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THEME OVERVIEW: IMMIGRATION AND AGRICULTURE

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JEL Classification: Q10 and Q18

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Over half of the hired workers employed on farms, and a significant share of workers employed in food processing and meat packing, are not authorized to work in the United States. The four papers in this themed issue deal with the effects of immigration and immigration policy on the agricultural and food processing industries, and on rural communities. Martin sets the stage, explaining the characteristics of crop workers. Artz looks beyond the agricultural industry and describes the effects on rural towns with meatpacking plants. Zahniser et al use a CGE model to explore the effects on agriculture of changes in the availability of foreign-born labor, while Huffman explores the status of labor-saving mechanization. By looking at the continuum of immigration welfare effects, this series of articles illustrate the direct and more subtle implications of current immigration policy and the uncertainty of any changes that may emerge in the near future.

Obtaining an adequate supply of labor at an affordable cost is a perennial challenge for farming. In the mid-1960s, the end of the Bracero program led to rapidly rising farm wages and a wave of labor-saving mechanization. In the late 1980s, fears of another labor supply shock evaporated as unauthorized migration accelerated. At present, half of hired workers on U.S. farms, and perhaps a quarter of workers employed in meatpacking plants, are believed to be unauthorized, explaining the keen interest of farm and farm-related employers in the future of immigration policy.

The tension between economic pressures to employ unauthorized labor and political opposition to immigration reform appears likely to persist. Martin uses data from the U.S. Department of Labor's National Agricultural Workers Survey (NAWS) to find that over 70% of hired farm workers are immigrants. Since the mid-1990s, some 50 to 60% of crop workers have been unauthorized. Half of U.S. crop workers have at least 10 years of U.S. farm work experience and almost 90% were hired directly rather than by a contractor or other intermediary. Workers report average wages of \$9 an hour in 2009, less than the \$10.50 reported by farm employers to NASS, but well above the federal government's \$7.25 minimum wage. Despite the 2007-09 recession, average weeks of farm work for crop workers have been rising and poverty rates falling.

Artz sheds light on one community development aspect of opposition to immigration by examining the effects of expanding meatpacking employment. Meatpacking is the largest manufacturing employer in rural America, and 60% of the almost 500,000 employees in the animal slaughtering and processing industry (NAICS 3116) were in nonmetro areas in 2000. Meatpacking often involves large plants in small towns that can transform local demographics and generate controversy. Comparisons of rural (nonmetro) counties with and without meatpacking plants find that the presence of plants was associated with slightly faster employment growth but slower wage growth in the 1990s, suggesting that the arrival or expansion of a meatpacking plant may "crowd out" or deter other industries that may have faster wage growth.

Artz also finds that meatpacking plants are associated with an increase in the share of residents who are foreign-born and Hispanic, and an increase in the number of English-language learners and students eligible for free or reduced-price lunches in local schools. Counties with meatpacking plants also had rising poverty rates in the 1990s, but there was no evidence of rising public expenditures on health, education, police, corrections, or public assistance.

Zahniser et al model the long-run effects of two hypothetical policy changes on agricultural output and both farm and nonfarm employment and wages. They first consider an expansion of the H-2A program, which lowers labor costs and increases employment in agriculture, farm output and exports. Next they simulate the effect of reducing the number of unauthorized workers in all industries, farm and nonfarm, by 40%, and find that the resulting wage increases reduce agricultural output and income received by authorized U.S. residents. However, wages rise in

lower-paid occupations that had large shares of unauthorized workers and the dollar strengthens, reducing farm exports.

Could labor-saving mechanization offset the loss of an unauthorized workforce? Huffman emphasizes that mechanization is more of a process than an event, and often leads to fewer, larger and more specialized farms. Mechanization usually requires biological changes in the plant to promote more uniform ripening, developing machines to harvest the commodity in one pass through the field, and modifying farming practices and packing or processing technologies to handle mechanically harvested fruits and vegetables. It seems unlikely that the considerable investments needed to perfect many of these technologies will be undertaken unless immigration policy is changed in ways that promise rising labor costs.

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THE STATUS OF LABOR-SAVING MECHANIZATION IN U.S. FRUIT AND VEGETABLE HARVESTING

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Regional communities are made up of thousands, even millions of people, without an official hierarchy and with no single individual in charge. The establishment of a change agenda for such an entity and management of an action plan to implement the change are formidable challenges even for highly skilled organizational development experts. Virtually all individuals, however, belong to just such an organization, because they live and work in a regional community. According to the Brookings Institution (2011), 83% of the U.S. population lives in metropolitan regions, 85% of jobs are based there, and these regions represent the nation's hubs for economic growth. Because they are home to such high concentrations of population and economic activity, it is important to understand how regions function. This article examines a new model for regional transformation, Strategic Doing, and offers North Central Indiana as a case study.

Farmers advanced through oxen, horses and mules, steam tractors and then tractors with internal combustion engines to provide power on farms. Tractors started to be a competitive source of power in the early 20th century as progress moved from steam to internal combustion engines and steel to rubber tires. Early reapers and binders were forerunners of stationary threshing machines and mobile combines or mechanical harvesters for grain, beans and cotton, which became available over 1930-1960s. However, mechanical harvesting of fruits and vegetables generally lagged behind. The invention and later adoption of the self-propelled processed tomato harvester in the mid-60s was a major labor-saving factor for that industry; later related inventions yielded further labor-saving and product quality improvements. Mechanical harvesters have been developed for some other fruit and vegetables, although much of the industry still relies on hand harvesting. Even without mechanical harvesting, labor aids, which improve labor productivity instead of replacing labor, have made the harvesting process faster and with less stress on workers' backs. Calvin and Martin (2010) report an estimate from 2000 that 75% of vegetables and melons are harvested by machine and 55% of fruit production, with processing products being more likely mechanically harvested than fresh.

For decades, U.S. growers have drawn upon illegal and legal workers from Mexico for planting and harvesting labor in these crops. Over time, mechanization, modification of production practices, and improved management practices have been central to reducing labor requirements for growing and harvesting fruits and vegetables. Still, labor makes up 42% of the variable production expenses for U.S. fruit and vegetable farms, although labor's share varies significantly depending on the characteristics of the commodity and whether the harvest is mechanized. In a global economy with produce imports from countries with low wages, U.S. growers are anxious to reduce their labor costs.

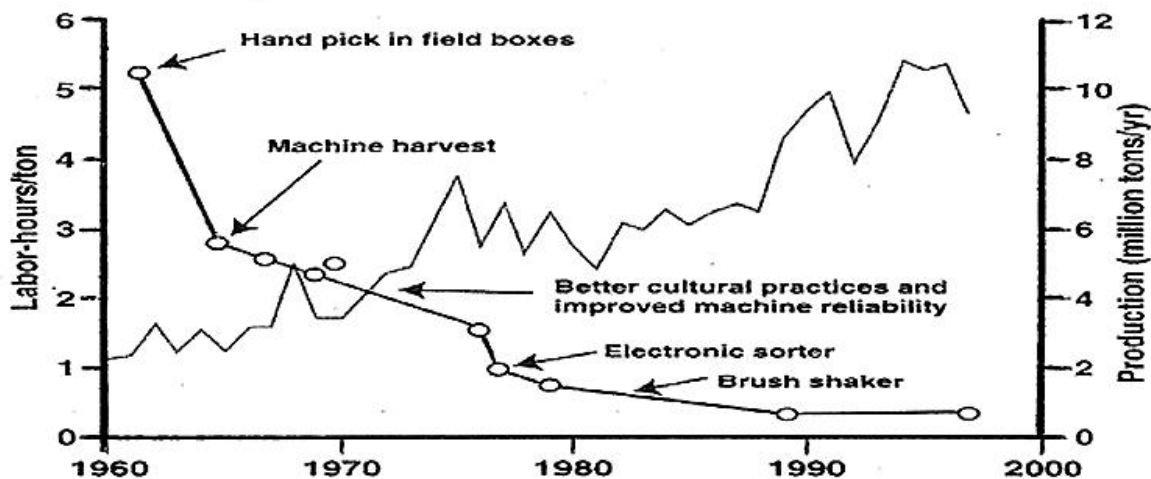
This paper provides a description of important steps in the mechanization of U.S. fruit and vegetable harvesting, which can be hard, backbreaking work and, in addition, the risk of falling is significant for hand-harvesting of tree fruit from ladders. Consumers demand fresh market produce with minimal blemishes, bruises or damage. This eliminates the option of mechanical harvesting, with current technology, for many products. However, a small amount of damage in harvesting is permitted for fruits and vegetables destined for processing, and mechanical harvesting can sometimes bring major cost savings. Switching to mechanical harvesting frequently requires transformation of a farming operation—new crop varieties, new field configurations, and new packing processes. In addition, a significant capital outlay is frequently required. Several photographs are included with this article as an aide to visualizing mechanical harvesting technologies.

Mechanization of Processing Fruits and Vegetables

California Tomatoes

The most storied success in mechanical fruit and vegetable harvesters is the self-propelled Johnson Tomato Harvester in California. Research and development to mechanize harvesting of processing tomatoes in California was spurred by the anticipated end of the Bracero Program in 1964. This program had provided a opportunity for Mexicans to obtain a permits to work in the United States, and as the program ended, the supply of tomato harvesting labor was significantly reduced. In the 1950s, 5.3 hours of harvesting labor was required per ton of processed tomatoes (Figure 1). In 1950, Jack Hanna, Department of Vegetable Crops, and Coby Lorenzen, of the Department of Agricultural Engineering, both at UC Davis, began development of a system for mechanically harvesting processing tomatoes. Hanna began breeding a tomato that could withstand the stress of mechanical handling, would ripen uniformly and would detach from the plant during machine harvesting. Lorenzen worked on a harvesting machine to harvest tomatoes. In the late 1950s, another UC Davis agricultural engineer developed a fruit-vine separator for Lorenzen's harvester. By 1960, the University of California had obtained a patent for the new tomato variety, and the Blackwelder Manufacturing Company, Rio Vista, California, undertook manufacturing and selling the first mechanical tomato harvesters.

Figure 1. Typical Harvest Labor Use and Annual Production of Processing Tomatoes in California, 1960-1997



This early mechanical tomato harvester cut the tomato plants at soil level and lifted them up into a shaking mechanism that separated the fruit from the vines. Twelve workers rode on the early machines to sort the fruit, remove green or blemished tomatoes and clods of dirt, requiring 2.9 hours of harvesting labor per ton of fruit--a 60% reduction from hand harvesting. The tomatoes are conveyed directly into pallet bins that are transported on a trailer pulled beside the harvester (Thompson and Blank 2000).

In 1964, 75 harvesters were sold in California and in 1965, 250 were sold, yielding a combined capacity to harvest roughly 25% of the tomato crop. In five years, 95% of the total California processing tomato crop was harvested by mechanical harvesters, a major social gain (Schmitz and Seckler 1970). In the mid-1970s, a further major technical advance occurred with the invention of high-speed electronic color sorters incorporated into the harvester, which identified ripe tomatoes and used blasts of air to separate the ripe fruit from green and rotten fruit and clumps of dirt. With improved leveling and ridging of tomato fields, new tomato varieties and a new shaker innovation, labor requirements were reduced from 12 to 2-4 hand sorters per machine or to 0.4 hour of harvesting labor per ton (Figure 2). Over 35 years, this dominant California technology has reduced labor requirements per ton of California processing tomatoes by 92% (Figure 1).

