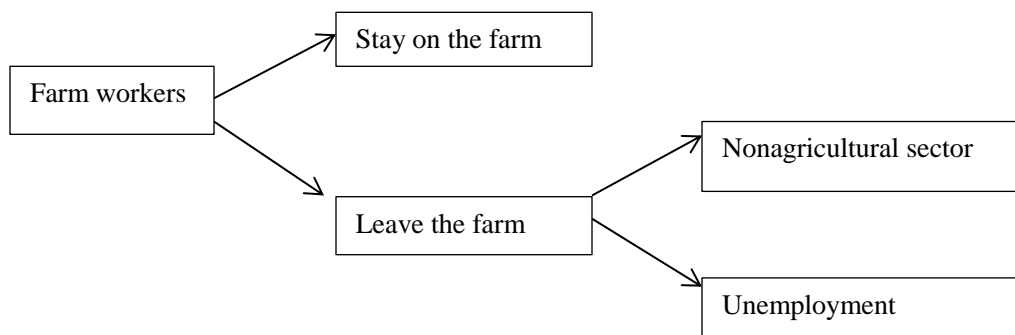


Figure 1. Two stage occupational decision by farm workers

The appropriate analytical framework for this decision process is a bivariate probit model that involves two equations indicating the two stages of decision-making separately. The first

equation would capture the choice of leaving or staying on the farm; then the second equation focuses for the selection of being unemployed or being employed in nonagricultural sectors. We expect some correlation between disturbance terms of the two equations in the same manner as the typical seemingly unrelated regression model. The system of bivariate probit equations is defined as:

$$y_1^* = x_1\beta_1 + m_1\beta_2 + \epsilon_1, y_1 = 1 \text{ if } y_1^* > 0, 0 \text{ otherwise}$$

$$y_2^* = x_2\gamma_1 + m_2\gamma_2 + \epsilon_2, y_2 = 1 \text{ if } y_2^* > 0, 0 \text{ otherwise}$$

In the first equation, the selection to leave the farm is identified by the latent dependent variable y_1^* . Since y_1^* is not directly observable, we set $y_1 = 1$ for decisions to leave the farm and $y_1 = 0$ for decisions to remain working on the farm. The selection between the nonagricultural sector and unemployment after the leaving is measured by the latent dependent variable y_2^* . In the same fashion as in the first equation, $y_2 = 1$ if the worker chooses to become unemployed and $y_2 = 0$ if the worker decides to take on a non-agricultural position. x_1 and x_2 represent the individual characteristic regressors while m_1 and m_2 are the macroeconomic indicators. The two equations have different set of variables included based on the economic sense and omitting the statistically insignificant variables.

We assume the distribution of the error term in each equation follows the normal distribution:

$$[\epsilon_1, \epsilon_2] \sim N(0, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix})$$

Empirical Result Analysis

Using the bivariate probit model, we can identify influential factors that would shape the occupational decisions for farm workers. As in the U.S. we can basically divide the agricultural workers into three types: citizens, green card holders and unauthorized farm workers. Based on the belief about the differences in labor migration pattern of legal and undocumented workers (Tran and Perloff 2002), we expect that the two stages of decisions for the different categories of workers will most likely be affected by different sets of the factors.

Determinants of citizen and green card holder agricultural workers

Table 2. Estimate of determinants of citizen and green card agricultural workers

	Citizen		Greencard	
	stage1	stage2	stage1	stage2
age14to23	0.5313***	0.6320***	-0.012	0.0228
	-0.102	-0.113	-0.164	-0.157
age24to33	-0.128	-0.2556*	0.0387	0.0753
	-0.094	-0.113	-0.124	-0.114
age34to43	-0.1795*	-0.3427**	0.0735	0.0986
	-0.089	-0.105	-0.102	-0.092
age44to53	-0.2441**	-0.3438***	0.123	0.1141
	-0.082	-0.092	-0.093	-0.085
gender	0.4659***	0.6117***	-0.8794***	-0.7857***
	-0.052	-0.06	-0.07	-0.061
numyrsfw	-0.0145***	-0.0087**	0.0104*	0.0118**
	-0.003	-0.003	-0.004	-0.004
wagetask1	-0.0327***		0.0073	
	-0.005		-0.007	
numkid	-0.033	0.0133	-0.004	-0.002
	-0.025	-0.031	-0.023	-0.02
wageratio	0.1499	0.075	-0.3690***	-0.4021***
	-0.08	-0.084	-0.111	-0.104
agcontri	-0.008		0.0238	
	-0.042		-0.014	
popdensity	-0.007	-0.012	-0.003	-0.011

