# U.S. Agricultural Labor Out-migration Determinants, 1939-2004

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Xinxin Zhang and Evert Van der Sluis

Graduate Student
University of Florida
Department of Food and Resource Economics
PO Box 110240
1167 McCarty Hall
Gainesville, FL 32611-0240
e-mail: xinxinzhang787@hotmail.com

and

Professor
Economics Department
Scobey Hall
Box 504
South Dakota State University
Brookings, SD 57007
605-688-4872
fax: 605-688-6386
e-mail evert.vandersluis@sdstate.edu

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Technology changes have decreased the costs of capital inputs and contributed to a substitution of capital for labor in U.S. agriculture since the 1930s. Also caused by a drop in agriculture's contribution to the overall economy, the resulting decline in employment opportunities led to a gradual but substantial migration out of the agricultural sector.

In the absence of legal or institutional barriers to movement, resources move to sectors in which they can achieve their highest return. Under this paradigm, people working in agriculture and seeking employment elsewhere may decide to move between sectors if their expected returns outside of agriculture exceed those achieved in the farm sector. This labor reallocation continues until differences in the real returns between the sectors are eliminated, net of transfer costs.

In this article, we assess economic determinants of migration out of agriculture for three groups of migrants in the United States – hired farm workers, farm operators, and all farm workers. After reviewing previous studies and findings, we discuss our theoretical and empirical models used, followed by a detailed description of the data used in the analysis.

**Previous Work**

Human migration studies generally employ either a micro or a macro approach. The former deals with factors influencing an individual's decision to migrate, and explores the effects of demographic characteristics on migration. In the macro approach, researchers attempt to explain general migration patterns by utilizing aggregate economic variables as explanatory variables. Further, migration studies either consider gross (a single flow or the sum of unidirectional flows from origin to destination) or net (the difference between the two gross flows) movements of people. Net migration reveals only part of reality, because it is the residual effect of at least two distinct and mutually counteracting forces. Here, we study net migration, using a macro approach.

Migration decisions are influenced by four types of factors, including those associated with a migrant's origin, destination, intervening obstacles, and personal aspects (Lee). Both origin and destination factors include "pull" and "push" components. For example, a relative high wage rate at the destination occupation encourages migration towards an alternative occupation, while poor working conditions may push people away from the same occupation. Nearly all factors considered in the macro-oriented migration studies reported below can be divided into one of Lee's categories.

Sjaastad (1960) was the first to use human capital theory in analyzing off-farm migration. He argued that a potential migrant would prefer employment in the sector in which the real value of his or her expected income is greatest. By comparing the net present values of expected lifetime earnings in the current versus the alternative occupation, and subtracting any costs associated with a move, the potential migrant would select the occupation with the highest expected lifetime earnings. Todaro also merged migration and human capital theories, and defined expected income in the nonagricultural sector as the product of the wage rate and the probability of a potential migrant obtaining a job in the sector. In Todaro's model, individuals' human capital characteristics affect their wages and the likelihood of obtaining employment. Although the model was first used to help explain geographical migration in less developed countries (LDCs), it has also been applied to U.S. occupational migration. Further refinements to the earlier migration models were made by Tyrchniewicz and Schuh, who divided the farm labor force into three subgroups; farm operators, hired labor, and unpaid family labor. By estimating supply elasticities for each group, the authors found that the short-run supply elasticities of hired labor and unpaid family labor were higher than the farm operators supply elasticity, suggesting the latter group is relatively less responsive to income changes and more strongly committed to agriculture than the former two.

Migration model have also been applied to internationally. In analyzing Japanese data, Mundlak and Strauss found that differences in the economic growth rate and sectoral income differences were key determinants in explaining migration in periods before and after World War II, respectively. The latter variable will also be incorporated in our model. Further, in analyzing 70 countries using data from 1950 to 1970, Mundlak found that the number of migrants varies by the relative size and composition of a nation's labor force sectors. That is, the larger the nonagricultural labor force, the easier new migrants find employment outside of agriculture. The author also found that the income differential, the relative labor force composition, and education level influence migration. Larson and Mundlak (1997) fitted the same regression equation to 98 countries over five decades from 1950 to 1990, with results similar to Mundlak's.

