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# Farm Employment, Immigration, and Poverty: A Structural Analysis

Philip Martin and J. Edward Taylor

This study tests for structural change in the poverty-farm employment relationship between 1980 and 1990. Econometric findings from a partially simultaneous block triangular regression model estimated with census data reveal a circular relationship between farm employment and immigration that was associated with a significant decrease in the number of people in impoverished U.S. households in 1980. However, in 1990, the farm employment-poverty relationship reversed: an additional farm job was associated with an increase in poverty. Our findings suggest immigration to fill low-skilled farm jobs is transferring poverty from rural Mexico to communities in the United States.

*Key words:* farm employment, immigration, poverty, rural communities

## Introduction

Michael Harrington's stirring book *The Other America* described the conditions of poor farmers and farmworkers in the early 1960s, encouraging the United States to launch a War on Poverty. Poverty in rural and farm areas was sharply reduced, as an average of one million farm residents per year moved to urban areas during the 1960s. In 1959, one-third of rural residents were poor; by 1969, the number had declined to only one-fifth. The 1970s witnessed significant gains in farmworker earnings and a narrowing of the urban-rural wage gap [U.S. Department of Agriculture (USDA) 1991, 2003].<sup>1</sup>

Rural-urban migration, together with an expansion of labor-intensive fruit, vegetable, and horticultural (FVH) crops, created a vacuum at the bottom of the rural job-skill ladder, facilitating farmworker unionization and putting upward pressure on agricultural wages (USDA 1991). In this environment, new farm jobs, like nonfarm jobs, could be expected to reduce poverty. However, during the 1980s and 1990s, immigration, overwhelmingly from rural Mexico, expanded to supply additional farmworkers. According to the National Agricultural Workers Survey, Mexico-born persons represented an

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Philip Martin and J. Edward Taylor are professors of Agricultural and Resource Economics at the University of California, Davis, and members of the Giannini Foundation of Agricultural Economics. We are grateful to Art Havenner, Aaron Smith, Richard Green, and two anonymous referees for their valuable suggestions and comments. This research was supported by the Rosenberg Foundation, the Giannini Foundation of Agricultural Economics, and the William and Flora Hewlett Foundation.

Review coordinated by Gary D. Thompson.

<sup>1</sup>Rural means relating to the country (as opposed to the city) or relating to agriculture. Generally, rural is defined in terms of population density and is often considered synonymous with agriculture because most farming occurs in areas with lower population densities. However, the federal government defines rural areas as places (incorporated or unincorporated) with fewer than 2,500 residents and open territory, and the USDA (2000) emphasizes that rural residents can live in metro counties. Much labor-intensive agriculture is in metropolitan counties, but many people in these counties refer to themselves as rural because of the presence of agriculture and farmers and farmworkers. Our econometric analysis, presented below, includes both metro and nonmetro counties.

estimated 77% of the U.S. farm workforce in 1997–98, up from 57% in 1990. Ninety-five percent of those with fewer than two years of U.S. farm work experience were born abroad (U.S. Department of Labor 1991, 2000). Today, virtually all new entrants to the hired farm workforce on crop farms are immigrants from poor areas in rural Mexico, implying the farmworkers of the future are growing up today outside the United States.<sup>2</sup>

The basic thesis of this study is that there is a circular relationship between farm employment and immigration which transfers rural poverty from Mexico to the United States. Sixty percent of farmworker households in the United States have incomes below the poverty line (U.S. Department of Labor 2000). Seasonality and low earnings in farm jobs are the primary factors contributing to farmworker poverty.

How farm employment and immigration affect poverty is an empirical question. A partially simultaneous block triangular equation system was estimated with data from the 1970, 1980, and 1990 *U.S. Census of the Population* (U.S. Department of Commerce) to test the hypothesis of a circular relationship between U.S. farm employment and immigration that became positively associated with rural poverty in 1990.

### Theory and Hypotheses

During the 1960s, many leading agricultural economists examined the determinants of rural-urban migration and its impacts on rural poverty. Schuh found econometric evidence showing increases in expected nonfarm income, either through a reduction in unemployment or an increase in urban wages, resulted in large leftward shifts in the U.S. farm labor supply—i.e., nonfarm jobs or wages pulled “surplus” labor out of agriculture. Schuh also found that farm incomes could be raised, although not greatly, by commodity price-support programs, and education positively affected farm incomes by accelerating migration and raising the productivity of the labor force remaining in agriculture.