	-0.012	-0.013	-0.01	-0.009
regunemprate	0.0891***	0.0589*	-0.0440*	-0.0555**
	-0.022	-0.024	-0.022	-0.02
east	1.408	1.6984	0.2333	0.3926
	-1.203	-1.358	-1.103	-1
southeast	-0.296	-0.991	-0.29	-1.545
	-1.648	-1.301	-1.041	-0.926
midwest	-0.168	-0.935	-1.035	-2.4161*
	-1.938	-1.64	-1.302	-1.176
southwest	-0.331	-1.273	-0.861	-2.578
	-2.403	-2.154	-1.705	-1.55
northwest	-0.376	-1.474	-0.995	-2.837
	-2.674	-2.416	-1.906	-1.738
single	0.0829	0.1834**	0.0105	-0.012
	-0.057	-0.066	-0.085	-0.079
yrseeduc	-0.008	-0.0324***	-0.0233**	-0.0252***
	-0.008	-0.009	-0.007	-0.007
a17a	0.0740**	0.0688**	-0.004	-0.061
	-0.023	-0.026	-0.04	-0.033
conteduc	-0.034	-0.1	0.0149	0.0132
	-0.044	-0.055	-0.062	-0.057
_cons	-0.225	0.672	2.9343	5.0554*
	-3.086	-2.838	-2.202	-1.999

Note: (a) ***significant at 1%, **significant at 5%, *significant at 10%. (b) Biprobit indicates bivariate probit model and SUR Biprobit indicates seemingly unrelated bivariate probit model. (c) The number under each coefficient is robust standard error.

Among citizens, male farm workers have a higher likelihood of leaving the farm. Due to the fact that the citizen farm workers are more likely to volunteer to work on the farm, their migration patterns may be largely affected by cultural factors wherein females are naturally assigned to household activities (Beyene 2008). The age dummies suggested that younger individuals are prone to exit the farm compared with the farmers that are 54 years old and more. Meanwhile, farmers in the 44 to 53 age bracket are less willing to move out, which might indicate that the farmers who are 54 years old and older may be constrained by retirement or health issues.

The regional unemployment rate is significant and has a positive sign indicates that the higher the unemployment rate, the more likely for citizen farmworkers to leave the farm. Although this result may seem counterintuitive, if we combine this result with the positive sign of regional unemployment rate in the second stage, we can see that the increasing unemployment rate would also increase the chance of citizen farmers to be unemployed. This is largely due to the fact that the economic shock may reduce the demand for agricultural workers, which would be followed by the decreasing wage. As we pointed out before, citizens are significantly more responsive to wage changes, thus with broader choices and higher salary requirement, they may be more likely choose to be unemployed. The last statistically significant variable would be the a17a, which represents the number of family members who working in the nonfarm sector. It suggests that the more people around are working in nonfarm sector, farmers may be more induced to exit possibly through the influence from the relatives and friends.

For green card holders, they have more freedom in changing jobs and their mobility is not limited by the laws and regulation anymore. The third and fourth column shows the regression result for green card holders.

In this group of workers, we find that age does not matter in the choice of staying or leaving the farm. Age also does not matter in the later choice of becoming unemployed or going to nonfarm sectors. These results can be explained by the fact that employment decisions are reckoned at the time of the approval of green card applications, which can happen at no fixed moment in the life stages of a person. Another explanation could be that since green card farmers were originally foreign workers, they may only have farm related skills which make it harder to leave the farm. Interestingly, such result is validated by the outcome for unauthorized farm

workers, which clearly shows some similarity of motivations for these two types of foreign born farm workers.

Male green card farmers would more likely stay on the farm, though such fact goes against the traditional roles of male and female workers. But this finding is supported by other studies. Bojnec, Dries and Swinnen (2003) find that female workers seem to leave the agricultural sector more easily than male counterparts. Males are less prone *ceteris paribus* to move to other sectors than female and women are more likely to leave the primary sectors (Gullstrand and Tezic 2008).

