

THREE ESSAYS ON IMMIGRATION REFORM, WORKER SELF-SELECTIVITY AND
EARNINGS IN THE U.S. FARM LABOR MARKET

By

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To my family for their unconditional love, guidance and support
and to the memory of my father, the late Ivor L. Walters
An educator by profession and at heart,
he was equally my toughest critic and my staunchest supporter
I deeply regret that he passed away before he saw the fruits
of his labor for he would have been extremely proud

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LIST OF ABBREVIATIONS

ATE	Average Treatment Effect
ATET	Average Treatment Effect on the Treated
ATEU	Average Treatment Effect on the Untreated
FLC(s)	Farm Labor Contractor(s)
IRCA	Immigration Reform and Control Act
LAW	Legally Authorized Worker
MTE(s)	Marginal Treatment Effect(s)
NAWS	National Agricultural Workers Survey
RAW	Replenishment Agricultural Worker
SAW	Special Agricultural Worker
TE	Treatment Effects

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The purpose of this study is to examine contemporary issues in US farm labor markets and immigration policy via three stated objectives. Specifically, the study evaluates how farm labor market outcomes have changed with the increasing presence of foreign workers and in the wake of past immigration policies, it assesses the implications of legal status for unauthorized workers' wages and employment, and it evaluates the potential impact of immigration policy reform for farm workers' earnings.

The first essay evaluates the historical linkages between U.S. immigration policy and U.S. farm labor markets, and specifically how market outcomes have evolved following previous legislation such as the Immigration Reform and Control Act (IRCA). This is accomplished with a review of previous research on immigration policies from 1917 through 1986, and with an evaluation of detailed descriptive statistics on farm worker and labor market characteristics from the National Agricultural Workers Survey (NAWS). The descriptive statistics are used to characterize the US and Florida farm labor markets in the post IRCA period.

The implications of legal status for unauthorized workers' wages and employment are assessed in the second essay. Foreign farm workers are found to jointly select into U.S. farm

employment in an authorized or unauthorized status and into skilled or unskilled jobs, and these choices are found to have certain earnings implications. The essay makes a contribution to the literature by analyzing workers' joint selections into authorized and unauthorized status and skilled and unskilled employment in the context of a double selectivity framework. Previous studies have dealt with both of these issues but separately.

The issue of legalization for unauthorized workers is addressed in the final essay. The analytical approach uses a treatment effects approach which casts legalization as a treatment (or policy intervention) under the assumption of heterogeneity. The results show an overall positive impact of legalization on farm worker wage outcomes, and with the expected positive sorting on the gains from legal status. The evaluation of immigration policy implications for the farm labor market via the treatment effects framework is a valuable contribution to the literature since this approach has not been used in the context of farm labor before.

Given the current strong national and political interest in immigration reform and attendant issues for the agricultural sector, the study is a timely contribution. It should also be of considerable interest to agricultural economists, particularly those working in areas of labor intensive agriculture where labor issues are prime concerns for growers.

CHAPTER 1 INTRODUCTION

Overview

Throughout much of the last century, the participation of foreign born workers in US agriculture steadily increased. This is particularly evident in the specialty crop sector where growers are the largest users of hired and contract workers on a per-farm basis (Oliveira et al, 1993), due to the heavy reliance on manual labor for seasonal tasks. Recent statistics from the National Agricultural Workers Survey (NAWS) estimate that foreign born workers comprise about 78% of the crop farm workforce (Carroll et al. 2005). However, the problematic issue with the use of foreign labor in agriculture stems from the lack of legal status for about 53% of the workforce (Carroll et al. 2005).

The marked increase in the proportion of unauthorized workers in the agricultural labor market and other low-skilled occupations has renewed national and political interest in immigration reform, leading to intense political debate. Numerous legislative proposals were introduced in the 109th US Congress, but two, in particular, have provoked much debate across America and currently serve to frame U.S. immigration issues. Legislative proposal H.R. 4437 (the *Border Protection, Antiterrorism, and Illegal Immigration Control Act of 2005*) was passed by the House of Representatives in December 2005. It was arguably one of the more restrictive proposals introduced for consideration in Congress. It took a pro-enforcement stance on illegal immigration and employment, advocating criminal penalties for unauthorized immigrants and significant fines for the U.S. employers who may have hired them. It made no modifications for legal immigration nor did it advocate legalization for illegal immigrants. In contrast, S. 2611 (the *Comprehensive Immigration Reform Act of 2006*) passed by the U.S. Senate in May 2006 proposed earned legalization for unauthorized immigrants and favored modifications to existing

laws on legal immigration. It was not as severe as H.R. 4437 but favored a strict approach to enforcement. S.2611 also contained specific provisions for agriculture under AgJOBS (*Agricultural Job Opportunity, Benefits and Security Act of 2005* (S. 359/H.R. 884; S.2611 Subtitle B), which sought to improve the administrative process for the admittance of foreign farm workers, to improve wages and benefits, and to establish a pilot program for earned legalization for qualified unauthorized workers. The 109th Congress concluded without resolution on comprehensive immigration reform and neither bill passed. Similar bills have been introduced in the 110th Congress, both in the Senate (*the Secure Borders, Economic Opportunity and Immigration Reform Act of 2007*, S. 1348) and the House of Representatives (*the STRIVE¹ Act of 2007*, H.R.1645), but neither has been passed.

Arguing that citizen workers are unwilling to do farm work, farm employers have repeatedly expressed a preference for increased access to immigrant labor and favor using guest worker programs to offset possible labor shortages during harvest time. Employers have expressed concern about immigration reform that may curtail their access to foreign labor and increase wage rates. Employers fear that the subsequent wage increases may lead to significant crop losses in the short-run that may eventually threaten their livelihoods. Producers of labor-intensive specialty crops may be especially vulnerable, given the lack of mechanization. On the other hand, farm worker advocates favor legalization, as it is viewed as a means of improving workers' economic opportunities.

Against this backdrop, the purpose of this dissertation is to examine the issues that are germane to US farm labor markets and immigration policy. Given this overall theme, the following questions are relevant and comprise the specific objectives of the dissertation:

¹ This is an acronym for “*Security through Regularized Immigration and a Vibrant Economy*.”

- How have farm labor market outcomes changed with the increasing presence of foreign workers?
- What are the implications of legal status for unauthorized workers' wages and employment?
- What are the implications of immigration reform for the farm labor market?

These questions are evaluated through three distinct essays. In addressing the first objective, the first essay reviews the historical linkages between U.S. immigration policy and U.S. farm labor markets, and specifically how market outcomes have evolved in the wake of past policies. A substantial portion of the chapter focuses on the set of changes in the farm labor market after the 1986 Immigration Reform and Control Act (IRCA) and uses detailed descriptive statistics on farm worker characteristics, employment, benefits and compensation to characterize the US and Florida farm labor markets.

In keeping with the second objective, the second essay makes the argument that foreign born workers jointly select into U.S. farm employment in an authorized or unauthorized status and into skilled or unskilled jobs, and that their decisions may have certain earnings implications. Previous studies have dealt with both of these issues but separately. The essay makes a contribution to the literature by analyzing workers' joint selections into authorized or unauthorized status and skilled or unskilled employment in the context of a double selectivity model framework.

The final objective is addressed in the third essay which evaluates the effects of proposed legalization for earnings outcomes of unauthorized farm workers. The issue is addressed from a treatment effects (TE) perspective in which legalization is cast as a treatment (or policy intervention) and the earnings outcomes for treated and non-treated farm worker groups are noted. The TE framework has not been used in previous analyses of immigration policy impacts on farm labor markets.

Data

The NAWS was established by a mandate of the 1986 IRCA which required the U.S. Secretaries of Labor and Agriculture to measure the farm labor supply between 1990 and 1993 for possible annual labor shortages.² The NAWS is an employment-based random survey of the U.S. crop workforce which gathers and analyzes data on demographic characteristics, employment, wages and working conditions, health, safety and educational, social service and housing issues (US-DOL, 2007). Respondents are hired workers employed in perishable crops (fruits and vegetables, nursery crops, field crops, cash grains, silage and animal fodder), and there are four sampling levels (region, crop reporting district, county and employer). A multistage sampling process is used to overcome the challenges associated with obtaining a nationally representative sample due to seasonality of farm work and mobility of the hired workforce. Workers are surveyed in three cycles annually, and each cycle lasts about twelve weeks. Interviews are allocated according to proportional allotment across twelve regions, and the number of interviews per cycle is proportional to the amount of seasonal agricultural service activity at the time of year (Perloff, Lynch and Gabbard, 1998).

The data used in this study encompasses the entire survey period (1989-2006) that is currently available. With the exception of the first essay, subsamples of foreign workers (with complete data) are used in the analysis.

² Had shortages been detected, foreign workers would have been granted authorization for temporary U.S. employment under the Replenishment Agricultural Worker (RAW) program.

CHAPTER 2 U.S. IMMIGRATION POLICY AND FARM LABOR MARKETS

Overview

U.S. immigration policy has long been intertwined with the labor needs of the U.S. agricultural industry (Levine, 2004) which tend to be driven by the specialty crop sector. The farm labor force has become increasingly reliant on foreign workers over time, with most workers originating from Mexico. The most contentious aspect of foreign workers' participation in low-skilled occupations such as agriculture stems from the undocumented status of a large percentage of these workers. Indeed, it creates a conundrum for lawmakers who aim to establish and enforce immigration policy goals but who are cognizant of the potential economic implications. Immigration reform has taken center stage once more in the political arena, and agriculture has drawn scrutiny due to the significant proportion of unauthorized workers in the crop workforce.¹

The participation of unauthorized workers in agriculture was first formally addressed during the third phase of the *Bracero* program when tighter restrictions were placed on employers' use of foreign labor.² The Immigration Reform and Control Act (IRCA) of 1986 was crafted in a similar vein and sought to discourage illegal immigration and employment through several provisions. First, sanctions were put in place to penalize employers who knowingly hired unauthorized workers and to remove the commercial incentives associated with illegal

¹ The term is used in the literature to describe foreign nationals who lack authorization for U.S. employment. They are not citizens or permanent residents and are not categorized under any of the temporary authorized statuses that would allow longer-term residence or employment (Passel, 2005). It is also used to describe persons who enter the US without proper inspection at the borders, who overstay their visas and/or work in violation of nonimmigrant visas that were lawfully obtained (Chiswick, 1988).

² The program allowed for admission of Mexican workers (1942-1964) for employment on US farms. The term "*bracero*" originates from the Spanish term '*brazo*' (meaning arm) – thus the designation '*bracero*' meant 'one who works with his arms' (Briggs, 2004).

immigration. Second, unauthorized workers present in the U.S. at the time of IRCA's passage were adjusted to legal status under the Legally Authorized Worker (LAW) and Special Agricultural Worker (SAW) programs, provided that they met certain qualifications. Approximately 3 million unauthorized immigrants gained legal status in this manner. Third, the Replenishment Agricultural Worker (RAW) program was implemented to facilitate employment of foreign guest workers if needed.³ This was done to assuage growers' concerns of labor shortages if the newly converted SAWs left agriculture following legalization. However, these shortages never materialized and the program was allowed to expire in 1993. Fourth, the H-2 program was separated into the H-2A and H-2B programs in order to create a more efficient process for hiring foreign guest workers for temporary agricultural (H-2A) and non-agricultural (H-2B) U.S. employment.

Studies documenting IRCA's effect on the national farm labor market suggest that its core objectives have not been achieved. Not only has illegal immigration dramatically increased, with most illegal immigrants arriving after 1990 (Passel, 2005; Passel and Suro, 2005), but the overall proportion of unauthorized workers in some low-skilled occupations has increased markedly since IRCA (Passel, 2006; Mines, Gabbard and Steirman, 1997; Carroll et al. 2005). In the case of agriculture, statistics from the National Agricultural Workers Survey (NAWS) show that the percentage of unauthorized crop workers has grown consistently since the mid 1990s. Whereas unauthorized workers comprised only 7% of the workforce in 1989, by 1994-1995 and 2001-2002, this proportion had expanded to 32% and 53%, respectively (Mines, Gabbard and Steirman, 1997; Carroll et al. 2005). Declining and lax enforcement of employer

³ A guest worker is typically a foreign low-skilled worker, hired on a temporary basis for seasonal work, usually in agriculture (Bruno, 2006).

sanctions and limited enforcement at worksites and U.S. borders are some of the factors which may have contributed to these trends (Thompson and Martin, 1991; Brownell, 2005).

The broad objective of this introductory chapter is to review the historical linkages between U.S. immigration policy and U.S. farm labor markets, with specific focus on how market outcomes have evolved in the wake of past policies. The first section of the chapter briefly reviews the various policy measures that were authorized by immigration law from 1917 onwards, and the implications for farm labor. The second section of the chapter provides more direct insight into the market outcomes under the 1986 Immigration Reform and Control Act (IRCA) and characterizes the U.S. and Florida farm labor markets based on data from the National Agricultural Workers Survey (NAWS) for 1989 to 2004. The NAWS is a rich nationally representative data set on farm workers in crops in the U.S, including approximately 2,500 workers each year. It is well-suited for this exercise as it allows for a fairly extensive overview of crop farm worker demographics, legal status, employment and wages.⁴ Much of the discussion in this section centers on the legal status of the workforce, particularly in the context of distinctions between authorized and unauthorized workers. The final section of the chapter summarizes the key findings and the main conclusions.

U.S. Immigration Policy Review

Agriculture's linkage with immigration policy can be traced to the 1870s when Western growers successfully lobbied the United States Congress for the admission of immigrant workers from Asia and Mexico on the grounds that they were “. . . needed to establish and maintain a viable agriculture . . .” (Martin, 1990, pg. 71); since then, immigration legislation has explicitly considered the purported labor needs of the agricultural industry. The origin and historical role

⁴ Data on working conditions, farm worker households, health and health care access, income and assets are also available through the Survey but are excluded since they are less important to the overall objective of the chapter.

of guest worker programs in the United States has been as national emergency programs during military conflicts (Briggs, 2004), whereby guest workers are permitted entry when efforts to obtain U.S. workers have failed (Oliveira, 1989). The first of such programs was authorized by the Ninth Proviso to Section 3 of the 1917 Immigration Act in response to requests from Southwest growers. The order suspended the contract labor prohibition, the head tax and literacy test stipulation on aliens and new immigrants to allow for the entry of Mexican farm workers to alleviate labor shortages caused by World War I (Heppel and Papademetriou (1999); Briggs (2004)). The program was deemed a remarkable achievement by the agricultural and railroad sectors since the Act explicitly forbade the entry of foreign workers for employment in the United States (Briggs, 1983). It was discontinued in 1922 after it could no longer be justified as a national defense policy (Briggs, 2004).

The *Bracero* Program

The Mexican Labor Program, more commonly known as the *Bracero* program, was established in 1942 following formal negotiations between the U.S. and Mexican governments. Authorized by Public Law 45 (P.L. 45), the objective of the labor program was to mitigate labor shortages in U.S. agriculture that were brought about by World War II. Workers were to be employed in the agricultural sector only; they were subject to immediate deportation if found working in any other industry (Briggs, 2004). The *Bracero* Program was implemented in three phases. The first phase (1942-1947) was executed during wartime and authorized via the omnibus appropriations bill Public Law 45 which permitted entry of foreign workers for agricultural employment only (Briggs, 2004). The second phase of the program (1948-1951) was regulated by a joint agreement with Mexico and according to the provisions of the 1917 Immigration Act. Growers became more directly involved in recruitment and employment after their successful lobbying of the US Congress, which resulted in significant revision to the

original agreement. According to Heppel and Papademetriou (1999), intergovernmental contracts were replaced by grower-to-*bracero* contracts wherein farm employers were allowed to recruit at the border, after which workers were admitted by the Immigration and Naturalization Service (INS). The Mexican government strongly protested these arrangements, citing lax enforcement and the potential for breach of contract by U.S. employers (Heppel and Papademetriou, 1999). It is estimated that 65,000 workers were admitted annually on average between 1945 and 1950 for employment on Southwestern farms (Oliveira, 1989; Briggs, 1983).

Amendments to the *Bracero* Program

The *Bracero* program was amended by P.L. 78 in 1951, mainly to assuage concerns over labor shortages caused by the Korean War (Oliveira, 1989; Heppel and Papademetriou, 1999). The program was expanded and tighter employment restrictions were put in place to discourage increased illegal immigration from Mexico. U.S. employers were permitted to hire Mexican workers only if domestic (U.S) workers were unavailable and certain guarantees could be made that their employment would not adversely affect the wages and working conditions of domestic workers. To lessen the likelihood of worker exploitation, the Mexican government insisted that workers be guaranteed employment for specific periods according to contract and that they be paid the same wages as domestic workers (Oliveira, 1989). In comparison to the earlier phases, the number of foreign nationals admitted for employment purposes increased dramatically: for example, the number of foreign temporary farm workers grew from 204,000 in 1951, to 460,000 in 1956. It decreased to about 200,000 workers when the program was finally terminated in 1964. It is estimated that Mexican workers comprised 93% of the farm workforce for the duration of the *Bracero* Program (Oliveira, 1989).

Whether or not the *Bracero* program was effective in curbing illegal immigration remains a point of contention. On one hand, the program provisions were somewhat contradictory: for

example, the employment restrictions of the third phase were undermined in some respects by a 1949 amendment that granted legal status (via *bracero* contracts) to unauthorized Mexican workers who resided in the U.S (prior to the amendment). Heppel and Papademetriou (1999) argued that these strategies may have actually increased illegal immigration as unauthorized Mexicans figured that the best way to obtain legal status in the United States (as a *bracero*) was to migrate illegally to the U.S. On the other hand, reports based on apprehensions data show that illegal immigration decreased significantly during the program (CRS, 1980; Anderson, 2003), but increased after its termination (Anderson, 2003) as thousands of former *braceros* continued to migrate to the U.S. for work (Briggs, 2004). Given this overall context, guest worker programs have been sharply criticized as inherently flawed policy instruments that create immigrant networks and ultimately facilitate future illegal immigration (Briggs, 1986, 2004; Krikorian, 2001; Martin, 2000).

The British West Indies (BWI) Temporary Alien Labor Program

Foreign workers were also granted legal entry to the U.S. via the British West Indies (BWI) Temporary Alien Labor program, which operated concurrently with the *Bracero* Program. The BWI Labor program was authorized by Public Law 45 and established in April 1943 by joint agreement with governments of the British West Indies in response to Eastern growers' claims of wartime labor shortages (Briggs, 2004). The notable difference between the BWI and *Bracero* programs was that BWI contract workers were permitted to work in the nonagricultural sector (Heppel and Papademetriou, 1999; Briggs, 2004). During its initial phase (1943-1947), an estimated 19,000 workers per year were admitted for farm work, mostly in Florida (Briggs, 2004). Though seemingly insignificant relative to the *Bracero* Program, the influx of workers

had a substantial impact on the farm labor markets in which the foreign workers were employed (U.S. Senate Committee on the Judiciary, 1978).

Between 1947 and 1952, the program was converted to a temporary worker program in which tripartite contracts were established between foreign workers, their governments and U.S. employers only – the U.S. government played no formal role in the process other than to authorize the workers' entry to the U.S (Heppel and Papademetriou, 1999; Briggs, 2004). Following the passage of the Immigration and Nationality Act in 1952, contract workers from the BWI were employed through the H-2 program (Heppel and Papademetriou, 1999)

The H-2 Program

The H-2 program was authorized by sections 101(a)(15)(H)(ii) and 214(c) of the 1952 Immigration and Nationality Act and differed from its precursors in the sense that it was a permanent part of immigration law and not geared towards specific labor shortages *per se* (Oliveira, 1989). Though open to all U.S. employers, it was most widely used by agricultural employers. Employers were required to pay foreign and domestic workers the higher of the adverse effect wage rate (AEWR), the Federal or State minimum wage, or the prevailing wage rate in the area of employment.⁵ They also had to offer identical benefits, such as free transportation and housing and the minimum wage, to domestic and foreign workers (Heppel and Papademetriou, 1999). The relatively strict hiring requirements of the program caused fewer foreign workers to be admitted for U.S. employment, in comparison to the other programs: on average, only 18,000 foreign workers were admitted annually between 1965 and 1987 under the H-2 program, compared to the admission of an annual average of 242,000 workers between 1945

⁵ The AEWR was established by the U.S. Department of Labor in 1961. It is the wage rate which “*must be offered and paid, as a minimum, to every H-2A worker and every U.S. worker for a particular occupation and/or area in which an employer employs or seeks to employ an H-2A worker so that the wages of similarly employed U.S. workers will not be adversely affected*” (U.S. Dept. of Labor, 2006).

and 1964 under the *Bracero* program (Oliveira, 1989). These workers were employed mainly by growers in the Eastern States since growers in the Southwest had an ample supply of unauthorized workers, who were either former *braceros* or newcomers (Oliveira, 1989).

The Immigration Reform & Control Act of 1986

In the mid 1980s, concern over increased illegal immigration gave way to legislative reform via the Immigration Reform and Control Act (IRCA), P.L. 99-603, which passed in 1986. Lawmakers hoped to reduce illegal immigration and discourage the employment of unauthorized labor by U.S. employers through specific policy instruments such as employer sanctions, industry-specific legalization programs and guest worker programs (the RAW and H-2A programs). Based on the findings of previous studies, the specific objectives and impacts of these policy instruments are examined in the following sections.

Employer sanctions

These were intended to remove the commercial or employment incentives associated with illegal immigration and were authorized by Title I, Part (A), Section 101 of IRCA. According to the law, employers who knowingly hired unauthorized workers could be fined up to \$10,000 per unauthorized worker and imprisoned for six months (Library of Congress, 1986; LSC-OIG, 2007). Given the risks and penalties associated with the employment of illegals, it was widely assumed that employers would improve wages and working conditions in order to attract and retain legal workers. Employer sanctions were phased in more slowly in agriculture than the rest of the economy, ironically because growers successfully made the case that “. . . they had become dependent on unauthorized immigrant workers because the U.S. government had not prohibited hiring such workers in the past” (Taylor and Thilmany, 1993, pg. 350). Agricultural employers were thus exempt from sanctions compliance and enforcement until December 1988.

According to Taylor and Thilmany (1993), employer sanctions did little to reduce the inflow of illegal newcomers to the farm labor market during the transition period or to reduce worker turnover. Research by Thompson and Martin (1991), Martin (1994) and Brownell (2005) show that sanctions enforcement has waned over time and that enforcement has been lax in the years since IRCA's passage. Inadequate funding, limited personnel, limited intra- and inter-agency coordination, competing priorities among agencies and an overall inefficient bureaucratic system for ensuring employer compliance have been cited as primary factors in this respect (Thompson and Martin, 1991; Brownell, 2005). Martin and Taylor (1990) have argued that employers have seemingly made little effort to improve working conditions and wages. According to Taylor and Thilmany (1993), the agricultural labor market has continued to be characterized by high turnover and with a large proportion of unauthorized workers.

Another factor that may have indirectly affected enforcement is the problem of "documented illegals" – workers with counterfeit work authorization documents – in farm labor markets in the U.S. Such documents have proliferated quite easily since federal law does not allow employers to question the employment eligibility of workers who present the requisite documentation (Taylor and Thilmany, 1993; Rural Migration News, 2000). In short, employers are required to verify legality of status only, and not the authenticity of the documents that are presented as proof of legality.

IRCA's enforcement provisions may have encouraged some growers to shift their management responsibilities to farm labor contractors (FLCs), arguably to lessen the risk of penalties associated with the employment of unauthorized workers. FLC operations have increased in major specialty crop producing states such as California and Florida (Martin and Taylor, 1990; Polopolus and Emerson, 1991; Thilmany, 1996). FLCs tend to be more adept at

dealing with the threat of sanctions and recruiting unauthorized immigrants for seasonal farm work than growers, and generally have extensive contacts with farm worker communities and migration networks (Polopolus and Emerson, 1991). Consequently, there exists considerable speculation as to whether growers have used FLCs to stabilize employment or to merely circumvent the law without actually reducing their reliance on unauthorized labor (Taylor and Thilmany, 1992).

Legalization

The Special Agricultural Worker (SAW) program legalized roughly 1.3 million unauthorized crop workers who did at least 90 days of farm work in 1985-86 (Duffield, Morehart and Coltrane, 1989; Thompson and Martin, 1991). The overall goal of legalization was to improve the economic circumstances for unauthorized workers based on the assumption that employers would be encouraged to improve wages and working conditions to attract and retain legal workers (Martin, 1990; Taylor, 1992). This was a valid assumption since lack of legal status has been shown to affect wages and occupational mobility of agricultural workers (Taylor, 1992; Isé and Perloff, 1995; Iwai, Emerson and Walters, 2006a).

The first of these studies on the agricultural sector was done by Taylor (1992), who examined the relationship between legal status, wages and workers' self-selection into primary (skilled) and secondary (unskilled) agricultural jobs based on data from a 1983 survey of male farm workers in California. Selection bias into skilled or unskilled employment was accounted for via the Heckman two-stage procedure, and legal status was assumed as having an exogenous influence on wages. His employment results indicated that unauthorized workers were less likely than authorized workers to be observed in primary (skilled) farm jobs and that they were far more likely to be hired for low-skill jobs than were authorized workers. At the very least, this finding suggests that unauthorized status either hinders workers' mobility into skilled

employment, or that it causes workers to earn lower primary wages which discourages them from seeking skilled employment. The wage results indicated that unauthorized workers in skilled (unskilled) jobs earned 33% (5%) less on average than legal workers in skilled (unskilled) jobs. Taylor concluded that their wages and economic mobility would likely improve with legalization but cautioned that these benefits would be tempered by an influx of unauthorized newcomers seeking farm employment.