Stark and Levhari (1982) argued that migration decisions in LDCs are made by rural households – as opposed to individual actors – and provide households with capital and a means to reduce risk by diversifying income sources. The authors also found that rural market imperfections, such as lack of access to credit and income insurance, provide incentives for households to self-finance new production methods and to self-insure against perceived income risks by investing in and facilitating family member migration.

Other examples of occupational migration include a study by Shepard and Collins (1988), who used a national U.S. data set from 1910 to 1978 to identify factors influencing farm bankruptcy rates in the United States, and a study by Goetz and Debertin (2001), who examined the effects of off-farm employment and federal government payments on farm exits. Although many economists have argued that off-farm employment might facilitate the transition of farm proprietors to move out of the agricultural sector, results of these two studies suggest off-farm employment has little effect on farm exits.

In a frequently cited study on U.S. agricultural out-migration between 1940 and 1985, Barkley (1990) examined two measures of income differentials between sectors – the nonfarm-farm ratio of average labor productivity, and alternatively, the ratio of per capita incomes in the two sectors. The author found agricultural out-migration increases as nonagricultural incomes and employment rise relative to their agricultural counterparts. Barkley further found that a rise in the real value of land decreases off-farm migration, but unemployment levels and government payments to agriculture did not influence occupational out-migration. In a similar study, Hatton and Williamson also concluded that wage differentials cause long-run migration trends, but argued that unemployment rates determine the timing of, and annual fluctuations in, migration. In another analysis of annual time series data between 1950 and 1990 similar to Barkley's (1990), Huang, et al. provided justification for linking the determinants of rural population change and those of agricultural out-migration, because they found that rural population decline is directly related to net out-migration.

Evenson and Huffman documented the influence of part-time farming on total factor productivity changes in U.S. agriculture over the past decennia. They also showed that off-farm wage increases encourage farmers to seek off-farm work, but farm wage increases have the opposite effect. Further, while the authors found that dairy price support programs encourage off-farm work, crop price supports lessened off-farm work efforts among farmers. Finally, Tran and Perloff (2002) used an occupational migration model to assess the impacts of the Immigration Reform and Control Act in 1986 (ICRA), which granted amnesty to selected illegal agricultural workers in the United States. While some growers and politicians predicted the law would encourage illegal workers receiving amnesty to leave agriculture, the authors found the controversial policy was not a cause of agricultural out-migration.

**Theoretical Model**

We analyze agricultural out-migration decisions using a utility maximization model developed by Barkley (1990). Following Barkley's notation, we consider a two-sector economy consisting of agriculture (sector *i*) and nonagriculture (sector *j*). Individuals choose between working in agriculture or the nonagricultural sector, and will leave agriculture and seek nonagricultural employment if their expected discounted lifetime utility from nonfarm employment exceeds that of farm employment.

The individual's consumption of goods, services, and activities is directly tied to income derived from the position, so for simplification we assume consumption equals income. Further, the price of the composite consumption good equals one, so that utility derived from an occupation is a function of expected income and time spent at work.

An individual selects one occupation over the other at time *t*, such that:

$$(1) \quad \max \int e^{-rt} U(Y_t, L_t) dt,$$

where $Y_t$ is expected income, $L_t$ is the working time, $U$ is the utility function, and $r$ is the rate of discount. Expected income represents an individual's ability to earn a living, and we assume that income increases lead to higher levels of utility. The returns to labor summarize all forces affecting the labor market, and are found at the intersection of labor supply and demand – the wage and employment allocation at which the labor market is in equilibrium. Labor markets in disequilibrium – characterized by a discrepancy between the returns to labor in the farm sector and those achievable in the nonfarm sector – will lead to migration from one sector of the economy to another.

The agricultural labor force consists of hired farm workers, farm operators and their family members, each of which have their own returns to labor. For hired farm workers, incomes are directly derived from farm work wages. If wage levels in other occupations are higher than those in the farm sector, hired farm workers are expected to move away from agriculture. However, even though manufacturing wages may be higher than those associated with farming, a person currently engaged in agriculture may discount the relatively high nonfarm wages by the probability of getting employed in the industrial sector. Thus, hired farm workers select an occupation as follows:

$$(2) \quad \max \int e^{-rt} U\left(Y_{t,} L_t\right) dt, Y = w_t L_t q_t ,$$

where $w_t$ is the wage rate, and $q_t$ is the possibility of employment.