Barkley concluded that economic growth resulting in rising returns to nonfarm relative to farm labor significantly explained the occupational migration of labor out of agriculture between 1940 and 1985. The elasticity of out-migration with respect to the ratio of nonfarm-to-farm average labor products (a proxy for wages) was estimated at 4.5. In contrast to the earlier findings of Schuh, Barkley found that, controlling for this labor-returns variable, urban unemployment did not deter labor migration, and the effect of agricultural policies (government payments to agriculture as a share of farm income) on labor migration from agriculture was insignificant. The diminishing effect of unemployment and agricultural policy variables, which were a focus of migration research in the 1960s, probably reflects the fact that rural-to-urban migration in the United States had largely run its course, and also that the principal source of hired labor for U.S. agriculture had shifted from domestic to foreign.

During the 1980s, there was uncertainty about the availability of immigrant farmworkers because of immigration reforms which introduced employer sanctions in the form of fines and prison terms for employers who knowingly hired unauthorized workers. Because of labor supply uncertainty, some observers predicted labor-intensive agriculture

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<sup>2</sup> Analysis of the characteristics of crop workers over the past 15 years, when the total workforce was estimated to be stable at 1.8 million, suggests the median age of crop workers remained at 31 and average years of U.S. farm work remained at six years. Workers who leave the farm workforce are replaced by immigrants (Findeis et al.).

**Table 1. Expansion of U.S. Fruit, Vegetable, and Horticultural Acreage, 1987–1997**

Commodity	1997 Acres	1987–1997 % Change
Vegetables	3,539,670	8
Fruits, Nuts, Berries	5,158,064	13
Nursery and Greenhouse:		
Nursery	1,234,510	113
Greenhouse (sq. ft.)	1,027,000	35

Source: 1997 U.S. Census of Agriculture (USDA).

would not expand after the Immigration Reform and Control Act of 1986 was enacted. However, the acreage in labor-intensive FVH commodities rose significantly between 1987 and 1997, years during which the United States attempted to restrict illegal immigration with stepped-up border controls and employer sanctions (see table 1). Furthermore, labor contractors and other intermediaries expanded their activities to match recently arrived workers with seasonal jobs, serving as risk buffers for farmers who otherwise could face fines for knowingly hiring unauthorized immigrant workers. The supply of agricultural labor was also aided by the Special Agricultural Worker (SAW) program, which legalized an unexpectedly large number of farmworkers (Thilmany). The availability of low-wage immigrant labor, through new immigration and SAW legalization, was instrumental in fueling the expansion of FVH production.

Based on early research by Fuller, after farming shifted from dryland grazing and field crops to irrigated fruits and vegetables, relatively large farms in the western United States were preserved by the availability of immigrant workers with few other job options. Because these workers had to be paid only when they worked, relatively low labor costs were capitalized into high land prices, giving land owners an incentive for immigration to continue.<sup>3</sup>

The arrival of immigrants with little education to fill jobs, many of which are seasonal, raises the prospect of a new era of rural and farm-related poverty, and underlines the importance of research in developing an understanding of the relationships among farm employment, immigration, and poverty. Previous empirical studies of economic impacts of immigration have focused almost exclusively on nonfarm sectors (e.g., Borjas 1990, 1994; DeFritas; Altonji and Card; Bean, Lowell, and Taylor; LaLonde and Topel; Grossman; Muller and Espenshade; Winegarden and Khor; Simon, Moore, and Sullivan; Card; Butcher and Card; Vroman and Worden; Fix and Passel; Frey; Filer). Most of these studies concluded immigration does not increase poverty in urban labor markets (for a contrasting view, see Borjas 1994).

Research on interstate migration points to simultaneous interactions between employment and migration. Hunt and Greenwood found employment in metropolitan areas both stimulated and was stimulated by migration. This and other studies (e.g., Muth) highlight the importance of a simultaneous approach to model determinants and impacts

<sup>3</sup> Fuller quoted a farm representative in the 1920s who stated, “[I]f we should be forced to maintain our [farm] labor when it is idle we would be forced out of business” (1939, reprinted 1940, 1986).

of migration. Nevertheless, findings from urban-based and interstate-migration research offer little insight into immigration-poverty interactions in agricultural labor markets, where employment is seasonal and average farmworker earnings are below the poverty line.

### **Employment-Immigration-Poverty Interactions**

The interactions between employment and immigration are complex. Economic models of migration postulate that employment drives migration (Taylor). However, Muth argued that employment growth and migration are mutually dependent. Regions in which employment growth is highest experience high rates of in-migration and low rates of out-migration. Migration, in turn, affects both the supply and demand for local labor. Both Muth, and Hunt and Greenwood, found evidence showing the employment-migration relationship is simultaneous. Migration can stimulate employment through factor markets (by increasing the available workforce, altering the skill mix, and influencing technology choices) as well as through product markets (e.g., by increasing the demand for consumer goods in an area).