Current models of the Johnson self-propelled tomato harvester (Figure 2), sold by the California Tomato Machinery Company, are equipped with two 32-channel high-speed color and dirt sorters and use 2-4 hand sorters costing roughly \$450,000 with a life of 15-20 years with intensive post-harvest maintenance. They have a maximum capacity of 70 tons per hour and regularly are operated in two 10-hours shifts. Total harvesting costs are about \$28 per ton. Under this new technology, yield per acre for California processing tomatoes has increased and total production has increased from 3 million tons—69% of total U.S. tonnage—in 1965 to about 12 million tons in 2010 (96% of total U.S. tonnage).

Figure 2. Self-Propelled Johnson Mechanical Tomato Harvester



Midwestern and Eastern Tomatoes

The Pik Rite Company is a leader for inventing and manufacturing tractor drawn harvesters for small-scale fruit and vegetable harvesting in the U.S. Midwest and East. The founder of the company built his first mechanical tomato harvester in 1983, and after three years of improving and testing, sales began in 1986.

The Model 190 is a low capacity, 30 to 40 ton per hour, tractor-drawn harvesting machine with a lateral rotating single-brush-shaker system. This machine has high-speed optical color sorters with blasts of air as an aid to the separation of ripe tomatoes from green ones and chunks of dirt. The cost of this machine is \$150,000-\$160,000 and has a work life of 12-15 years. The Pik Rite tomato harvester is used in Indiana, Michigan, Ohio and Pennsylvania, where harvesting costs are roughly \$48 per ton, substantially higher than the \$28 per ton costs in California.

Midwestern and Eastern Cucumbers, Carrots and Peppers

Pik Rite also develops and markets tractor drawn mechanical harvesters for processing cucumbers, carrots and peppers. The cucumber harvester has a special dirt removal system that uses blasts of air along with a “scrubber” belt to remove trash. It also has nonpinch conveyor chains spaced so small and medium-sized cucumbers are saved and elevated to a storage bin, but oversized fruit exit with the vines into the field for better harvesting efficiency. This separation process is aided by blasts of air blowing the vines and chaff upward and out of the rear of the machine. This machine can unload its 125 bushel collecting bin in 20 seconds.

Florida Oranges

In Florida, oranges are grown for processing into orange juice. Hand harvesting still dominates but growers have experimented with several mechanical harvesters. These trees are hand-picked by workers on ladders with a bag, and when the bags are filled, the worker transfers the fruit to large metal box on the ground. This is hard, dangerous work.

Several companies have manufactured tree-fruit harvesters for Florida citrus growers. They include Coe -Collier, OXBO, and Koran, which have supplied canopy-shaking and trunk -shaking technologies. Oranges are difficult to harvest mechanically because they remain firmly attached to the tree when ripe so both types of mechanical harvesting systems can cause significant tree damage; either to tree branches or tree trunks. The canopy-shaking technology has two variations: one allows the fruit to fall to the ground where it is then picked up by workers or machines. The other variation is a two-part motorized machine with one part gripping the tree trunk for shaking and

the second being a matching sloping table to aid with catching the falling fruit (Figure 3). The harvested fruit are conveyed into boxes.

Figure 3. Coe-Collier Self-Propelled Trunk-Shaker and Catch Harvester of Florida Oranges



In an attempt to reduce tree damage in harvesting oranges, the University of Florida has experimented with fruit loosening agents—abscission compounds. When applied, this chemical loosens the stems so the ripe oranges are more easily dislodged, which reduces damage from mechanical harvesting. However, mechanical harvesting of late-season Valencia oranges poses an additional problem in that the trees at that time contain mature fruit that is ready for harvest and the young crop of oranges that will mature in the next season. A successful abscission chemical needs to selectively loosen only the mature fruit, leaving the young crop unaffected. The abscission compound has not yet been approved by the U.S. Environmental Protection Agency, which has made mechanical harvesting less attractive. In addition, the arrival in Florida of the disease known as citrus greening which kills orange trees has also reduced interest in mechanical harvesting. When trees are unhealthy, growers are more reluctant to add the additional stress of mechanical harvesting. However, the main current form of mechanical harvesting is the trunk-shake and catch method (Figure 3), but without an approved loosening agent for oranges, mechanical harvesting of oranges peaked at about 7% of the harvested acreage in the 2008/09 season and then declined. In California processed plum harvesting, a similar trunk-shaking harvester is being widely used successfully. Ripe plums detach more easily and reduce tree damage with mechanical harvesting.

Other crops

Mechanical harvesters for processing tart cherries have been successful in Michigan. The machine is of a shake-and-catch type. This is a two-part self-propelled unit that is a lighter version of the harvester used for Florida oranges (Figure 3). Ripe tart cherries bruise some in this harvesting system, but since the cherries are going immediately for processing, the damage has not been viewed as significant. A large share of Michigan sour cherries are now harvested with this type of mechanical harvester.

For a large share of California wine grapes, mechanical harvesters are now used. These machines are a relatively tall self-propelled unit that straddles the trellised grapevine rows. The harvester has rotating arms that dislodge the fruit that is then caught on a table and conveyed into a wagon. See the machine by Korvan (Figure 4).

Figure 4. Korvan Self-Propelled Mechanical Wine-Grape Harvester



Korvan also manufactures and sells a mechanical berry picker for processing berries—largely for raspberries and blueberries. This machine is self-propelled and surrounds the row of berry bushes similar to the wine grape harvester. It does some damage to the fruit, but since it is going immediately for processing, this is not a serious problem.

A little experimentation has been done with robotic harvesters that use GPS to scout fruit location and then to pick fruit. However, electronic assessment of tree fruit is complicated by the fact that tree limbs and unripe fruit may block the view of the electronic eyes.

Mechanization of Fresh Fruit and Vegetable Harvesting

The potato is a large volume crop where mechanical harvesters were first invented almost 100 years ago. Although simple mechanical potato diggers existed in the early 1900, the first complete harvester-separator machines did not exist until the 1950s. Incremental innovations over time have transformed these machines into the modern self-propelled mechanical potato harvester. Today's machines scoop up the potato plant and soil beneath it. This material is elevated up a rotating apron-chain consisting of steel links several feet wide, which allows loose dirt to fall away while retaining the potatoes. The chain deposits this mixture into an area where further separation occurs. The most complex designs use vine choppers and shakers, electronic sorters along with a blower system to separate good potatoes from rotten potatoes, stones, dirt and vines. Potatoes are deposited into a trailing wagon or truck. These potatoes are used for both the fresh and processing markets.

Other mechanical harvesters for fresh fruits and vegetables are largely experimental. Fresh-market California iceberg lettuce, melons, strawberries and tomatoes have substantial harvesting costs and labor aids have reduced the workload. For example, with iceberg lettuce, the head is cut by hand and trimmed, then laid on a table that conveys it to the center where workers on the wagon field wrap it in plastic and place 32-heads per box, which are then stacked on the wagon. This process has significantly reduced the cost of harvesting and packing iceberg lettuce. A similar process is applied to melons and cantaloupe, except they are packed directly into boxes without plastic wrap. The

hand-harvesting cost of fresh-market California strawberries is very high, about \$615 per ton, for this high-value delicate crop, which grows close to the ground and does not ripen uniformly. Some California growers use conveyor belts as a labor aid to improve worker productivity.

Washington State University and USDA-ARS scientists have developed an experimental mechanical harvester for fresh market sweet cherries and apples (Peterson 2005); this machine harvests the sweet cherries without their stems. A chemical fruit-loosening agent (abscission) is first applied to the trees a few days before harvesting. The mechanical harvester is a two-part self-propelled machine with each part going on opposite sides of the trees. Cushioned catcher pans on each unit are used to seal around the trunk and connect the two units. The harvester has a high density rubber arm on each unit that bumps the tree branches, and this energy dislodges the ripe fruit (see Figure 5). Both harvesting units have inclined catchment tables, but the mechanical conveyors are covered with a soft spongy material that reduces impact and the padded conveyers move the fruit gently to the outer top side of each of the machines catching tables. As the fruit rolls over the table a fan blows away leaves and trash, and the fruit passes to two slowly rotating modest sized storage bins or boxes.

A benefit to growers and consumers is that mechanically harvested cherries have less bruising or damage than hand-harvested fruit and reduced exposure to bacteria-laden human hands. Sweet cherry consumers are accustomed to their cherries having stems, but research has shown that consumers can make the transition to stemless sweet cherries. For mechanically harvesting sweet cherries and apples, a special tree architecture is needed—short with a “Y” shape, opposed to the 20-25 feet tall conventional trees (see Figure 5). The mechanical sweet cherry harvester has excellent long-term potential for harvesting high quality sweet cherries for the fresh market at an 80-90% reduction in harvest labor costs with less damage than hand-harvested cherries (Whiting 2006).

Figure 5. Self-Propelled Mechanical Fresh Market Apple (and Sweet Cherry) Harvester



The new experimental BEI Black Ice Harvester works with delicate fresh-market bush berries—raspberries, blackberries and blueberries. The Black Ice Harvester uses jets of air to create a turbulent local environment within the machine and around the berry bushes, which then gently dislodge those that are ripe. The machine has padded walls, and the berries fall onto a bed or table (the Centipede Scale catching frame) and then are gently conveyed to one pound or smaller containers that are carried on the machine. A major advantage of this machine is that berries and bushes are not touched by a picking or rotating-arm mechanism. This helps minimize damage to ripe berries and scarring of the bushes. With the minimal plant damage by the harvester, the machine can be used to make multiple passes over the same bushes as the berries ripen at different dates. With this machine, fruit quality meets or exceeds that of hand-harvested, and since no human handling of the fruit is required in the harvesting and packing, there are reduced food safety concerns. The machine is being farm tested. Its estimated cost is \$150,000 for the smaller model and \$200,000 for a larger model.

A Perspective on the Future of Mechanization

As in the past, future mechanization of additional crops will be driven largely by benefit-cost considerations, including the likely future international competitiveness of the U.S. industry. Relatively good machines exist for mechanically harvesting many fruits and vegetables for processing. The most exciting development is that there are new and effective harvesters that are in the final stages of testing for fresh market berries, and for sweet cherries. These technologies would move forward rapidly if there is a sudden increase in the cost of harvesting labor or uncertainty of availability of this type of labor. Furthermore, these machines have potential for other crops. However, a short-term hurdle is that some crops are declining in acreage because of changing demand and international competition. Also, some old orchard and vineyard architectures are not compatible with the new harvesting systems. When the future prospects are good, orchards can be replaced with shorter and trellised trees and vines. Uniform ripening of fruit and berries is critical to the success of some of these new harvesting systems.

For More Information

Calvin, L. and Martin, P.L. (2010). The U.S. produce industry and labor: Facing the future in a global economy. USDA, ERS Economic Research Report No. 106, Nov. .

Huffman, W.E. (2012). The status of labor-saving mechanization in U.S. fruit and vegetable harvesting. Iowa State University, Department of Economics Working Paper #12009, May.

Peterson, D.L. (2005). Harvest mechanization progress and prospects for fresh market quality deciduous tree fruits. *Hortechonology* 15, 72-75.

Schmitz, A. and Seckler, D. (1970). Mechanized agriculture and social welfare: The case of the tomato harvester. *American Journal of Agricultural Economics* 52:569-577.

Thompson, J.F. and Blank, S.C. (2000). Harvest mechanization helps agriculture remain competitive. *California Agriculture*, May-June.