Isé and Perloff (1995) estimated models for legal status, farm wages and hours of farm employment based on NAWS data for 1989-1991. A multinomial logit model was used to estimate workers' selection into native citizen, naturalized citizen, amnesty recipient, permanent resident, and unauthorized status categories. Selection bias into the non-native categories was addressed using Lee's extension of Heckman's two stage procedure. On average, authorized workers were found to earn 15% more per hour and per week than their unauthorized cohorts.

Using NAWS data for 1989-2004, Iwai, Emerson and Walters (2006a) estimated an ordered probit model for self selection into different legal statuses (unauthorized, authorized, permanent resident and citizen) and simulated how unauthorized workers' wages would change with an adjustment to legal status. Self-selection into employment (job) type was not considered. In almost 100% of the scenarios simulated, unauthorized workers' wages increased after legal status was acquired. Unauthorized workers who selected into temporary authorized status had wage increases between 6% and 31% after 2001. The findings in this study compared relatively well with previous work by Taylor (1992) and Isé and Perloff (1995).

Much of the controversy surrounding legalization under IRCA centered on whether it would cause workers to shun agriculture for other occupations. Lawmakers sought to assuage these concerns by establishing the Replenishment Agricultural Worker (RAW) program to

legally admit foreign guest workers for agricultural employment during labor shortages. However, the RAW program was never used as the annual calculations of labor supply and demand made by the U.S. Departments of Agriculture and Labor for fiscal years 1990 through 1993 found no national farm labor shortages (Levine, 2004), and the program was allowed to expire in 1993.

Several studies examining the employment effects of legalization found that it had no particularly adverse effects on employment duration (Hashida and Perloff, 1996; Emerson and Napasintuwong, 2002; Tran and Perloff, 2002; Iwai, Napasintuwong and Emerson, 2005; Iwai, Emerson and Walters, 2006b). Hashida and Perloff examined the impact of legalization on farm work duration with multinomial logit and duration models based on 1989-1991 data from the NAWS. They corrected for selection bias in legal status using Lee's extension of Heckman's two-stage method and used completed employment spells. Their findings indicated that expected employment duration increased when workers were employed under a legal status.

In a different approach based on uncompleted spells, Emerson and Napasintuwong (2002) examined employment duration in the context of the number of years reported working in U.S. agriculture as opposed to individual job length. The expected duration of employment was found to be larger for authorized than unauthorized workers. Tran and Perloff (2002) estimated a Markovian model of migration between agriculture, nonagricultural work and unemployment based on 1989-1991 NAWS data. Migration rates were conditioned on workers' demographic characteristics and legal status, and completed employment spells were used. Though job mobility patterns were found to be significantly different by legal status, Tran and Perloff determined that newly legalized farm workers did not leave agriculture as predicted, and

concluded that IRCA's legalization provision seemed to increase the long-run probability that legalized workers would remain in agriculture.

Similarly, Iwai, Napasintuwong and Emerson (2005) and Iwai, Emerson and Walters (2006b) found that there was a greater likelihood of longer employment duration once workers obtained legal status. The 2005 study utilized an ordered probit model with selection on legal status, and a duration model based on completed employment spells. Unauthorized workers' employment duration was found to be no shorter than authorized workers' employment duration, particularly if the workers were converted to authorized or permanent resident status. The 2006 study utilized a similar approach to Tran and Perloff (2002) but extended the Markov chain model by accounting for selection bias on legal status. The likelihood of workers remaining in agriculture post-IRCA was shown to increase modestly with legalization.

The H-2A temporary worker program

A revision of the H-2 temporary worker program was also mandated by IRCA. Separate H-2A and H-2B programs were created to legally admit foreign workers for temporary agricultural and non-agricultural employment provided that qualified U.S. workers are unavailable.⁶ Title III, part (A), section 301(c) of the law states that employers must be certified through the U.S. Department of Labor (DOL) before they are allowed to hire workers from overseas, so as to (1) certify that U.S. workers are unavailable and that (2) the employment of foreign workers will not adversely affect the wages or working conditions of similarly employed U.S. workers (Library of Congress, 1986; LSC-OIG, 2007). The Department of State (DOS) issues the H-2A visas and temporary worker admissions are recorded by the Department of Homeland Security (DHS).

⁶ Visas are typically issued for a period of up to one year in duration, but extensions totaling three consecutive years may be granted (Wasem and Collver, 2001).

As shown by Figure 2-1 however, the H-2A program has yet to be used on a large scale. Following an initial admission of a little over 30,000 workers in 1989, admissions fell by nearly 40% the following year and trended steadily downward for much of the early to mid 1990s, supposedly as a result of mechanization of the Florida sugarcane harvest and an overall lack of demand for H-2A workers in other sectors (Rural Migration News, 2001). Admissions rebounded dramatically between 1998 and 2000, with an all-time high of 33,982 workers in 2000. Most of these workers were employed on tobacco, vegetable and peach farms in North Carolina and Georgia (Rural Migration News, 2001). The erratic pattern in the admissions data between 2003 and 2005 may be reflecting a similar usage pattern by growers. Growers have often cited the program's cost and cumbersome procedures as the main reasons for their limited usage of H-2A workers (Effland and Runyan, 1998; Bruno, 2006). No doubt, the ready availability of unauthorized workers may have also been a factor in this respect.

Specialty Crop Agriculture and Farm Labor

Specialty crop agriculture involves the production of non-program crops such as citrus, vegetables, fruits, nuts, berries, tobacco and horticultural and greenhouse commodities. It is the largest sector by value of the U.S. agricultural sector with approximate 2002 farm-gate and export values of \$58.7 billion and \$9.3 billion, respectively (The California Institute for Federal Policy Research, 2003). California and Florida are the top producers in the nation. Crop cash receipts comprised more than 70% of the total cash receipts from commodity marketings in 2003, totaling \$27.8 billion and \$6.4 billion for California and Florida, respectively (USDA-NASS, 2002). Florida's 2003 crop cash marketings were valued at roughly \$5.2 billion, with greenhouse and nursery products (24.8%), oranges (15.3%), sugar cane (8.7%), and tomatoes (8%) as the principal commodities. Florida also ranked second nationally in 2003 vegetable receipts, and accounted for 8.4% and 21.8% of total receipts at the national and state levels,

respectively. It ranked third in receipts for fruits and nuts, accounting for 11.1% and 22.5% of total receipts at the national and state levels, respectively. Though Florida's contribution (9.8%) to national strawberry cash receipts was significantly less than California's (84.7%) contribution, it ranked second nationally. Strawberry receipts comprised 2% of the total for all commodities marketed at the state level (ERS, 2005).

Markets for fresh produce and horticultural products have expanded rapidly over the last twenty years, fueled in part by increased consumer demand and technological developments in transportation and storage facilities (Rural Migration News, 2000). Strong market growth has increased crop acreage and farm labor demand, particularly in California and Florida. An estimated 20-25% of vegetable acreage and 40-45% of fruit tree acreage is harvested by hand (Sarig, Thompson and Brown, 2000) and large amounts of labor are typically required on seasonal basis. Labor needs are particularly crucial during the harvest periods such that the produce may be quickly harvested to preserve quality. This labor intensity causes labor expenditure in the specialty crop sector to exceed labor expenditures in other agricultural sectors, and more so for the agricultural sector as a whole. In 2002 for example, labor expenditures in the fruit, vegetable, and horticultural sectors comprised 37% of total production expenditures in comparison to 13% for the agricultural sector as a whole (USDA-NASS, 2002). California's total labor expenditures were 29% of total farm production expenses whereas Florida's were 33% – nearly triple the percentage for the entire U.S. agricultural sector (USDA-NASS, 2002).

Florida's hired and contract labor expenditures were 24.4% and 8.9%, respectively, of overall 2002 production expenditure in comparison to 10.7% and 2%, respectively, for the entire U.S. agricultural sector. On the basis of farm type, labor expenditures comprised 40% of all production expenses reported by Florida's vegetable and melon farms, and 38% for fruit and tree

nuts farms. Figure 2-2 illustrates the contribution of each farm type to Florida's total agricultural labor expenditure for 2002. Forty six percent of the overall labor expense was attributed to vegetable, melon, fruit and tree nuts farms combined. Greenhouse, nursery and floriculture farms accounted for 36% of labor expenditure, an increase of 19% over 1978 expenditures in this category (USDA-NASS, 1978; 2002).

The specialty crop sector has increasingly faced challenges from foreign competition, environmental regulations, consumer concerns about health and product quality, and rising production costs in recent years (USDA, 2007). At present, there is growing interest in applications for the fresh market that would reduce costs, increase on-farm productivity, and reduce the strenuous labor requirements and reliance on foreign labor.⁷ In this respect, the Bush Administration has recommended the establishment of a Specialty Crop Research Initiative in the 2007 Farm Bill, which would be supported by \$100 million in annual mandatory funding (USDA, 2007).

The large supply of farm workers, many of whom are unauthorized, is widely viewed as a factor that stymied technological advancement in U.S. agriculture over the last several years (Sarig, Thompson and Brown, 2000; Krikorian, 2001 and 2004; Martin; 2001). Napasintuwong (2004) and Napasintuwong and Emerson (2004) by way of an induced innovation approach analyzed the impacts of changes in immigration policies and labor markets on the rate and direction of technological change in Florida and the U.S. between 1960 and 1999. Comparing technological changes before and after IRCA, they determined that technology had been labor-saving prior to IRCA but had become labor neutral after IRCA due to the large labor supply.

⁷ Suitable applications for the fresh market have been slow to develop due to lack of public funding for mechanization research. Sarig, Thompson and Brown (2000) attribute this to the policy stance taken by Bob Bergland, former U.S. Secretary of Agriculture in the Carter Administration, who argued against public funding of mechanization R&D that would result in displacement of farm labor.

These results imply that immigration policies that restrict employers' access to foreign labor may cause mechanization to increase in agriculture (Napasintuwong, 2004; Napasintuwong and Emerson, 2004).

The Immigration Reform and Control Act and Farm Labor Market Outcomes

The aim of IRCA was to control illegal immigration and employment, primarily through employer sanctions and legalization programs. In order to gauge the success of the legislation, it is instructive to assess the historical data on labor market outcomes. In this respect, summary statistics based on data from the National Agricultural Worker Survey (NAWS) for 1989-2004 is evaluated. Toward the end of the chapter, these are discussed and compared in the context of IRCA's stated objectives.

The findings summarized in the following sections are based on the responses of about 42,000 crop workers in the U.S. and 5,000 crop workers in Florida who were interviewed for the NAWS between 1989 and 2004. The findings are organized according to workforce and labor market characteristics, compensation and employment patterns, with legal status used as a common frame of reference. Florida is singled out for comparison as a major specialty crop producer with high labor intensity relative to the rest of the United States. Florida also has a large immigrant workforce much of which is unauthorized for US employment. California is similar in these respects but will not be evaluated in this chapter.

US and Florida Farm Labor Market Outcomes, 1989-2004

Workforce Characteristics

Demographics

At the national level, crop farm workers hired between 1989 and 2004 were mostly foreign born (73%), Hispanic (80%) and male (78%). Only a quarter (25.4%) of the workforce had been born in the United States. Most workers were Mexican (68.2%), and to a lesser extent,

of other nationalities: Central America (2.88%) and Puerto Rico, South America, the Caribbean and Pacific islands, Asia and Southeast Asia combined (<4%). In comparison, Florida had a larger proportion of foreign born workers (82%), most of whom were Hispanic (86%) and male (74%). Participation of citizen workers in the Florida labor market was significantly less than at the national level (<one-eighth of the workforce). In Florida, Mexicans also comprised the majority (59.1%) of the foreign-born population overall, but the workforce was more diverse in terms of representation by other nationalities. For example, the proportion of Central American workers (16.4%) was more than five times that observed for the U.S. crop workforce. Workers from Puerto Rico (5.8%) and other countries (6.5%, including South America, the Caribbean and Pacific Islands, Asia and Southeast Asia) also comprised larger proportions than observed for the U.S. as a whole.

Over the sample period, the average worker in the U.S. and Florida labor markets was about 34 years. Central American workers tended to be younger (~29 years) than their cohorts from other countries (~38 years). Most workers had migrated to the United States at around 22 years, with some divergence apparent between the different nationalities. For example, Mexican, Central American and Puerto Rican workers were about 24 years on average at the time of initial entry, whereas their cohorts from South America, the Caribbean, Pacific Islands and Asia had migrated to the U.S. at around age 30.

Given that Hispanic workers comprised significant proportions of both labor markets over the sample period, it is not surprising that a majority of the workforce identified Spanish as their primary language. Seventy five percent of all workers at the national level identified themselves in this manner, whereas 21% identified as English-speaking and 4% identified with

another primary language.⁸ In Florida, 79% of the workforce identified Spanish as a primary language whereas less than one tenth identified English as their primary language.

Approximately 12% of all workers identified with another language. These characteristics carried over to workers' command of the English language. At the national level, fewer than a quarter (22%) indicated that they could speak English well; the vast majority either could not speak it at all (41%), or could speak only 'a little' (29%) or could speak it 'somewhat' (8%).

The trends were more pronounced in Florida: only 19% indicated that they had decent English speaking ability, 33% indicated that they spoke only 'a little' and 47% could not speak English at all.⁹ In sum, these findings suggest that most of these workers would be constrained in their ability to participate in the mainstream economy (Emerson, 2000).

Immigrant workers in agriculture are known to be low-skilled and this view was reinforced by the data on both labor markets. The average worker interviewed between 1989 and 2004 had completed only up to the 6th grade in formal education. The outliers in this respect were citizen workers – who had completed up to the 10th grade – and Central American workers who had completed up to the 4th grade only. In addition, few workers had undergone formal training since migrating to the U.S. Prior to the time of the interview, only 30% of U.S. crop workers and 28% of Florida crop workers had taken English/ESL, literacy, citizenship, job training, GED/High School Equivalency, Migrant Education, Adult Basic education classes or college/university courses.

⁸ In addition to Spanish and English, the NAWS allows for selection on the following languages: French, Creole, Laotian, Hmong, Vietnamese, Cambodian, Tagalog/Ilocano, Mixtec, Kanjobal (Codebook for NAWS data, 2005). These were grouped as 'other' during the analysis to avoid cell sizes of less than 50 observations.

⁹ Workers who spoke English 'somewhat' and 'well' were grouped into one category to avoid cell sizes of less than 50 observations.

Legal status

Legal status is self-reported in the NAWS. During the interview, workers are asked whether or not they are citizens and if not, what form of work authorization, if any, they have. Workers are categorized as unauthorized if they lack employment authorization, as having ‘other’ work authorization if they have some form of temporary authorization for U.S. employment, as permanent residents if they have green cards, or as citizens if they were born in the US or naturalized.

Between 1989 and 2004, roughly 42% of crop workers at the national level self-identified as unauthorized for U.S. employment. Of those workers who reported being in a legal status, citizens comprised 29%, and permanent residents and ‘other’ authorized workers comprised 22% and 7%, respectively, of the workforce. In Florida, 53% of the crop workforce was unauthorized. Of those workers who reported being in a legal status, 20% were citizens, 18% were permanent residents and 9% were otherwise authorized. For the remainder of this chapter, workers are broadly categorized as authorized if they reported being in a legal status.

Figures 2-3 and 2-4 chart the proportion of authorized and unauthorized crop workers in the U.S. and Florida farm labor markets, respectively, for specific periods between 1989 and 2004. The impact of IRCA in the short term is reflected in the early periods (1989-1992) where a majority of the workforce was authorized for employment due to legalization under the SAW program. Past this point however, the data suggest that IRCA’s enforcement provisions were ineffectual with regard to illegal immigration and employment. The unauthorized portion of the workforce grew dramatically after 1992, comprising as much as 55% of the workforce between 1999 and 2001. The decline in the number of unauthorized workers that occurred in the later period (2002-2004) was likely in response to the heightened enforcement measures that were set in place in the months following the 2001 terrorist attacks. In the case of Florida however, the

summary statistics on Florida reveal a different pattern, indicating growth of about 10% in the unauthorized worker population between 1999-2001 and 2002-2004.

A comparison of crop workers' characteristics by legal status for the U.S. and Florida between 1989 and 2004 is given in Table 2-1. Relative to the US, the participation of unauthorized workers in the Florida labor market is more pronounced across all categories. Male workers were more frequently observed in unauthorized status than female workers. Most of the unauthorized workers were Mexican. With respect to adult education training undertaken by the workforce, the summary statistics indicate that authorized workers were better able to take advantage of these opportunities than unauthorized workers.

Labor Market Characteristics

Employer type and work experience

Farm workers may be either directly hired by growers or employed by farm labor contractors (FLCs). Studies by Martin and Taylor (1990), Polopolus and Emerson (1991), Taylor and Thilmany (1992), and Thilmany (1996) chart the emergence of FLC operations since IRCA and discuss their role in farm labor markets. Some of the more interesting points raised are that FLCs may have facilitated growers' circumvention of immigration laws (allowing for continued employment of unauthorized workers with reduced risk of penalty) and that workers employed with FLCs are paid lower wages.

At the national level, growers directly hired 80% of the workers who were interviewed between 1989 and 2004. Although FLCs in Florida did slightly more hiring than at the national level (25%), the trend was similar in that the bulk of the hiring was done by growers (75%). Table 2-2 examines these trends further in the context of legal status. An immediate observation is that the Florida labor force had a higher percentage of unauthorized workers than existed for the US labor market, and among all employer types. In both markets, authorized workers had

more farm work experience. In Florida, the vast majority of workers with less than a year of experience were unauthorized. FLCs generally hired larger proportions of unauthorized to authorized workers than growers.

Workforce composition trends over time for both markets are shown in Table 2-3 and Table 2-4, respectively. On average, growers hired a larger proportion of authorized workers than FLCs, although both employer types hired larger proportions of unauthorized workers each consecutive period except the last. This pattern is more evident for Florida, and although a direct comparison cannot be made for the final period, it is worth noting that unauthorized workers comprised well over 50% of the workforce between 1998 and 2004.¹⁰ However, an important caveat is that these findings *do not* suggest that employers knowingly hired unauthorized workers. The proliferation of fraudulent work authorization documents is a well known problem in farm labor markets with immigrant workers (Taylor and Thilmany, 1993); Rural Migration, News, 2000) and by law, employers are not required to authenticate documents that are presented as proof of legality.

Task at the time of interview

It is instructive to examine the various tasks held by farm workers at the time of the NAWS interview, given that remunerative premia are associated with increasing skill levels and workers with authorized status (Taylor, 1992). The NAWS lists six task categories: pre-harvest, harvest, post-harvest, semi-skilled, supervisory and other.¹¹ The data reveal that most workers were employed in unskilled tasks. Between 1989 and 2004, 19% of all crop workers at the national level were engaged in pre-harvest activities, 35% and 12% performed harvest and post

¹⁰ The difference in time periods arises from grouping to avoid small cell sizes in the Florida sample.

¹¹ For convenience, the first three tasks may be considered unskilled and the last three skilled.

harvest work, respectively. Semi-skilled workers comprised almost 21% of the workforce and less than one% of the workforce (0.32%) had supervisory roles. The remaining 13% of the workforce were assigned to other miscellaneous duties. In Florida, a larger proportion of the workforce did harvest work (43%), whereas 20%, 8.9% and 7.6%, respectively, did pre-harvest, post-harvest and semi-skilled work. Compared with the national level data, more workers (28.4%) were assigned supervisory and other miscellaneous duties combined. The proportion of workers by legal status employed in each task at the time of interview between 1989 and 2004 for both markets is shown in Table 2-5. In both labor markets, the most obvious characteristic is that unauthorized workers constituted significantly larger proportions of the pre-harvest and harvest work crews than the other task categories. This underscores the vulnerability of the crop sector to changes in immigration policy that would be stricter on legal status requirements for employment and enforcement.

Seasonal employment

Much of specialty crop agriculture, such as tree crop and vegetable production is characterized by large labor requirements over short time spans. Nursery and greenhouse production also utilizes manual labor, but more so on a yearly basis (Emerson, 2007). Most crop workers between 1989 and 2004 were hired on a seasonal basis (74% and 61% in the U.S. and Florida, respectively), with little over 50% reporting between four and twenty years of U.S. farm work experience. For the US as a whole, approximately 56% of all seasonal workers were authorized for employment in the United States compared to 43% of seasonal workers in Florida. In both markets, the seasonal workforce was predominately Hispanic (85% in U.S; 90% in Florida) and Mexican-born (72% in U.S; 67% in Florida). Consistent with the hiring patterns reported in previous sections, most seasonal workers were directly hired by growers (76% in US; 65% in Florida). Florida FLCs did more hiring (35%) compared to US FLCs (24%).

Figures 2-5 through 2-7 illustrate the changes in the composition of the U.S. farm workforce across different time periods by legal status and task at the time of the interview.¹² An interesting observation is that unauthorized workers have increasingly been hired for low-skilled tasks (pre-harvest and harvest) over time relative to the other task types (post-harvest, semi-skilled and other) where authorized workers have comprised the majority of the workforce. Whether this reflects deliberate action on the part of employers is debatable, and has long been an argument advanced by farm labor advocates: that unauthorized status relegates unauthorized workers to unskilled jobs and limits their economic opportunities. A comparison of Figures 2-6 and 2-7 indicates how the proportion of unauthorized workers in pre-harvest and harvest work grew from 1999 onwards – exceeding 50% in either case. Although larger proportions of authorized workers were hired in the post-harvest and semi-skilled categories, the proportion of unauthorized workers employed in those task categories increased significantly as well – coming within 6 percentage points or less of the authorized proportion over the 1999 and 2001 period. It was only during the 2002-2004 period that the percentage of unauthorized workers in all task categories declined.

Compensation by Task, Employer Type, Contract Length and Legal Status

Tables 2-6 and 2-7 document the compensation methods that were used in the US and Florida labor markets. Most workers were paid an hourly wage and salary and combination methods were not used to a large extent. The exception to this trend appears for harvest workers in both labor markets, where over 40% of the harvest workers were paid by piece rate – particularly in Florida. Table 2-8 shows employers' preferences for the hourly rate over other methods. The sole exception in this case is among FLCs in Florida, who paid more than half of

¹² Only five of the six task categories are represented; the supervisory category is omitted as it has too few observations to be meaningful.

the workforce by piece rate. Both employer types at the national level used an hourly wage to compensate more than 60% of their work crews. In Florida, over 70% of directly hired workers were paid an hourly wage whereas only 39% of labor-contracted workers were compensated via this method.

Table 2-9 shows the average real hourly earnings for the U.S. and Florida by employer type and legal status, task, and contract length for 1989-2004. US farm employers paid wages that generally exceeded those paid by employers in Florida; this was the case across all categories. That legal status matters for remuneration is evident with a comparison of workers by legal status for both markets and employer types, where authorized workers' wages are shown to exceed those of unauthorized workers. In the remaining categories that show average wages by task and contract type, workers involved in pre-, harvest and post-harvest activities were generally paid lower wages, than semi skilled workers. Seasonal workers also reported lower wage rates relative to year-round workers.

Employment Patterns

Duration of labor force activity

Prior to IRCA's passage, agricultural employers expressed significant concern regarding the potential adverse effects of immigration reform, as it was widely assumed that farm workers with legal status would shun agriculture for other occupations resulting in significant labor shortages and higher wages. Previous work by Hashida and Perloff (1996), Emerson and Napasintuwong (2002), Tran and Perloff (2002), Iwai, Napasintuwong and Emerson (2005), and Iwai, Emerson and Walters (2006b) provide economic rationale for legalization of unauthorized farm workers and show its positive influence on employment duration. The remaining sections of this study analyze labor force activity across legal status and employer type, focusing on how activity patterns have shifted over time.

Labor force activity is organized by farm and non-farm employment spells, unemployment spells and time spent abroad for foreign born workers by legal status. In general, authorized workers had longer employment spells than unauthorized workers. At the national level, they spent 15 years on average in the United States, with roughly 13 years of farm employment and 1.5 years of nonfarm employment. In contrast, unauthorized workers spent considerably less time in the U.S. and had fewer years of employment: the average U.S. stay was 4.8 years, with about 4.3 years of farm employment and one year of nonfarm employment. The average authorized worker in Florida spent about 12.67 years in the U.S, had 10 years of farm employment and slightly more than a year of nonfarm employment. In contrast, the average unauthorized worker spent 4.6 years in the U.S, had 4.3 years of farm employment and less than a year of nonfarm employment.

Legal status notwithstanding, the data show certain interesting patterns in foreign-born workers' labor force activities over the sample period. In general, they have opted for longer stays in the United States and have increased (decreased) their tenure in farm work (non-farm work), respectively. Prior to 2002, unauthorized workers typically spent fewer than 5 years on average in the United States. After this period (2002 -2004), their average US stays increased to more than 5 years on average, and they reported longer farm employment spells. Average farm and nonfarm work spells both increased for unauthorized workers but only at the national level; in Florida there was a tendency for unauthorized workers to do more farm work but less nonfarm work. Authorized workers in the U.S. labor market had longer farm and nonfarm employment spells, whereas those in Florida reported shorter spells of nonfarm work. Arguably, the heightened enforcement and the increase in immigration restrictions following the September

2001 terrorist event is likely to have brought about these changes – particularly in the case of unauthorized workers.

Summary statistics were also generated to determine the number of consecutive days in an average spell of activity.¹³ Over the sample period, workers who reported non-farm work generally had longer non-farm work spells, with a difference of up to 35 days for both authorized and unauthorized workers. The average period of unemployment for unauthorized workers was markedly less than that for authorized workers, a difference of 33.5 days on average.