In the specification where the first stage and second stage have different sets of variables, farm wage is not significant. The insensitivity of green card agricultural workers may be caused by the fact that the green card farm worker may be less educated or less skilled, which could limit their change of transitioning to other sectors even if they may enjoy higher mobility. When the regional unemployment rate goes up, the green card farm workers would be less likely to leave the farm. The fewer chances of being employed outside agriculture and the backflow of workers into the agriculture may keep those farmers on the farm.

For green card holders, male farm workers have a lower probability to be unemployed compared with female workers. It is quite possible that male green card workers have broader job options because of their better physical condition, more motivation and less family constraints. The higher the educational attainment, the less likelihood there is for green card farmers to leave the farm. Such scenario is also confirmed among illegal farm workers. Other studies may report reverse findings that increased human capital investment will encourage the farmers to leave the farm (Gardner 1992, Goddard et al. 1993). However, Elliott and Lindley (2006) find that the more educated individuals were less likely to change sectors.

Determinants of unauthorized agricultural workers

Table 3 Estimate of determinants of unauthorized agricultural workers

	Decision stage 1	Decision stage 2
age14to23	-0.0484	-0.1888
	-0.136	-0.134
age24to33	0.0699	-0.1263
	-0.132	-0.128
age34to43	0.0965	-0.1518
	-0.135	-0.129
age44to53	0.0353	-0.1601
	-0.144	-0.136
gender	-0.6282***	-0.4441***
	-0.046	-0.043
numyrsfw	0.0170***	0.0150***
	-0.004	-0.004
wagetask1	0.0015	
	-0.006	
numkid	-0.0445*	-0.0213
	-0.018	-0.017
wageratio	-0.2747***	-0.2182***
	-0.072	-0.065
agcontri	-0.0098	
	-0.021	
popdensity	-0.0147*	-0.0119
	-0.007	-0.006
regunemprate	-0.0357**	-0.0369**
	-0.013	-0.013
east	0.7051	0.5248
	-0.834	-0.661
southeast	-2.1516**	-1.6452*
	-0.776	-0.649
mideast	-2.9230**	-2.4128**
	-0.942	-0.815
southwest	-3.1550**	-2.6386*
	-1.207	-1.069
northwest	-3.6689**	-2.9094*
	-1.352	-1.2
single	0.1056*	0.0641
	-0.043	-0.04
yrseduc	-0.0209***	-0.0220***
	-0.006	-0.006

a17a	-0.1249***	-0.1309***
	-0.02	-0.019
conteduc	-0.1304**	-0.1749***
	-0.05	-0.046
_cons	6.0270***	5.0793***
	-1.573	-1.395

Note: (a) ***significant at 1%, **significant at 5%, *significant at 10%. (b) Biprobit indicates bivariate probit model and SUR Biprobit indicates seemingly unrelated bivariate probit model. (c) The number under each coefficient is robust standard error.

Similar to the results for green card farm workers, the age dummies for illegal farm workers are insignificant as well. If farm workers do not have the legal permit to work in the United States, the individuals in any age would be constrained by immigration laws.

Unauthorized female farm workers are more likely to move out of the farm than the male workers. This is similar to the result for green card holders, and confirmed by results in other studies. The obvious difference between the illegal migrant workers and the other two types of agricultural workers is that geographical factors are significant for the unauthorized workers. We can see that the California state has the highest probability of farm exit for illegal workers. California has the highest number of illegal immigrants (Pew Hispanic Center 2010). Thus the high concentration of illegal immigrant together with the stricter enforcement of immigration policies there definitely should induce more illegal farmers to leave the local farms and move to neighboring areas (Kostandini, Mykerezzi and Escalante 2012).

When the number of people around who work in the nonfarm job increases, the probability of leaving the farm would decrease. Thus for illegal workers, when they have some members in the family already working in nonfarm sectors, then it would actually reduce the urgency for illegal workers to move out of agriculture. Besides, with family people working in other industries, it may not be worth the risk to find jobs in other sectors as occupational diversity in one family would stabilize family income. Studies on off-farm income reported similar result: Kimhi and Bollman (1999), Kimhi (2000), Glauben et al. (2006) found out the higher the extent of off-farm

work, the lower the probability of exit. Goetz and Debertin (2001) did the same research on the U.S., but found the ambiguous results that depended on the location of the counties.