Whiting, M. (2006). Mechanical harvesting of sweet cherries. *Resource*, American Society of Agricultural Engineers, Oct.

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HIRED FARM WORKERS

Philip Martin

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There are three major types of workers employed on U.S. farms: farm operators, unpaid family members, and hired workers. During the 1990s, when USDA's National Agricultural Statistics Service (NASS) collected data on all three types of workers, there were an average two million farmers and unpaid family workers and 1.3 million hired workers employed on farms, meaning that farmers and unpaid family members accounted for 60% of average farm employment. The numbers of all three types of workers on farms have trended downward, but farmers and unpaid family members today likely contribute over half of the hours worked on U.S. farms.

Hired workers are not employed evenly throughout U.S. agriculture. Instead, they are concentrated in three inter-related ways, by commodity, geography, and size of farm. Fewer than 75,000 producers of fruits, vegetables, and horticultural specialty crops (collectively known as FVH commodities) paid half of the \$26 billion in farm labor expenses in 2007, according to the Census of Agriculture. Most of these expenses were paid by large farm employers in California, Florida, Texas, and Washington.

Hired farm workers, especially those employed on FVH farms, are mostly immigrants from Mexico. Before the Immigration Reform and Control Act of 1986, (IRCA) the best evidence suggested that up to a quarter of hired farm workers in southwestern states such as California were unauthorized. Their distribution in the early 1980s reflected the risks to producers of completing tasks in a timely way under the pre-1986 enforcement strategy, which involved driving into fields and checking workers. The highest share of unauthorized workers were employed working with less perishable crops such as citrus, while there were fewer unauthorized workers working with more perishable leafy green vegetables (Martin, Mines, Diaz, 1985).

Today roughly half of hired farm workers on crop farms are believed to be unauthorized. There are unauthorized workers throughout FVH agriculture and on dairy and other livestock farms, and there are few differences in shares of unauthorized workers categorized according to the perishability of a commodity. Indeed, the share of unauthorized workers employed on Vermont dairies or North Carolina vegetable farms appears to be similar to that on California fruit and vegetable farms (Martin, 2009).

This article summarizes the changing status of hired workers employed on crop farms. Data are drawn primarily from the U.S. Department of Labor's National Agricultural Workers Survey (NAWS), which has been interviewing 2,000 to 3,000 farm workers a year since 1989. The NAWS, launched to determine if the 1986 IRCA contributed to farm labor shortages, has continued to generate a wealth of information on hired farm workers and their families. The NAWS does not interview workers employed on livestock farms and excludes H-2A guest workers on crop farms.

Farm Employment

Less than a quarter of the 2.2 million U.S. farms reported expenses for hired labor in the 2007 Census of Agriculture (COA). Approximately 482,000 farms reported almost \$22 billion in labor expenses for workers hired directly by the farm operator and \$4.5 billion for contract labor—workers brought to farms by labor contractors and other intermediaries—totaling \$26 billion or a seventh of total variable production expenses in agriculture.

Farmers report to the COA the number of workers they hire directly. They reported 2.6 million hires in 2007, including 35%—or 910,000 workers—which were hired for 150 days or more on their farms. This 2.6 million jobs-on-farms number must be interpreted carefully. It does not include workers brought to farms by contractors, and it double counts individuals who are employed on two farms and reported by two farmers.

The National Agricultural Statistics Service (NASS) surveys farm employers quarterly to obtain employment and earnings data on hired workers. No survey was conducted in January 2007, but in April 2007 farm employers reported 736,000 directly hired workers and 253,000 agricultural service workers, a total of 898,000. In July 2007 843,000 hired workers and 363,000 agricultural service workers were reported totaling 1.2 million workers. In October 2007, 806,000 hired workers and 316,000 service workers were reported. Average hired worker employment over these quarters was 1.1 million.

Table 1

**Hired Worker Hours and Earnings,
2002 and 2007**

	2002	2007
Farm Labor Expenditures (\$ billion)	22	26
Average Hourly Earnings (\$ hour)	8.80	10.21
Estimated Hours Worked (millions)	2,500	2,547
Estimated FTE Jobs (millions)	1.20	1.22

Note: An FTE is 2080 hours

Source: Census of Agriculture and NASS Farm Labor Survey

Table 1 combines labor expense data from the COA and earnings data from NASS to estimate the number of full-time equivalent (FTE) or 2,080 hour-a year jobs on U.S. farms. It divides labor expenses of \$26.4 billion by NASS's annual average hourly earnings of \$10.21 for hired farm workers in 2007 to estimate that there were 1.2 million FTE jobs in 2007; results were similar for 2002. To put hired farm worker employment in perspective, food manufacturing employment averages about 1.4 million jobs, including 500,000 in meatpacking.

There are more farm workers than the average number of farm jobs because of seasonality and turnover, that is, more than 1.2 million individuals work on farms during a typical year in order to fill peak employment requirements and to account for the fact that many workers are employed less than a full year. During the 1980s, the number of individuals employed sometime during the year for wages on U.S. farms was 2.5 million according to the December Current Population Survey (Oliveira, 1989). A count of unique individuals reported by agricultural establishments to

unemployment insurance (UI) authorities in California, a state that requires all employers paying \$100 or more in quarterly wages to provide UI coverage to workers, found two individuals employed for each FTE farm job in the 1990s (Khan, Martin, Hardiman, 2004). If we apply this same two-to-one ratio between workers and FTE jobs today, there are 2.4 million hired farm workers across the United States, including 800,000 in California.

Farm Workers: U.S. and Foreign-born

The NAWS finds a mostly young, Mexican-born, and male agricultural work force working on crops. In recent years, 70% of crop workers were born in Mexico, three-fourths were male, and half were unauthorized. Half of crop workers were under 35, two-thirds had less than 10 years schooling, and two-thirds spoke little or no English.

Some 1.1 million unauthorized farm workers were legalized in 1987-88 under the Special Agricultural Workers (SAW) program, and there were four SAWs for each unauthorized worker in the first NAWS survey in 1989 (see Figure 1).

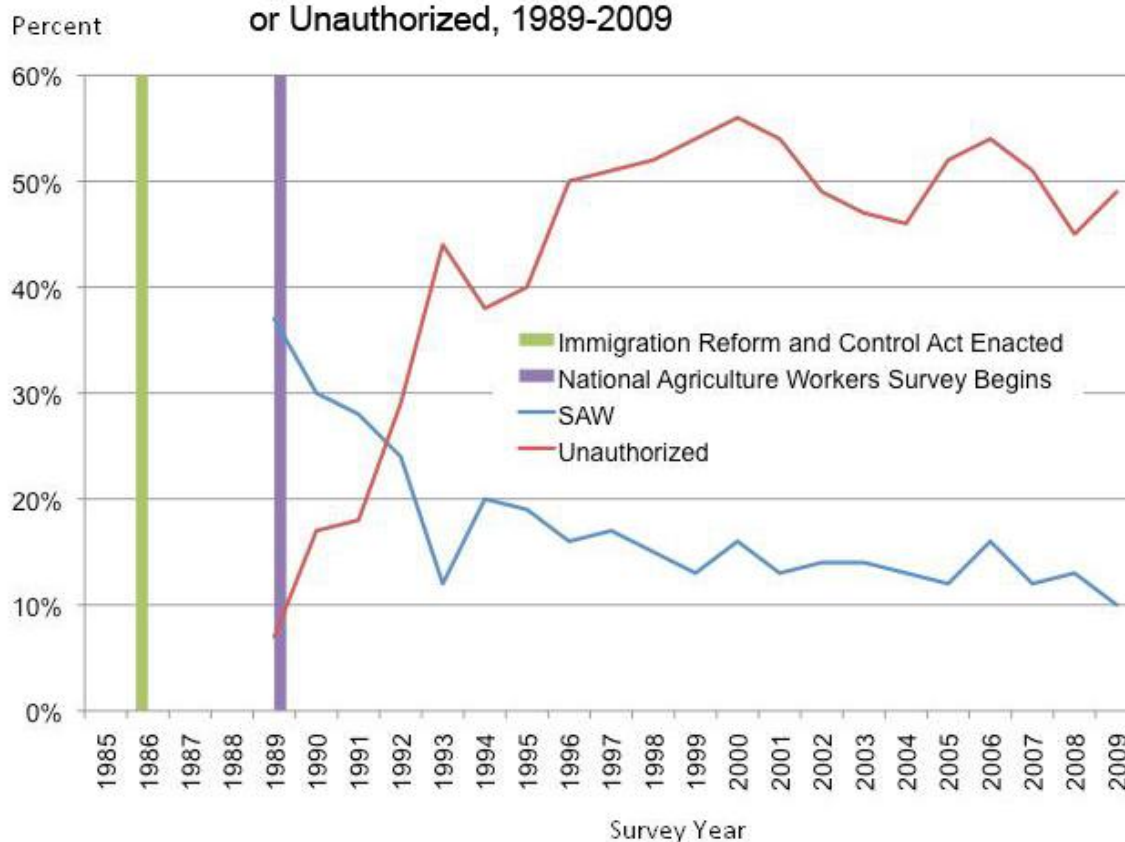
By 1991 the declining share of SAWs among hired farm workers was matched by the rising share of unauthorized workers, and by the mid-1990s there were almost four unauthorized workers for each legalized SAW worker. Unauthorized workers have continued to be about half of crop workers, but the share of SAWs has declined to less than 10 percent. These data suggest that, if there were to be another legalization of unauthorized workers, most would leave farm work within five years.

Between 2007 and 2009, almost 30% of crop workers were born in the United States and 70% were born abroad, almost always in Mexico. Table 2 shows that foreign-born and U.S.-born workers were similar in many respects. Their average age was 36-37 and 77-78% were male. About the same share of foreign-born and U.S.-born workers had incomes below the poverty line, a third of foreign-born families received some means-tested welfare benefit versus a quarter of U.S.-born families, and very few workers were follow-the-crop migrants.

In other respects, foreign-born differ significantly from U.S.-born crop workers. For example, 55% are unauthorized, only 13% completed high school, and only 3% spoke English well. Foreign-born crop workers are also more likely than U.S.-born crop workers to be married.

Foreign-born and U.S.-born crop workers got their first farm jobs at age 22-23 and had completed an average 13 years of farm work when interviewed. However, foreign-born workers were more likely to be hired by contractors and other intermediaries (17%), were more likely to be working in FVH crops (88%), and more likely to be filling harvest and post-harvest jobs (52%). Almost 40% of U.S.-born workers were employed in field crops such as corn and grains, and over 35% were employed in nurseries.

Figure 1. Share of Crop Workers who are SAWs or Unauthorized, 1989-2009



U.S.-born workers had average hourly earnings of \$9.74 in 2007-09, almost \$1 more than the average \$8.89 of foreign-born workers. Foreign-born workers had more days of farm work in the past 12 months, 200 versus 180, and were less likely to have health insurance provided by their current farm employer. A seventh of foreign-born workers, versus a quarter of U.S.-born workers, had employer-provided health insurance in their current job.

Over three-fourths of foreign-born workers, and two-thirds of U.S.-born workers, planned to continue working in agriculture at least five more years. A third of the foreign-born, versus two-thirds of the U.S.-born, said they could find a nonfarm job within a month.