Employment is the most fundamental economic variable influencing poverty in the United States. However, employment expansion is not a sufficient condition for poverty alleviation, because new jobs may not provide adequate income to place households above the poverty line. Low earnings and high seasonality of farm jobs make it difficult for farmworkers to attain above-poverty income levels, particularly at late stages of the immigration and integration process when solo farmworkers are joined by their families in U.S. rural communities.

Taylor, Martin, and Fix found evidence that the farm employment-immigration interaction increased poverty in rural California during the 1980s. Although the western region is clearly advanced with respect to immigration and immigrant integration, including farmworker family reunification in rural communities, over the past two decades low-skilled Mexican immigrants have become a quintessential feature of rural economies in other parts of the United States as well.

Immigration and immigrant integration in agricultural areas appears to be characterized by four major phases, each with different implications for assessing rural poverty impacts (Taylor, Martin, and Fix):

- Phase one is the entry of solo males to fill seasonal farm jobs. These pioneer seasonal workers aim to maximize remittances to their families at home, so they often live in on-farm or irregular housing, and most return to their families abroad at least once a year. Despite low earnings, the lack of dependents and a tenuous attachment to the United States make this group unlikely to affect poverty statistics significantly, in part because they are often not counted in surveys, and their expenditures in the United States may create income multipliers. This solo-male phase characterized the early stages of Mexican immigration to agricultural jobs in the western United States (U.S. Commission on Immigration Reform).
- The second migration phase witnesses the shift of some seasonal farmworkers to year-round farm and nonfarm work in food processing, construction, and services to achieve more hours of work and potentially higher earnings. Increasing shares

of nonfarm jobs in total employment of rural areas illustrate this labor-market transformation.<sup>4</sup> However, the departure of workers to nonfarm sectors creates an excess demand for agricultural workers, which is filled by new immigrants.

- The third phase begins with some immigrants settling in rural areas and then sending for their spouses and children or forming families in the United States. This settlement phase is the one in which both communities and statistics begin to “notice” the immigrants, because the presence of children highlights issues such as whether children should be educated in bilingual classes and which public services should be provided in languages other than English. During the debate on education and public services, the first hints of externalities emerge. Some local residents opposed to the changing face of their communities argue the hiring decisions of local farmers or meatpackers impose costs on the community that the employers do not bear.<sup>5</sup> Others counter that the immigrants are needed to sustain local industries and communities, and generate positive externalities in the form of higher land prices and more economic activity (U.S. General Accounting Office).
- Phase four is the further integration of immigrants and their families, including political activism after naturalized immigrants and their U.S.-born children advocate changes. Much of the phase-four activism concerns persisting poverty, largely because farmworker earnings are insufficient to support other family members in the United States, and gainful employment opportunities for other family members often are scarce in rural areas (Green, Martin, and Taylor).

This four-phase immigration and integration process occurs over variable lengths of time, and there are no data to indicate when seasonal workers switch to year-round jobs or unify families. Thus, how farm employment and immigration affect poverty is an empirical question, and the relationship between employment and poverty may be different at different points in time. It is hypothesized that farm jobs reduced poverty in 1980 but increased poverty in 1990, as immigrant farmworker families settled and FVH production stimulated immigration to fill low-paying seasonal farm jobs.<sup>6</sup>

### The Model

The econometric model to test for employment-immigration-poverty interactions builds upon seminal work by Muth. The model consists of a block triangular system of three equations, two of which (farm employment and immigration) constitute a simultaneous sub-block that is recursively related to the third (poverty). This model corresponds to a structural partial-equilibrium theoretical model which includes immigrant labor supply, farm labor demand, and poverty outcomes. The general form of the model is specified as follows:

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<sup>4</sup>See the “Data” section of *Rural Migration News* (online at <http://migration.ucdavis.edu>) for changing sector shares of rural community and county employment between 1980 and 1990.

<sup>5</sup>Local conflicts and controversy over immigration and immigrant integration are documented in papers presented at conferences on Immigration and the Changing Face of Rural America, available through the *Rural Migration News* website (<http://migration.ucdavis.edu>).

<sup>6</sup>It is likely the various phases of migration overlap, making structural changes in farm employment-poverty interactions difficult to identify in some cases.

$$(1) \quad FARM_t^i = \varphi_1(w_t^i, FOR_t^i, \mathbf{X1}_t^i; \varepsilon_{1t}^i),$$

$$(2) \quad FOR_t^i = \varphi_2(w_t^i, FARM_t^i, C_t^i, \mathbf{X2}_t^i; \varepsilon_{2t}^i),$$

$$(3) \quad POV_t^i = \varphi_3(FARM_t^i, FOR_t^i, \mathbf{X3}_t^i; \varepsilon_{3t}^i),$$

where superscript  $i$  denotes census tract, and subscript  $t$  denotes census year (1980 or 1990). The left-hand variables are defined as:  $FARM_t^i$  = the number of people employed in farm jobs in census tract  $i$  at time  $t$ ,<sup>7</sup>  $FOR_t^i$  = the number of foreign-born persons residing in the census tract at time  $t$ ,<sup>8</sup> and  $POV_t^i$  = the number of people in the census tract residing in households with incomes below the poverty line at time (census year)  $t$ . These variables, together with the exogenous variables in the model, are described in table 2, as well as their summary statistics by census year. An equation-by-equation exposition of explanatory variables and their hypothesized effects follows.