The positive signs of the years of education as well as the continued education indicate that more years of education or continuous education would make illegal farmers stay on the farm. The less educated unlawful migrant workers may be more likely to make reckless decisions and try their luck in other sectors or just become unemployed.

In the second stage of choice, the illegal male workers are less likely to be unemployed. The regional dummy variables are not significant in the second stage, particularly in the second specification, which tells us that the choice pattern of nonfarm and unemployment for unauthorized farm workers would not be different across the regions.

Higher education and continued education such as career training and English lessons would decrease the probability of unemployment. Similar to the results for green card holders, illegal workers may find it unnecessary to take the risk of working in nonfarm sectors if some of their families are already in such sectors.

Conclusion

This study has analyzed the factors that could influence several classes of farm workers to consider changes in their occupational path. Results indicate that these three groups of workers actually make employment decisions using different sets of motivations or influencing factors. Health or retirement considerations have induced older farmers to leave the farms. But among green card and illegal farm workers, age does not play a significant role in their employment decisions. As for gender differences, male citizens are more likely to leave the farm, as opposed to green card holders and illegal farm workers.

Increases in agricultural wages may actually increase the probability of staying on the farm for citizens and green card holders. However, illegal farmers are insensitive to the changes in wages. Raising the wage might be a good way to keep local citizen farm workers on the farm but because of the large number of illegal farm workers, such strategy might be difficult to apply.

Under economic recession, these three types of farmers would also have divergent reactions. For citizens, if the unemployment rate goes up, they would leave the farm and choose to become unemployed. Citizen farm workers are less willing to try looking for jobs under a recessionary period as their relatively wealthier background or unemployment benefits from the government could allow them remain jobless. Among green card and illegal farm workers, increasing unemployment rates would keep them on the farm as they would have less employment options.

Intuitively, higher educational attainment and more career training would be more associated with high exit rates. However, this study's results do not confirm this trend. This study's results indicate that more years of education and continued education would actually decrease the probability of foreign born farm workers leaving their farm jobs. The main reason would be that more job training and education would enhance the agricultural skills for farmers and make higher earnings; but it would be inadequate for demanding industrial jobs, or given the skill enhancement from the training, the final payment from industrial job is lower than that of agriculture, as a result foreign farmers would stay on the farm. Hence educational and career training programs targeted at those workers provided by the government or society should help in keeping such workers employed in the agricultural sector. Besides, it reduces the likelihood for illegal farmers to be unemployed.

References

- Bentley SE, Saupe WE. Exits from Farming in outhwestern Wisconsin, 1982–1986. Agricultural Economic Report No. 631. Washington, DC: U.S. Department of Agriculture; 1990.
- Bojnec, Å . and Dries, L. (2005). Causes of Changes in Agricultural Employment in Slovenia: Evidence from Micro-Data, *Journal of Agricultural Economics*, 56(3): 399-416.
- Breustedt, G. and Glauben, T. (2007), Driving Forces behind Exiting from Farming in Western Europe. *Journal of Agricultural Economics*, 58: 115–127.
- Dries, Liesbeth and Johan F.M. Swinnen, 2002, Institutional Reform and Labor Reallocation during Transition: Evidence from Polish Agriculture, *World Development*, 30(3), pp. 457-474.
- Elliott, R.J.R. and Lindley, J.K. (2001), Intra-Sectoral Mobility and Adjustment Costs, CGEP Research Paper 2001/38, University of Nottingham.
- Gray, I., & Lawrence, G., (1996), Predictors of Stress Among Australian Farmers, *Australian Journal Of Social Issues* 31 (2), 173-189.
- Glauben, T., Herzfeld, T., Wang, X., 2004. Labor Market Participation of Chinese Agricultural Households, *Journal of Comparative Economics* under review.
- Goetz, Stephan J. and David L. Debertin. “Why Farmers Quit::A County-Level Analysis”*Amer. J. Agr. Econ* 83(4) November, 2001:1010-1023.
- Glauben, T., H. Tietje & C. Weiss: Intergenerational Succession in Farm Households: Evidence from Upper Austria. *Review of Economics of the Household*, 2 (2004), 443-461.
- Harris, John R & Todaro, Michael P, 1970. Migration, Unemployment & Development: A Two-Sector Analysis. *American Economic Review*, American Economic Association, vol. 60(1): 126-42.
- J. Edward Taylor, Diane Charlton and Antonio Yúnez-Naude. 2012. The End of Farm Labor Abundance. *Applied Economic Perspectives and Policy* 34(4):587-598.