Table 3 examines two groups of farm workers whose share of crop workers changed over time. SAW-legalized farm worker employment, including a few workers legalized under the general legalization and Central American programs, fell from 32% of the agricultural work force to 16% between 1989-91 and 1998-00; their share has since stabilized at just over 10% of crop workers. Foreign-born newcomers—workers in the United States less than a year before they were interviewed—rose sharply during the 1990s to almost a quarter of all crop workers in 1998-00, and fell to less than 10% of workers between 2007 and 2009.

As would be expected, SAW-legalized workers are much older than newcomers: their average age was 49 in 2007-09, versus 25 for newcomers. Three-fourths of the SAW-legalized workers did not move, but a quarter returned to Mexico, usually over the Christmas holidays. Over 90% of the newcomers moved from Mexico to the United States in the year before they were interviewed.

SAW-legalized workers had less education than newcomers, an average five versus six years of schooling in 2007, but were more likely to speak English well and to have incomes above the poverty line. By contrast, 94% of newcomers had below-poverty level incomes. Almost one-third of the newcomers worked for labor contractors, versus just 12% of SAW-legalized workers in 2007. Newcomers, many of whom were in the United States less than 12 months before being interviewed, had fewer days of farm work than SAW-legalized workers, who have been doing farm work for two decades.

Table 2**Characteristics of U.S.-Born and Foreign-Born Crop Workers, 2007-2009**

	All	U.S. Born	Foreign Born
Demographics			
Authorized (%)	52	100	45
Male (%)	78	77	78
Average age (%)	36	37	36
At least high school education (%)	28	68	13
Speak English well (%)	30	97	3
Married (%)	59	44	69
Families < poverty income (%)	23	23	23
Families receiving welfare benefits (%)	30	23	32
Follow-the-crop migrant (%)	6	1	7
Farm Work			
Age at first farm job (years)	23	22	23
Average years of farm work	13	14	12
Directly hired (%)	88	98	83
>10 years with current employer (%)	17	20	15
>4 farm employers in past year (%)	1	0	1
FVH crops (%)	78	56	88
Harvest and post-harvest jobs (%)	45	27	52
Wages, Benefits, Plans			
Average hourly earnings (\$)	9.13	9.74	8.89
Farm days worked in past year	194	180	200
Has health insurance in current job (%)	18	26	14
Plan to continue to farm work > 5 years (%)	73	76	78
Could find nonfarm job < 1 month (%)	44	76	31

Note: 29% of all crop workers between 2007 and 2009 were U.S.-born

Source: NAWS interviews 2007-2009

About 90% of both SAW-legalized and newcomer workers are concentrated in FVH commodity production, a pattern that has not changed over the past two decades. The share of both SAW-legalized and newcomer workers filling harvest and post-harvest jobs has been falling, and was half or less in 2007-09.

SAW-legalized workers earned an average 1.5 times the federal minimum wage in 1989-1991, but their average premium over the minimum wage fell in subsequent periods. Newcomers earned a 30% premium over the federal minimum wage in 1989-91, and their premium has continued to fall, so that it was only 10% above the federal minimum wage in 2007-09. A third of SAW-legalized workers, but only an eighth of newcomers, believe they could get a nonfarm job in a month.

In a hired farm work force that numbers 2.5 million individuals sometime during a typical year, equivalent to the average number of janitors and cleaners, farm worker averages can be misleading. For example, almost all foreign-born farm workers were born in Mexico, but increasingly Mexican-born U.S. farm workers are from southern Mexico rather than west-central Mexico, the origin of Braceros—Mexican guest workers admitted between 1942 and 1964. Some Spanish-speaking west-central Mexicans have become supervisors of newly arrived indigenous workers from southern Mexico who do not speak English and may not speak Spanish well, reflecting the growing complexity of the hired farm work force.

Immigration Reform and Farm Workers

The NAWS has found a more stable crop work force in recent years, one that is older, that is obtaining more days of farm work, and more inclined to remain as farm workers. The share of workers with more than 10 years of experience rose from 30% in 1999-00 to 45% of the workforce in recent years, which could reflect more difficulties finding nonfarm jobs and fewer newcomers, so that farm employers make more efforts to retain current workers.

Average hourly earnings have been rising slowly, from \$7.54 in 2000 to \$10.36 in 2011, up 37%—in nominal terms—but just 5% in real terms. Annual farm worker earnings rose as well. About 40% of farm workers reported \$5,000 to \$15,000 in farm earnings in 1999-00, compared to 35% in 2009-10, meaning that more workers were in higher income brackets. Meanwhile, the share of workers earning over \$20,000 rose from less than 5% to almost 25%.

Half of crop and nursery workers remain unauthorized, which helps to explain the keen interest of farm employers in immigration reforms that could require them to fire experienced workers. The Agricultural Jobs, Opportunity, Benefits and Security Act (AgJOBS) negotiated by worker and employee advocates in December 2000 would have repeated IRCA's legalization and E-Z guest worker approach to farm

Table 3**Characteristics of Foreign-Born Crop Farm Workers, 1989-2009**

	SAW-Legalized			Foreign-Born Newcomers		
	1989-91	1998-00	2007-09	1989-91	1998-00	2007-09
Share of workers (%)	32	16	13	4	22	9
Demographics						
Authorized (%)	100	100	100	13	1.4	0.1
Male (%)	86	86	84	74	88	88
Average age (years)	31	40	49	23	25	25
Average years of education	5.3	5.3	5.2	8.1	6.2	6.1
Speak English (%)	3.0	4.8	2.3	7.3	0.4	0.1
Married (%)	62	77	86	42	36	33
Families <poverty income (%)	na	38	12	na	94	94
Families receiving public assistance(%)	14	26	22	2	2	2
Follow-the-crop migrant (%)	25	13	3	16	14	7
Farm Work						
Average years of farm work	8	16	25	1	1	1
Directly hired (%)	75	76	88	58	60	70
FVH crops (%)	85	87	88	93	77	93
Harvest and post-harvest jobs (%)	59	40	46	72	45	51
Wages, Benefits, Plans						
Average hourly earnings (\$)	5.50	6.95	9.84	4.91	5.98	7.88
Federal minimum wage (\$)	3.80	5.15	7.25	3.80	5.15	7.25
Farm days worked in past year	191	193	226	77	76	90
Has health insurance in current job (%)		18	27		3	4
Could find nonfarm job <1 month (%)	45	40	38	20	13	12

Note: Forms of public assistance counted here include foodstamps, disability insurance, general assistance/welfare, TANF

Source: NAWS interviews 1989-2009

workers with several important changes (Rural Migration News, 2009). Like the SAW program, if passed AgJOBS would have allowed currently unauthorized farm workers to legalize their status and to “earn” a regular immigrant status for themselves and their families. Those legalized under AgJOBS would have to continue to do farm work. The purpose of tying newly legalized workers to continued farm work under AgJOBS is to prevent an immediate exodus of newly legalized farm workers to nonfarm jobs.

The most recent version of AgJOBS, S 1038 and HR 2414 introduced in May 2009, would have allowed up to 1.35 million unauthorized farm workers who did at least 150 days or 863 hours of farm work in the 24-month period ending December 31, 2008 to apply for Blue Card probationary status. Blue Card holders could work and travel freely within the United States and enter and leave the United States, and could earn an immigrant status for themselves and their families by continuing to do farm work over the next three to five years. AgJOBS had three farm work options to earn citizenship: (1) performing at least 150 days (a day is at least 5.75 hours) of farm work a year during each of the first three years after enactment; (2) doing at least 100 days of farm work a year during the first five years after enactment; or (3) working at least 150 days in any three years, plus 100 days in a fourth year (for workers who do not do 150 days in the first three years) after enactment.

For six years, farm employers of Blue Card holders would have to provide Blue Card employees with written records of their farm work and submit a copy to the Department of Homeland Security or face fines of up to \$1,000. After documenting their continued farm work, Blue Card holders could pay fees and fines and become immigrants, and make their family members legal immigrants at the same time.

AgJOBS would change the H-2A program in three major ways to make it easier for farmers to recruit and employ legal guest workers. First, attestation would replace certification, effectively shifting control of the border gate from the U.S. Department of Labor to employers, who would make assertions (assurances) to DOL that they have vacant jobs, are paying at least the

minimum or prevailing wage, and will comply with other H-2A requirements. DOL would review employer assurances for "completeness and obvious inaccuracies" and approve them within seven days of receipt.

Second, rather than provide the free housing to H-2A and out-of-area U.S. workers that is currently required, AgJOBS would allow farm employers to pay a housing allowance of \$1 to \$2 an hour, depending on local costs, to rent two-bedroom units, provided state governors certified that there is sufficient rental housing for the guest workers in the area where they will be employed. Third, the Adverse Effect Wage Rate (AEWR)—the minimum wage that must be paid to legal guest workers—would be frozen at the 2008 level and studied, effectively reducing it by \$1 to \$2 an hour and offsetting the cost of the housing allowance.

Whither Farm Workers?

The United States has what has been called an "apartheid farm workforce" of mostly older, white and U.S. citizen farm employers and mostly young, Hispanic, and foreign-born hired workers. If current trends continue, new hired workers will continue to be born outside the United States, while future farmers will be born in the United States.

Hiring farm workers increasingly means navigating the immigration system to check the legal status of newly hired workers and to ensure that special regulations governing guest worker recruitment and employment are followed. The share of hired workers on crop farms who are unauthorized has been about half for much of the past two decades. NAWs data suggest that this unauthorized work force is stabilizing as fewer newcomers increase average days of farm work and farm earnings. The question is whether and how these workers will be replaced by new foreign-born workers. Will they be newcomers who are unauthorized, as occurred over the past two decades; will they be legal guest workers admitted under a revised H-2A program; or will aging farm workers be replaced by machines and trade?

For More Information

Khan, A, Martin, P and Hardiman, P. (2004). Expanded production of labor-intensive crops increases agricultural employment. *California Agriculture*. January-March. Pp35-39.
<http://californiaagriculture.ucanr.org/landingpage.cfm?article=ca.v058n01p35&fulltext=yes>

Martin, Philip. (2009). *Importing Poverty? Immigration and the changing face of rural America*. Yale University Press.
<http://yalepress.yale.edu/yupbooks/book.asp?isbn=9780300139174>

Martin, P, Mines, R and Diaz, A. (1985). A profile of California farmworkers. *California Agriculture*. May. 16-18.
<http://californiaagriculture.ucanr.org/landingpage.cfm?article=ca.v039n05p16&abstract=yes>

NASS. Various years. Farm Labor Survey
<http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1063>

NASS. (2009). Census of Agriculture: 2007

NAWS. various years. National Agricultural Workers Survey. <http://www.doleta.gov/agworker/naws.cfm>

Oliveira, V. (1989). Trends in the hired farm work force, 1945-87. Washington: United States Department of Agriculture, Economic Research Service, *Agricultural Information Bulletin* 561

Rural Migration News. (2009). AgJOBS: Provisions, eligibility. Vol 15. No 3. July.
http://migration.ucdavis.edu/rmn/more.php?id=1466_0_4_0

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IMMIGRATION AND MEATPACKING IN THE MIDWEST

Georgeanne M. Artz

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Keywords: Immigration, Meatpacking, Rural Communities

Over the past five years, meat packing plants have been a focus of increased enforcement by federal immigration agents. Raids at these plants have resulted in the arrests of unauthorized workers and have brought renewed attention to the controversies surrounding employment practices of the meat packing and processing industry. In particular, media accounts of these events have heightened a negative image of meat packing and processing companies as users and exploiters of illegal labor and as poor corporate citizens in their communities.