#### *Farm Employment ( $FARM_t^i$ )*

Given high levels of unemployment in rural areas and an elastic supply of immigrant farm labor, farm employment is primarily demand driven by farms whose profit-maximizing behavior implies that the marginal product of farm labor equals the wage:  $MVP_L = w$ . This yields a farm labor demand function represented by equation (1), where  $w_t^i$  denotes the wage at time  $t$  in region  $i$ , and  $\mathbf{X1}_t^i$  is a vector of other variables (including prices) influencing farm labor demand as well as controlling for the structure of local labor markets. The agricultural wage is determined largely outside the United States, where the farm labor supply originates, and politically by minimum wage laws that set a lower bound on entry-level farm wages. Farm prices are also exogenous, determined in national or world markets. Because they are constant at given points in time, they are not included in the model.<sup>9</sup>

To the extent wages and prices change over time, their effects will be captured by a time dummy variable ( $D90_t^i = 1$  in 1990, 0 otherwise). The  $\mathbf{X1}_t^i$  vector includes the size of the local working-age population as well as the number of people employed in farm jobs lagged to the previous census year, to control for demographic and local labor market structure. These controls are necessary given the heterogeneity of census tracts in terms of their demographic and labor market structures.

A key hypothesis of this research (following Muth, and Hunt and Greenwood) is that the relationship between farm employment and migration is simultaneous: farm employment stimulates migration, which in turn stimulates farm employment. In agricultural labor markets, immigration's critical contribution is to ensure a reliable supply of low-wage labor to farms at given farm wages. To test this simultaneity hypothesis, the foreign-born population ( $FOR_t^i$ ) is included as an explanatory variable in the farm employment equation.

<sup>7</sup> Farm employment is the number of persons employed for wages with farmworker occupations (questions 29 and 30 of the 1990 Census of the Population questionnaire; see [www.census.gov/prod/1990dec/cph4/appdx.pdf](http://www.census.gov/prod/1990dec/cph4/appdx.pdf)).

<sup>8</sup> Immigrants are persons who leave the country in which they are born or have citizenship to settle in another country. Since virtually all U.S.-born persons are U.S. citizens, in the United States immigrants and foreign-born are synonymous.

<sup>9</sup> Moreover, data on wages and farm prices are not available for each census tract included in our analysis.

**Table 2. Variable Definitions, Sample Means, and Standard Deviations, by Census Year (sample size = 4,502 observations)**

Variable	Definition	Census Year		
		1970	1980	1990
$POV_t^i$	Number of people in poverty at time $t$	436.6 (479.8)	499.5 (541.1)	535.6 (587.6)
$FOR_t^i$	Size of foreign-born population at time $t$	261.8 (373.0)	347.6 (510.4)	406.0 (637.0)
$FARM_t^i$	Number of people in farm jobs at time $t$	12.3 (34.1)	19.1 (34.3)	23.8 (41.5)
$POP_t^i$	Total population at time $t$ (000s)	3,923.3 (1,996.1)	3,976.4 (1,873.3)	3,945.9 (1,930.4)
$WPOP_t^i$	Total working-age population at time $t$ (000s)	3,103.3 (1,618.4)	3,191.4 (1,557.3)	3,135.4 (1,614.9)
$DIST_t^i$	Shortest distance from tract to Mexico border (000s of miles)		1.13 (0.69)	
$D90_t^i$	Dummy variable = 1 for 1990, 0 otherwise		0.51 (0.50)	
$DNE_t^i$	Dummy variable = 1 if tract is in the Northeast census region, 0 otherwise		0.30 (0.46)	
$DSO_t^i$	Dummy variable = 1 if tract is in the South census region, 0 otherwise		0.24 (0.43)	
$DMW_t^i$	Dummy variable = 1 if tract is in the Midwest census region, 0 otherwise		0.27 (0.44)	

Note: Values in parentheses are standard deviations.

### Foreign-Born Population ( $FOR_t^i$ )

Although most foreign-born workers in the United States are not employed in agriculture, virtually all new entrants into the U.S. farm workforce are immigrants. Migrant farm labor supply is determined by “push,” “pull,” and “network” factors that influence net gains from migrating to U.S. farm jobs. In the model, foreign-born population is used as a proxy for the supply of immigrant labor available to farms. There is an extensive theoretical and empirical literature on the determinants of immigration, and thus the number of foreign-born individuals in local populations.