Unauthorized workers with time spent abroad reported almost 3.7 months abroad on average, roughly 26 days more than authorized workers who also reported spending time overseas. The spells reported for workers in the Florida farm labor market were comparable with the US, except that farm work spells exceeded the national average by 60 days or more. Authorized workers in Florida also had shorter unemployment spells than their national cohorts, but there was virtually no difference between average unemployment spells for unauthorized workers in either labor market over the sample period.

Post 9/11 labor force activity

The stricter immigration rules that ensued immediately following 9/11 created cause for concern in farm labor markets, given the sizeable percentage of unauthorized workers. To gain some insight into how this may have affected worker behavior, work spells were generated for the pre- and post 9/11 periods (Table 2-10). Except for unemployment spells, the trends in the two labor markets tend to counter each other. At the national level, workers with farm employment reported longer farm work duration post 9/11, those with nonfarm employment reported fewer days post 9/11, and those with time spent abroad reported longer spells post 9/11.

¹³ A “spell” in the NAWS data is a continuous period of activity with the same employer and task (if employed). Averages pertain only to those individuals who participated in each activity.

The opposite occurred in the Florida farm labor market. The more significant changes for Florida were in terms of non-farm employment and time spent abroad. For workers with nonfarm employment, their nonfarm employment spells lengthened by 3 weeks on average, whereas those workers who reported time spent abroad curtailed their stays by 55 days on average. On the latter, workers may have been trying to avoid increased scrutiny from immigration authorities, which is not surprising given the significant presence of unauthorized workers in the Florida labor market.

Duration of labor force activity by employer type

Workers with nonfarm employment who were employed primarily with FLCs generally had more consecutive days of nonfarm employment relative to farm employment. In contrast, workers employed with growers had more consecutive days of farm employment though they also reported longer unemployment spells. In general, workers with authorized status were able to secure more consecutive days of farm employment with both types of employers, though average tenure was longer with growers, and particularly in Florida.

Table 2-11 shows employment duration (day counts) in the last year prior to the interview by legal status, employer type and contract type for workers who were involved in farm and non-farm work. The extent of Florida's labor intensity relative to the US is reflected in farm work employment duration, which does not vary dramatically by employer type. Only among those workers with nonfarm work are some differences apparent. On average, US workers reported more days of nonfarm employment if they were authorized and employed with growers; the direct opposite occurred in Florida where workers reported more days of nonfarm employment if they were unauthorized and employed with FLCs. In general, seasonal workers also reported

more days of nonfarm employment relative to their cohorts employed on year-round contracts.¹⁴ That seasonal workers would have more days of nonfarm employment is not surprising; in their case, farm employment is contingent about tree crop and vegetable production that is highly seasonal and with labor demand highest during harvest. Year-round workers, on the other hand, are mostly employed with greenhouse and nursery operations that are far less subject to seasonal shifts in labor demand.

Concluding Remarks

The purpose of this chapter was to provide a historical context of the link between U.S. immigration policy and U.S. farm labor markets, focusing specifically on how market outcomes have evolved in the wake of past policies such as IRCA. The first section of the chapter summarized the implications of past policies (1917-1986) based on previous studies, whereas the second section focused more on farm labor market outcomes as revealed by the NAWS data for 1989-2004. As IRCA was passed in 1986, the NAWS dataset is useful for characterizing the market since its passage.

Based on the preceding findings, what inferences can be drawn as per the outcomes following the 1986 IRCA? Recalling that IRCA's primary objectives were to curtail illegal immigration and employment, the summary statistics from the NAWS data suggest that the legislation has not been effective in these respects. Lax enforcement, particularly in the area of sanctions enforcement, has clearly undermined the intended efficacy of the legislation. Over time, employers have hired more unauthorized workers. It is difficult to establish whether their actions have been deliberate given that they are not required to authenticate work authorization documents presented by workers, and further, the proliferation of false documents among

¹⁴ Estimates are unavailable for the Florida labor market.

workers is a known problem. These observations seem to point to flaws in the legislation itself that future reform legislation would have to address in tandem with increased enforcement efforts in order to effectively discourage employment of unauthorized workers.

An important finding was that the farm workforce is predominately foreign born and unauthorized, particularly in key areas of production such as harvesting. The farm labor market is driven primarily by the specialty crop sector and has increased concomitantly with expansion of the sector. Technology in agriculture has become labor neutral as opposed to labor saving given the ready availability of immigrant labor – implying that the technologies did not cause employers to shift away from labor (Napasintuwong and Emerson, 2004). Also, lack of mechanical applications for the fresh market undoubtedly plays a role in this respect. The data also indicated that a vast majority of the workers were low-skilled, had poor English speaking skills and if unauthorized, they were paid lower farm wages on average than their authorized cohorts. According to the Pew Hispanic Center (2005; 2006) and Lewis (2007), many unauthorized workers readily seek employment in other low skilled occupations besides agriculture.¹⁵ Coupled with the preceding observations, it would seem to suggest that employers' reliance on this type of labor is problematic. Further, if enforcement efforts were increased through stricter legislation, there may be significant ramifications for the specialty crop sector on various levels.

As discussed in the first section of the chapter, the emergence of FLCs in markets with high immigrant worker populations has often led to speculation that they act as a convenient medium for growers' circumvention of immigration laws. Although FLCs do considerably less hiring than growers, the summary statistics indicate that more unauthorized workers are

¹⁵ These workers are mostly Mexican immigrants.

employed with FLCs, average hourly wages are lower for workers employed with FLCs, and that workers have fewer consecutive days of farm employment if employed with FLCs. While these findings are not proof that FLCs permit growers to circumvent immigration laws, they offer some insight about the stability of farm employment under FLCs.

The studies reviewed at the beginning of the chapter suggest that IRCA's legalization provisions did not adversely affect farm employment duration – in fact it increased once unauthorized workers had been adjusted to legal status. This was reflected in the summary statistics on duration which indicated that authorized workers had more consecutive days of farm employment on average than unauthorized workers. That authorized workers earned higher average hourly wages and tended to be employed in task categories other than harvesting further points to the overall significance of legal status for workers' economic opportunities.

Temporary guest worker programs have traditionally been used to alleviate labor shortages during national emergencies (for example, the *Bracero* and British West Indies Labor programs). Studies have shown that the H-2A program that was authorized under IRCA has not been utilized on a large scale, which is not surprising given the ready availability of unauthorized immigrant labor. Growers have cited the cost and cumbersome nature of the applications process as reasons for lack of usage.

The debate on immigration is usually couched in terms of whether citizens are disadvantaged (or not) by the presence of skilled or unskilled immigrants. Although addressing this issue specifically is beyond the scope of this paper, it is somewhat difficult to make the case that they are disadvantaged by the increasing presence of immigrant farm workers. The differences in skills and legal status between the average citizen and immigrant farm worker suggest that they are not likely to compete for the same types of jobs; further, citizens participate

only minimally in the crop farm sector. Lewis (2007) expressed a similar view, arguing that the adverse distributional consequences of immigration were likely small, and that American consumers and businesses would benefit due to the associated multiplier effects.

Overall, the findings of this study suggest that immigration policies have influenced certain changes in the farm labor market over time, whether directly or indirectly. Since the NAWS was only established in 1986 by mandate, it is not possible to establish patterns in the unauthorized farm worker populations before and after IRCA's passage. However, the fact that the proportion of unauthorized workers increased following IRCA – particularly after legalization under the SAW program – points to its overall ineffectiveness with respect to controlling illegal immigration. Further, the fact that unauthorized workers continued to gain employment in agriculture after the law was passed also suggests significant flaws in its enforcement provisions and how they have been executed up to this point.

Low-skilled sectors such as agriculture that have employed foreign labor, much of which is unauthorized, are clearly vulnerable to future changes in immigration policy that may restrict employers' access to foreign labor. Although reform proposals were introduced in the 109th and 110th Congress, lack of agreement has stymied the reform process thus far. The shortcomings of IRCA as revealed by the findings of this study suggest that improvement in enforcement measures would be needed for future legislation to be more effective in curtailing illegal immigration and employment.

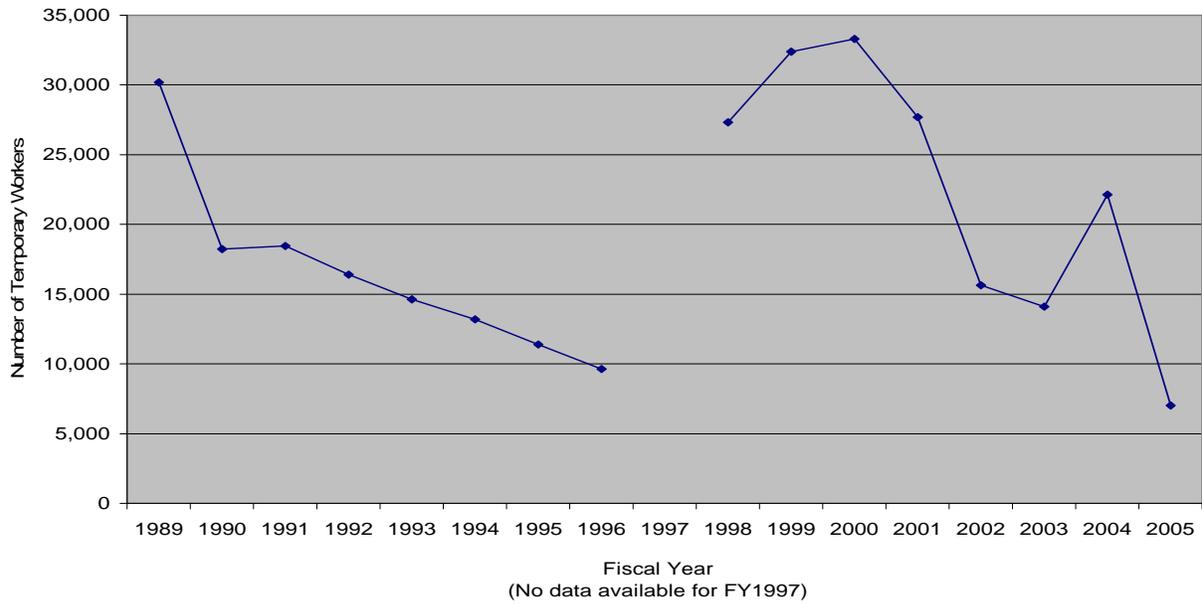


Figure 2-1. Temporary foreign worker admissions under the H-2A program 1989-2005 (Source: US Dept. of Homeland Security, Yearbook of Immigration Statistics)

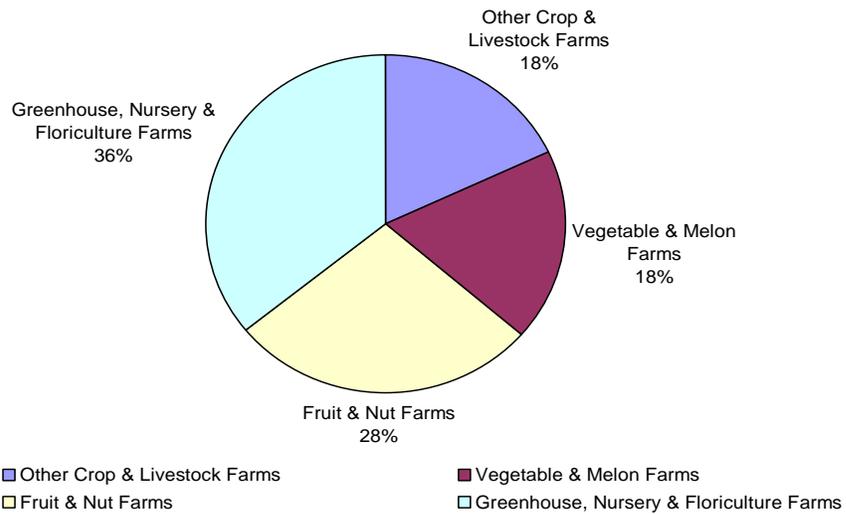


Figure 2-2. 2002 Florida agricultural labor expenditures (Source: 2002 USDA-NASS, Census of Agriculture)

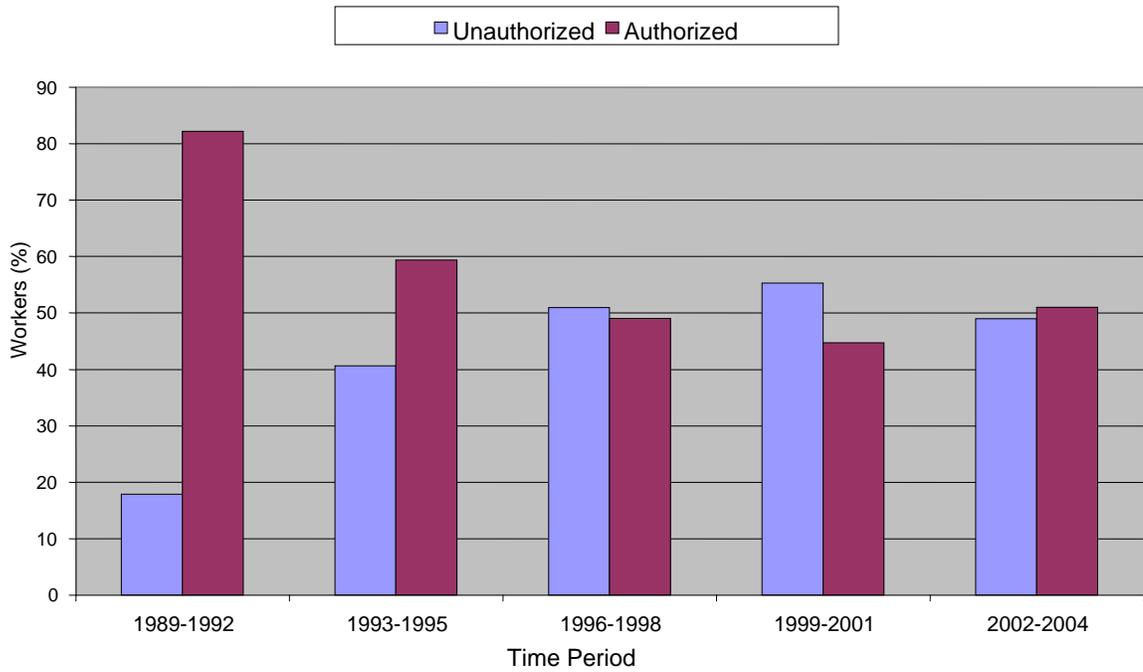


Figure 2-3. Proportion of authorized to unauthorized crop workers in the United States farm labor market, 1989-2004

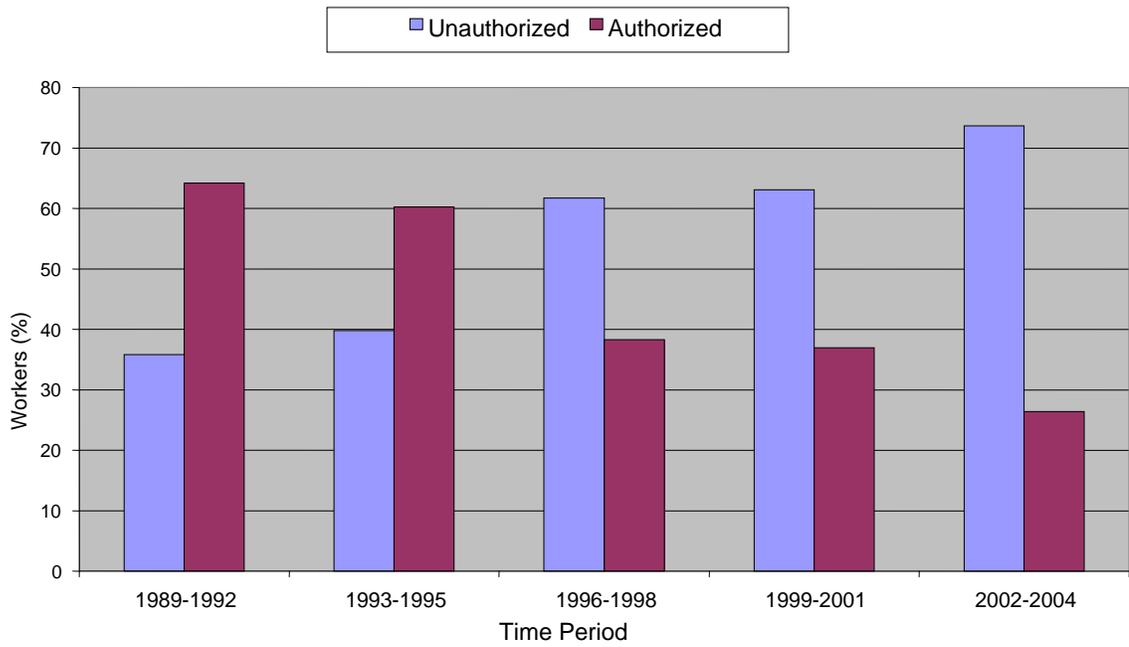


Figure 2-4. Proportion of authorized to unauthorized crop workers in the Florida farm labor market, 1989-2004

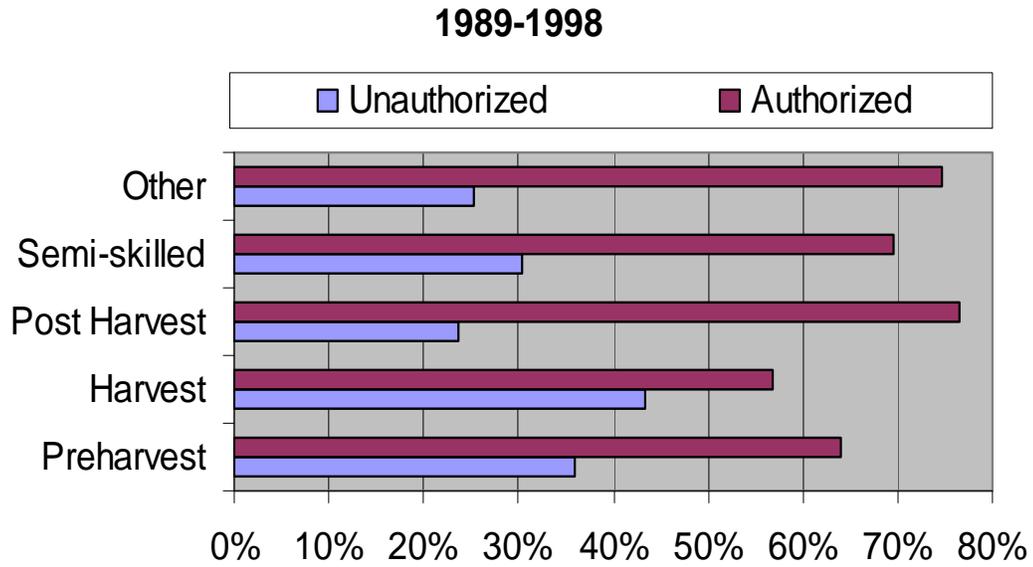


Figure 2-5. Legal status by task at time of interview over time, United States farm labor market, 1989-1998

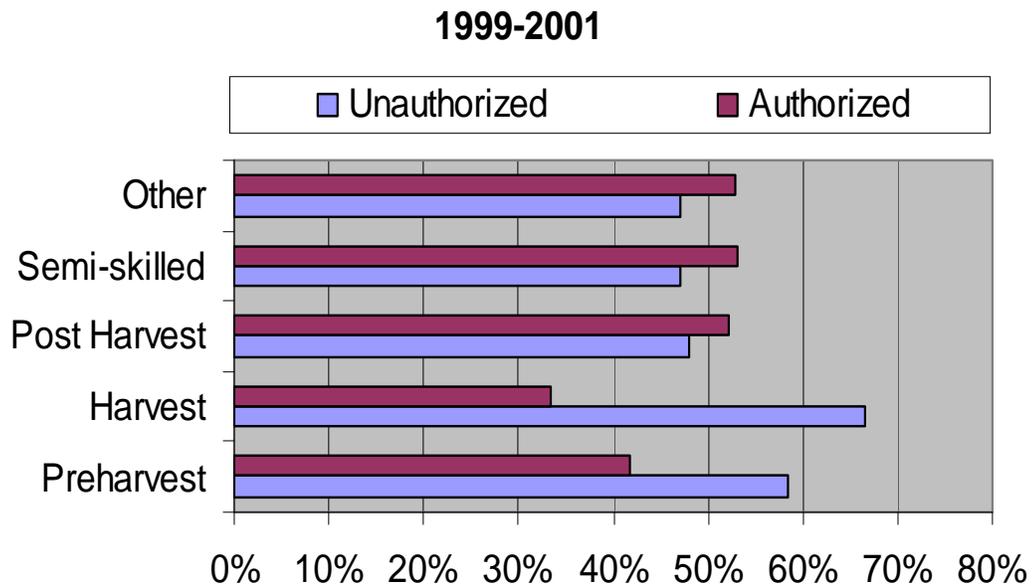


Figure 2-6. Legal status and task at time of interview over time, United States farm labor market, 1999-2001

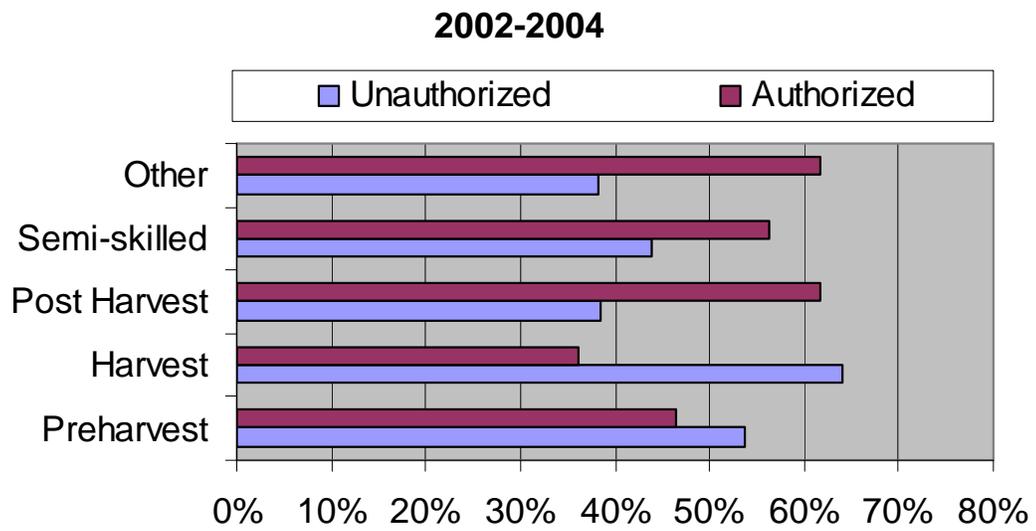


Figure 2-7. Legal status and task at time of interview over time, United States farm labor market, 2002-2004

Table 2-1. Crop worker characteristics by legal status, United States and Florida, 1989-2004

Characteristic	U.S. Crop Workers (%)		FL Crop Workers (%)	
	Authorized	Unauthorized	Authorized	Unauthorized
All Workers	58	42	47	53
Demographic				
Male	55	45	43	57
Female	72	28	60	40
Single	51	49	43	57
Married	64	36	52	48
Ethnicity				
Hispanic	49	51	43	57
Non-Hispanic	96	4	N/A	N/A
Nationality				
Mexican	43	57	38	62
Other	91	9	61	39
U.S. Adult Education	78	22	63	37

Table 2-2. Farm labor market characteristics by legal status, United States and Florida, 1989-2004

Characteristic	U.S. Crop Workers (%)		Florida Crop Workers (%)	
	Authorized	Unauthorized	Authorized	Unauthorized
All Workers	58	42	47	53
Employer Type				
Grower	63	38	52	48
Farm Labor Contractor	42	58	32	68
U.S. Farm Work Experience (years)				
≤1 year	23	77	10	90
>1 year & ≤ 4 years	44	56	31	69
> 4 years & ≤ 10 years	64	36	54	46
> 10 years & ≤ 20 years	88	12	84	16

Table 2-3. Workforce composition by legal status and employer type across time, United States

% U.S. Workforce	1989-1992		1993-1997		1998-2001		2002-2004	
	Grower	FLC	Grower	FLC	Grower	FLC	Grower	FLC
All Workers	84	16	81	19	74	26	81	19
Unauthorized	15	36	42	58	50	68	46	63
Authorized	85	64	59	42	50	32	54	38

Table 2-4. Workforce composition by legal status & employer type over time, Florida

% FL Workforce	1989-1992		1993-1997		1998-2004	
	Grower	FLC	Grower	FLC	Grower	FLC
All Workers	73	27	79	21	74	26
Unauthorized	32	56	46	65	61	79
Authorized	68	44	55	35	39	21

Table 2-5. Legal status by task at time of interview, United States and Florida, 1989-2004

Task at Time of Interview	U.S. Crop Workers (%)		Florida Crop Workers (%)	
	Authorized	Unauthorized	Authorized	Unauthorized
All Workers	58	42	47	53
Pre-harvest	57	43	50	50
Harvest	51	50	35	65
Post-harvest	71	29	62	38
Semi-skilled	65	35	72	29
Supervisory	94	6	86	14
Other	63	37	59	41

Table 2-6. Compensation method by task type, United States, 1989-2004

Task at the Time of Interview	Percentage of workforce				TOTAL
	Hourly	Piece Rate	Combination	Salary	
All Workers	77	19	2	2	100
Pre-harvest	93	5	0	2	100
Harvest	53	42	4	1	100
Post-harvest	87	10	2	1	100
Semi-skilled	85	12	0	3	100
Supervisory	80	9	1	10	100
Other	93	2	1	4	100

Table 2-7. Compensation method by task type, Florida, 1989-2004

Task at the Time of Interview	Percentage of workforce				TOTAL
	Hourly	Piece Rate	Combination	Salary	
All Workers	65	33	1	1	100
Pre-harvest	92	7	0	1	100
Harvest	27	70	2	0	100
Post-harvest	84	13	3	0	100
Semi-skilled	93	6	0	1	100
Supervisory	74	16	2	9	100
Other	96	2	0	2	100

Table 2-8. Compensation method by employer type, United States and Florida, 1989-2004

Compensation Method	Workforce Percentage by Employer Type			
	US Employer		Florida Employer	
	Grower	FLC	Grower	FLC
All Workers	80	20	76	24
Hourly	80	65	73	39
Piece Rate	16	32	25	59
Combination	2	2	1	2
Salary	2	1	1	0

Table 2-9. Average real hourly earnings by legal status, employer type, task and contract length, United States and Florida, 1989-2004

	Wage Rate (\$) by Employer Type			
	US Grower	US FLC	FL Grower	FL FLC
Legal Status				
Unauthorized	6.65	6.42	6.17	5.81
Authorized	7.21	6.60	6.85	5.91
Task at Time of Interview^a				
Pre-harvest	6.80	6.35	6.33	5.57
Harvest	6.79	6.41	6.18	5.89
Post-harvest	6.89	6.61	6.35	5.65
Semi-skilled	7.13	6.71	7.07	6.56
Other	7.47	6.63	6.74	5.94
Contract Length				
Year-round	7.48	6.43	6.70	6.00
Seasonal	6.71	6.42	6.09	5.79

^a The supervisory category has too few observations to be meaningful and is therefore omitted.