The U.S. meatpacking industry has a long history of employing immigrant labor. Over a century ago, Upton Sinclair's classic novel *The Jungle* depicted the life of immigrants working in the Chicago Stockyards. More recently, census data from 2010 show that roughly one-third of workers in the industry are foreign-born, although the number is likely higher since Census data under report undocumented workers. Jeffrey Passel of the Pew Hispanic Center estimated that 20 to 25% of workers in the meat packing and processing industry were undocumented migrants in 2005, although the current proportion is likely lower due to increased enforcement by U.S. Immigration and Customs Enforcement (ICE) and the recent economic recession.

The controversy surrounding meat packing's employment of immigrant labor has been particularly acute because of the industry's more recent expansion into the rural Midwest and South. While in Sinclair's day meatpacking was predominately an urban industry, by 2000 more than 60% of meat packing and processing jobs were located in rural areas. Most rural areas have a lower number of foreign-born residents than urban areas, so meatpacking growth is more likely to change the demographics of their host communities. And, because meatpacking plants are atypically large relative to other rural employers, industry growth can influence the overall economy of a rural area to a much greater extent than would be seen in an urban one.

Certainly, attracting agricultural processing facilities is a logical strategy for rural communities in agriculturally dependent regions. New facilities provide expanded job opportunities, supplemental income for farm families, increased public revenues, and multiplier effects for further development in related industries. Having processing facilities nearby benefits local livestock producers by reducing transport costs and weight loss of live animals as they are transported to packing plants. Yet concerns about the potential negative impacts on the host communities seem to overshadow the more positive possibilities in many rural communities. A chief fear is that an influx of new immigrant workers will adversely impact the communities in which facilities locate.

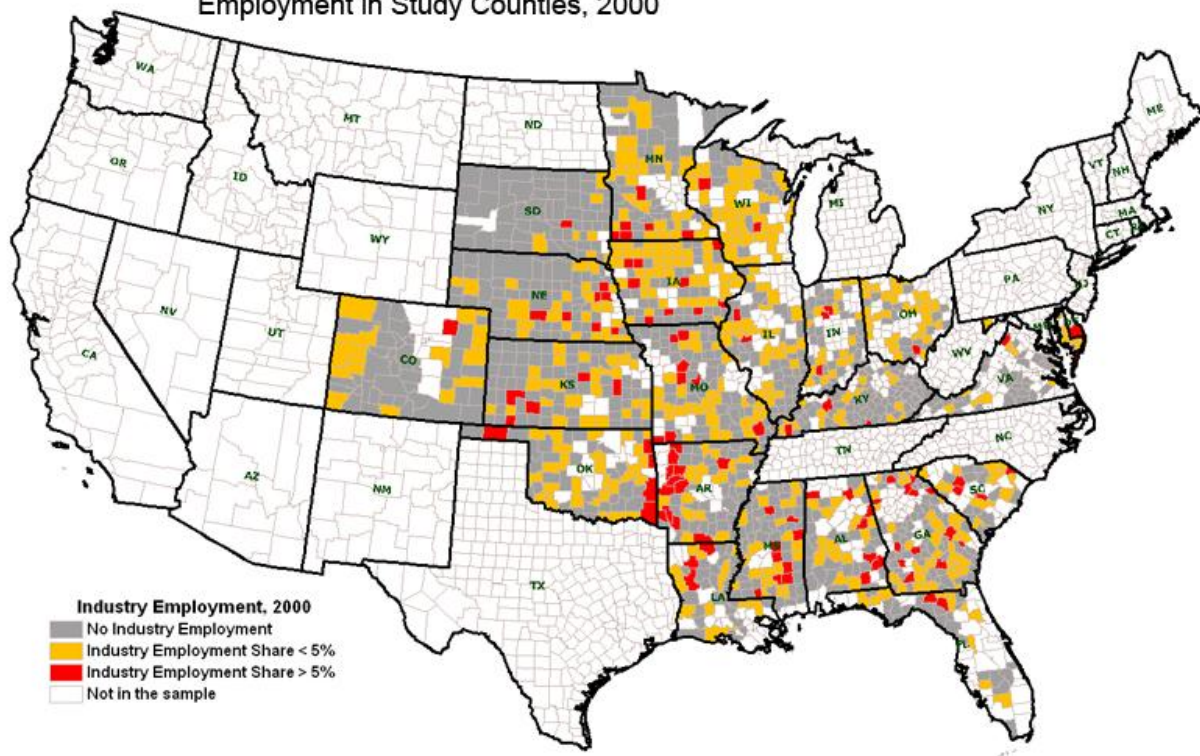
Common perceptions have held that in-migration of immigrant workers are associated with a host of social problems, including higher levels of crime, increased welfare loads, heavier burdens on public services such as schools, health care providers and low-income housing and the inconvenience of bilingual commerce. In *Fast Food Nation*, Eric Schlosser paints a grim picture of the effects of a new meatpacking plant on Lexington, Nebraska:

"In 1990, IBP opened a slaughterhouse in Lexington. A year later, the town, with a population of roughly seven thousand, had the highest crime rate in the state of Nebraska. Within a decade, the number of serious crimes doubled; the number of Medicaid cases nearly doubled; Lexington became a major distribution center for illegal drugs; gang members appeared in town and committed drive-by shootings; the majority of Lexington's white inhabitants moved elsewhere; and the proportion of Latino inhabitants increased more than tenfold, climbing to over 50 percent" (p. 165).

Media accounts and some case study research finds more or less similar effects on other rural communities (for example, see Stull, Broadway and Griffith, 1995; Stull and Broadway, 2004). However, the tendency of these

descriptions to report only the most egregious cases makes it difficult to assess whether the positive or negative social and economic outcomes in one case are actually typical.

Figure 1. Meatpacking Industry Employment as a Percent of Total County Employment in Study Counties, 2000



The goal of our research on this topic has been to examine how meatpacking's growth into rural areas has impacted the economic, social, and demographic characteristics of its host communities in a more comprehensive manner. We analyzed data for 1,404 nonmetropolitan counties in 23 Midwestern and Southern states spanning 1990-2000 to assess changes associated with the growth or decline in meatpacking industry size, controlling for confounding factors. This experiment allowed a comparison of immigrant labor use in counties with meatpacking jobs to those that do not have such jobs.

The states in our study accounted for roughly 52% of the establishments and 71% of the employment and annual payroll in the meat packing and processing industry in 2000. Roughly 40% of the counties in the study had some meatpacking jobs. Figure 1 shows the meatpacking industry's share of total county employment in 2000. For most host counties, meat packing industry employment accounted for less than 1% of county employment; however, in some counties it ranged as high as 47%. During the 1990s the prominence of the industry in these counties increased. In 1990, the average county with meatpacking had 251 jobs. Average county-industry employment rose over the decade by about 50% to 377 employees in 2000. Industry wages in counties with meatpacking and processing firms averaged about \$4.2 million in 1990 rising to an average of \$6.8 million (in inflation-adjusted, 1990 dollars) by 2000.

Key Findings

Table 1 summarizes the main findings of this research to date. The leftmost column divides the measures which growth in the meatpacking industry was expected to impact into four categories: economic, demographic, and social indicators and public expenditures. We assessed how growth in these measures varied as the relative size of the meatpacking industry changed, controlling for confounding factors. We measured the meat packing industry's employment as a share of total county employment. This measure allowed for the possibility that a very large plant in a sparsely populated area would be expected to have greater effects, whether positive or negative, than would a plant that represents a much smaller share of the local labor market. For each outcome, a check mark in the appropriate column—*increase*, *decrease* or *no impact*—denotes the direction and significance of meatpacking and

processing industry growth on the measure. *Note that this does not reflect whether the result is good or bad for the community.* For example, we find that growth in the industry is positively related to poverty rates, meaning that as meatpacking employment rose, so did the share of residents with below-poverty level incomes. While the relationship between these two variables is positive, the outcome for the community is arguably not.

Economic Indicators

Table 1
Summary of the Meatpacking Industry's Impacts on Nonmetropolitan Host Counties

Indicator	Increase	Decrease	No Impact
Economic Indicators			
Total Income			√
Average Wage		√	
Total Employment	√		
Net Employment		√	
Demographic Indicators			
Hispanic Population	√		
Asian Population			√
Foreign-born Population	√		
Native Population			√
Population with Limited English	√		
Migrant Students	√		
Social Indicators			
Poverty Rate	√		
Property Crime			√
Violent Crime			√
Public Expenditures			
Health			√
Education			√
Corrections			√
Police			√
Welfare		√	
Free and Reduced meals	√		
English Language Learners	√		

Growth in the meat packing and processing industry spurred total employment growth in its host counties during the 1990s. However, wage growth slowed relative to counties without the industry, and total income growth in the county did not change. These findings imply that the negative wage effect roughly canceled out the positive effect of rising employment. Employment net of the meatpacking sector grew more slowly, suggesting that meatpacking and processing employment, rather than having multiplier effects, may in fact crowd out some growth in other sectors of the economy. Although not depicted in Table 1, an important finding is that the estimated magnitudes of the economic impacts were small. For example, a 1% change in a county's share of industry employment resulted in a less than 0.4% change in total employment.

Demographic Indicators

Meat packing and processing plants, especially large ones, changed the demographics of their communities. Industry plants were associated with increases in the foreign born population and Hispanic population, especially those with limited English ability. In contrast to the relatively minor changes in economic measures, in many cases the estimated demographic changes were very large. For example, in counties with high concentrations of industry employment—20% of total county employment or more—the increase in Hispanic population between 1990 and 2000 was 200 percentage points larger than the Hispanic population change in non host counties over the decade. These counties gained an average of 2,050 foreign born residents over the decade. A charge against meatpacking plants is that as a result of the influx of immigrants to the communities, many, if not a majority of the native—white—residents move away. However, our analysis finds no impact of the industry on native population trends at the county level.

Social Indicators and Public Expenditures

One of the bigger worries surrounding the impacts of the meat packing and processing industry and its associated immigrant workforce is the changes it brings to local school systems. Mirroring the general population, host counties saw increasing diversity in the student population. They also experienced escalating numbers of students requiring special

services. Host counties experienced faster growth in the number of migrant students, English language learners and students receiving free lunch between 1990 and 2000 when compared to counties without meatpacking jobs.

Host counties also experienced rising poverty levels associated with the presence of the industry. Despite this, we find no evidence of related fiscal impacts, such as increased per capita government expenditures on health or

education. In fact, growth in the industry between 1990 and 2000 reduced per capita government spending on welfare. One plausible explanation is that the burden of providing social services to poor families may be borne by private charitable organizations such as churches, rather than local governments. However, a recent study by Osili and Xie (2009) concludes that foreign-born adults and their children are less likely to be a burden on their host communities than are native-born Americans, since they are less likely to receive benefits from nongovernment sources such as charities. Another possible explanation is that, on average, industry presence generates sufficient local public resources that it pays its own way for any associated need for public services. Consequently, our research finds that the increased presence of foreign-born and nonnative speakers in rural communities hosting meatpacking plants does not typically create an undue burden on public services.

Another major concern is that meatpacking's immigrant workforce will lead to increased crime. Yet, we find no evidence that the industry was associated with increases in property or violent crime rates on average. Correspondingly, we do not find that host counties incurred increased expenditures on police protection or corrections.