Migration determinants can be classified into three groups. The first consists of “push” factors stimulating migration at migrant origins. They include variables affecting the opportunity cost of migrating—wages, employment rates, and characteristics of migrant-sending areas, including various kinds of market imperfections, that shape migration and remittance impacts on migrant-source areas, as hypothesized by the new economics of labor migration. The second group is characterized by “pull” factors, such as income and employment prospects at migrant destinations. The third migration determinant group is migration costs, which depend not only on distance but also on “networks,” or contacts with family or friends at migrant destinations (Taylor and Martin).

Mexico is the single largest source of migrants and overwhelmingly the origin of farm labor in the United States. “Push” factors shaping the U.S. farm labor supply include labor market conditions in migrant-source areas as well as elsewhere in Mexico; U.S.



farmers compete with Mexican employers (both rural and urban) for migrant labor from Mexican villages. These market conditions are constant in the cross-section, and thus are not included explicitly in our econometric analysis.<sup>10</sup> To the extent that changing market conditions over time affect migration pressures, they will be captured by the time dummy variable in equation (2). Controlling for total working-age population ( $WPOP_t^i$ ), it is hypothesized that changes in farm labor demand ( $FARM_t^i$ ) positively affect the number of foreign born. Migration costs are proxied by the shortest distance between the census tract and the U.S.-Mexico border ( $DIST_t^i$ ). To control for network effects (Massey et al.), the size of the foreign-born population in the previous census ( $FOR_{t-1}^i$ ) is included as an explanatory variable in (2) along with total tract population ( $POP_t^i$ ). These controls are elements of the  $\mathbf{X2}_t^i$  vector.

#### Poverty ( $POV_t^i$ )

Changes in farm jobs are hypothesized to be negatively associated with poverty in 1980 but positively associated with poverty in 1990, for reasons presented earlier. A test for structural change in the impact of farm employment on poverty in 1990 is conducted by including an interaction term ( $FARM_t^i * D90_t^i$ ) together with the linear farm employment term in the poverty equation. A negative coefficient on farm employment and a sufficiently large, positive coefficient on the interaction term would support the farm employment-poverty hypothesis.

Immigration in response to employment can influence poverty independently, because most immigrants have low levels of human capital and are more likely than the native-born population to be poor (Huffman). This direct effect of immigration on poverty is captured by the  $FOR_t^i$  variable in the poverty equation. The  $\mathbf{X3}_t^i$  vector includes the number of poor persons in the previous census year ( $POV_{t-1}^i$ ), a proxy for variables influencing poverty at the census-tract level.

The number of people in impoverished households is hypothesized to be a positive function of total tract population (other things equal, a larger population increases the potential number of individuals in poverty) and a negative function of the size of the working-age population. Specifically, the more the population composition favors working-age individuals (as opposed to dependents—elderly and children), the lower the number of people in poverty. A dummy variable for 1990 (described earlier) is included to test for a structural (intercept) shift in poverty between 1980 and 1990.

#### The Equation System and Central Hypotheses

All three equations in the model include regional dummy variables for the Northeast, South, and Midwest. The default region is the West. The specific form of the equation system is:

$$(4) \quad FARM_t^i = \alpha_0 + \alpha_1 FOR_t^i + \alpha_2 WPOP_t^i + \alpha_3 FARM_{t-1}^i + \alpha_4 D90_t^i \\ + \alpha_5 DNE_t^i + \alpha_6 DSO_t^i + \alpha_7 DMW_t^i + \varepsilon_{1t}^i,$$

<sup>10</sup> The U.S. Census does not provide information about immigrants' places of origin within countries abroad.

$$(5) \quad FOR_t^i = \beta_0 + \beta_1 FARM_t^i + \beta_2 POP_t^i + \beta_3 WPOP_t^i + \beta_4 DIST_t^i + \beta_5 FOR_{t-1}^i \\ + \beta_6 D90_t^i + \beta_7 DNE_t^i + \beta_8 DSO_t^i + \beta_9 DMW_t^i + \varepsilon_{2t}^i,$$

$$(6) \quad POV_t^i = \gamma_0 + \gamma_1 FARM_t^i + \gamma_2 FARM_t^i * D90_t^i + \gamma_3 FOR_t^i + \gamma_4 POP_t^i + \gamma_5 WPOP_t^i \\ + \gamma_6 POV_{t-1}^i + \gamma_7 D90_t^i + \gamma_8 DNE_t^i + \gamma_9 DSO_t^i + \gamma_{10} DMW_t^i + \varepsilon_{3t}^i,$$

The three central hypotheses of this analysis are: (a) farm employment affected poverty negatively in 1980 ( $\gamma_1 < 0$ ), but positively in 1990 ( $\gamma_1 + \gamma_2 > 0$ ); (b) farm employment stimulates migration ( $\beta_1 > 0$ ); and (c) migration, in turn, stimulates farm employment ( $\alpha_1 > 0$ ), the farm labor analogue to Muth, and Hunt and Greenwood.