Table 2-10. Activity duration (days) in the last year: United States and Florida farm labor markets, pre- and post 2001

Type of Activity Spell ^a	US		Florida	
	Pre-2001	Post 2001	Pre-2001	Post 2001
Farm Employment	64	83	83	78
Non-farm Employment	110	94	94	115
Unemployment	48	39	39	33
Abroad	100	133	133	78

^aThe duration averages specified pertain only to individuals who participated in each activity, respectively.

Table 2-11. Total days of employment in the last year by legal status, employer type and contract type, United States and Florida

	U.S.		Florida	
	Farm Work	Non-Farm Work ^a	Farm Work	Non-Farm Work ^b
<u>Legal Status</u>				
Authorized	149	130	167	111
Unauthorized	144	117	164	118
<u>Employer Type</u>				
Grower	148	126	167	112
Contractor	147	123	164	123
<u>Contract Type</u>				
Seasonal	135	129	N/A	N/A
Year-round	189	117	N/A	N/A

^{a,b} The non-farm work values reflect the averages only of those individuals who had non-farm work. Consequently, the values for farm work and non-farm work cannot be added together for an estimate of total days employed in any type of work for the year.

CHAPTER 3
WORKER SELF-SELECTIVITY AND FARM WAGES

Introduction

Are unauthorized farm workers more likely to be observed in unskilled farm jobs than authorized farm workers? Further, do they earn less than authorized farm workers for the same type of work? Proponents of legalization may respond to these questions in the affirmative given that they have long maintained that lack of legal status limits unauthorized workers' labor market opportunities, and that their situation would improve with adjustment to legal status. The significance of legal status for farm employment and wages was first analyzed by Taylor (1992), who found that unauthorized farm workers are more likely to be selected into low-skilled, low-paying farm jobs, and that they tend to earn less than their authorized cohorts for the same type of work. Taylor argued that there was self-selectivity into primary (skilled) and secondary (unskilled) farm jobs and estimated separate earnings functions for each job type. Legal status entered the equations as an exogenous influence, argued to affect earnings differently for each job type.

This paper is motivated in part by Taylor's findings but utilizes a different modeling approach. A major distinction is that workers' selections into legal status categories are assumed to be endogenous – as are their selections into job type (skilled or unskilled). Workers' decisions are modeled as a joint process involving two potential sources of selection bias – legal status and job type. Specifying one of these choices as exogenous, or ignoring it, may result in biased and inconsistent wage parameter estimates if there are two underlying decisions guiding farm workers into various groups for farm work in the United States. It is in this respect that this paper also differs from previous work by Isé and Perloff (1995) and Iwai, Emerson and Walters

(2006a), which evaluated the farm wage implications of selection into legal status but not job type.

The main argument set forth in this paper is that foreign born workers opt to jointly select into U.S. farm employment in an authorized or unauthorized status and into skilled or unskilled jobs, and that these decisions may have certain earnings implications. As such, there may be two decision criteria and not a single criterion function as assumed in previous studies. It is conceivable that foreign born workers would sort themselves in this fashion, arguably because they have considered the net benefits of working in the United States in a particular employment status (legal status-skill combination). Specifically, this study examines whether the decisions are interrelated and whether they result in earnings differentials among groups of foreign born workers. The analysis is based on a sample of foreign born workers who were interviewed between 1993 and 2002 for the National Agricultural Workers Survey (NAWS). U.S. born workers are excluded from the sample since, as citizens, they would not select into legal status for employment in the United States.

The paper is organized as follows. The second section reviews the theoretical underpinnings of the earnings function as an empirical tool in earnings determination. Context for the later sections is provided with a brief discussion of the Roy (1951) model. The third section discusses the problem of selectivity bias and its implications for earnings. The fourth section describes the econometric model used in the study and gives a brief discussion of the data. The study findings are discussed in the fifth section of the paper. The concluding remarks that are given in the final section serve to evaluate the findings in the context of the current immigration debate.

Theoretical and Analytical Framework

Earnings Functions

Earnings functions, as developed by Mincer (1974), are the standard approach for characterizing individuals' earnings profiles. Individuals' human capital stocks are assumed to be homogeneous, and individuals are assumed to undertake investments to maximize their present value earnings. They are also assumed as having the same rate of return to human capital investment, and investing the same fraction of their earnings capacities. With these assumptions, log earnings are specified as:

$$\ln y = \beta_0 + \beta_1 S + \beta_2 EXP + \beta_3 EXP^2 + u \quad (3-1)$$

where y , S , and EXP denote earnings, years of schooling and post-schooling (on-the-job training) investments, respectively, and u is a normally distributed homoscedastic error term [$E(u | S, EXP) = 0$]. The percentage increase in earnings generated by an additional year of schooling is given by β_1 ; it is interpreted as the rate of return to educational investment and is assumed to be the same across all schooling levels. The coefficients on the experience terms estimate the growth rate of earnings resulting from an additional year of labor market experience. These post-schooling investments decrease over time relative to potential earnings and as experience increases (Willis, 1986; Polachek and Siebert, 1993; Chiswick, 2003). Mincer's earnings function emphasizes the life cycle dynamics of earnings and the relationship between observed earnings, potential earnings and human capital investment for both formal schooling and on-the-job training (Heckman, Lochner and Todd, 2003).

According to Willis (1986), a key assumption underlying the use of the human capital earnings function is that it accurately represents the opportunity set faced by a typical individual. However, this assumption presents two sets of empirical difficulties as it is not possible to

observe the earnings of the same individual who makes alternative choices on human capital investment, nor is it possible to observe all the characteristics that determine his earnings opportunities (Willis, 1986). This characterizes a self selection problem, implying that data used in wage determination would be censored based on the individual's optimal choice. The wage equation estimates would also be biased unless the selection bias is explicitly accounted for.

The seminal work of Roy (1951) was the first to bring the implications of self selectivity to bear on earnings distributions. The model has since been formalized and applied to different issues of interest in labor economics. These include the effects of unionization on wages (Lee (1978); Abowd and Farber (1982), education (Willis and Rosen (1979) and migration (Sjaastad (1962); Chiswick (1999)), among other topics. In its simplest context, the Roy model looks at the earnings implications of individuals' occupational choices; based on their skill endowment and their comparative advantage in one activity versus another, individuals choose the occupation that provides the highest earnings. In this respect, the pursuit of comparative advantage in a competitive market results in distributions that reflect less earnings inequality than if individuals were randomly assigned (Heckman and Honoré, 1990).

Sample Selection Bias¹

The main concern with sample selection bias is that it results in nonrandom samples of an underlying population. This may arise from the assortment of individuals of their own choice into specific groups (Heckman, 1979), commonly referred to as self-selectivity in the literature. Sample selection bias presents certain empirical problems which, if ignored, may lead to incorrect inferences about the effects of explanatory variables on a dependent variable of interest. The significance of sample selection bias for empirical research was first addressed in research

¹ The terms 'sample selection bias' and 'selectivity bias' are used interchangeably throughout the paper, as is the case in the body of literature.

on earnings determination and labor supply behavior of women by Gronau (1974) and Heckman (1974). The decision to work was shown to be nonrandom and as having significant implications for women's earnings based on the differences in characteristics between working and non-working women. An example of self selectivity in the overall context of this dissertation would be the decision made by foreign born workers to work in the United States in a particular legal status (whether authorized or unauthorized). Since workers are likely to sort themselves into legal status categories that would seem most advantageous given their characteristics, each group would exhibit different characteristics. Wage w_{ij} would therefore be observed only if worker i has legal status j and bias would arise because the legal status decision is correlated with earnings determination.

Based on a random sample of N observations, the conventional model for the i^{th} individual takes the form:

$$Y_i^* = x_i' \beta + \varepsilon_i; \quad i = 1, \dots, N; \quad (3-2)$$

$$J_i^* = z_i' \gamma + v_i; \quad i = 1, \dots, N; \quad (3-3)$$

$$\begin{aligned} J_i = 1 & \text{ if } J_i^* \geq 0 & \text{ Prob}(J_i = 1) &= \Phi(z_i' \gamma); \\ J_i = 0 & \text{ if } J_i^* \leq 0 & \text{ Prob}(J_i = 0) &= 1 - \Phi(z_i' \gamma) \end{aligned}$$

$$\begin{aligned} Y_i &= Y_i^* \text{ iff } z_i' \gamma + v_i \geq 0 \\ Y_i &= 0 \text{ iff } z_i' \gamma + v_i < 0 \end{aligned} \quad (3-4)$$

where Y_i is an endogenous variable (log earnings) to be estimated in the outcome equation, x_i and z_i are vectors of exogenous variables, β and γ are vectors of unknown parameters and the error terms ε_i and v_i are joint normally distributed with zero mean and variance σ^2 . Inclusion

in a particular group is determined by a latent selection rule (Equation 3-3), which has an index function (J_i) that determines observability.

With the i^{th} individual's selection into a group, the observations on Y_i^* are censored for the observed range of Y_i where $J_i = 1$ if $J_i^* > 0$. The expected value of Y_i is determined as:

$$\begin{aligned} E(Y_i | x_i, z_i; J_i^* > 0) &= E[(x_i' \beta) + (\varepsilon_i | z_i' \gamma + v_i > 0)] \\ &= x_i' \beta + E[\varepsilon_i | v_i > -z_i' \gamma] \end{aligned} \quad (3-5)$$

The conditional mean of ε_i would be nonzero if the error terms ε_i and v_i are correlated.

Estimation of Y_i by ordinary least squares over the subsample of n observations would result in biased and inconsistent estimates of β unless the selection bias is addressed. The inconsistency arises due to the correlation between x_i and ε_i , operating through the correlation between the two error terms, ε_i and v_i .

Empirical Remedies

Sample selection bias is usually resolved using maximum likelihood estimation (MLE) or two-step estimation procedures, either of which requires distributional assumptions on the error terms. Heckman (1974; 1979) is credited with the initial parametric formulations for both sets of procedures. These have been extended to include semi- and non-parametric methods that relax the distributional assumptions; several of these are discussed in detail by Vella (1998).

The first empirical solution for sample selection bias was the maximum likelihood estimator proposed by Heckman (1974). This formulation assumes that the error terms (ε_i, v_i) have zero mean and are identically and independently normally distributed with variance-covariance

matrix $\Sigma = \begin{pmatrix} \sigma_\varepsilon^2 & \sigma_{\varepsilon v} \\ \sigma_{\varepsilon v} & \sigma_v^2 \end{pmatrix}$. The errors are also assumed to be independent of the explanatory

variables in the selection equation (Equation 3.3) (Heckman, 1974; Vella, 1998). Given the normality assumption, the maximum likelihood estimates are efficient and consistent. If normality is violated however, consistency will fail.

Within the class of two-step estimation procedures, the parametric version developed by Heckman (1976; 1979) is the most popular. The errors are assumed to be joint normally distributed, and the misspecification created by the censoring pattern is resolved by including a correction term to account for selectivity. Following Heckman (1979) and Greene (2000), joint normality of the errors allows for the specification of the conditional mean of Y_i as follows:

$$\begin{aligned} E(Y_i | x_i; J_i^* > 0) &= E[(x_i' \beta) + (\varepsilon_i | z_i' \gamma + v_i > 0)] \\ &= x_i' \beta + E[\varepsilon_i | v_i > -z_i' \gamma] \\ &= x_i' \beta + \rho \sigma_\varepsilon \lambda_i \end{aligned} \quad (3-6)$$

where $\rho = \frac{\sigma_{\varepsilon v}}{\sigma_\varepsilon \sigma_v}$ is the correlation between the two errors, and $\lambda_i = \frac{\phi(z_i' \gamma / \sigma_v)}{\Phi(z_i' \gamma / \sigma_v)}$ is the inverse

Mills ratio, with ϕ and Φ as the density and distribution functions of the standard normal distribution, respectively.² In practice, the first stage of Heckman's two step procedure involves estimation of the parameters of the selection equation over the entire sample N with a probit model. The first stage probit estimates are used to construct inverse Mills ratios that are included as selectivity correction terms in the second stage estimation, which entails ordinary least squares estimation of Y_i by over the subsample n :

$$Y_i = \beta' x_i + \beta_\lambda \lambda_i + \xi_i \quad \text{for } J_i^* > 0 \quad (3-7)$$

² Joint normality of the errors implies $\varepsilon = \alpha v + \eta$, where ε and η are independent and $\alpha = \frac{\sigma_{\varepsilon v}}{\sigma_v^2}$. Using the mean of the truncated normal distribution where $\mu + \sigma \lambda$, $\mu = 0$, and manipulating Equation (3-6)

yields $E(Y_i | x_i; J_i^* > 0) = x_i' \beta + \frac{\sigma_{\varepsilon v}}{\sigma_v^2} \sigma_v \lambda_i = x_i' \beta + \frac{\sigma_{\varepsilon v}}{\sigma_\varepsilon \sigma_v} \sigma_\varepsilon \lambda_i = x_i' \beta + \rho \sigma_\varepsilon \lambda_i$.

The second stage estimation yields estimates that are consistent estimates of the population parameters. The heteroscedastic error term, ξ_i , has variance $\sigma_i^2 = \sigma_\varepsilon^2(1 - \rho^2\delta_i)$,

where $\delta_i = \lambda_i^2 - \alpha_i\lambda_i$; $\alpha = \frac{-z'\gamma}{\sigma_v}$. The parameters δ_i and σ_i^2 are generated from the two-stage estimation and are used to derive consistent estimates of σ_ε^2 and ρ .

Except for the case where no sample selection bias exists, that is where ($\rho = 0$), the standard errors reported from the OLS regression are inappropriate for tests of significance of the estimated coefficients (Heckman, 1979). Following Greene (1981; 2000), Equation (3.7) may be revised to show an additional source of variation, brought about by using an estimate of the inverse Mills ratio as opposed to its true value:

$$Y_i = \beta' x_i + \beta_\lambda \hat{\lambda}_i + \xi_i - \beta_\lambda (\hat{\lambda}_i - \lambda_i) \quad \text{for } J_i^* > 0 \quad (3-8)$$

In this case, the appropriate asymptotic covariance matrix takes the form:

$$\text{Var}[\hat{\beta}, \hat{\beta}_\lambda] = \hat{\sigma}_\varepsilon^2 [X_*' X_*]^{-1} [X_*' (I - \hat{\rho}^2 \hat{\Delta}) X_* + Q] [X_*' X_*]^{-1} \quad (3-9)$$

where $Q = \hat{\rho}^2 (X_*' \hat{\Delta} W) \hat{V} (W' \hat{\Delta} X_*)$ with W containing vectors of derivatives $\frac{\partial \hat{\lambda}_j}{\partial \left(\frac{z'\gamma}{\sigma_v} \right)}$.

In this covariance matrix, X_* is a larger $N \times K$ matrix comprising rows $x_* = [x_i, \hat{\lambda}_i]$, $\hat{\Delta}$ is a diagonal $N \times N$ matrix with δ_i on the diagonal, and \hat{V} is the asymptotic variance corresponding to the probit model coefficients generated in the first stage (Greene, 2000).

Multiple Selection Rules

Models with multiple decision criteria have been used to evaluate the implications of self selectivity on various topics including employment and occupational choice, college and student financial aid choices, migration, and maternity. In contrast, studies with relevance to agricultural

employment and earnings have focused on a single criterion function only (Taylor, 1992; Isé and Perloff, 1995; Iwai, Emerson and Walters, 2006a). However, if farm employment or earnings are actually determined by multiple decision rules, sample selection bias will remain unresolved if one of the rules is ignored or assumed to be exogenous.

Incorporation of additional criteria into the analytical framework first requires a determination of whether the decision rules are simultaneous or sequential, as it may affect the selectivity correction procedures employed during estimation (Lee and Maddala, 1985). In the simultaneous case, the latent selection rules are defined over the entire set of observations. In the sequential case however, the second selection rule is defined only over a subsample of observations for which the first rule is observed (Maddala, 1983). A student financial aid scenario may be used to illustrate this: students decide whether to attend college (1st rule), then decide whether to apply for financial aid or not (2nd rule). Clearly, a student is ineligible for financial aid if he decides to forego college. As noted in Lee and Maddala (1985), the error term of the first rule would be defined over the entire population of high school graduates whereas the error term corresponding to the second rule would be defined for the college student subsample only.

In this paper, selectivity bias is assumed to arise from two simultaneous decisions and the econometric model employed for the analysis is based on the double selection model proposed by Tunali (1986). As the term implies, a double selection process involves two rules that may arise from the related decisions of independent parties or from simultaneous or sequential decisions involving one party (Tunali, 1986). If the rules are correlated, joint estimation of the decision functions would generate asymptotically more efficient estimators (Tunali, 1986). The framework is as follows:

$$y_{1i}^* = x_{1i}'\beta_1 + u_{1i} \quad \text{Legal status decision} \quad (3-10)$$

$$y_{2i}^* = x_{2i}'\beta_2 + u_{2i} \quad \text{Job (skill) type decision} \quad (3-11)$$

$$\ln W_{3i} = x_{3i}'\beta_3 + \sigma_3 u_{3i} \quad \text{Wage equation} \quad (3-12)$$

In this system, x and β are explanatory variables and unknown coefficients, respectively, and σ_3 is an unknown scale parameter. The joint normal error terms (u_{1i}, u_{2i}, u_{3i})

have zero mean and covariance matrix $\Sigma = \begin{bmatrix} 1 & \rho & \rho_{13} \\ \rho & 1 & \rho_{23} \\ \rho_{13} & \rho_{23} & 1 \end{bmatrix}$. Decisions y_{1i}^* and y_{2i}^* are unobserved,

but the outcomes of the dichotomous variables D_1 (indicating whether the farm worker is authorized or unauthorized for U.S. employment) and D_2 (indicating whether he is employed for a skilled or unskilled job) are:

$$D_1 = \begin{cases} 1 & \text{if } y_{1i}^* > 0 \\ 0 & \text{if } y_{1i}^* \leq 0 \end{cases} \quad D_2 = \begin{cases} 1 & \text{if } y_{2i}^* > 0 \\ 0 & \text{if } y_{2i}^* \leq 0 \end{cases} \quad (3-13)$$

This censoring process generates four groups G_j ($j = 1, \dots, 4$), the elements of which are combinations of D_1 and D_2 : $G_1 = (0, 0)$, $G_2 = (0, 1)$, $G_3 = (1, 0)$ and $G_4 = (1, 1)$.

Group G_1 denotes foreign-born farm workers who are *unauthorized & unskilled*, and G_2 , G_3 and G_4 are foreign-born farm workers who are *unauthorized & skilled*, *authorized & unskilled*, and *authorized & skilled*, respectively. Per the NAWS data set, pre-harvest, harvest and post-harvest jobs are classified as unskilled positions, whereas semi-skilled, supervisory and jobs in the 'other' category are classified as skilled. Provided that the four groups are distinct and completely classified, the probability S_j that an individual is assigned to the j^{th} group is:

$$\begin{aligned} S_1 &= Pr(D_1=0, D_2=0) = Pr(y_{1i}^* \leq 0, y_{2i}^* \leq 0) \\ &= Pr(u_{1i} \leq -C_1, u_{2i} \leq -C_2) \\ &= \Phi_2(-C_1, -C_2; \rho) \end{aligned} \quad (3-14)$$

$$\begin{aligned}
S_2 &= Pr(D_1=0, D_2=1) = Pr(y_{1i}^* \leq 0, y_{2i}^* > 0) \\
&= Pr(u_{1i} \leq -C_1, u_{2i} > -C_2) \\
&= \Phi_2(-C_1, C_2; -\rho)
\end{aligned} \tag{3-15}$$

$$\begin{aligned}
S_3 &= Pr(D_1=1, D_2=0) = Pr(y_{1i}^* > 0, y_{2i}^* \leq 0) \\
&= Pr(u_{1i} > -C_1, u_{2i} \leq -C_2) \\
&= \Phi_2(C_1, -C_2; -\rho)
\end{aligned} \tag{3-16}$$

$$\begin{aligned}
S_4 &= Pr(D_1=1, D_2=1) = Pr(y_{1i}^* > 0, y_{2i}^* > 0) \\
&= Pr(u_{1i} > -C_1, u_{2i} > -C_2) \\
&= \Phi_2(C_1, C_2; \rho)
\end{aligned} \tag{3-17}$$

In Equations (3-14) through (3-17), $C_1 = x'_{1i} \beta_1$ and $C_2 = x'_{2i} \beta_2$, Φ_2 is the standard bivariate normal distribution function and ρ is the correlation coefficient between u_1 and u_2 . With outcomes observed for all workers in all groups, these probabilities may be estimated using a bivariate probit model with the likelihood function:

$$\begin{aligned}
L &= \prod_{S_1} \Phi_2(-C_1, -C_2, \rho) \cdot \prod_{S_2} \Phi_2(C_1, -C_2, -\rho) \\
&\quad \cdot \prod_{S_3} \Phi_2(-C_1, C_2, -\rho) \cdot \prod_{S_4} \Phi_2(C_1, C_2, \rho)
\end{aligned} \tag{3-18}$$

The inverse Mills ratios corresponding to each group are constructed from the probit estimates and are used for selectivity correction in stage two. In Equations (3-19) through (3-22) below, symbols $\phi(\cdot)$ and $\Phi(\cdot)$ denote the standard univariate normal density and distribution functions, respectively.

(i) For $i \in G_1$ (i.e. $D_1=D_2=0$): $E(u_{3i} | u_{1i} \leq -C_1, u_{2i} \leq -C_2) = \rho_{13}\lambda_{11} + \rho_{23}\lambda_{12}$

$$\begin{aligned}
\lambda_{11} &= -\left[\frac{\phi(C_1)\Phi(-C_2^*)}{(S_1)} \right], \quad \lambda_{12} = -\left[\frac{\phi(C_2)\Phi(-C_1^*)}{(S_1)} \right] \\
\text{where } C_1^* &= \frac{C_1 - \rho C_2}{\sqrt{1 - \rho^2}}; \quad C_2^* = \frac{C_2 - \rho C_1}{\sqrt{1 - \rho^2}}
\end{aligned} \tag{3-19}$$

(ii) For $i \in G_2$ (i.e. $D_1=0; D_2=1$): $E(u_{3i} | u_{1i} \leq -C_1, u_{2i} > -C_2) = \rho_{13}\lambda_{21} + \rho_{23}\lambda_{22}$

$$\lambda_{21} = -\left[\frac{\phi(C_1)\Phi(C_2^*)}{(S_2)} \right], \lambda_{22} = \left[\frac{\phi(C_2)\Phi(-C_1^*)}{(S_2)} \right] \quad (3-20)$$

(iii) For $i \in G_3$ (i.e. $D_1=1; D_2=0$): $E(u_{3i} | u_{1i} > -C_1, u_{2i} \leq -C_2) = \rho_{13}\lambda_{31} + \rho_{23}\lambda_{32}$

$$\lambda_{31} = \left[\frac{\phi(C_1)\Phi(-C_2^*)}{(S_3)} \right], \lambda_{32} = -\left[\frac{\phi(C_2)\Phi(C_1^*)}{(S_3)} \right] \quad (3-21)$$

(iv) For $i \in G_4$ (i.e. $D_1=1; D_2=1$): $E(u_{3i} | u_{1i} > -C_1, u_{2i} > -C_2) = \rho_{13}\lambda_{41} + \rho_{23}\lambda_{42}$

$$\lambda_{41} = \left[\frac{\phi(C_1)\Phi(C_2^*)}{(S_4)} \right], \lambda_{42} = \left[\frac{\phi(C_2)\Phi(C_1^*)}{(S_4)} \right] \quad (3-22)$$

The mean log earnings function for the i^{th} individual conditioned on the explanatory variables and the joint outcome of selection is expressed as:

$$E(\ln W_{3i} | x_{3i}, \theta) = x_{3i}' \beta_i + \sigma_3 E(u_{3i} | x_{3i}, \theta) \quad (3-23)$$

where θ denotes the joint outcome of the double selection process. Selectivity bias arises if the expected value of the disturbance term is nonzero $[E(u_{3i} | x_{3i}, \theta) \neq 0]$ (Heckman, 1979; Tunali, 1986; Vella, 1998). The equation is estimated by ordinary least squares over n observations:

$$\begin{aligned} \ln W &= x' \beta + \sigma_3 \rho_{13} \lambda_{11} + \sigma_3 \rho_{23} \lambda_{12} + \sigma_3 v \\ &= x' \beta + \beta_1 \lambda_{11} + \beta_2 \lambda_{12} + \sigma_3 v \end{aligned} \quad (3-24)$$

where $\beta_1 = \sigma_3 \rho_{13}$, $\beta_2 = \sigma_3 \rho_{23}$, and $v = u_{3i} - \rho_{13} \lambda_{11} - \rho_{23} \lambda_{12}$. Provided that the estimates from the first stage are consistent, this stage provides consistent estimates of the wage equation parameters for each legal status-skill category. The estimated coefficients will be inefficient due to the heteroscedastic nature of the error term (v) in the regression equation. As with the single selection case discussed in the previous section, the standard errors obtained from the OLS regression are not therefore appropriate for hypothesis testing. Following Tunali (1986), the error term v has variance:

$$Var(v | i \in S_j) = 1 + \mu_j \quad (3-25)$$

$$\text{Thus, } \text{Var}(\ln W | i \in S_j) = \sigma^2 \text{Var}(v | i \in S_j) \quad (3-26)$$

$$\begin{aligned} \mu_j = & \rho_{13}^2 C_1 \lambda_{j1} - \rho_{23}^2 C_2 \lambda_{j2} - \left[\rho_{13} \lambda_{j1} - (-1)^{D_1+D_2} \rho_{23} \lambda_{j2} \right]^2 \\ \text{where} & + \left[2\rho_{13}\rho_{23} - \rho(\rho_{13}^2 + \rho_{23}^2) \right] \frac{g}{S_j}, \quad j = 1, \dots, 4 \end{aligned} \quad (3-27)$$

where g is a bivariate density, S_j is the probability that an individual is assigned to group j , and all other parameters are as defined previously. Using the sum of squared residuals for the i^{th} observation given by Equation (3-28), a consistent estimator of the variance of the regression is derived as shown in Equation (3-29):

$$\hat{T} \cong \sum_{i=1}^N \sigma^2 (1 + \mu_j) = N\sigma^2 + \sum_{i=1}^N \sigma^2 \hat{\mu}_j = N\sigma^2 + \hat{W} \quad (3-28)$$

$$\therefore \hat{\sigma}^2 \cong \frac{1}{N} [\hat{T} - \hat{W}] \quad (3-29)$$

The asymptotic covariance matrix for the parameter estimates is expressed as:

$$\text{Var}(\hat{\theta}) \cong \left[X_*' X_* \right]^{-1} X_*' \left[\hat{\sigma}^2 \text{Var}(v) + \hat{\sigma}^2 (\rho_{13} \Lambda_1 + \rho_{23} \Lambda_2)' \text{Var}(\hat{\psi}) (\rho_{13} \Lambda_1 + \rho_{23} \Lambda_2) \right] X_* (X_*' X_*)^{-1} \quad (3-30)$$

where $\hat{\psi}$ is the parameter vector from the first stage bivariate probit and Λ_1 and Λ_2 are the gradient vectors for the derivatives of the lambda terms with respect to the parameters of the first stage bivariate probit. Interested readers may refer to Tunali (1986) for specifics on the derivations.