Meatpacking's relocation and expansion into rural regions of the United States has in fact changed the nature of its host communities and much of the change stems from the nature of the workforce the industry employs. Industry growth raises overall employment growth, which helps explain why some communities actively recruit these firms. But the addition of the industry can dramatically change the demographics of a rural town, and host communities do absorb some costs, specifically a rise in foreign-born populations with limited English skills and a rise in poverty rates. The story of meatpacking and processing's move into rural communities has been one of trade-offs, but a key point of this research is that they are in general not as severe as media accounts and some case studies suggest.

For More Information

Artz, G., Orazem, P., and Otto, D. (2007). Measuring the impact of meat packing and processing facilities in the nonmetropolitan midwest: a difference-in-differences approach. *American Journal of Agricultural Economics*, 89(3), 557-570.

Artz, G., Jackson, R., and Orazem, P. (2010). Is it a jungle out there?: meat packing, immigrants and rural communities. *Journal of Agricultural and Resource Economics*, 35(2), 299-315.

Kandel, W., and Parrado E. (2005). restructuring of the us meat processing industry and new hispanic migrant destinations. *Population and Development Review*, 31(3), 447-471.

Martin, P. (1997). Immigration and the changing face of rural America. *Increasing Understanding of Public Problems and Policies*. p. 201-212.

Martin, P. (2009). *Importing poverty?: Immigration and the changing face of rural america*. New Haven, CT: Yale University Press.

Osili, U. O., and Xie, J. (2009). Do immigrants and their children free ride more than natives? *American Economic Review*, 99(2), 28-34.

Passel, J.S. (2006). The size and characteristics of the unauthorized migrant population in the U.S. Estimates based on the March 2005 current population survey. Pew Hispanic Center. Available online: <http://www.pewhispanic.org/files/reports/61.pdf>

Schlosser, E. (2002). *Fast food nation*. New York, NY: Perennial.

Sinclair, U. (2010). *The jungle*. Oxford England ; New York : Oxford University Press.

Stull, D.D., and Broadway, M.J (2004). *Slaughterhouse Blues: The meat and poultry industry in North America*. Belmont, CA: Wadsworth/Thomson Learning.

Stull, D.D., Broadway, M.J., and Griffith, D. (Eds.). (1995). *Any way you cut it: Meat processing and small-town America*. Lawrence, KS: University of Kansas Press

United States Department of Commerce, Bureau of the Census. (2011). *American community survey (ACS): Three-year public use microdata sample (PUMS), 2005-2007*. [Data file]. Available online: http://www.census.gov/acs/www/data_documentation/public_use_microdata_sample/

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ANALYZING THE EFFECTS OF IMMIGRATION REFORMS ON AGRICULTURE

Steven Zahniser, Tom Hertz, Peter Dixon, and Maureen Rimmer

JEL Classification: J15, J43, Q17, Q18

Keywords: CGE, Farm Workers, H-2A Program, Immigration

Changes to U.S. immigration laws and policies could alter the supply of foreign-born labor to all industries, including agriculture. As of March 2010, unauthorized immigrants accounted for 5.2% of the U.S. civilian labor force, according to estimates by Passell and Cohn (2011). In crop agriculture, this proportion is much higher: 48% of hired farmworkers are unauthorized, according to data for 2007-09 from the U.S. Department of Labor's National Agricultural Workers Survey (NAWS) (Carroll, Georges, and Saltz, 2011). Similar survey-based data are not available for the livestock and animal product sectors, although unauthorized immigrant workers are certainly present in those sectors as well.

To better understand how changes in the supply of foreign-born labor might affect agriculture, we use a computable general equilibrium (CGE) model of the U.S. economy to evaluate two different scenarios: (1) a 156,000-person increase in the number of temporary nonimmigrant farmworkers, such as those now admitted via the H-2A Temporary Agricultural Program, and (2) a 5.8-million-person reduction in the number of unauthorized workers in all sectors of the economy, including agriculture. These figures were chosen to represent possible policy-induced changes to the supply of labor but do not represent an assessment of the effects of any specific legislative proposal.

A CGE model is well suited for this type of analysis because it takes account of linkages between factor and product markets in all industries, allowing us to quantify the potential effects of changes in immigration policy on domestic demand for U.S. agricultural output, on the U.S. labor market and wage costs to agriculture, and on exchange rates and international agricultural trade. In this article, we summarize the main findings of our modeling work and discuss the evolving economic context for foreign-born farm labor in the United States. A more detailed discussion of our modeling results may be found in a recently published report by USDA's Economic Research Service (Zahniser, et al., 2012). An analysis of the status of current legislative proposals relating to immigration and agriculture may be found in Martin (2012).

Is the Supply of Farm Labor Tightening?

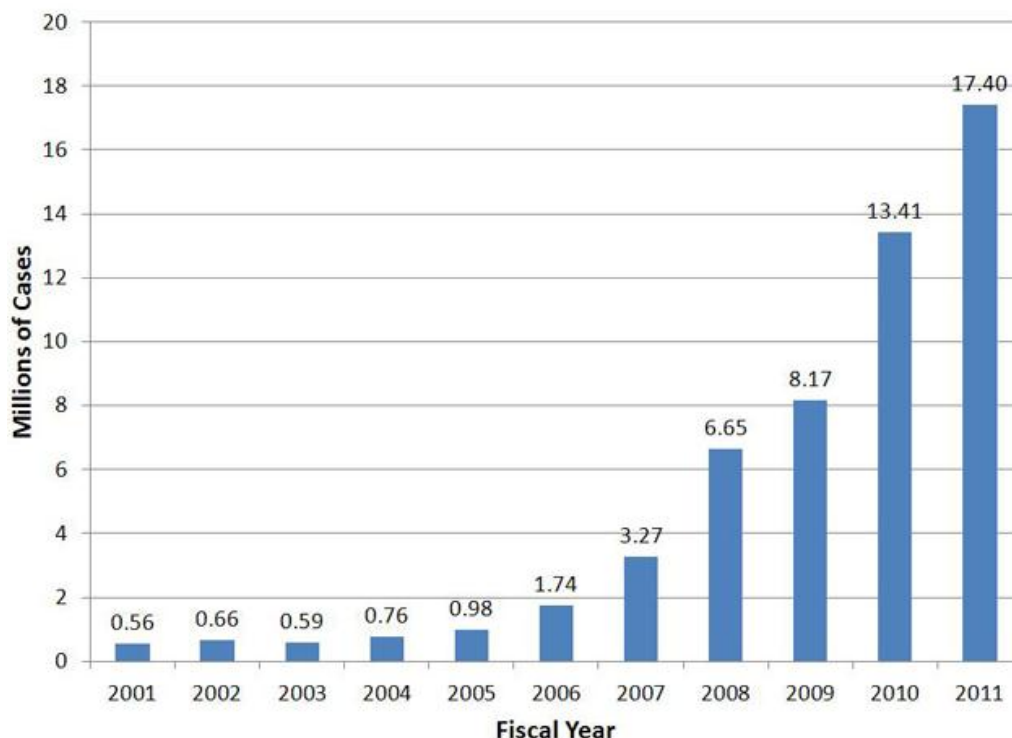
Over the past several years, a number of news stories and reports commissioned by grower organizations have suggested the existence of agricultural labor shortages in certain parts of the United States (see, for example, Turnbull's (2011) examination of the Washington apple industry and McKissick and Kane's (2011) survey of fruit and vegetable growers in Georgia). While localized shortages at times of peak labor demand are a recurring challenge, and there is evidence that some state-level policy changes have reduced the size of the unauthorized labor force in particular states, it is important to consider evidence from multiple sources before reaching conclusions about general trends in the farm labor market. We look first at the rate of net immigration from Mexico, which has slowed, suggesting that the supply of farm labor might be tightening. However, participation levels in the H-2A program and national trends in farmworker wages do not support this conclusion at the national level.

Several researchers who study Mexican migration—including Douglas Massey of the Mexican Migration Project (as cited by Cave, 2011) and Jeffrey Passel, D'Vera Cohn, and Ana Gonzalez-Barrera (2012) of the Pew Hispanic Trust—have concluded that, after being at high levels over the past 40 years, unauthorized immigration from Mexico is no longer keeping up with the number of immigrants returning to Mexico. Since Mexico is traditionally the leading country of origin of foreign-born U.S. farmworkers, this phenomenon of "net zero" or even "net negative" migration implies that the existing unauthorized farm workforce is not being replaced. This could cause the U.S. farm labor supply to tighten, as older workers exit from agriculture. The NAWS data, in fact, indicate that the agricultural labor force is gradually aging, with the average age of a farmworker in U.S. crop agriculture increasing from 31 to 37 years between 1995-97 and 2007-09 (Carroll, Georges, and Saltz, 2011). However, the researchers observing net zero

migration do not provide specific estimates for farmworkers, who make up a relatively small share of unauthorized Mexican immigrants. When unauthorized immigrants from all countries are considered, the farming, fishing, and forestry sectors accounted for less than 4% of the unauthorized U.S. workforce in March 2008, according to estimates by Passel and Cohn (2009). Moreover, it is possible that unauthorized workers in occupations other than farm work could move into agriculture, as employment opportunities in other industries remain hard to find.

Multiple economic factors explain the decrease in Mexican migration, including improved economic prospects in Mexico, violence that targets unauthorized migrants as they try to emigrate from Mexico, the U.S. recession of 2008-09, and high levels of U.S. unemployment since then. Heightened enforcement of U.S. immigration restrictions has also played a role. The U.S. border patrol program budget has increased, from \$1.1 billion in fiscal year (FY) 2001 to \$3.5 billion in FY 2011 (U.S. Department of Homeland Security, Customs and Border Protection, 2012). So, too, has the annual number of unauthorized immigrants removed from the United States to Mexico, from about 151,000 in 2001 to 282,000 in 2010 (U.S. Department of Homeland Security, Office of Immigration Statistics, 2011).

Figure 1



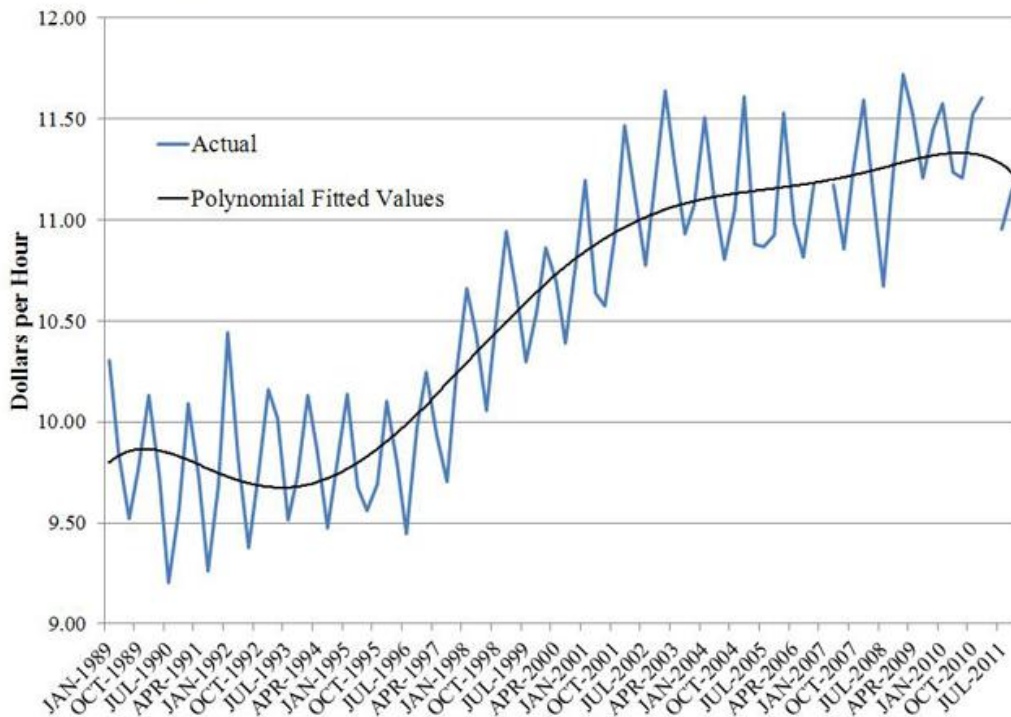
Source: U.S. Department of Homeland Security, Citizenship and Immigration Services (2012).