The stochastic error terms  $\varepsilon_{kt}^i$  ( $k = 1, \dots, 3$ ) are assumed to be distributed as approximately normal with zero mean and a variance of  $\sigma_k^2$ , uncorrelated across observations. Equations (4) and (5) constitute a simultaneous-equation sub-block, which was estimated using three-stage least squares (3SLS). If the errors in this sub-block,  $\varepsilon_{1t}^i$  and  $\varepsilon_{2t}^i$ , are not correlated with  $\varepsilon_{3t}^i$  (that is, the disturbance matrix,  $\Sigma$ , is block diagonal), ordinary least squares (OLS) yields parameter estimates for (6) which are optimal and identical to those obtained using full information maximum likelihood (e.g., see Lahiri and Schmidt). Equation (6) was estimated using OLS.

Table 3 presents the correlation matrix of residuals from the 3SLS estimation of the farm employment and immigration equations and the OLS-estimated poverty equation. The correlations  $r_{13}$  and  $r_{23}$  are small (0.11 and 0.05, respectively), and both are smaller than  $r_{12}$  obtained from 3SLS estimation (0.12)—evidence the equation system is not only block triangular, but also block recursive.<sup>11</sup>

Due to lagged right-hand-side variables ( $FARM_{t-1}^i$ ,  $FOR_{t-1}^i$ , and  $POV_{t-1}^i$ ), the model encompasses only two of the three census years ( $t = 1980, 1990$ ), while drawing contemporaneous explanatory variables from 1980 and 1990 and predetermined lagged variables from 1970 and 1980. Each equation in the simultaneous system is identified, with at least as many excluded exogenous or predetermined variables as included endogenous variables. Because of this, there is no need for instruments from outside the system.

### Data and Descriptive Statistics

The model was estimated with data from a matched 10% random sample of rural and urban census tracts, areas with 2,500 to 10,000 residents in households tending to have similar characteristics, from the censuses of 1970, 1980, and 1990.<sup>12</sup> Data from these three census years make it possible to test for changes in farm employment-immigration-poverty interactions between 1980 and 1990 with instruments drawn from the previous (1970 and 1980, respectively) census years.

<sup>11</sup> At a referee's request, a model of *changes* in poverty, foreign-born population, and farm employment between census years was also estimated with qualitatively similar results, illustrating the robustness of the findings with respect to model specification.

<sup>12</sup> A similar analysis using 2000 census data will not be possible until after 2003. The findings from this study can serve as a baseline of comparison with 2000 census information, once it becomes available.

**Table 3. Correlation Matrix of Residuals from OLS Poverty ( $\varepsilon_{3t}^i$ ) and 3SLS Farm Employment and Immigration Equations ( $\varepsilon_{1t}^i$  and  $\varepsilon_{2t}^i$ )**

	$\varepsilon_{2t}^i$	$\varepsilon_{3t}^i$
$\varepsilon_{1t}^i$	0.122	0.114
$\varepsilon_{2t}^i$	1.000	0.055

The data were stacked into a file containing 4,502 observations (2,251 for each of 1980 and 1990). Observations include contemporaneous data and lagged variables from the preceding census as they appear in equations (4)–(6). There were some changes in the boundaries of census tracts between 1970 and 1990. A “comparability file” produced by the Bureau of the Census makes it possible to reconfigure data to track changes in demographic and economic characteristics of census tracts over time. All endogenous variables in the equation system were measured as quantities (persons living in impoverished households, foreign-born population, and number of individuals employed in farm jobs) in the corresponding census year. Estimated coefficients in the model therefore measure absolute effects of changes in explanatory variables on these dependent variables.

The census provides the most detailed and representative information on census tracts, a unit of analysis closely corresponding to neighborhoods or communities. These are the only reliable data available for this analysis. However, it should be emphasized that the census is conducted in April, when many seasonal farmworkers may not be employed (and may not be in the United States), and the census probably undercounts unauthorized migrants. Inasmuch as census data are likely to provide a more reliable statistical portrait of U.S.-born and settled foreign-born populations, their use may lead one to understate correlations between farm employment and immigration (Fix, Zimmerman, and Passel). If recent immigrants not counted by the census settle and then later resemble the immigrants who are enumerated, our findings offer insights into the future impacts of current immigration.