Data

The data consist of 12,851 foreign born workers with complete data from the National Agricultural Workers Survey (NAWS) for 1993 to 2002. The NAWS is an employment based random survey of the U.S. crop farm workforce which contains an extensive set of variables on workers' demographic characteristics, employment, wages and working conditions, health,

safety and educational, social service and housing issues (US-DOL, 2007). The Survey is administered nationally three times per year (January, April/May, and October). Table 3-1 defines the explanatory variables that were used in the bivariate probit and wage equation models. They reflect the demographic characteristics of the crop farm workforce, as well as certain farm labor market characteristics. Dummy variables reflecting the location (state) and time period of interview are also included.

Determinants of the Legal Status Decision

Demographic characteristics that influence foreign born workers' choice of legal status are: nationality (Mexican), gender (female), marital status (married), English speaking ability (English), and age. Relevant human capital variables include education and experience, thought to positively affect productivity and wages. Squared terms are included on the age and experience variables to allow for nonlinear effects. Foreign farm work experience and adult education are included as additional indicators of foreign born workers' human capital and may have similar directions of influence on earnings as the conventional human capital variables. After 2001 is a dummy variable that is used to distinguish between the years that precede and follow the September 2001 event.

Determinants of the Job Type Decision

The job type decision is influenced primarily by the basic human capital variables defined above and certain labor market variables (seasonal worker, foreign farm work experience, years with employer, farm work weeks, piece rate, grower, specialty crop), English and female. One would expect education to positively affect a worker's decision to seek or accept skilled employment. Workers with good English speaking skills are expected to be better able to capitalize on opportunities as they arise, and are expected to seek skilled farm employment in the U.S. more readily than their cohorts with limited English speaking skills.

Determinants of Farm Earnings

Farm earnings are influenced by the human capital characteristics (education, experience), other workforce demographic characteristics and labor market characteristics as defined previously. A location dummy variable (California) is included to control for workers' location at the time of the interview. Selectivity correction terms (λ_{ij}) are also included in the earnings equations for each group to account for the effect of the decision criteria on earnings.

Results and Discussion

Descriptive Statistics

Table 3-2 reports the means and standard deviations for each group (authorized and skilled, authorized and unskilled, unauthorized and skilled, unauthorized and unskilled) identified from a sample of 12,851 foreign born farm workers who were interviewed between 1993 and 2002. Over this period, more than half of the workforce was unauthorized: 37.9% were unauthorized & unskilled workers whereas 17.9% were unauthorized & skilled workers. Within the same time frame, a little over 44% of all foreign born farm workers identified as authorized workers: 25.3% were authorized & unskilled, and the remaining 18.9% were authorized & skilled.

The descriptive statistics for the different groups reveal that the average foreign born farm worker employed between 1993 and 2002 was a Mexican male with limited English speaking ability. The worker had completed only 6 years of schooling on average, and had not taken any adult education courses since migrating to the U.S.

Regardless of job type, authorized workers tended to be older than their unauthorized cohorts. The average authorized worker was about 38 years compared to 29 years for the average unauthorized worker. Workers were employed on a seasonal basis with growers, and

were compensated by methods other than the piece rate. They reported having foreign farm work experience and five years or more of U.S. farm work experience. Unauthorized workers (skilled and unskilled) had about five years of U.S. farm work on average in comparison to authorized workers (skilled and unskilled) who had 14 or more years of U.S. farm work experience. Authorized workers also reported more years of employment with their current employers than did unauthorized workers. On average, the workers reported completing 30 weeks of farm work in the year preceding the NAWS interviews.

According to Table 3-2, the average worker interviewed in California was authorized. As noted in Walters, Emerson and Iwai (2007), this result is a consequence of restricting the sample to foreign born workers. Most authorized workers on the East Coast are native born so that when native born citizen workers are excluded, virtually all workers are unauthorized, for example, there tend to be few green card farm workers on the East Coast. By contrast, on the West Coast most authorized workers were foreign born (green card, naturalized citizen, or other form of authorization). As such, the exclusion of native born citizens on the East Coast results in a very large change in the proportions of authorized and unauthorized workers from what they would be over all types of workers, including native born citizens (Walters, Emerson and Iwai, 2007).

Determinants of Legal Status and Job Type Decisions

The results of the bivariate probit model are reported in Table 3-3. The rho coefficient is positive and statistically significant at the 1% significance level. This indicates that the two selection rules are interrelated, in that foreign born workers jointly consider legal status and job type when seeking U.S. farm employment. That the rho coefficient is positive indicates that foreign born workers who choose to work in the U.S. as authorized workers are also more likely to be observed in a skilled farm jobs. It is likewise suggestive of the opposite case that foreign

born workers who opt to work in the U.S. in an unauthorized status are more likely to hold unskilled farm jobs.

Most of the estimated coefficients are statistically significant at the 10% significance level or better and have the expected signs. All else being the same, the characteristics associated with increased probability of authorized status are if the worker is female, married, has several years of U.S. farm work experience and speaks English well. Workers with higher schooling levels and who have taken additional training (adult education) since migrating to the U.S also have a higher probability of being authorized. Conversely, workers from Mexico are less likely to be authorized, as are workers who were interviewed after 2001.

Based on the results for the job type equation, foreign born workers with U.S and foreign farm work experience have a higher probability of being employed in skilled farm jobs, all else being the same. This was also the case for workers who did farm work the previous year, and who had worked for several years with their current employers, and for workers with good English speaking skills. The latter characteristic is logical as it implies that such workers may be better able to capitalize on job opportunities, particularly if English proficiency is required. On the other hand, the characteristics that increase the probability that workers are observed in unskilled jobs are if the workers are female, if they are employed in the specialty crop sector and on a seasonal basis, or compensated by piece rate.

The statistical insignificance of the education coefficient suggests that it has practically no effect on the probability that a worker acquires a skilled farm job, holding all other factors constant. This finding runs counter to human capital theory, from which education is expected to improve a worker's skill set and, logically, the probability that he is employed in a skilled job. It also contrasts with that reported by Taylor (1992), where the education coefficient was

significantly positive and shown to increase the probability of selection into skilled employment.¹

The marginal effects corresponding to the bivariate probit model are reported in Table 3-5. Holding all other characteristics constant, the marginal effect indicates the change in the observed outcome given a change in the independent variable of interest.² For each group, the marginal effects for the after 2001 dummy variable implies that foreign born workers who were interviewed after 2001 were 7% less (more) likely to be authorized & skilled (unauthorized & skilled), and 12% less (more) likely to be authorized and unskilled (unauthorized & unskilled) than if they were interviewed prior to that period. Holding all other characteristics constant, the results also suggest a stronger tendency for Mexican workers to choose to work as unauthorized workers: they were 2% less (more) likely to be authorized & skilled (unauthorized & skilled) and 4% less (more) authorized & unskilled (unauthorized & unskilled), respectively.

The significance of English speaking ability for authorized employment is evident from the positive marginal effects for those groups with authorized status. Regardless of skill level and holding all other characteristics constant, workers are 6% more likely to choose to work in authorized statuses if they are able to converse in English. In this respect, such workers are also 9% less likely to be unauthorized & unskilled.

Among those characteristics that directly impact workers' choices, the piece rate and specialty crop variables have the largest marginal effects. Holding all else constant, piece rate workers are 11% more (less) likely to be unauthorized & unskilled (unauthorized & skilled) and 8% more (less) likely to be authorized & unskilled (authorized & skilled). The direction of

¹ However, Taylor's study focused on a considerably smaller sample (<600) of male farm workers in California.

² Note that for any variable included in one equation but not the other, the marginal effects are the mirror image for the opposite group in most cases.

influence is similar if the workers are employed in the specialty crop sector, where they are 3% more (less) likely to select into U.S. employment as authorized & unskilled (authorized & skilled).

Selectivity Corrected Wage Equation Models

The estimated coefficients and asymptotic standard errors of the selectivity corrected wage models for each group are reported in Table 3-5. With few exceptions, most parameter estimates are statistically significant at 10% or better and have the expected signs. The selectivity variables for legal status and job type, λ_1 and λ_2 , account for potential selection bias arising from foreign born workers' selections into U.S. employment in authorized or unauthorized status and skilled or unskilled employment, respectively. The estimated coefficients for both of these variables are statistically significant at the 5% significance level or better across all worker groups, suggesting the presence of selectivity bias in the system. The estimated coefficients in the wage equations would therefore be biased if the selectivity correction variables were excluded from the wage equation models.

The conventional variables of interest in earnings models, education and experience, are shown to have significantly positive effects on earnings across all worker groups. The education coefficient points to the fact that schooling levels have a limited impact on mean earnings of farm workers in general; holding all other characteristics constant, education increased mean earnings by less than 1% across all groups. Farm workers typically have low levels of formal education and from previous studies it would appear that the overall implication of education for farm workers is unclear (Taylor, 1992; Isé and Perloff, 1995; Iwai, Emerson and Walters, 2006a).³ Dummy variables for adult education were included in the models to proxy additional

³ Across a broader range of occupations (agricultural versus non-agricultural occupations), the magnitude of the education impact is expected to be larger.

educational and training undertaken by farm workers, and are shown to have significantly positive effects on earnings across the board. The earnings effects are less than 2%, holding all other characteristics constant, for unauthorized workers in general.

Demographic variables denoting gender, age and English competency are also statistically significant across all groups, and shown to positively affect earnings. The exception in the latter respect is the female coefficient in the unauthorized & unskilled group which implies a penalty of about 1.8% on earnings for female workers in that group, holding all other factors constant. This finding is more in keeping with those reported by previous studies by Isé and Perloff (1995) and Iwai, Emerson and Walters (2006a), where female farm workers reportedly earn less than male farm workers. Age has a significant positive nonlinear effect on earnings except for unauthorized & unskilled workers. Speech competency in English has a significantly positive impact on earnings, and particularly among skilled workers; for authorized & skilled and unauthorized & skilled workers, respectively, mean earnings increase by 3% or more if workers can speak English, holding all other factors constant. Though positive, the magnitude of influence on mean earnings is smaller for unskilled workers.

Among the labor market variables reported, the piece rate dummy is most dominant and has significantly positive effects on earnings across all the worker groups. Holding all other characteristics constant, payment by piece rate increased the mean earnings by 25% or more in all groups except the unauthorized & skilled group. Regardless of job (skill) type, the magnitude of influence is greater for the authorized workers than for unauthorized workers. The remaining explanatory variables denoting employment with a grower, employment in California, and seasonal employment have significantly positive effects on earnings across the board, the exception to this being for seasonal workers in the unauthorized & unskilled group. Iwai,

Emerson and Walters (2006a) reported a statistically negative impact of seasonal work on farm worker earnings in their study.⁴

The average predicted earnings for each worker group are reported in Table 3-6. Again, the importance of legal status is evident from the fact that authorized workers earn more than unauthorized workers. Specifically, average predicted earnings authorized & skilled and authorized & unskilled workers exceed those for workers of the other groups. Perhaps the most interesting finding is that even unauthorized & unskilled workers earn more than unauthorized & skilled workers. It clearly implies that for foreign born workers lacking legal status, selection into skilled employment is not advantageous; if anything, employment in the U.S. in an unauthorized status penalizes skilled workers. According to Emerson (2007), the wage penalty conferred by unauthorized status may be interpreted as a risk premium to employers to compensate for potential penalties and production losses that may arise if unauthorized workers were apprehended by the authorities.

This finding is broadly consistent with employment impact noted by Taylor (1992) and lends support to his argument that unauthorized status may lessen workers' chances of acquiring skilled jobs, or at least may discourage workers from seeking skilled jobs given the low earnings potential. From an employer's perspective, if a worker is suspected or known to be unauthorized for US employment, placing that worker in a skilled job position increases risks considerably if he were apprehended by the authorities. Following Taylor's argument, *ceteris paribus*, the apprehension of a worker employed at a skilled position implies an associated loss of human capital which translates to larger production losses for the employer than if the worker were

⁴ Other farm worker earnings studies with a legal status or job type selection focus (Taylor (1992) and Isé and Perloff (1995)) did not include seasonal dummies in the wage models.

employed at an unskilled position (Taylor, 1992; p. 890).⁵ The punitive effect of unauthorized status on earnings is consistent with Isé and Perloff (1995) and (Iwai, Emerson and Walters, 2006a) as well. Legal status is evidently the dominant factor affecting employment opportunities and earnings potential of foreign born farm workers; whether or not they possess valuable job skills appears less important for employment in the U.S. crop farm sector.

Concluding Remarks

This study sought to address two key points that are commonly raised in the debate over legalization for unauthorized workers: (1) whether unauthorized farm workers are more likely to be observed in unskilled farm jobs than their authorized cohorts and, (2) whether they earn less than authorized farm workers for the same type of work. Previous studies have dealt with both of these issues but separately: selection bias was modeled as originating from a single criterion function, as opposed to the multiple decision criteria assumed in this study.

The significantly positive bivariate probit model results reveal that the two decision criteria (legal status and job type) jointly affect foreign farm workers' choices on U.S. farm employment, and that unauthorized workers are more likely to be observed in unskilled farm jobs. In addition to education, age and farm work experience, marital status, gender (female) and English speaking ability are shown to influence employment as authorized workers. In terms of job type, the work experience (U.S. and foreign), English speaking skills, education and employment with a grower are the characteristics associated with skilled employment.

Among the key variables of interest in the wage models, consistent significantly positive effects are shown for education and experience on earnings for all workers. Similar effects are

⁵ Taylor (1992) proposed a theoretical model that shows how wages of authorized and unauthorized workers may differ for the same job position, and how potential penalties and production and human capital losses may factor into the wage rates that are offered to workers.

noted for employment with a grower, employment in California, English speaking ability, and the piece rate. The latter is shown to have a particularly strong effect relative to the other explanatory variables. In most instances, variables denoting seasonal employment and female gender had significantly positive effects on farm worker earnings. However, these findings contrast directly with estimates reported in past studies.

The predicted earnings results highlight the fact that legal status is most important for foreign born workers. Assuming that foreign workers view U.S. employment as an optimal economic choice, employment in an illegal status is ill advised since it would not increase earnings. Even if the workers were skilled, they would still earn less than if they chose to work as *unauthorized & unskilled* workers. Consequently, the lack of legal status may be correctly viewed as a barrier, in the sense that unauthorized workers would be discouraged from seeking and holding skilled farm jobs due to the wage penalty.

In the context of the ongoing immigration reform debate, the results of this study would seem to suggest that if unauthorized workers were able to gain legal status, they could earn higher wages and possibly move into better paying jobs. Under the proposed *Comprehensive Immigration Reform Act of 2007* (S.1348), the proposed *Agricultural Job Opportunities, Benefits and Security Act of 2007* (AgJOBS) (S.237, S.340, H.R.371) would establish a pilot program for adjustment to permanent resident status of qualifying agricultural workers who have worked in the United States during the two-year period ending December 31, 2005, and have been employed for specified periods of time subsequent to enactment of the Act (Library of Congress, 2007). To date, however, S.1348 has not been passed into law as it has been met with considerable opposition from segments of the American public that oppose its legalization provisions in particular.

Legalization must be addressed if the labor market opportunities are to improve for the majority of farm workforce, most of whom are unauthorized foreign born workers. That more than half of the current workforce fits this profile is an untenable position for not only the workers, but also for agricultural employers, given the financial risks associated with apprehensions.

Table 3-1. Explanatory variables for models based on the National Agricultural Workers Survey for 1993-2002

Variable ^a	Definition
LnWage	Natural logarithm of the real farm wage in 2002 dollars. Conversions from the nominal wage were made using the consumer price index for all urban consumers
Authorized	=1 if farm worker is authorized for U.S. employment (citizen, permanent resident, or has other work authorization) = 0 if otherwise (i.e. unauthorized)
Skill	=1 if task is semi-skilled, supervisory, or other =0 if otherwise (pre-harvest, harvest, post harvest jobs)
Piece Rate	= 1 if worker is paid by piece rate = 0 if otherwise (by the hour, hour/piece combination, or salary)
Seasonal Worker	=1 if worker is employed on a seasonal basis = 0 if otherwise (year-round)
Female	=1 if female =0 if male
Mexican	= 1 if worker is of Mexican nationality =0 if otherwise
Education	Highest grade level of education completed by the farm worker, ranging from 0 to 16
Adult Education ^b	=1 if worker had attended any adult education classes or school in the U.S. =0 if otherwise
After 2001	Dummy variable reflecting the interview years following September 2001
California (CA)	Dummy variable reflecting employment in California at the time of the interview
English (speaking ability)	= 1 if 'none at all' = 2 if 'a little' = 3 if 'somewhat' = 4 if 'well'

Table 3-1. Continued.

Variable	Definition
Married	= 1 if 'married/living together' =0 if otherwise
Years with current employer	Number of years of employment worker has completed with current employer. One year is measured as one or more days per year (NAWS)
Farmwork weeks	Farmwork weeks completed in the last year
Foreign Farm Work Experience	=1 if worker had been employed in agriculture, either full-time or part-time, while living in native (foreign) country =0 if worker had been employed in non-agricultural sector or had never worked while living in native (foreign) country
Grower	= 1 if employed by a grower = 0 if employed by a farm labor contractor
Specialty Crop	= 1 if worker was employed in specialty crop production at the time of the interview =0 if otherwise
Age	Respondent age in years
Age ²	Age squared
Experience	Years of U.S. farm work
Experience ²	Experience squared
λ_1	Selectivity correction term from the legal status (authorized) decision equation
λ_2	Selectivity correction term from the job type (skilled) decision equation

^a Data were sourced from the National Agricultural Workers Survey. Definitions enclosed in quotation marks are as they appear in the NAWS Codebook. ^b This would include English/ESL, citizenship, literacy, job training and Adult Basic Education classes, GED/high school equivalency classes, college or university classes, and Even Start and Migrant Education classes.

Table 3-2. Descriptive statistics for explanatory variables (N =12,851 foreign workers)

Variable	Authorized & Skilled Group (n=2428)		Authorized & Unskilled Group (n=3251)		Unauthorized & Skilled Group (n=2300)		Unauthorized & Unskilled Group (n=4872)	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Real wage	7.30	1.98	7.26	2.61	6.51	1.54	6.77	2.22
Adult education	0.27	0.45	0.26	0.44	0.15	0.36	0.14	0.34
After 2001	0.31	0.46	0.20	0.40	0.42	0.49	0.24	0.43
Female	0.14	0.35	0.22	0.42	0.12	0.32	0.14	0.35
Married	0.80	0.40	0.76	0.43	0.51	0.50	0.48	0.50
English	2.12	0.92	1.91	0.91	1.56	0.70	1.52	0.72
Mexican	0.87	0.33	0.90	0.30	0.89	0.32	0.91	0.29
Education	5.69	3.38	5.72	3.48	6.11	3.18	5.99	3.25
Experience	16.32	8.83	14.46	8.51	5.68	5.84	5.10	5.70
Experience squared	344.25	365.38	281.45	338.92	66.34	183.62	58.52	176.06
Age	39.45	11.19	37.92	11.16	28.46	9.66	28.47	10.25
Age squared	1681.28	954.27	1562.21	927.95	903.38	685.67	915.79	756.23
Seasonal worker	0.63	0.48	0.78	0.41	0.69	0.46	0.83	0.38
Foreign farm work								
Experience	0.70	0.46	0.63	0.48	0.70	0.46	0.69	0.46
Years with current								
Employer	6.74	5.80	5.22	4.81	2.79	2.79	2.32	2.26
Farm work weeks	39.14	12.29	34.71	13.48	35.26	15.43	31.67	16.19
Piece rate	0.11	0.31	0.24	0.43	0.11	0.32	0.29	0.45
Grower	0.84	0.37	0.78	0.42	0.81	0.39	0.74	0.44
Specialty crop	0.80	0.40	0.86	0.34	0.72	0.45	0.78	0.42
California	0.58	0.49	0.46	0.50	0.33	0.47	0.24	0.43

Table 3-3. Bivariate probit model estimates for foreign-born workers' legal status and job type selections

Variable ^a	Authorized		Skilled	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
Adult education	0.1803***	0.0360	---	---
After 2001	-0.5173***	0.0325	---	---
Female	0.4586***	0.0377	-0.1491***	0.0353
Married	0.2305***	0.0318	---	---
English	0.2987***	0.0188	0.0886***	0.0152
Mexican	-0.1596**	0.0460		
Education	0.0351***	0.0048	0.0043	0.0040
Experience	0.2074***	0.0051	0.0095***	0.0016
Experience squared	-0.0036***	0.0001	---	---
Age	0.0531***	0.0077	---	---
Age squared	-0.0005***	0.0001	---	---
Seasonal worker	---	---	-0.2252***	0.0297
Foreign farm work experience	---	---	0.0619**	0.0283
Years with employer	---	---	0.0160***	0.0032
Farm work weeks	---	---	0.0061***	0.0009
Piece rate	---	---	-0.5303***	0.0313
Grower	---	---	0.0655**	0.0294
Specialty crop	---	---	-0.1758***	0.0289
Constant	-3.5134***	0.1459	-0.5545***	0.0673

Sample size = 12851; Log likelihood = -13172.59; Rho (ρ) = 0.095***

^a Triple and double asterisks (***, **) indicate statistical significance at 1% and 5% levels of significance, respectively.

Table 3-4. Marginal effects of bivariate probit selection estimates into legal status & job type

Marginal Effect ^a				
Variable	Authorized & Skilled	Authorized & Unskilled	Unauthorized & Skilled	Unauthorized & Unskilled
Adult education	0.0257	0.0447	-0.0257	-0.0447
After 2001	-0.0710	-0.1203	0.0710	0.1203
Female	0.0357	0.1449	-0.0903	-0.0903
Married	0.0325	0.0558	-0.0325	-0.0558
English	0.0562	0.0594	-0.0231	-0.0925
Mexican	-0.0228	-0.0397	0.0228	0.0397
Education	0.0056	0.0079	-0.0040	-0.0095
Experience	0.0453	0.0592	-0.0453	-0.0592
Age	0.0020	0.0033	-0.0020	-0.0033
Seasonal worker	-0.0353	0.0353	-0.0503	0.0503
Foreign farm work				
Experience	0.0096	-0.0096	0.0135	-0.0135
Years with current				
Employer	0.0025	-0.0025	0.0035	-0.0035
Farm work weeks	0.0009	-0.0009	0.0013	-0.0013
Piece rate	-0.0772	0.0772	-0.1066	0.1066
Grower	0.0101	-0.0101	0.0142	-0.0142
Specialty crop	-0.0276	0.0276	-0.0392	0.0392

^a All marginal effects are statistically significant at the 5% level or better.