At the same time, an Internet-based system called E-Verify, operated by the U.S. Department of Homeland Security in partnership with the Social Security Administration, is being used more widely to confirm the employment eligibility of U.S. workers. **E-Verify** enables employers to determine the eligibility of their employees to work in the United States using the information reported by employees on their Form I-9, Employment Eligibility Verification. Although the Federal Government does not currently require all private-sector employers to use E-Verify, several State Governments do, including Arizona, Alabama, Mississippi, and South Carolina. In addition, Utah requires that all private-sector employers use one of several methods to confirm employment eligibility, with E-Verify being one of the specified options, and Georgia is phasing in its own E-Verify mandate by 2013 for businesses with 11 or more employees. Over the past decade, the number of cases in which E-Verify was used has increased dramatically, reaching 17.4 million in FY 2011 (Figure. 1).

The extent to which E-Verify has affected migration trends at the national level is not known, but it definitely reduces the supply of labor available to employers who are required to use it. Moreover, the evidence from Georgia and Arizona suggests that E-Verify, along with other legislative changes, has reduced the number of unauthorized workers in those states. In a survey of farmers, processors, and individuals in other agriculture-related professions in Georgia, about one fourth of the respondents who hired fewer workers in 2011 than they had on average during the

five previous years cited the State's new immigration law as the reason for their difficulty in recruiting labor (Georgia Department of Agriculture, 2012). This decline took place in advance of the implementation of Georgia's E-Verify mandate and may have occurred because unauthorized workers acted in anticipation of the law. Similarly, Lofstrom, Bohn, and Raphael (2011) estimate that the number of unauthorized people of working age in Arizona decreased by 17% following implementation of Arizona's E-Verify mandate in 2008.

Figure 2



Nominal wages are deflated using the Consumer Price Index-Urban (CPI-U). Data are for directly hired workers and do not include contract and service workers in agriculture. No wage surveys of hired farm workers were conducted in January 2007 and April 2011. However, the U.S. Department of Agriculture's National Agricultural Statistics Service (NASS) has produced model-based estimates of the 2011 average.

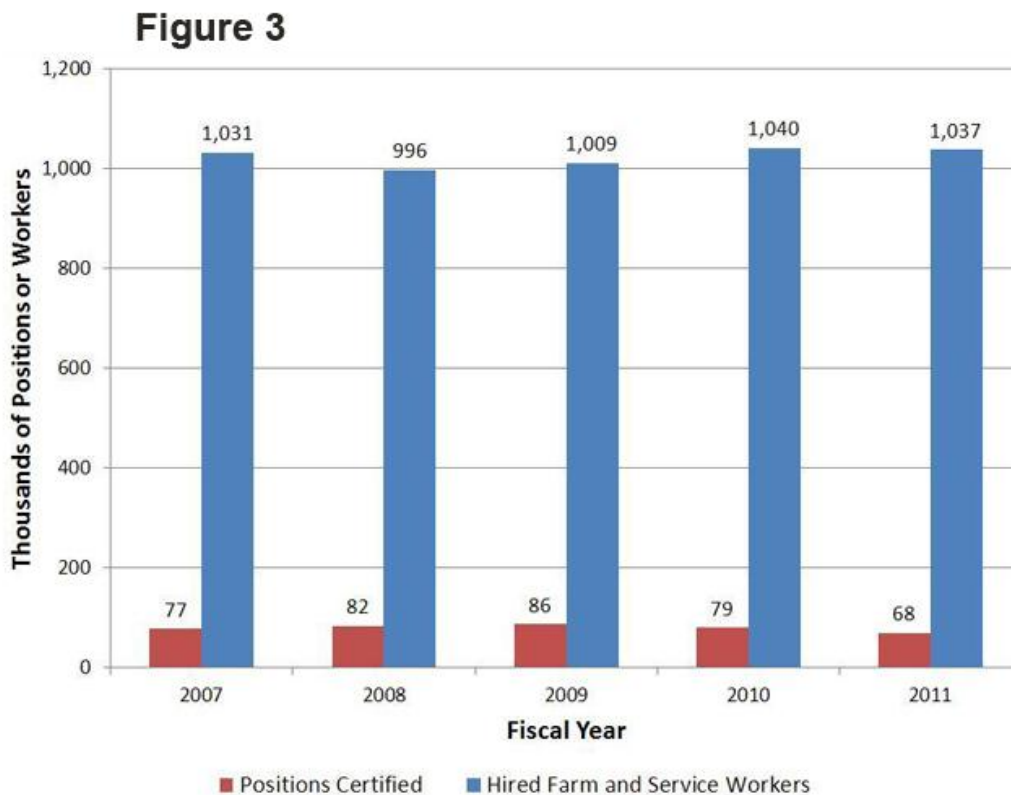
Sources: U.S. Department of Agriculture, National Agricultural Statistics Service (2012) (nominal wages), and U.S. Department of Labor, Bureau of Labor Statistics (2012) (CPI-U).

These findings suggest that a combination of economic forces and increased enforcement have reduced the number of new immigrants and may be deterring unauthorized workers from living in certain states, reducing the supply of farm labor at either the national or state level. Meanwhile, demand for farm labor has remained relatively constant: annual average farm employment has fluctuated around 1 million since 2007 (USDA, National Agricultural Statistics Service, 2007-11). If the supply of foreign-born labor is no longer being replenished by new immigrants and if workers in other occupations are not shifting to agriculture while demand is remaining constant, then a farm labor shortage may indeed occur.

On the other hand, two important indicators suggest that labor supply is not falling relative to demand. First, the real wage of directly hired farmworkers—both authorized and unauthorized, in all farm occupations—which is the most reliable indicator of labor scarcity, does not appear to be rising. Directly hired farm workers, whose ranks do not include contract and service workers in agriculture, account for roughly 70-75% of hired labor in agriculture (USDA, National Agricultural Statistics Service, 2007-11). Figure 2 shows the real hourly wage of directly hired U.S. farmworkers at October 2011 prices. After rising at a compound annual rate of about 1.6% between 1994 and 2002, the real wage rate grew at just 0.1% per annum between 2002 and 2011. This latter increase corresponds to an increase of just 11 cents per hour over a nine year period. Moreover, real wages fell by 1.7% between 2010 and 2011.

A second way to estimate the degree of labor shortage is to ask whether participation in the Federal Government's H-2A Temporary Agricultural Program has been increasing. The H-2A program, as described by the U.S. Department of Labor, "establishes a means by which agricultural employers who anticipate a shortage of domestic workers can

bring in nonimmigrant foreign workers to the U.S. to perform agricultural labor or services of a temporary or seasonal nature.” Although there is no legal limit to the number of workers who can participate in the program each year, just 78,579 positions in the program were requested by prospective H-2A employers in FY 2011, 68,088 of which were certified. Over the past 5 FYs, the number of positions certified has corresponded to less than one tenth of the number of hired workers in agriculture (Figure. 2). If labor were indeed scarce, one would expect H-2A participation levels to rise. Instead, use of the program has decreased in recent years.



Note: The fiscal year data for the number of hired farm and service workers are each the average of four quarterly observations. To fill in missing observations, the average of the January 2006 and January 2008 observations was used for January 2007, and then observation for April 2010 was used for April 2011.

Sources: U.S. Department of Labor, Employment Training Administration (2012, 2011, 2010) (H-2A positions), and U.S. Department of Agriculture, National Agricultural Statistics Service (2007-11) (hired farm and service workers).

The information presented above suggests that despite the apparent onset of net negative migration from Mexico, there is not yet a widespread shortage of agricultural labor in the United States. In our simulation analysis discussed below, we consider how more pronounced changes in the supply of foreign-born labor might affect U.S. agriculture, the market for hired farm labor, and the economy as a whole.

Simulation Analysis of Immigration Policy and U.S. Agriculture

To quantify the impacts of alternative immigration policy scenarios, we use a type of economic model called a computable general equilibrium (CGE) model. A CGE model uses interrelated equations to represent an entire economy—the agricultural and the nonagricultural sectors—and the interactions among its parts. Our particular model—the U.S. Applied General Equilibrium (USAGE) Model—differentiates the U.S. workforce into 50 occupations and three categories pertaining to immigration status:

1. U.S. born;
2. Foreign-born, permanent resident: a person with the U.S. immigration status of permanent resident—including naturalized citizens—and thus legally authorized to work in the United States; and

Table 1

Changes in Labor Supply Affect Output, Exports, Employment, and Earnings in the Long Run

Variable	Scenarios	
	Increased farm labor supply	Decreased unauthorized labor supply
Assumed impact on labor supply (over 15 years)	+156,000 farmworkers	-5.8 million farm and nonfarm workers
Fruit, tree nuts, vegetables, and nurseries		
Output	+1.1 to 2.0%	-2.0 to -5.4%
Exports	+1.7 to 3.2%	-2.5 to -9.3%
Other agricultural sectors		
Output	+0.1 to 1.5%	-1.6 to -4.9%
Exports	+0.2 to 2.6%	-0.3 to -7.4%
Employment in agriculture		
U.S. born and foreign born permanent resident	+1.7%	-3.4 to -5.5%
Foreign born, not a permanent resident	-5.7%	+2.4 to 4.0%
Foreign born, not a permanent resident	+32.4%	-34.1 to -38.8%
Earnings per job in agriculture		
U.S. born and foreign born permanent resident	-4.4%	+3.9 to 9.9%
U.S. born and foreign born permanent resident	-3.4%	+3.3 to 7.5%
Foreign born, not a permanent resident	-10.0%	+13.6 to 39.8%
Nonfarm employment of U.S. born and other permanent residents		
Lower paying occupations		+2.2 to 3.2%
Higher paying occupations*		-0.5 to -0.7%
Nonfarm earnings of U.S. born and other permanent residents		
Lower paying occupations	Negligible effects on nonfarm economy	+1.7 to 4.5%
Higher paying occupations*		-0.2 to -0.6%
Gross National Product, less payment to unauthorized workers		
		-0.9 to -1.1%

Results are estimates of percent differences in the outcome between the base forecast and the policy scenario in Year 15 of the projection.

*Annual income of \$20,000 or more.

A negligible effect is an increase or decrease of less than 0.05%.

Source: Zahniser, et al. (2012).

3. Foreign-born, not a permanent resident: a person without the U.S. immigration status of permanent residency.

The majority of persons in this third category are not legally authorized to work in the United States. For this reason, we sometimes use the term “authorized” to refer to people in the first and second categories and the term “unauthorized” to refer to people in the third category. The third category, however, also includes foreign-born persons with nonimmigrant visas, such as H-2A workers, who are legally authorized to work in the United States during a specified period but are not permanent residents of the United States.