Rural tracts are not identified in the census, and many agricultural counties in the United States (including the 10 California counties with the highest farm sales) are classified as urban or metropolitan. The data for this analysis include both rural and urban census tracts with no possibility of distinguishing between them.

Table 2 reports summary statistics on variables in the econometric analysis for each of the three census years. In 1990, the average U.S. census tract had a population of 3,946, of whom 406 (10.3%) were foreign-born, 536 (13.6%) lived in impoverished households, and 24 (0.6%) reported being employed in agriculture at the time of the census. The average number of foreign-born, people employed in agriculture, and people in impoverished households all increased between the 1970 and 1990 census years.

### Estimation Results

Econometric findings are summarized in table 4, and elasticities ( $\eta$ ) are given in table 5. The columns in these tables correspond to equations and the rows to explanatory (endogenous and exogenous) variables.

**Table 4. 3SLS Results: Employment-Immigration-Poverty Interactions, United States, 1980 and 1990 (sample size = 4,502 observations)**

Variable	EQUATION					
	Poverty		Foreign-Born Population		Farm Employment	
	Estimated Coefficient	Asymptotic <i>t</i> -Statistic	Estimated Coefficient	Asymptotic <i>t</i> -Statistic	Estimated Coefficient	Asymptotic <i>t</i> -Statistic
$FARM_t^i$	-0.57*	-3.06	0.34*	2.51	—	—
$FARM_t^i * D90_t^i$	1.42*	5.99	—	—	—	—
$FOR_t^i$ ( $\times 100$ )	14.30*	17.55	—	—	0.31*	4.60
$POP_t^i$ ( $\times 100$ )	11.33*	8.77	8.84*	7.60	—	—
$WPOP_t^i$ ( $\times 100$ )	-13.59*	-8.91	-11.66*	-8.58	0.08*	3.80
$DIST_t^i$	—	—	-87.43*	-8.23	—	—
$POV_{t-1}^i$	0.93*	95.82	—	—	—	—
$FOR_{t-1}^i$	—	—	1.25*	119.30	—	—
$FARM_{t-1}^i$	—	—	—	—	0.87*	88.97
$D90_t^i$	-50.32*	-4.93	-4.02	-0.50	-1.58*	-2.36
$DNE_t^i$	-39.23*	-2.97	-103.85*	-4.93	-9.37*	-9.42
$DSO_t^i$	39.86*	2.79	-136.69*	-8.33	-8.98*	-8.22
$DMW_t^i$	17.52	1.26	-96.49*	-6.78	-4.51*	-4.27
Constant	36.75*	2.42	222.29*	16.37	10.89*	9.93

Notes: An asterisk (\*) denotes statistical significance of the coefficient at the 0.01 level or lower;  $\chi^2 = 12,728$  (16 d.f.) for likelihood-ratio test of whether all slope coefficients in the two-equation 3SLS sub-block are zero;  $R^2 = 0.75$  from OLS estimate of poverty equation.

**Table 5. Estimated Elasticities at Sample Means**

Variable	Estimated Elasticities <sup>a</sup>		
	Poverty Equation	Foreign-Born Population Equation	Farm Employment Equation
$FARM_t^i$	-0.023	0.018	—
$FARM_t^i * D90_t^i$	0.032	—	—
$FOR_t^i$	0.108	—	0.058
$POP_t^i$	0.835	0.859	—
$WPOP_t^i$	-0.787	-0.891	0.121
$DIST_t^i$	—	-0.243	—
$POV_{t-1}^i$	0.810	—	—
$FOR_{t-1}^i$	—	0.937	—
$FARM_{t-1}^i$	—	—	0.640

<sup>a</sup> All elasticities reported in the table are based on regression coefficients significant at the 0.01 level or below (see table 4 above).

The findings confirm a circular relationship between farm employment and immigration. Other things equal, an additional farm job stimulates migration by 0.34 persons (statistically significant at below the 0.01 level). A one-person increase in foreign-born population, in turn, is associated with a statistically significant increase in farm jobs which, although small in absolute terms (0.003), is larger in percentage terms ( $\eta = 0.06$ ; see table 5). Although nearly all farm job vacancies are filled by immigrant workers, the

small absolute magnitude of the immigration effect on farm employment occurs because most immigrants are not employed in farm jobs.

Increases in farm employment were negatively associated with poverty in 1980; an additional farm job reduced the number of people in impoverished households by 0.57 individuals. However, this favorable poverty impact reversed in 1990. The coefficient of 1.42 ( $t = 5.99$ ) on the interaction term in the poverty equation indicates that the effect of farm employment on poverty was significantly greater in 1990 than in 1980. Other things equal, an additional farm job increased poverty by 0.85 ( $1.42 - 0.57$ ) individuals in 1990 (significantly greater than zero at the 0.01 level).<sup>13</sup> These findings support the hypothesis of a structural change in the relationship between farm employment and poverty between the 1980 and 1990 census years.