Table 3-5. Selectivity corrected wage models for each worker group

Variable ^a	Authorized & Skilled (n=2428)		Authorized & Unskilled (n=3251)		Unauthorized & Skilled (n=2300)		Unauthorized & Unskilled (n=4872)	
	Parameter Estimate	Corrected S. Error	Parameter Estimate	Corrected S. Error	Parameter Estimate	Corrected S. Error	Parameter Estimate	Corrected S. Error
Adult Education	0.05212***	0.01110	0.02067***	0.00417	0.01635***	0.00617	0.01712**	0.00724
California	0.03884***	0.00214	0.07742***	0.00129	0.03523***	0.00117	0.05191***	0.00178
Grower	0.04725***	0.01070	0.06010***	0.00655	0.04405***	0.00352	0.06167***	0.00179
Piece Rate	0.28992***	0.02381	0.39628***	0.01242	0.17457***	0.01016	0.25901***	0.00719
Seasonal Worker	0.05484***	0.01363	0.04477***	0.01010	-0.01700***	0.00323	0.01050***	0.00310
Female	0.07900***	0.01872	0.02021**	0.00921	0.01377**	0.00662	-0.01860***	0.00647
Education	0.00558***	0.00192	0.00588***	0.00101	0.00593***	0.00052	0.00564***	0.00059
English	0.04105***	0.00805	0.01584***	0.00480	0.03391***	0.00454	0.01616***	0.00498
Age	0.01764***	0.00201	0.01022***	0.00070	0.00862***	0.00330	0.00132	0.00129
Age squared	-0.00021***	0.00003	-0.00012***	0.00001	-0.00011**	0.00005	-0.00001	0.00002
Experience	0.02801***	0.00236	0.01416***	0.00118	0.02643***	0.00481	0.01875***	0.00355
Experience squared	-0.00052***	0.00005	-0.00030***	0.00002	-0.00048***	0.00012	-0.00038***	0.00007

Table 3-5. Continued.

Variable ^a	Authorized & Skilled		Authorized & Unskilled		Unauthorized & Skilled		Unauthorized & Unskilled	
	Parameter Estimate	Corrected S. Error	Parameter Estimate	Corrected S. Error	Parameter Estimate	Corrected S. Error	Parameter Estimate	Corrected S. Error
λ_1	0.19174***	0.01979	0.08284***	0.01001	0.13674***	0.05268	0.09735**	0.04468
λ_2	-0.47152***	0.05304	-0.41924***	0.03725	-0.10748***	0.02129	-0.13658***	0.03013
Constant	1.38847**	0.66197	1.01502**	0.43046	1.61350***	0.35618	1.53875***	0.30150

^a Triple and double asterisks (***, **) indicate statistical significance at 1% and 5% levels of significance, respectively.

Table 3-6. Average predicted conditional wage for each legal status & job type group

Legal Status & Job Type Groups	Wage ^a (\$)
Authorized & skilled (G11)	8.42
Authorized & unskilled (G10)	7.76
Unauthorized & skilled G(01)	6.62
Unauthorized & unskilled G(00)	6.78

^a Average wages are conditioned on the selectivity variables for legal status and skill type.

CHAPTER 4 PROPOSED IMMIGRATION POLICY REFORM & FARMWORKER OUTCOMES

Overview

Immigration reform has generated much political debate in recent years. The last substantial revision of immigration law occurred in 1986 with the passage of the Immigration Reform and Control Act (IRCA), which authorized several policy instruments to discourage illegal immigration and employment. In the twenty years since however, it is apparent that IRCA has failed in its stated objectives for not only has illegal immigration increased significantly, but unauthorized immigrants have continued to gain employment in the U.S. particularly in the low-skilled, low-wage sectors of the economy (Passel, 2005; Passel and Suro, 2005; Passel, 2006; Mines, Gabbard and Steirman, 1997; Carroll et al. 2005). Statistics published by the Pew Hispanic Center provide ample evidence in these respects. In 2004, for example:

- There were 10.3 million unauthorized immigrants residing in the United States. They accounted for 29% of the foreign born population;
- Most unauthorized immigrants had arrived since 1990; 66% arrived between 1994 and 2004, and 30% migrated to the U.S. between 2000 and 2004;
- Most unauthorized immigrants were Latin American (81%), with Mexicans comprising the largest subgroup (57%);
- Occupations with the highest percentage of unauthorized workers included agriculture (19%), cleaning (17%) and construction (12%) (Passel, 2005).

Unsurprisingly, media attention on these trends has refocused national interest on immigration reform. Judging from the intensity of the debate in political and national fora, issues attendant to policy reform (border and worksite enforcement and legalization of unauthorized immigrants) will feature prominently in the 2008 presidential elections.

The political debate began in earnest with the passage of two earlier proposals in the 109th US Congress. Legislative proposal H.R. 4437 (the *Border Protection, Antiterrorism, and Illegal Immigration Control Act of 2005*) was passed by the US House of Representatives in December 2005. It is arguably one of the more restrictive proposals introduced for consideration in the 109th Congress in that it contained no provisions for legalization of unauthorized workers or for a guest worker program. H.R. 4437 emphasized a pro-enforcement stance on immigration reform; it advocated criminal penalties for unauthorized immigrants and significant fines for the U.S. employers who would hire them. The proposal also argued for I-9 document reform and for increased worksite/interior/border enforcement, but made no mention of modifications to existing laws on legal immigration.

In contrast, S. 2611 (the *Comprehensive Immigration Reform Act of 2006*) passed by the U.S. Senate in May 2006 proposed earned legalization for unauthorized immigrants and modifications to existing laws on legal immigration. Though it favored stricter enforcement and I-9 reform, overall, it was not as severe as H.R. 4437 in the overall approach to illegal immigration. Specific provisions for the agricultural sector were proposed under AgJOBS (*Agricultural Job Opportunity, Benefits and Security Act of 2005* (S. 359/H.R. 884; S.2611 Subtitle B), which would streamline the H-2A program to improve wages, working conditions and minimum benefits (housing and transportation) for farm workers and establish a pilot program for earned legalization of eligible unauthorized workers.¹

Neither S.2611 nor H.R. 4437 was passed since Congress failed to reach a compromise between the two sets of views on immigration. The failure to achieve compromise can be linked directly to the competing interests that lawmakers had to contend with: disagreements on policy

¹ Unauthorized workers would have to meet certain work-related requirements to qualify for legalization under the AgJOBS.

provisions between anti-immigration/pro-enforcement groups and pro-immigration groups, disagreements on specific reform measures between and within political parties in Congress, and intense lobbying from employer and worker advocacy groups for certain concessions. In many respects, the most divisive issue has been proposed legalization for unauthorized immigrants. There are segments of the American public that strongly oppose legalization on the grounds that it would reward illegal behavior and encourage future illegal immigration, as there are others that view legalization as the only viable means of bringing unauthorized immigrants into mainstream U.S. society, that is, in lieu of mass deportations.

Amidst these divergent views, employers of low skilled foreign labor – particularly farm employers – have expressed preference for increased access to immigrant labor to offset labor shortages. This issue is particularly important to farm employers that have high demand for manual labor over short periods during harvest time. Immigrant workers presently comprise a significant proportion of the crop farm workforce (78%), an estimated 53% of which is unauthorized for US employment (Carroll et al. 2005). Farm employers are justifiably concerned since these statistics clearly highlight their vulnerability to changes in immigration policy that may curtail their access to foreign labor.

Given this context, the purpose of this paper is to evaluate the implications of U.S. immigration policy reform for U.S. farm labor market outcomes, focusing specifically on proposed legalization for unauthorized immigrant workers. The study uses a treatment effects (TE) framework in which legalization is modeled as a treatment or (policy) intervention. The TE framework is a novel approach to immigration policy evaluation that has not been used in previous studies that have evaluated the potential impact of legalization for farm outcomes.

The paper is organized as follows. Following this introduction, the second section reviews the immigration policy proposals of the 109th Congress (S.2611 and H.R. 4437). Much of the discussion is devoted to the AgJOBS proposal. The proposals that were introduced in the 110th Congress (S.1348 and H.R. 1645) are only briefly mentioned since they have not been debated or passed by Congress. The third section comprises the analytical framework employed in the study, and the fourth section presents the study findings. The final sections of the paper present the policy implications and some concluding remarks.

Immigration Policy Reform Proposals

The reform measures proposed in S.2611 and H.R. 4437 may be broadly categorized into six core issues: worksite enforcement, document reform, enforcement provisions, guest worker programs, legal immigration and adjustment to legal status for unauthorized immigrants. In general, H.R. 4437 took a more restrictive stance on immigration reform than S.2611 and proposed stricter penalties for employers and unauthorized workers. The similarities between the two proposals concerned issues pertaining to enforcement (worksite and border) and document reform. Their major differences were primarily on legalization measures, specifically adjustment to legal status for unauthorized immigrants and guest worker programs. Whereas S.2611 set forth various conditions for legalization, H.R. 4437 was notably silent on this issue except for a single stipulation on sanctions for unauthorized presence in the US. The sanctions stipulation would have changed the criminal penalty for illegal entry and unauthorized presence (from a misdemeanor to a felony) (Library of Congress, 2007).

S.2611 addressed matters of work authorization and legalization of unauthorized immigrants under Title VI, Subtitle A, Section 601. Unauthorized immigrants could qualify for ‘earned adjustment’ status provided that they were able to give proof of unauthorized US

presence on or before April 5, 2001.² Except for brief absences, they would be required to show that they had not departed the United States before that date. Unauthorized immigrants would have been required to demonstrate that they were employed in the United States for at least three out of the five years prior to application for legal status and show employment for six years after the date of enactment of the Act. Immigrants would be required to pay fines, taxes and meet other conditions for admissibility (Library of Congress, 2007). Section 245c indicates similar unauthorized presence and employment conditions for unauthorized immigrants seeking to apply for ‘deferred mandatory departure’ status. However, except for brief departures, the unauthorized immigrant would have been required to give proof of continuous US presence on January 7, 2004 as well as employment before and after that date.³ ‘Earned adjustment’ would allow for automatic legal permanent resident status whereas ‘deferred mandatory departure’ status would allow immigrants to apply for visas while in the US. Both statuses have specific ineligibility conditions under which unauthorized immigrants may have been disqualified for authorized US residence (Library of Congress, 2007).

The main proposals of the 110th Congress – the *Comprehensive Immigration Reform Act of 2007* or the *Secure Borders, Economic Opportunity and Immigration Reform Act of 2007* (S.1348) and the *Security through Regularized Immigration and a Vibrant Economy (STRIVE) Act of 2007* (H.R. 1645) – were introduced in the US Senate and House of Representatives, respectively. As they exist currently, they appear to have more in common with proposal S.2611 on certain core issues. To date, neither proposal has been passed by Congress.

² This section is also cited as the ‘Immigrant Accountability Act of 2006.’

³ This particular status is granted to unauthorized immigrants to allow them time to depart the US and apply for readmission as a nonimmigrant or immigrant alien (Library of Congress, 2007).

Legalization conditions for agricultural workers are addressed via the AgJOBS (*Agricultural Job Opportunity, Benefits and Security Act of 2005* (S. 359/H.R. 884; S.2611 Subtitle B) proposal.⁴ It first gained bipartisan support in Congress in 2000 and was adopted by the Senate in May 2006 under Senate Bill S.2611. AgJOBS has two major objectives, the first of which would involve revision of the existing H-2A temporary worker program. Title II of the proposal stipulates:

- Revision of the administrative procedures, including elimination of the labor certification process;
- Reformation of the hiring requirements for H-2A employers, including an immediate reduction and gradual elimination of the Adverse Effect Wage Rate;
- Streamlining of the process for admission of H-2A aliens. There is also a provision which seeks to eliminate, on a one-time basis, the statutory bar preventing aliens not currently in the program from acquiring H-2A status (Library of Congress, 2007; Craig, 2006).

The second major objective focuses on ‘earned’ legalization. This would allow agricultural workers to obtain temporary legal status based on past work experience with the possibility of adjusting to permanent status through future/continued work in agriculture. Title I, Subtitle A, Section 101 of S. 237 stipulates the following conditions for blue card qualification. The worker must:

- Perform agricultural employment in the United States for at least 863 hours or 150 work days during the 24-month period ending on December 31, 2006;
- Apply for blue card status during the 18-month application period beginning on the first day of the seventh month that begins after the date of enactment of the legislation. Immediate family members would acquire derivative legal status and spouses would be able to apply for work permits;
- Must be otherwise admissible to the United States and have no history of felony or misdemeanor convictions involving bodily injury, threat of serious bodily injury, or harm to property in excess of \$500 (Library of Congress, 2007).

⁴ AgJOBS is referenced as S.237/S.340/H.R.371 in the 110th Congress (see Library of Congress, 2007).

Title I Subtitle B of the proposal also allows for amendment of Social Security records to permit exemption of blue card aliens from prosecution for improper conduct (related to identity or payment false statements) if they committed such conduct prior to acquiring blue card status (Library of Congress, 2007).

Transition to permanent (green card) status is addressed in Title I Section 103 of the proposal. In order to qualify for legal permanent resident status, workers must complete additional agricultural work of *either* 100 days annually for each of the five years beginning on the enactment date of AgJOBS *or* 100 days for one year and 150 days annually for three years during a 4-year period beginning on the enactment date *or* 150 days annually for each of the three years during the 3-year period beginning on the enactment date. Their immediate families would be granted legal status contingent upon their fulfillment of these requirements (Library of Congress, 2007).

The last major legalization program in recent history was the Special Agricultural Worker (SAW) program of the 1986 Immigration Reform and Control Act (IRCA), which granted legal status to an estimated 1.1 million farm workers. Analyzing the wage effects of this legalization program could provide significant insight into the potential wage impact of the proposed AgJOBS for different segments of the workforce. It would also be instructive to look at the factors that may affect workers' decisions on obtaining legal status for US farm work.

Analytical Framework

According to Heckman and Vytlačil (2005), the structural econometric (SE) approach and the treatment effects approach (TE) are two competing paradigms in the area of empirical policy evaluation. Of the 'three central tasks of economics' (p. 669) described (policy evaluation, forecasting of policy effects in new settings, and prediction of new policies), the SE approach is noted for its applicability to all three tasks provided that certain assumptions are satisfied. The

TE approach, as currently developed, differs markedly in that it concentrates more on policy evaluation and compares outcomes for treatment participants and non-participants. It therefore invokes fewer functional form and exogeneity assumptions and its linkages with economic theory are more loosely specified (Heckman and Vytlačil, 2005).

The differences between the two approaches were outlined in an earlier paper by Heckman (2001). First, whereas the SE approach seeks to answer many counterfactual questions via well defined economic parameters, the TE approach focuses on a more limited range of questions and analyzes them under weaker conditions. Second, whereas the parameters generated under the SE approach compare well across studies, those generated via the TE approach do not. Third, whereas the SE approach lends well to extrapolation, the TE approach allows for evaluation of a single program in a single environment only. Fourth, whereas the SE approach allows for partial as well as general equilibrium applications, the TE approach reflects a partial equilibrium viewpoint only and cannot be used for evaluation of interventions that apply universally within an economy (Heckman, 2001). These differences notwithstanding, the TE approach has become more popular in recent years because, as noted by Cameron and Trivedi (2005):

Policy relevance of treatment evaluation is direct because “successful” treatments can be linked to desirable social programs, or improvements in existing programs to attain objectives of social policy (p. 861).

Treatment Effects Approach

The treatment effects (TE) approach measures the impact of “treatment” on outcomes of interest. In this context, treatment may refer to medical treatments, public programs or social interventions (Basu et al. 2007), and the causal effect of the treatment on the outcome is defined as the treatment effect. The methodology originated with the medical sciences where interventions are primarily concerned with patients’ responses to treatment regimes relative to specific benchmarks that may include alternative treatment regimes or no treatment. The

analogy to be drawn with economics is that treatment is akin to participation in a program and outcomes are concerned with changes in the economic status or environment on the economic outcomes of individuals who elect to participate in the program (Cameron and Trivedi, 2005).⁵ The contrast between the two fields rests primarily on the type of data used. Medical studies tend to rely more on experimental data where non-participants adequately serve as controls to treatment, whereas economic studies rely more on non-experimental data where the use of control groups may be highly unethical (Lee, 2005). In medical studies therefore, the process is randomized whereas in economic studies, there is underlying self-selection into treatment. Economic issues that have utilized the TE approach include enrollment and evaluation of social programs (welfare and Job Corps programs), the impacts of changes in regulations for financial transactions and of changes in economic incentives.

The standard problem involves the inference of a causal connection between participation (treatment) (D) and the potential outcome (Y), where the potential outcomes for the participant (treated) (Y_1) and non-participant (non-treated) (Y_0) states are compared for the i^{th} individual to evaluate how his average economic outcome would change if he were to participate in a program or not. Following the latent variable framework of Heckman, Tobias and Vytlačil (2001; 2003) and Blundell and Costa Dias (2002), the potential outcomes based on observable characteristics (x), and the participation decision for a program may be defined as:

$$\begin{aligned}
 Y_1 &= g_1(x) + u_1 = \beta_1' X_i + u_1 && \text{(treated/participant group)} \\
 Y_0 &= g_0(x) + u_0 = \beta_0' X_i + u_0 && \text{(untreated/nonparticipant group)} \\
 D^* &= \alpha' Z_i + \varepsilon && \text{(decision to participate in treatment)} \\
 \text{where } D &= 1 \text{ if } D^* \geq 0; \quad D = 0 \text{ otherwise}
 \end{aligned}
 \tag{4-1}$$

⁵ 'Treatment' and 'participation' are used interchangeably throughout the chapter.

In this setup, $g_1(x)$, $g_0(x)$ represent the relationship between the observable characteristics and the potential outcomes and u_1, u_0, ε , Z and x are unobserved and observed random variables, respectively. The errors are assumed to be independent of x and Z . *Ceteris paribus*, the treatment or causal effect is defined as shown by equation (4.2), and is the difference between the potential outcomes:

$$\Delta_i = Y_{1i} - Y_{0i} \quad i = 1, \dots, N \quad (4-2)$$

This effect is not directly estimable as it is impossible to simultaneously observe an individual in both states. The observed outcome is actually:

$$Y_i = D_i Y_{1i} + (1 - D_i) Y_{0i} \quad (4-3)$$

where the unobservable portion of the effect is referred to as the counterfactual outcome. (For those individuals receiving treatment Y_0 is the counterfactual outcome; for those who do not, Y_1 is the counterfactual outcome.) The treatment effect of each person is independent of the treatment of other individuals, implying that an individual's potential outcomes are affected by his participation decision only and not the decisions of other individuals (Wooldridge, 2002; Caliendo, 2006).

Gains from treatment are typically defined as population averages. Some relevant parameters include:

- Average Treatment Effect (ATE). This is the expected gain from participating in a program for a randomly chosen individual (Heckman, Tobias and Vytlačil, 2001), calculated as the differences in expected outcomes before and after treatment:

$$\alpha_{ATE} = E(\Delta) = E(Y_1) - E(Y_0) \quad (4-4)$$

- Average Treatment Effect on the Treated (ATET). This is the average gain from treatment for those who select into the treatment (Heckman, Tobias and Vytlačil, 2001):

$$\alpha_{ATET} = E(\Delta | D = 1) = E(Y_1 | D = 1) - E(Y_0 | D = 1) \quad (4-5)$$

- Average Treatment Effect on the Untreated (ATEU). This is the effect for non-participants which may be useful for future policy decisions on extending treatment to groups that were excluded from treatment (Caliendo, 2006):

$$\alpha_{ATEU} = E(\Delta | D = 0) = E(Y_1 | D = 0) - E(Y_0 | D = 0) \quad (4-6)$$

- Marginal Treatment Effect (MTE).⁶ This is the expected effect of treatment conditional on observed (X) and unobserved (U_d) characteristics of participants (Heckman and Vytlacil, 2005).⁷ One interpretation is that it is the mean gain for an individual with characteristics X and unobservables U_d such that he is indifferent between treatment or not given a set of Z values, z , where $\Phi(\alpha'z) = u_d$. It is defined as:

$$\begin{aligned} MTE(X, U_d) &\equiv E(\Delta | X = x, U_d = u_d) = E(Y_1 - Y_0 | X = x, U_{di} = u_d) \\ &= E(\gamma | X = x, U_{di} = u_d) = X(\beta_1 - \beta_0) + E[u_{1i} - u_{0i} | U_{di} = u_d] \end{aligned} \quad (4-7)$$

The challenge posed by selection bias is evident in Equation (4-6), which shows a hypothetical outcome in the absence of treatment for those individuals who received treatment (Caliendo, 2006). With non-experimental data, this outcome is not equivalent to the outcome of non-participants:

$$E(Y_0 | D = 1) \neq E(Y_0 | D = 0) \quad (4-8)$$

Selection bias may arise since participants and non-participants may be deliberately selected groups with different outcomes, even in the absence of treatment, due to observable and unobservable factors that may determine participation (Caliendo, 2006):

$$E(Y_1 | D = 1) - E(Y_0 | D = 0) = \underbrace{E(Y_1 - Y_0 | D = 1)}_{ATEU} + \underbrace{[E(Y_0 | D = 1) - E(Y_0 | D = 0)]}_{Selection\ bias} \quad (4-9)$$

If selection bias is identified as arising from observed factors, matching methods, propensity scores and linear regression techniques are suitable estimation methods. Additionally, in cases where unobserved sources of selection bias are suspected, instrumental variable techniques,

⁶ Bjorklund and Moffitt (1987) are credited with introducing this concept to the literature.

⁷ The unobserved characteristics are introduced into the model by the decision rule described by equation (4-2).

difference-in-differences methods and selection models are more common – though not in the case of models that assume essential heterogeneity.

Homogeneous and heterogeneous treatment effects

Much of the previous literature on treatment effects assumed homogeneous responses to treatment, meaning that based on certain observable characteristics, effects are constant across individuals and that they would derive identical benefits from treatment. Recent studies have given more attention to heterogeneous responses where the effects vary across individuals due to their observable or unobservable characteristics. Much of the focus is now on the role of unobservable characteristics in determining outcomes particularly in cases where individuals are otherwise identical in their observed characteristics (Basu et al. 2007; Caliendo, 2006).

Basu et al. (2007) describe two instances in which heterogeneity (arising from unobservable characteristics) may factor into treatment evaluation. The first instance is where individuals with identical observable characteristics respond differently to treatment but do not opt for treatment based on their idiosyncratic benefits or gains (non-essential heterogeneity). The second instance is where individuals have identical observable characteristics and respond differently to treatment and are aware of the benefits to be derived from treatment. In this latter case, their treatment choices are influenced by anticipation of idiosyncratic gains (Basu et al. 2007). Basu et al. (2007) and Heckman, Urzua and Vytlacil (2006a; 2006b) refer to the second instance as *essential heterogeneity*.

In the context of this paper, heterogeneity of foreign farm worker responses to legalization is maintained and subjected to a statistical test. In the presence of heterogeneity, it is assumed that they would seek legalization through AgJOBS (or other legalization mechanisms) because of individually perceived wage benefits. The analysis follows a parametric approach developed by Heckman, Urzua and Vytlacil (2006b) to estimate the choice and outcome models,

and the treatment effects of legalization; alternative non-parametric estimates are also evaluated. Their MTE algorithm was used for the analysis.⁸ The overall models and estimation procedure are described in the following sections, and draw heavily on the theoretical expositions of Heckman, Urzua and Vytlačil (2006a; 2006b).

Parametric model with heterogeneous treatment effects

The parametric model with essential heterogeneity adopts the familiar latent variable framework shown:

$$\begin{aligned}
 D^* &= \alpha' Z - \varepsilon = \mu(Z) - \varepsilon && \text{Choice model/decision rule} \\
 D &= 1 \text{ if } D^* \geq 0 && \text{(if the worker opts for legal status)} \\
 D &= 0 && \text{(otherwise)}
 \end{aligned} \tag{4-10}$$

$$\begin{aligned}
 \ln Y_1 &= \beta_1' X_i + u_{1i} && \text{(Wage outcome for treated group)} \\
 \ln Y_0 &= \beta_0' X_i + u_{0i} && \text{(Wage outcome for untreated group)}
 \end{aligned} \tag{4-11}$$

where the Z and X are vectors of observable characteristics and $\varepsilon, u_{1i}, u_{0i}$ are error terms that encapsulate the unobservable characteristics of individuals. The decision to accept treatment (legal status) is defined by a choice model that allows for two separate log wage outcomes $(\ln Y_1, \ln Y_0)$.⁹ The choice model may be interpreted as a net utility for individuals with the characteristics Z and ε . Similarly, the (log wage) outcomes are functions of the i^{th} worker's characteristics denoted by X_i and u_{ji} ($j = 0,1$), respectively. The error of the choice model (ε) is assumed to be independent of Z given X . The parametric model assumes joint normality of the errors $(\varepsilon, u_{1i}, u_{0i})$, which are assumed to be independent of the observable characteristics (Z and

⁸ Information on the MTE is available at <http://jenni.uchicago.edu/underiv/> (Cited as Heckman, Urzua and Vytlačil, 2006c in reference list). Also, see Heckman, Urzua and Vytlačil (2006a; 2006b).

⁹ Parameters $\mu(Z)$ and ε are assumed to be additively separable as is the predominant specification in the literature.

X). Based on this assumption, the expectations on the errors of the outcome equations reflect the differences in legal status choice ($D=1$ if legalized/treated, $D=0$ if not legalized/untreated):

$$E(u_1 | X = x, D = 1, P(Z) = p) = \rho_1 \left(-\frac{\phi\left(\frac{\alpha'Z}{\sigma_\varepsilon}\right)}{P(Z)} \right) \quad (4-12)$$

$$E(u_0 | X = x, D = 0, P(Z) = p) = \rho_0 \left(\frac{\phi\left(\frac{\alpha'Z}{\sigma_\varepsilon}\right)}{1 - P(Z)} \right) \quad (4-13)$$

where $\rho_1 = \frac{\sigma_{\varepsilon,1}}{\sigma_\varepsilon}$; $\rho_0 = \frac{\sigma_{\varepsilon,0}}{\sigma_\varepsilon}$ are the correlations between the disturbances of the respective outcome equations and the choice equation, and $\phi(\cdot)$ denotes the standard normal density function (Heckman, Urzua and Vytlačil, 2006b).