With these categories in place, we use the model to generate long-run—15-year—economic projections for the United States under a base forecast and two different policy scenarios—one representing increased availability of temporary nonimmigrant foreign-born farm workers and the other representing a 40% decrease in the availability of unauthorized labor throughout the economy. The base forecast simulates how the economy would evolve under current laws and policies and serves as a benchmark for evaluating the two policy scenarios. The base year in our study is 2005, which corresponds roughly with the time when net migration from Mexico to the United States started to decrease.

Like many CGE models, the USAGE model achieves a long-run equilibrium in which all labor and capital resources are nearly fully employed. Thus, the simulations reported here do not apply to the current economic environment, in which about 8.1% of the U.S. workforce is unemployed—as of April 2012. Instead, the model results describe hypothetical, long-run scenarios in which the U.S. economy is much closer to full employment and has an unemployment rate of about 5%.

In the first policy scenario—increased farm labor supply—the number of temporary nonimmigrant foreign-born farm workers is assumed to increase by about 30,000 in Year 1 of the simulation and 83,000 in Year 2. The program’s growth rate declines in subsequent years, with participation reaching 156,000 additional workers in Year 15. The additional workers are assumed to be available to all agricultural sectors, including those that have been traditionally excluded by the H-2A program, such as dairy and most livestock production, and no constraint similar to the program’s minimum wage requirements is applied in the model.

In the second policy scenario—decreased unauthorized labor supply—the unauthorized workforce—agricultural and nonagricultural—is assumed to decrease by 2.1 million in absolute terms over the first five years of the scenario. Under this scenario in year five, the unauthorized workforce in the U.S. economy as a whole is 4.0 million people smaller than in the base forecast. Growth in the unauthorized workforce resumes thereafter but at a slower pace than in the base forecast. By Year 15, the projected size of the unauthorized workforce is 8.5 million, compared with 14.3 million in the base forecast, a difference of 5.8 million, or 40%.

Simulation Results

The results from the increased farm labor supply scenario (presented in Table 1) conform to basic economic principles. Greater supply of temporary nonimmigrant farmworkers leads to their increased employment at lower wages. This, in turn, results in long-run increases in agricultural output and exports, above and beyond the growth projected by the base forecast. The increases in output and exports are generally larger in labor-intensive sectors such as fruit, tree nuts, vegetables, and nursery products. By Year 15 of the scenario, these four sectors

experience a 1.1% to 2.0% increase in output and a 1.7% to 3.2% increase in exports, relative to the base forecast. Less labor-intensive sectors, such as grains, oilseeds, and livestock production, tend to have smaller increases, ranging from 0.1% to 1.5% for output and from 0.2% to 2.6% for exports.

Accompanying this additional growth in agricultural output and employment, however, would be a relative decrease of 5.7% in the number of U.S.-born and other permanent residents employed as farmworkers and a 3.4% relative decrease in their wage rate. In the model, U.S.-born and other permanent resident workers are assumed to compete with temporary nonimmigrant farmworkers in the labor market. A 3.4% relative decrease in the wage rate does not mean that wages are projected to fall by 3.4% over the 15-year period of the projection. Rather, it means that the wage rate in Year 15 is projected to be 3.4% lower in the increased farm labor supply scenario than in the base forecast.

The effects on agricultural output and exports in the second scenario modeled, in which unauthorized labor supply declines, are opposite in sign and larger in magnitude than those in the first scenario modeled. Fruit, tree nuts, vegetables, and nursery production are again among the most affected sectors, with long-run relative declines of 2.0% to 5.4% in output and 2.5% to 9.3% in exports. These effects tend to be smaller in other, less labor-intensive, sectors of agriculture—showing a 1.6% to 4.9% decrease in output and a 0.2% to 7.4% decrease in exports.

In the decreased unauthorized labor supply scenario, the number of unauthorized workers employed on farms falls by 34.1% to 38.8%, depending on modeling assumptions, relative to the base forecast for Year 15. At the same time, the number of farmworkers who are either U.S.-born or foreign-born permanent residents increases by 2.4% to 4.0% in the long run, compared with the base forecast, and their wage rate increases by 3.3% to 7.5%. However, the increased farm employment of U.S.-born and other permanent resident workers is not sufficient to offset the decrease in unauthorized farmworkers. As a result, the total number of farmworkers decreases by 3.4% to 5.5%.

Some observers question whether a reduction in the number of unauthorized workers would benefit or harm U.S.-born and other permanent resident workers. Our results suggest that wages would rise—relative to the base forecast—in some lower paying occupations where unauthorized workers are common, decrease slightly in many higher paying occupations, and decrease on average.

Several factors account for the slight decrease in earnings. First, the decrease in the supply of unauthorized labor leads to a long-run relative decrease in production, not just in agriculture but in all sectors of the economy. This, in turn, reduces incomes to many complementary factors of production, including capital, land, and U.S.-born and foreign-born permanent resident workers in higher paying occupations. Second, with fewer unauthorized workers, the occupational distribution of U.S.-born and other authorized workers necessarily shifts in the direction of more hired farm work and other lower paying occupations, such as food service, child care, and housekeeping, and away from higher paying occupations—a much larger category. The effect of this compositional change is to reduce the *average* real wage for authorized workers, even as real wages in many lower paying occupations rise. In the long term, overall gross national product accruing to the U.S.-born and to foreign-born permanent residents would fall by about 1%, compared with the base forecast.

In sum, the model captures some of the divergent economic interests at stake in the debate over immigration policy and agriculture. Farm employers benefited from the increased availability of temporary nonimmigrant farm workers, but wages fell for farm workers. A large, economy-wide reduction in the size of the unauthorized workforce, by contrast, raised wages in farm work and other lower paying occupations, but depressed agricultural output and exports. Moreover, total national income accruing to U.S.-born and foreign-born, permanent resident workers and to employers contracted as the size of the unauthorized workforce was reduced, and the occupational distribution of the workforce shifted toward hired farm labor and other lower paying jobs. This divergence of interests helps to explain why the debate over immigration policy continues.

For More Information

Carroll, D., Georges, A., and Saltz, R (2011, May). *Changing characteristics of U.S. farmworkers: 21 Years of findings from the National Agricultural Workers Survey*. Presentation at conference entitled “Immigration Reform: Implications for Farm Workers, Farmers and Communities,” University of California, Washington, DC, campus. Available online: <http://migration.ucdavis.edu/cf/files/2011-may/carroll-changing-characteristics.pdf>.

Cave, D. (2011, July 6). Better Lives for Mexicans Cut Allure of Going North. *New York Times*. Available online: <http://www.nytimes.com/interactive/2011/07/06/world/americas/immigration.html?scp=6&sq=mexican%20immigration&st=cse>.

Georgia Department of Agriculture (2012, January). Report on Agricultural Labor as Required by House Bill 87. Atlanta: Author. Available online: http://agr.georgia.gov/Data/Sites/1/media/ag_administration/legislation/AgLaborReport.pdf.

Lofstrom, M., Bohn, S., and Raphael, S. (2011, March). Lessons from the 2007 Legal Arizona Workers Act. San Francisco: Public Policy Institute of California. Available online: <http://www.ppic.org/main/publication.asp?i=915>.

Martin, P (2012, First Quarter). Immigration and Farm Labor: What Next? *Choices*, 27(1). Available online: <http://www.choicesmagazine.org/choices-magazine/policy-issues/immigration-and-farm-labor-what-next>.

McCissick, J., and Kane, S. (2011, October 6). *An evaluation of direct and indirect economic losses incurred by georgia fruit and vegetable producers in spring 2011—a preliminary data analysis and summary working paper*. Athens, Georgia: University of Georgia, Center for Agribusiness and Economic Development. Available online: <http://gfvga.org/wp-content/uploads/2011/10/Georgia-Fruit-and-Vegetable-Survey-Analysis-Preliminary-Report-10-6-2011.pdf>.

Passel, J., and Cohn, D (2011, February 1). Unauthorized immigrant population: national and state trends, 2010. Washington, DC: Pew Hispanic Center. Available online: <http://www.pewhispanic.org/files/reports/133.pdf>.

Passel, J., and Cohn, D. (2009, April 14). A portrait of unauthorized immigrants in the United States. Washington, DC: Pew Hispanic Center. Available online: <http://www.pewhispanic.org/files/reports/107.pdf>.

Passel, J., Cohn, D., and Gonzalez-Barrera, A. (2012, April 23). Net migration from Mexico falls to zero—and perhaps less. Washington, DC: Pew Hispanic Center. Available online: <http://www.pewhispanic.org/files/2012/04/PHC-04-23-Mexican-Migration.pdf>.

Turnbull, L. (2011, October 30). Washington apple growers scrambling to find workers. *Seattle Times*. Available online: http://seattletimes.nwsourc.com/html/localnews/2016652587_farmlabor31m.html.

U.S. Department of Agriculture, National Agricultural Statistics Service (2012). *Quick Stats 2.0 Beta*. Available online: <http://quickstats.nass.usda.gov/>.

U.S. Department of Agriculture, National Agricultural Statistics Service (2007-11, various issues). *Farm Labor*. Available online: <http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1063>.

U.S. Department of Homeland Security, Citizenship and Immigration Services (2012, April 5). *E-Verify: About the Program: History and Milestones*. Available online: <http://www.uscis.gov/portal/site/uscis/menuitem.1d4c2a3e5b9ac89243c6a7543f6d1a/?vgnextoid=84979589cdb76210VgnVCM100000b92ca60aRCRD&vgnextchannel=84979589cdb76210VgnVCM100000b92ca60aRCRD>.

U.S. Department of Homeland Security, Customs and Border Protection (2012). *United States border patrol enacted border patrol program budget by fiscal year (dollars in thousands)*. Available online: http://www.cbp.gov/linkhandler/cgov/border_security/border_patrol/usbp_statistics/budget_stats.ctt/budget_stats.pdf.

U.S. Department of Homeland Security, Office of Immigration Statistics (2011, August). *Yearbook of immigration statistics: 2010*. Available online: http://www.dhs.gov/xlibrary/assets/statistics/yearbook/2010/ois_yb_2010.pdf.

U.S. Department of Labor, Bureau of Labor Statistics (2012). *Consumer price index: CPI databases: all urban consumers (current series)*. Available online: <http://www.bls.gov/cpi/data.htm>.

U.S. Department of Labor, Employment and Training Administration (2012). *H-2A temporary agricultural visa program: fy 2011 select statistics*. Available online: http://www.foreignlaborcert.doleta.gov/pdf/h_2a_selected_statistics.pdf.

U.S. Department of Labor, Employment and Training Administration (2011, July 19). *Foreign labor certification: annual report october 1, 2009 – september 30, 2010*. Available online: http://www.foreignlaborcert.doleta.gov/pdf/OFLC_2010_Annual_Report_Master.pdf.

U.S. Department of Labor, Employment and Training Administration (2010, July 19). *The foreign labor certification report: 2009 data, trends and highlights across programs and states: october 1, 2008 – september 30, 2009*. Available online: www.foreignlaborcert.doleta.gov/pdf/2009_Annual_Report.pdf.

Zahniser, S., Hertz, T. Dixon, P, and Rimmer, M (2012, May). *The potential impact of changes in immigration policy on u.s. agriculture and the market for hired farm labor: a simulation analysis*, Economic Research Report, ERR-135. Washington, DC: U.S. Department of Agriculture, Economic Research Service. Available online: <http://www.ers.usda.gov/>.

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