Consistent with most migration theories (Taylor and Martin), immigration is influenced positively by networks, proxied by stocks of foreign-born in the previous census year, and influenced negatively by migration costs, proxied by distance from the U.S.-Mexico border. There is evidence showing new immigrants significantly are drawn to areas where immigrants already reside (Massey et al.). The elasticity of foreign-born population with respect to its 10-year lagged value is 0.94 (table 5), and the estimated migration multiplier is 1.25. The elasticity of foreign-born population with respect to distance from the U.S.-Mexico border is  $-0.24$ . Controlling for farm employment and total population, the working-age population, predictably, is negatively related to poverty ( $\eta = -0.79$ ), while the direct impact of immigration on poverty is positive ( $\eta = 0.11$ ).

The parameters on lagged right-hand-side variables are large quantitatively and highly significant in the three equations, reflecting a persistence of poverty, immigration, and farm employment over time. Farm employment, immigration, and poverty for the most part are significantly lower in other U.S. regions than in the West. The only exceptions are poverty in the South, which is higher than in the West, and poverty in the Midwest, which is not significantly different than in the West.

## Conclusions

Our econometric findings using census data indicate there was a structural change in the relationship between farm employment and poverty in 1990. Other things equal, increases in farm employment reduced poverty in 1980 but increased poverty in 1990. The results also reveal a circular relationship between farm employment and immigration.

It remains to be seen whether the vicious circle of farm employment, immigration, and poverty, which appears to have emerged in the western United States during the 1980s, persisted and spread to other regions of the country in the 1990s. Nevertheless, anecdotal evidence suggests immigration, stimulated in part by the availability of farm and associated nonfarm jobs, continued changing the face of rural America after 1990, as new immigrant groups moved into rural and agricultural communities with slow-growing or shrinking populations tending to be older and white.<sup>14</sup>

<sup>13</sup> The  $F$ -statistic corresponding to the null hypothesis that  $\gamma_1 + \gamma_2 = 0$  is  $31.03 > F^* = 6.63$ .

<sup>14</sup> Qualitative analyses of immigration and change in rural communities are available online at the *Rural Migration News* website (<http://migration.ucdavis.edu/rmn/changingface.html>).

Positive associations among farm employment, immigration, and poverty raise difficult policy challenges. The spectrum of policy responses to the new rural poverty is defined by two extremes. One is to restrict the availability of low-skill immigrant workers through heightened border and workplace enforcement of immigration and labor laws. Advocates of this restrictionist approach argue that limiting the supply of immigrant farmworkers would boost wages and (through induced labor-saving innovations) farmworker productivity to match. The other extreme is to focus instead on the integration of immigrant farmworkers and especially their children (Fix, Zimmerman, and Passel).

There is a marked contrast between the reception accorded immigrants in different regions of the United States, which may reflect the dynamics of immigrant integration. California voters approved an initiative (Proposition 187) to establish a screening system to prevent unauthorized foreigners from obtaining state-funded public services, including K–12 schooling. Although Proposition 187 was not implemented at the state level, some of its provisions were incorporated into federal welfare and immigration laws in 1996. By contrast, Iowa in 2000 launched a “New Iowans’ Pilot Project” to encourage local communities to attract and integrate immigrants, based on the theory that immigrants are essential to offset low birth rates and out-migration from the state.<sup>15</sup>

Farm labor policies can have long-term consequences, as illustrated by the U.S. experience with slavery, sharecropping, and Bracero immigration. There is uncertainty about the prospects for upward mobility of immigrants arriving in the United States to fill low-skill jobs in rural and agricultural areas, as well as for their children in rural communities. Thus, rural and agricultural areas may be at a crossroads.

The optimistic scenario is, in some cases (particularly in the mild climates of the West), states may be able to reverse the vicious circle between farm employment and immigration by developing more year-round jobs via farm mechanization or more effective management to move seasonal workers among commodities, providing individuals with more hours of work each year. The pessimistic scenario is that vicious circles, in which more seasonal farm jobs lead to more immigration and poverty, will intensify, and immigration to fill seasonal farm and related nonfarm jobs could be the vehicle by which rural poverty abroad becomes transferred to the United States.

[Received August 2001; final revision received March 2003.]

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<sup>15</sup> An Iowa poll in 2000 found that 58% of adults opposed the governor’s proposal to encourage immigration, and 34% approved, even though 59% agreed immigrants are filling jobs which otherwise might go unfilled (*Rural Migration News* 2000).

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