The probability of becoming legalized is defined as:

$$Pr(z) = Pr(D = 1 | Z = z) = Pr(\alpha'Z > \varepsilon) = \Phi_\varepsilon(\alpha'Z) \quad (4-14)$$

where $\Phi(\cdot)$ is the cumulative distribution of ε . Heckman, Urzua and Vytlačil (2006a) refer to this function as a propensity score, taken as a monotonic function of the mean utility of treatment (legal status). Equation (4-10) is revised to reflect the acceptance decision as:

$$D = I[\Phi_\varepsilon(\mu(Z)) > \Phi_\varepsilon(\varepsilon)] = I[P(Z) > U_d] \quad (4-15)$$

where U_d denotes the unobserved characteristics of individuals. The algorithm estimates the propensity score using a probit model, from which the predicted values for the treated and untreated groups are used to define values over which the marginal treatment effect (MTE) of legalization may be identified (Heckman, Urzua and Vytlačil, 2006b).

Since it is impossible to observe an individual in the treated and untreated states simultaneously, Equations (4-3) and (4-10) are used to derive the actual outcome to be estimated:

$$\begin{aligned}
\ln Y_i &= D_i \ln Y_{1i} + (1 - D_i) Y_{0i} \\
&= D_i [X_i(\beta_1 - \beta_0) + u_{1i} - u_{0i}] + \beta_0 X_i + u_{0i} \\
&= \gamma_i D_i + \beta_0 X_i + u_{0i}
\end{aligned} \tag{4-16}$$

where $\gamma_i = X_i(\beta_1 - \beta_0) + u_{1i} - u_{0i}$ is the heterogeneous return to legal status for the i^{th} foreign farm worker (i.e. the effect varies across all farm workers). If the heterogeneous effect were from a differential between the β_j terms only, this would be ‘observed heterogeneity’; if it were to arise as a consequence of differences between the u_{ji} terms, it would be ‘unobserved heterogeneity.’ In either case, this parameter would imply different wage effects of legalization across foreign workers in the farm workforce even if they have identical observable characteristics. Note that for individuals who gain legal status ($D=1$), γ_i captures the benefit of legal status.

Treatment effect parameters

The literature on marginal treatment effects (MTE) spearheaded by Heckman provides several interpretations of the MTE which are equivalent under certain assumptions that apply in this analysis (see Heckman and Vytlacil (2007b) and references therein). One interpretation of the MTE presents it as a measurement of the marginal return to individuals who are indifferent between foregoing ($D=0$) or accepting treatment ($D=1$) when their mean utility ($u_d(Z)$) is equivalent to U_d . If $\ln Y_j$ are defined as value outcomes, it may be interpreted as a ‘willingness to pay’ measure for individuals with certain observable characteristics (X) and unobserved heterogeneity (U_d) at a specified margin of indifference (Heckman and Li, 2004; Heckman, Urzua and Vytlacil, 2006a). The other treatment effect estimators – the average treatment effect (ATE), the average treatment effect on the treated (ATET) and the average treatment effect on

the untreated (ATEU) – are generated as weighted averages of the MTE (Heckman, Urzua and Vytlacil; 2006a; 2006b):

$$ATE = E(\gamma_i | X = x, U_d = u_d) = \int_0^1 \Delta^{MTE}(x, u_d) du_d \quad (4-17)$$

$$ATE_T = E(\gamma_i | X = x, D = 1) = \int_0^1 \Delta^{MTE} \omega_{ATE_T}(x, u_d) du_d \quad (4-18)$$

$$ATE_U = E(\gamma_i | X = x, D = 0) = \int_0^1 \Delta^{MTE} \omega_{ATE_U}(x, u_d) du_d \quad (4-19)$$

where the applicable weights based on the propensity score (P) are:

$$\omega_{ATE_T} = \frac{1 - \Phi_P}{E(P_i)} \quad \text{and} \quad \omega_{ATE_U} = \frac{\Phi_P}{1 - E(P_i)} \quad (4-20)$$

Data

The data consist of 19,152 foreign workers with complete data from the National Agricultural Workers Survey (NAWS) for 1989 to 2006. Subsamples reflecting the treated (those who have obtained legal status; $N_T=8097$) and untreated (those without legal status; $N_U=11055$) worker groups are specified. Table 4-1 defines the variables that were used in the analysis. The variables reflect the demographic characteristics of the crop farm workforce and certain characteristics of the farm labor market. Dummy variables reflecting the location, time period of interview, and time period when the foreign workers would have entered the US to live or work are also included.

Results and Discussion

Table 4-2 reports the summary statistics for the variables that were used in the analysis. The treated group comprised 8,097 foreign workers whereas the untreated group comprised 11,055 foreign workers. One of the more interesting findings to emerge from the data is the difference in time spent abroad by workers of the two groups: workers who are not legalized have much longer overseas stays than their cohorts who are legalized (5 weeks on average). In

addition, workers who gained legal status reported more months and weeks of farm work in the previous year on average than their cohorts who did not gain legal status. Although workers had similar foreign farm work experience, there was a sizeable difference in US farm work experience. On average, legalized workers reported 16.7 years of US farm work compared to 6 years for workers who were not legalized. Not surprisingly, legalized workers had migrated to the US much earlier (~12 years more) and had worked with their current employers for much longer periods (~4 years) in comparison to their cohorts who did not gain legal status. On average, 62% of the foreign farm workforce had migrated to the US to live and work after 1986. Among legalized workers, only 26% had migrated to US after 1986, whereas approximately 88% of unauthorized workers had entered the US since that period.

Tables 4-3 reports the estimated choice model results from the MTE algorithm. The instruments included in this model are farm work weeks, years with employer, years since immigration, after 1986 and weeks spent abroad. The characteristics that significantly increase the likelihood of legalization (treatment) are years with employer, English, and years since immigration; those that decrease the likelihood of treatment are farm work weeks, after 2001 and weeks spent abroad. The after 2001 dummy variable was included to distinguish between the pre- and post- 9/11 periods, and the after 1986 dummy was included to distinguish between the periods when workers first entered the US to live or work. The latter reflects the broad legalization through the SAWs program for those who were in the US and working prior to the passage of IRCA in 1986, and the relative difficulty of acquiring legal status since 1986. The direction of influence signaled by the after 2001 coefficient suggests that foreign farm workers were less likely to gain legal status following the September 2001 terrorist attacks; this makes sense given that enforcement efforts and security were heightened in the US following that

event. Arguably legal status would have been more difficult to attain with the additional checks and safeguards that were put in place. That is not to say that the tightening on legal status would have necessarily had a significant adverse effect on foreign farm workers; if anything, these workers are more likely to have migrated illegally across the US border with Mexico. The magnitude of the after 1986 dummy suggests that legal status has been difficult to acquire since the last major legalization in 1986 (the SAWs program). The farm work weeks effect indicates that more weeks of farm work reduce the likelihood of having legal status.

Table 4-4 presents the parametric model wage results for the treated and untreated worker groups.¹⁰ All parameter estimates have the expected direction of influence on the wage results, and the parameters are statistically significant at the 1% level of significance; the exceptions are the foreign farm work experience and age variables in the treated and non-treated groups, respectively. For both groups, the magnitude and statistical significance of the piece rate and after 2001 estimates suggest dominant influences on farm wages relative to the other variables of the model.

Table 4-5 reports the estimated treatment effects of legalization which are all positive. The average treatment effect (ATE) reflects the expected gain for a random foreign farm worker who became legalized, the average treatment effect on the treated (ATET) indicates the return to those workers who became legalized, and the average treatment effect on the untreated (ATEU) indicates the potential return for those who were not legalized. The order of magnitude of the estimates generated by each method indicates positive sorting on the gains associated with legalization ($ATET > ATE > ATEU$), wherein those foreign workers who were most likely to

¹⁰ Wage results for the nonparametric methods (polynomial, nonparametric I, nonparametric II) are reported in the Appendix.

participate in the legalization program benefited the most from it – more so than the average person and more so than their cohorts who were not legalized.

A comparison of the different estimation methods shows a striking difference between the parametric and nonparametric methods in the magnitude of sorting gains from legalization. The sorting gains are the difference between the ATET and ATE estimates – the average gains for the worker who opts for treatment (legalization) versus the worker who randomly selects into treatment. The parametric method reports the smallest sorting gain of the four estimation methods: the average earnings gain for the legalized (treated) foreign worker was 0.0023, implying that the average earnings gain to legalization was 0.23% greater than the average earnings gain for the average foreign worker who randomly selected into legalization. The gains for the nonparametric methods (polynomial, nonparametric I, and nonparametric II) range from 3.16% to 6.57%.

A comparison of the estimates reported within shows significant differences in the magnitude of average returns to legalization for the treated (legalized) and untreated (non-legalized) groups. The parametric method estimates are the exception in this respect: earnings gains average 10% across the board irrespective of treatment status. The differentials are largest for the nonparametric I method, followed by the nonparametric II and polynomial methods, respectively. The average earnings gain for the untreated (ATEU) range between 15% and 18%, and those for the treated (ATET) range between 24% and 26%. The ATEU are particularly informative as they suggest the potential gains of a future legalization for workers, most of whom would have entered the US after the SAWs program.

The relevant support for each marginal treatment effect (MTE) is given by the propensity score frequencies for foreign workers who were treated (legalized) and untreated (not legalized)

shown in Figure 4-1. The marginal treatment effects generated by each method are shown in Figure 4-2 through Figure 4-5. The MTE is evaluated at values at which the propensity score ($P(z)$) and unobservable factors (u_d) are equivalent (Heckman, Urzua and Vytlačil, 2006a; 2006b). Heckman and Vytlačil (2005) emphasize the role of the unobservable characteristics in the interpretation of the MTE: for smaller values of the unobservables (u_d) (points closer to zero on the x axis), the MTE is the expected benefit for individuals who are **more** likely to participate in treatment and who would participate even if the mean scale utility ($\mu_d(Z)$) were small. Conversely, for larger values of u_d the mean scale utility ($\mu_d(Z)$) would have to be much larger to induce individuals' participation in treatment and they are **less** likely to participate. The MTE may also be interpreted as the mean gain for persons with observable characteristics (X) who would be indifferent between acquiring legal status or not, and may be viewed as a willingness to pay (WTP) measure if the outcomes are value outcomes (Heckman and Vytlačil, 2007a; 2007b).

The latter interpretation of the MTE is useful given the findings depicted in Figures 4-2 through 4-5 which seem to conflict with the positive sorting on the gains indicated by the average treatment effect parameters. Figure 4-2, which is based on the parametric method, suggests that the worker who became legalized (on account of having a low u_d) benefited less than the worker who was not legalized (on account of having a high u_d). Although this is difficult to reconcile with the positive sorting on the gains indicated by the average treatment effect parameters, the WTP interpretation of the MTE may offer reasonable explanation. The upward slope of Figure 4-2 would therefore suggest an increasing willingness to pay by workers who have larger unobservables that usually would make them less eligible for participation in the program. The increasing u_d values may be indicative of idiosyncratic enhanced productivity, and a larger willingness to pay for legal status in order to permit more options to earn better returns.

The MTEs generated by the nonparametric methods shown in Figures 4-3 through 4-5 are quite different from the parametric MTE. Again, the WTP interpretation may offer some explanation for the three different segments exhibited by the MTEs along the u_d range. On the downward sloping segments, individuals who have lower unobservables are more likely to participate in a legalization program and exhibit a large willingness to pay for legal status acquisition. Toward the middle segment of the MTEs (~ 0.51) however, it is possible that workers are more difficult to categorize in terms of legal status on the basis of their observable and unobservable characteristics and therefore are the least willing to pay for legal status relative to other individuals. Individuals with high unobservables fall within the upper segment of the MTE. They exhibit high willingness to pay for legal status, arguably because they have a lower likelihood of gaining legal status due to unfavorable unobservable characteristics. On account of the lower likelihood of becoming legalized, these individuals are likely to have fewer options for employment in other sectors but may possibly be more productive than their cohorts who have legal status for US employment.

Policy Implications

Much of the political warring over immigration reform stems from proposed legalization of unauthorized immigrants – whether it would reward illegal behavior and encourage future illegal immigration or whether it would serve the nation’s interests better to adjust unauthorized workers to legal status to prevent shocks to the labor intensive industries that mostly hire them. In addressing these issues, AgJOBS seeks to stabilize the crop farm workforce that is extremely vulnerable to immigration reform that may affect labor supply, wages and labor costs.

The average treatment effect on the untreated (ATEU) parameter offers key insight as to how earnings may be potentially affected by a legalization program such as AgJOBS. Table 4-5 shows average earnings gains ranging from 0.1002 to 0.1784, suggesting potential earnings

increases between 10% and 18% for unauthorized workers that become adjusted to legal status. The findings are broadly consistent with previous work that assessed the earnings implications of legalization. Isé and Perloff (1995) estimated average wage increases of about 15% for unauthorized workers that are granted amnesty; if they were to become permanent residents however, their wages would increase by about 12%. Iwai, Emerson and Walters (2006a) found that unauthorized workers who gained legal status would, in general, earn higher wages. Wages would increase by as much as 31%: for example, unauthorized workers who selected into temporary authorized status had wage increases between 6% and 31% after 2001.¹¹

Such results suggest cost increases for farm employers of unauthorized workers. Given the large percentage of the farm workforce that is currently unauthorized for US employment, the increased cost may be substantial for employers with large proportions of unauthorized workers among their crews, and for whom labor costs comprise significant portion of total cost. Employers may respond by using other production factors more intensively; Napasintuwong (2004) suggested that the degree of intensity to which capital and labor are used in agriculture have been affected by the availability of immigrant labor, which is in turn affected by immigration policy.

Concluding Remarks

This study sought to analyze the potential impact of proposed legalization on the wage outcomes of foreign farm workers. The results provide some insight as to how future legalization could impact farm wages and, by extension, labor costs for employers. The key distinction between this study and previous work is analytical framework: this study approached the problem from a treatment effects perspective with legalization modeled as a policy intervention

¹¹ These are based on specific simulations that account for location, time, payment type, etc. See Iwai, Emerson and Walters (2006a) for details.

or treatment. The application of this analytical framework is a significant contribution to the literature on immigration policy evaluation and farm labor markets as it had not been previously applied in this context. The study also assumed that essential heterogeneity existed, meaning that workers would not only display different responses to treatment but would also select into treatment based on idiosyncratic gains. The test of essential heterogeneity suggested by Heckman, Urzua and Vytlačil (2006a) was used to show that this assumption was indeed supported by the data.

The results show an overall positive impact of legalization on farm worker outcomes. There is positive sorting on the gains from legalization, implying that foreign workers who specifically sought legalization benefited more than the average worker and even more so than their cohorts who had not been legalized. The magnitude of gain is sensitive to the method of estimation used, with modest increases noted for the parametric method relative to the nonparametric methods. The findings from the marginal treatment effects are not entirely clear, and seem to conflict in most respects with the average treatment effect results. Given the stark differences between the parametric and nonparametric methods, it would appear that the assumption of joint normality (on which the parametric method is based) is not supported by the data. However, this is not to imply that the nonparametric MTEs offer less ambiguous interpretations. As they are presently, they are somewhat difficult to reconcile with the findings suggested by the positive sorting gains suggested by the average treatment effect parameters. If the MTEs are viewed in the context of willingness to pay measures however, the interpretations seem reasonable. Clearly, these findings suggest a need for future research. A likely starting point would be additional refinement of estimates based on the nonparametric methods as the normality assumption appears problematic.

Most importantly, the results show that unauthorized workers may potentially gain from future legalization, with wage increases by as much as 18%. In this respect, the cost implications for farm employers are clear in that labor costs would increase if amnesty were to be granted to workers who are currently unauthorized. Whether this may encourage employers to shift to more capital intensive methods of production over time would depend on the magnitude of the cost increase and the degree of stringency and effectiveness of future legislation in controlling illegal immigration and employment.

Table 4-1. Explanatory variables of the choice and parametric wage regression models

Variable ^a	Definition
LnWage	Natural logarithm of the real farm wage in 2006 dollars. Conversions from the nominal wage were made using the consumer price index for all urban consumers
Legal status	=1 if farm worker is authorized for U.S. employment (citizen, permanent resident, or has other work authorization) = 0 if otherwise (i.e. unauthorized)
Piece rate	= 1 if worker is paid by piece rate = 0 if otherwise (by the hour, hour/piece combination, or salary)
Seasonal worker	=1 if worker is employed on a seasonal basis = 0 if otherwise (year-round)
Female	=1 if female =0 if male
Mexican	= 1 if worker is of Mexican nationality =0 if otherwise
Education	Highest grade level of education completed by the farm worker, ranging from 0 to 16
Adult education ^b	=1 if worker had attended any adult education classes or school in the U.S. =0 if otherwise
After 1986	Dummy variable reflecting years before and after 1986 when foreign workers entered the United States for the first time to live or work
After 2001	Dummy variable reflecting the interview years following September 2001
California (CA)	Dummy variable reflecting employment in California at the time of the interview
English (speaking ability)	= 1 if 'none at all' = 2 if 'a little' = 3 if 'somewhat' = 4 if 'well'
Married	= 1 if 'married/living together' =0 if otherwise

Table 4-1. Continued.

Variable	Definition
Years with current employer	Number of years of employment worker has completed with current employer. One year is measured as one or more days per year (NAWS)
Farm work weeks	Farm work weeks completed in the last year
Foreign farm work experience	=1 if worker had been employed in agriculture, either full-time or part-time, while living in native (foreign) country =0 if worker had been employed in non-agricultural sector or had never worked while living in native (foreign) country
Grower	= 1 if employed by a grower = 0 if employed by a farm labor contractor
Age	Respondent age in years
Age ²	Age squared
Experience	Years of U.S. farm work
Experience ²	Experience squared
Farm work in the last year	Months of US farm work in the previous year (prior to work grid estimate)
Weeks spent abroad	Number of weeks abroad last year

^a Data were sourced from the National Agricultural Workers Survey (1989-2006). Definitions enclosed in quotation marks are as they appear in the NAWS Codebook. ^b This would include English/ESL, citizenship, literacy, job training and Adult Basic Education classes, GED/high school equivalency classes, college or university classes, and Even Start and Migrant Education classes.

Table 4-2. Summary statistics of foreign farm workforce, NAWS, 1989-2006

Variable	$N=19152$ workers		$N_I=8097$ workers		$N_O=11055$ workers	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Lnwage	2.0351	0.2513	2.0876	0.2603	1.9966	0.2372
Weeks Spent						
Abroad	6.6531	12.2887	3.7974	8.4420	8.7447	14.1097
Specialty Crop	0.7986	0.4011	0.8176	0.3862	0.7846	0.4111
Adult Education	0.2007	0.4005	0.2812	0.4496	0.1417	0.3487
After 1986	0.6148	0.4867	0.2577	0.4374	0.8763	0.3293
After 2001	0.5198	0.4996	0.4763	0.4995	0.5517	0.4973
Female	0.1615	0.3680	0.1860	0.3891	0.1436	0.3507
Married	0.6314	0.4824	0.7866	0.4097	0.5177	0.4997
English	1.7231	0.8278	2.0042	0.9055	1.5172	0.6974
Mexican	0.8873	0.3163	0.8697	0.3366	0.9001	0.2998
Education	5.9630	3.2826	5.7599	3.4046	6.1118	3.1821
Experience	10.4756	9.0697	16.6972	9.1572	5.9188	5.6548
Age	33.7474	11.8152	39.9809	11.3513	29.1819	9.9084
Farm Work Done						
Last Year	7.4226	4.3196	8.6284	3.3334	6.5394	4.7268
Years Since						
Immigration	11.9724	10.0984	19.1250	9.4763	6.7336	6.7813
Year With						
Employer	4.5438	4.8579	6.8092	6.1175	2.8846	2.6388
California	0.3957	0.4890	0.5081	0.5000	0.3134	0.4639
Grower	0.8003	0.3998	0.8185	0.3855	0.7871	0.4094
Piece Rate	0.1839	0.3875	0.1601	0.3667	0.2014	0.4011
Seasonal Worker	0.6873	0.4636	0.6698	0.4703	0.7002	0.4582
Farm Work						
Weeks	36.4671	14.5541	37.7998	12.8602	35.4910	15.6077
Foreign Farm						
Work Experience	0.6830	0.4653	0.6684	0.4708	0.6936	0.4610

Table 4-3. Probit model estimates for legal status treatment

Variable	Parameter Estimate ^a	Standard Error
Constant	-0.5119***	0.0733
Farm Work Weeks	-0.0093***	0.0010
Years with Employer	0.0680***	0.0056
English	0.2464***	0.0134
Years since Immigration	0.0563***	0.0026
After 2001	-0.3544***	0.0276
Weeks Spent Abroad	-0.0192***	0.0013
After 1986	-0.7906***	0.0402

^a Triple asterisks (***) indicate statistical significance at 1% level.

Table 4-4. Estimated parameters from parametric wage regressions for treated and untreated groups

Variable	Authorized Status (Treated)		Unauthorized Status (Untreated)	
	Parameter ^a Estimate	Standard Error	Parameter ^b Estimate	Standard Error
Constant	1.68363***	0.04438	1.73827***	0.01594
Age	0.00821***	0.00205	0.00122	0.00083
Age sq.	-0.00012***	0.00002	-0.00003**	0.00001
Farm Work Last Year	0.00530***	0.00086	0.00386***	0.00055
Experience	0.00328***	0.00111	0.00704***	0.00108
Experience sq.	-0.00005**	0.00002	-0.00019***	0.00004
English	0.03114***	0.00467	0.01498***	0.00417
Female	-0.06034***	0.00785	-0.04470***	0.00555
Piece Rate	0.21334***	0.00992	0.18298***	0.00746
Grower	0.07502***	0.00651	0.05197***	0.00487
Seasonal Worker	-0.04230***	0.00551	-0.01224***	0.00359
Education	0.00455***	0.00095	0.00534***	0.00059
Foreign Farm Work				
Experience	0.00189	0.00569	0.01565***	0.00436
After 2001	0.11875***	0.00496	0.06282***	0.00319
California	0.04137***	0.00447	0.04523***	0.00408
Rho	0.04599***	0.00799	0.03842***	0.00799

^{a, b} Triple and double asterisks (***, **) indicate statistical significance at 1% and 5% levels of significance, respectively.

Table 4-5. Treatment effects of legalization

Parameter ^a	Parametric ^b Method	Polynomial Method ^c	Nonparametric Method I ^d	Nonparametric Method II ^e
ATET	0.1043	0.2385	0.2635	0.2538
ATEU	0.1002	0.1784	0.1459	0.1616
ATE	0.1020	0.2069	0.1978	0.2031
Sorting gain (ATET-ATE)	0.0023	0.0316	0.0657	0.0507

^a A test for essential heterogeneity in the treatment effects yielded an F-statistic (p value) of 18.19 (0.0000), indicating self-selection arising from heterogeneous and unobserved gains for individuals in the sample (See Heckman, Urzua and Vytlačil, 2006). ^bThe extent of selection bias is gauged with a comparison of the OLS and parametric model results: selection bias = OLS-ATET= 0.0359-0.1043= -0.0684. It shows that the OLS estimate of the average effect of legalization on earnings is downward biased, indicating a 3.6% average earnings gain relative to the 10% average gain suggested by the ATET estimate in the parametric method. Overall bias (OLS-ATE) is -0.0661. ^cThe outcome equation is estimated as a polynomial in the propensity score (Heckman, Urzua and Vytlačil, 2006). ^dThis is the LIV estimator from Heckman and Vytlačil (2001, 2005). ^eThis method combines the nonparametric I and the polynomial approach. See Appendix for the estimated parameters for the polynomial and nonparametric methods.