Joakim Gullstrand & Kerem Tezic, 2008. "Who leaves after entering the primary sector? Evidence from Swedish micro-level data," *European Review of Agricultural Economics*, Foundation for the European Review of Agricultural Economics, vol. 35(1): 1-28.

Kimhi, A., Bollman, R., 1999. "Family Farm Dynamics in Canada and Israel: The Case of Farm Exits." *Agricultural Economics* 21: 69-79.

Kossoudji, Sherrie A. and Ranney, Susan I. 1986. *Wage Rates of Temporary Mexican Migrants to the U.S.: The Role of Legal Status*. Ann Arbor, MI. Population Studies Center Discussion Paper.

Kostandini, Genti & Mykerezi, Elton & Escalante, Cesar L., 2012. "The Impact of Immigration Enforcement on the Farming Sector," 2012 Annual Meeting, August 12-14, 2012, Seattle, Washington 127674, Agricultural and Applied Economics Association.

Lass, D. A., Findeis, J. L., and Hallberg, M. C. "Off-farm Employment Decisions by Massachusetts Farm Households" *Northeastern J. Agr. Res. Econ.* Vol. 18 (1989): 149-159.

Lien H. Tran & Jeffrey M. Perloff, 2002. "Turnover in U.S. Agricultural Labor Markets," *American Journal of Agricultural Economics*, Agricultural and Applied Economics Association, vol. 84(2), pages 427-437.

Lowell D. Hill. 1962. Characteristics of the Farmers Leaving Agriculture in an Iowa County. *Journal of Farm Economics*. 44(2):419-426.

Martin, P.L. 2009. *Importing Poverty? Immigration and the Changing Face of Rural America*. New Haven: Yale University Press.

Passel, Jeffrey and D'Vera Cohn. 2012a. "Unauthorized Immigrants: 11.1 Million in 2011." Washington, DC: Pew Research Center's Hispanic Trends Project, December.

Passel, Jeffrey and D'Vera Cohn. 2012b. "U.S. Foreign-Born Population: How Much Change from 2009 to 2010?" Washington, DC: Pew Research Center's Hispanic Trends Project, January.

Pfeffer, M. J. (1989), "Part-time farming and the stability of family farms in the federal republic of germany", *European Review of Agricultural Economics*, Vol. 16, No. 4: 425-444.

Roe, B. (1995). *A Study of U.S. Farm Exits with Evidence from the Panel Study of Income Dynamics: 1968-89.* Unpublished, Dept. of Agr. Resour. Econ., University of Maryland.

Robert J. R. Elliott & Joanne K. Lindley, 2006. "Trade, Skills and Adjustment Costs: A Study of Intra-Sectoral Labor Mobility," *Review of Development Economics*, Wiley Blackwell, vol. 10(1), pages 20-41.

Stephen Devadoss and Jeff Luckstead (2011) *Implications of Immigration Policies for the U.S. Farm Sector and Workforce*, *Economic Inquiry*, 49(3): 857-875.

Tocco, B., A. Bailey, and S. Davidova (2012), "Labour adjustments in agriculture: evidence from Romania", 132nd Seminar, European Association of Agricultural Economists, October 25-27, 2012, Skopje, Republic of Macedonia.

Tom Hertz and Steven Zahniser . 2012. *Is There A Farm Labor Shortage?* *American J. of Agricultural Economics* 95(2): 476-481.

Wells, J. 2012. *California Farm Labor Shortage 'Worst It's Been, Ever'*. CNBC online, 20 Aug 2012.

Available at:

http://www.cnbc.com/id/48725145/California_Farm_Labor_Shortage_Worst_It_s_Been_Ever.

Weiss, C. 1999. "Farm Growth and Survival: Econometric Evidence for Individual Farms in Upper Austria," *American Journal of Agricultural Economics* 81(Feb.): 103-116.