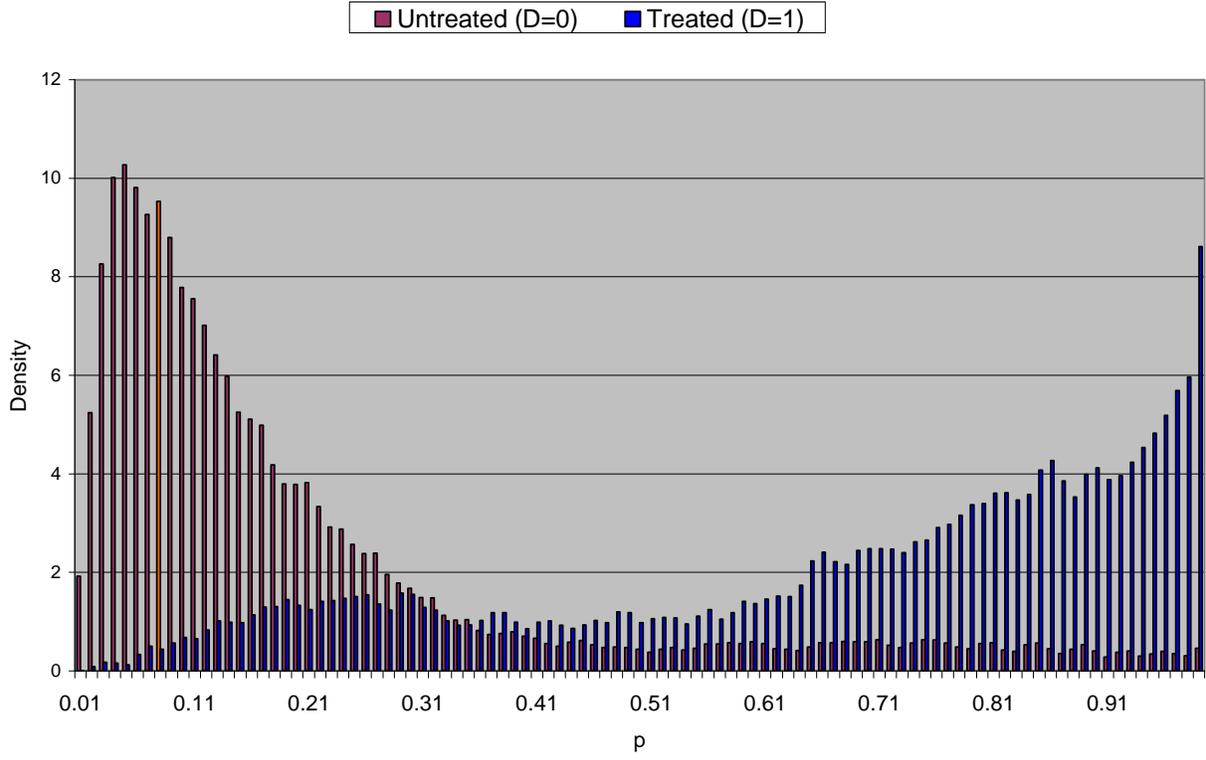


Figure 4-1. Frequency of Propensity Score by Legal Status

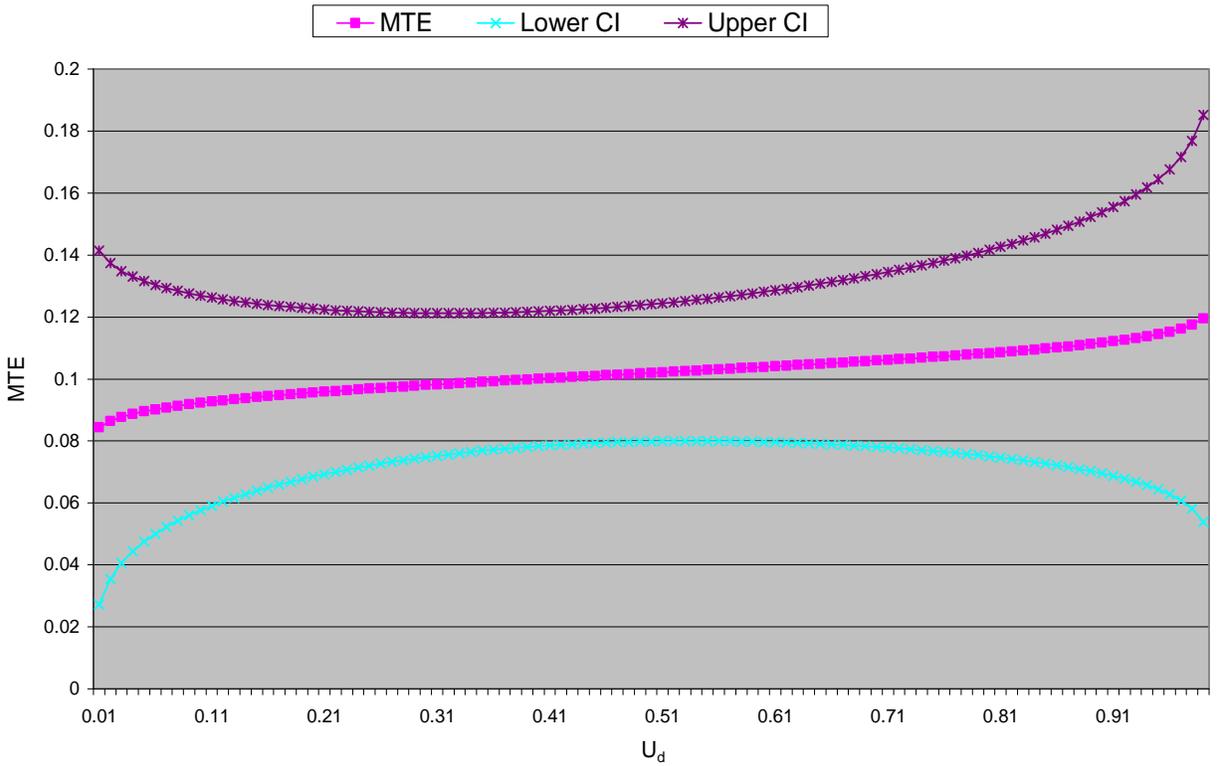


Figure 4-2. Marginal treatment effect (MTE) of legalization for foreign farm workers (with 95% confidence intervals), parametric method

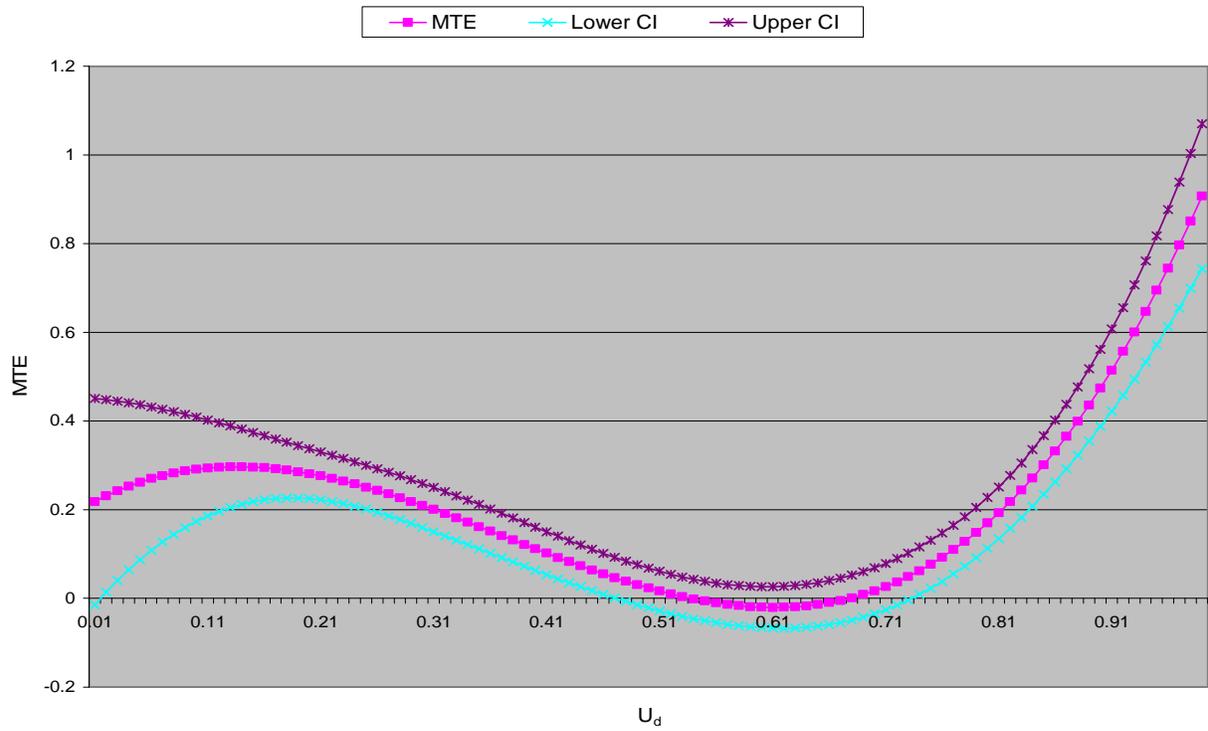


Figure 4-3. Marginal treatment effect (MTE) of legalization for foreign farm workers (with 95% confidence intervals), polynomial method

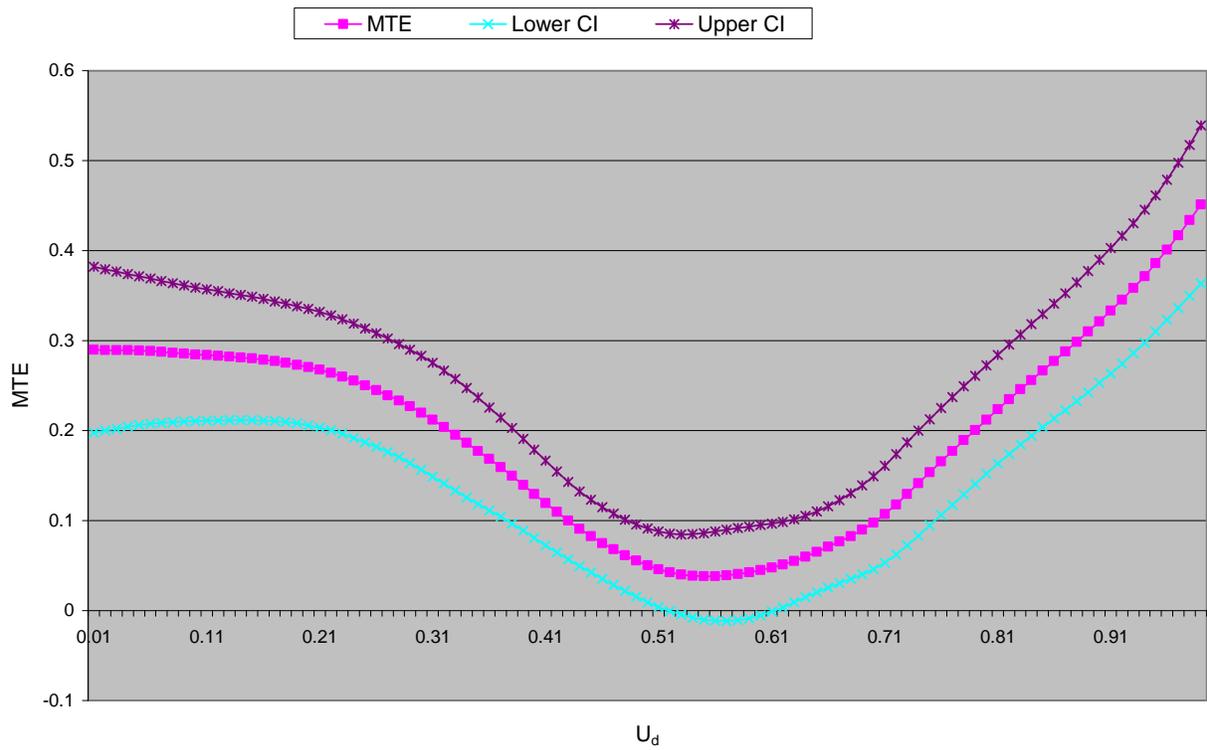


Figure 4-4. Marginal treatment effect (MTE) of legalization for foreign farm workers (with 95% confidence intervals), nonparametric method I

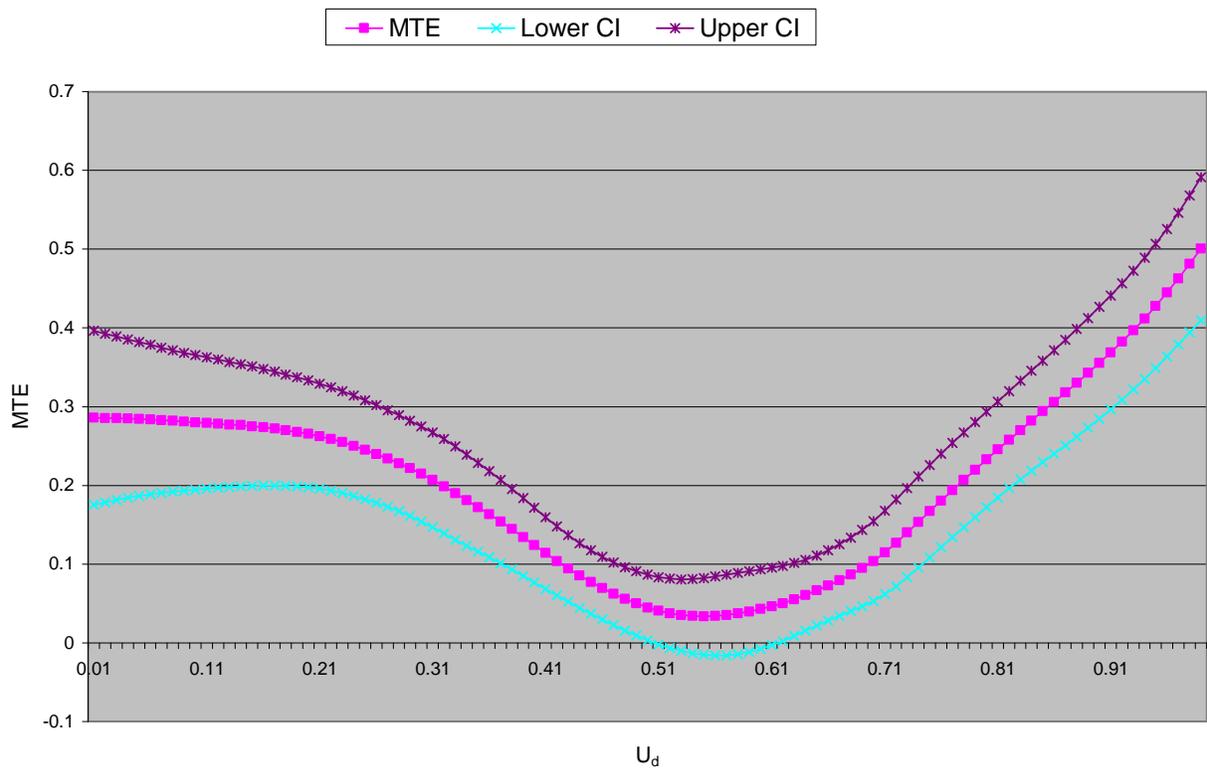


Figure 4-5. Marginal treatment effect (MTE) of legalization for foreign farm workers (with 95% confidence intervals), nonparametric method II

CHAPTER 5 CONCLUSIONS

Summary

Several contemporary issues on US farm labor markets and immigration policy were explored in this study. Specifically, the study evaluated how farm labor market outcomes have changed with the increasing presence of foreign workers, it assessed the implications of legal status for unauthorized workers' wages and employment, and it evaluated the potential impact of immigration policy reform – specifically legalization – for farm workers' earnings. On the latter issues, the study departs from previous work primarily on account of the empirical methods used, and in so doing contributes significantly to the existing literature on farm labor markets. This chapter summarizes the major findings that emerged from the different essays. It briefly discusses the research issues that were encountered during the respective analyses and sets forth certain points that may warrant additional research in the future.

The first essay provided an historical context of the linkages between U.S. immigration policy and U.S. farm labor markets, and focused on how labor market outcomes had evolved following the passage of immigration policies and programs, most importantly the Immigration Reform and Control Act (IRCA) of 1986. Reviews of previous research and findings from descriptive statistics based on the National Agricultural Workers Survey (NAWS) were used to characterize the farm labor market between 1989 and 2006. Although IRCA's stated objectives were to curtail illegal immigration and unauthorized employment, the evidence suggests that it has fallen short in these respects. The literature identifies lax enforcement of employer sanctions and the proliferation of fraudulent work authorization documents as key factors that undermined the efficacy of the legislation. The significance of these factors for effective immigration reform is not lost on lawmakers; in fact, these issues are addressed extensively in current reform

proposals that seek to improve sanctions enforcement and curtail the use of counterfeit documents in the farm labor market.

The first essay highlighted the critical linkages between specialty crop agriculture, the farm labor market and US immigration policy. In some respects, the US specialty crop sector is unique in the sense that a majority of the workforce is predominately foreign and unauthorized for US employment, yet are employed in critical areas of production such as harvesting. Clearly this underscores the vulnerability of the sector to immigration policy changes that may decrease labor availability, particularly in light of the fact that there are few mechanical options available for application to fresh market production.

An interesting finding to emerge from this essay was the impact of IRCA's legalization programs on farm employment. Critics of the program had argued that legalization would adversely impact employment duration, yet this did not occur. Several studies reported increased duration of farm employment, and this was also confirmed by the summary duration statistics. Legal status was shown to positively affect employment and earnings, wherein authorized workers had more consecutive days of farm employment, were more likely to be employed at skilled tasks, and earned higher hourly wages than their unauthorized cohorts.

In sum, the findings of the first essay highlight the influential role of US immigration policy on the US farm labor market and its development over time. Guest worker programs authorized by the various policies made it possible for employers to source farm labor from overseas, arguably because domestic laborers were unavailable. In the case of IRCA however, lack of synergism with the enforcement-oriented policy instruments has allowed for the development of a farm labor market that is mostly foreign born and unauthorized for US

employment. An unfortunate consequence is that the market is therefore very vulnerable to changes in immigration policy that may affect labor availability and labor costs for employers.

The second essay focused on two issues that are often raised in support of legalization for unauthorized workers: (1) whether unauthorized farm workers are more likely to be observed in unskilled farm jobs than their authorized cohorts and, (2) whether they earn less than authorized farm workers for the same type of work. This study offered a novel empirical approach in that selection bias was assumed to arise from multiple decision criteria and not a single criterion set forth by previous studies. This is an important methodological contribution to the literature.

Overall, the findings support the aforementioned hypotheses. The results indicated that indeed the multiple decision criteria specified (legal status and job type) jointly affect foreign workers' choices on U.S. farm employment. Foreign workers were likely to select into US employment as unauthorized (authorized) workers in unskilled (skilled) employment. Education, age and farm work experience, marital status, gender (female) and English speaking ability were reported as key characteristics that influenced employment in an authorized status, whereas US and foreign farm work experience, English speaking skills, education and employment with a grower were some of the key characteristics associated with skilled employment.

The wage regression models found significantly positive effects for education and experience on earnings for all workers. Similar effects were noted for employment with a grower, employment in California, English speaking ability, and the piece rate. The latter was reported as having a particularly strong effect relative to the other explanatory variables. In most instances, variables denoting seasonal employment and female gender had significantly positive effects on farm worker earnings.

The predicted earnings results indicated that legal status was the most important consideration for foreign workers who chose US employment. Assuming that foreign workers view U.S. employment as an optimal economic choice relative to employment opportunities elsewhere, employment in an unauthorized status adversely impacts earnings. It is particularly disadvantageous if the unauthorized workers were employed at skilled positions since they would earn substantially less than their authorized cohorts at the same positions. This is because unauthorized workers employed in skilled positions are viewed as considerable risks for employers. If these workers were apprehended by the immigration authorities, employers could not only incur significant financial penalties, but also experience major production losses, particularly if the workers held key positions at the farm operation. Interestingly, the results also indicated that unauthorized skilled workers would earn less than other workers who were similarly unauthorized but employed at unskilled positions.

Legalization is arguably the most contentious issue of the reform process; as a matter of fact, it is perhaps the political wrangling and national dissension on this particular issue that has stymied passage of comprehensive immigration reform to date. The potential effects of legalization on the wage outcomes for foreign farm workers were addressed in the third essay. A treatment effects framework was used. Essential heterogeneity was found to exist in the data, implying that foreign farm workers' wage outcomes were non-constant and that their selection into legal status was influenced by perceived idiosyncratic gains. The overall methodology employed is a significant contribution to the literature on the earnings implications of immigration reform in light of the fact that it has not been used in the context of farm labor before. The results are intended to provide some insight as to the potential effect of legalization under AgJOBS, if it were passed.

Legalization was shown to increase earnings of foreign farm workers, with positive sorting on the average gains from legalization. This is consistent with theoretical expectations where the individuals that specifically opt for legalization benefit more than the average worker and unauthorized workers. In the context of this study, the average treatment effect on the untreated (ATEU) offers significant insight as to the potential gains for foreign workers who are currently unauthorized, but who may acquire legal status in the future. Unauthorized workers may experience wage increases of as much as 18%. The cost implications are evident in that an amnesty in the future would definitely increase labor costs for farm employers. The extent to which the increased labor cost is offset by reduced risk to the employer was not evaluated in this essay. In lieu of current mechanical applications for the fresh market, legalization of unauthorized workers could pose significant financial challenges for farm employers in the short run.

Research Issues and Suggestions for Future Research

Construction of the variable denoting skilled employment status posed some challenges during the analysis. The data shows the vast majority of farm workers as being employed at unskilled tasks (pre-harvest, harvest, post-harvest) with few observations on the supervisory category, which is typically assumed as denoting skilled status. The semi-skilled task category was taken to reflect skilled employment. It was difficult to obtain reliable predictions for the skill categories (unskilled/skilled) based on the bivariate probit model used in the first stage of the analysis in essay two, and as such wage simulations of different scenarios could not be completed. Further inspection of the data indicated myriad categories of farm work (broadly categorized in the NAWS as pre-harvest, harvest, post-harvest, semi-skilled, supervisory and other), some of which could not be clearly assigned to either the skilled or unskilled category based on given descriptions. It would seem that certain improvements are necessary in this

regard such that future analysts may gain better appreciation for the distinctions between the tasks.

In essay three, the sizeable differentials in the average gains to legalization and the dissimilarities in the MTE curves between the parametric and nonparametric methods would seem to suggest that the normality assumption (assumed in the parametric method) is not supported by the data. The interpretations suggested by the MTEs are also not entirely consistent with the positive sorting suggested by the average treatment effect parameters. This may suggest need for additional refinement on the underlying choice model, in which context the issue of ‘freedom of choice’ on legalization by foreign workers must be looked at more carefully. It may present some limitations on the specifications that are reasonable for the choice model.

Finally, it would be useful if data sets with legalization information were available on other sectors besides agriculture. This would permit future analysts to better gauge comparative advantage of legal status, particularly as workers move between sectors of the economy in search of lucrative employment opportunities. Since agricultural employment is viewed as an option of last resort for workers with legal status, any information that would enable analysts to better appreciate the significance of legal status would be valuable for the policy process.

APPENDIX
POLYNOMIAL AND NONPARAMETRIC WAGE REGRESSIONS

Table A-1. Beta coefficients and standard errors for the outcome equations estimated by polynomial, nonparametric I and nonparametric II methods

Variable ^a	Polynomial Method		Nonparametric Method I		Nonparametric Method II	
	Coefficient	S.Error	Coefficient	S.Error	Coefficient	S.Error
Constant	1.79182	0.02072	----	----	---	---
Age	-0.00115	0.00117	-0.00104	0.00118	-0.00115	0.00117
Age sq.	0.00001	0.00002	0.00001	0.00002	0.00001	0.00002
Farm work last year	0.00192	0.00072	0.00180	0.00074	0.00192	0.00072
Experience	0.01189	0.00186	0.01282	0.00189	0.01189	0.00186
Experience sq	-0.00059	0.00010	-0.00065	0.00010	-0.00059	0.00010
English	-0.00392	0.00530	-0.00418	0.00533	-0.00392	0.00530
Female	-0.03970	0.00842	-0.03997	0.00827	-0.03970	0.00842
Piece rate	0.17784	0.00901	0.17786	0.00900	0.17784	0.00901
Grower	0.04105	0.00633	0.04085	0.00632	0.04105	0.00633
Seasonal worker	0.00011	0.00498	0.00033	0.00499	0.00011	0.00498
Education	0.00600	0.00084	0.00597	0.00084	0.00600	0.00084
Foreign farm work						
Experience	0.00620	0.00535	0.00630	0.00536	0.00620	0.00535
After 2001	0.06019	0.00683	0.05984	0.00650	0.06019	0.00683
California	0.04973	0.00376	0.04965	0.00376	0.04973	0.00376
Age*pscore	0.01188	0.00285	0.01167	0.00286	0.01188	0.00285
Age sq*pscore	-0.00016	0.00003	-0.00016	0.00003	-0.00016	0.00003
Farm work last year*pscore	0.00521	0.00164	0.00532	0.00168	0.00521	0.00164
Experience*pscore	-0.00584	0.00251	-0.00652	0.00242	-0.00584	0.00251
Experience sq*pscore	0.00047	0.00010	0.00054	0.00010	0.00047	0.00010
English*pscore	0.03746	0.00746	0.03962	0.00745	0.03746	0.00746
Female*pscore	-0.03008	0.01768	-0.02901	0.01753	-0.03008	0.01768
Piece rate*pscore	0.04276	0.01960	0.04278	0.01953	0.04276	0.01960
Grower*pscore	0.04555	0.01480	0.04666	0.01475	0.04555	0.01480
Seasonal Worker*pscore	-0.04703	0.01385	-0.04818	0.01388	-0.04703	0.01385
Education*pscore	-0.00254	0.00172	-0.00241	0.00174	-0.00254	0.00172
Foreign farm work Experience*pscore	0.00837	0.01151	0.00740	0.01152	0.00837	0.01151
After 2001*pscore	0.06955	0.01541	0.07020	0.01507	0.06955	0.01541
California*pscore	-0.01112	0.00848	-0.01116	0.00844	-0.01112	0.00848
Pscore	-0.15046	0.10896	----	----	---	---
Pscore ²	0.73697	0.44991	----	----	---	---
Pscore ³	-2.20958	0.61096	----	----	---	---
Pscore ⁴	1.47909	0.28288	----	----	---	---

^a 'Pscore' denotes the propensity score, which is the probability of becoming legalized.

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BIOGRAPHICAL SKETCH

Lurleen M. Walters was born on February 6, 1974 in Nevis, West Indies. Following several years' teaching with the Nevis Island Administration, she enrolled at Alabama A&M University in 1994 and graduated with a Bachelor of Science degree in agribusiness management in 1997. She earned her Master of Science degree in agribusiness from Alabama A&M University in 1999. She was employed as a Research Associate with the Department of Agribusiness at Alabama A&M University for several years. A graduate research assistantship at the University of Florida provided her with several opportunities for research in the areas of agricultural labor, immigration policy, and international trade and development, in addition to other professional experiences that served to enrich her academic training. Lurleen graduated with a Doctor of Philosophy degree in food and resource economics from the University of Florida in 2008.