Because the success of the farm operation hinges on cost control, production efficiency and marketing strategies, farm operator returns to labor must include earnings from entrepreneurship or management:

$$(3) \quad \max \int e^{-rt} U\left(Y_t, L_t\right) dt, Y_{it} = pF\left(v_t, L_{1t,} K_t\right) - p_{vt} v_t , \quad and\ Y_{jt} = w_{jt} L_{jt} q_{jt} ,$$

where $Y_{it}$ and $Y_{jt}$ are the agricultural and nonagricultural incomes, respectively. Further, $p$ is the price of agricultural output; $v_t$ is a vector of variable inputs; $K_t$ is capital input; $L_{1t}$ is labor input; $p_{vt}$ is the price of the vector of variable inputs; and $F$ represents the production function. The amount of time spent working in an occupation enters the utility function through expected income, but also directly, because a person enjoying his or her work may accept low wages and remain employed in his or her current occupation. That is, if the derivative of the utility function with respect to work time is positive, then the job is enjoyable.

We assume farm workers enter the labor force at age $G_0$, retire at age $T$, and migrate out of agriculture at age $G_1$, where $G_0 < G_1 < T$. Farm workers' occupational move occurs when expected lifetime utility in nonfarming – net of the costs associated with changing jobs – exceeds expected lifetime utility in the current employment:

$$(4)\quad H_i = \int e^{-rt} U(Y_{it,} L_{it}) dt - \int e^{-rt} \left[ U(Y_{jt,} L_{jt}) + C_{ijt} \right] dt \, ,$$

where $C_{ij}$ indicates total costs of changing from occupation $i$ to $j$. Individual $k$ migrates when $H_i$ is negative. We employ an index $f$ to separate migrants from nonmigrants, such that $f_{ik} = 1$ if $H_{ik} < 0$ (migration occurs); and $f_{ik} = 0$ if $H_{ik} \geq 0$ (migration does not occur). Summarizing every $f$ over the agricultural labor force yields gross migration out of agriculture: $M_{ij} = \sum f_{ik}$. Finally, net agricultural out-migration is defined as the difference between the two one-directional gross migration flows, $M = M_{ij} - M_{ji}$, where $M_{ji}$ denotes gross migration into agriculture.

**Empirical Model**

Because there are no sector-specific data on the number people migrating in and out of agriculture, we follow Barkley's method of approximating net agricultural out-migration ($M$) by taking the difference in the number of farm sector workers between two years, relative to the agricultural labor force size in the base period. That is, $M = [(1+n)L_{1t-1} - L_{1t}]/L_{1t-1}]$, where $L_{1t-1}$ and $L_{1t}$ represent the agricultural labor force in years $t-1$ and $t$, respectively, and $n$ is the agricultural labor force growth rate. Without migration, the agricultural labor force in year $t$ would be be $(1+n) \times L_{1t-1}$, so the actually observed difference in the agricultural labor force size between years $t$ and $t-1$ is attributable to migration when ignoring exits of the farm sector due to retirement. Further, agricultural out-migration is expected to increase as returns in the nonagricultural sector rise in comparison to those achieved in agriculture, so that $M = f(d),$ and $df(d)/dM > 0,$ where $d$ represents the ratio of nonagricultural to agricultural returns.

We consider migration of four groups, including total farm sector workers, as well as its three components – farm operators, family members of farm operators, and hired farm workers.

For the purpose of this analysis, the main difference between these groups of migrants is the way in which relative labor returns are measured. For total migration, the relative labor returns are approximated by the ratio of the average products (output divided by employment) of the two sectors. An alternative measure for representing the differences in returns to labor between the two sectors is the ratio of average nonfarm personal income to average farm income. In general, personal income more accurately reflects a sector's returns to labor than the average product, because the former specifically measures the returns to workers, whereas the latter represents a sector's combination of all inputs. In assessing hired farm worker migration, we use the ratio of hired farm worker wages over nonfarm worker wage rates, whereas for farm operators, we utilize the ratio of average returns among farm operators to average nonfarm personal income to represent the difference in returns between the two sectors.

An additional explanatory variable is the value of agricultural land, which is influenced by the earnings capability of productive land, as well as the opportunity cost of money tied up in the land (i.e., the interest rate). That is, $V = R \div I$, where $V$ is the current value of agricultural land, $R$ is the expected return to agricultural land, and $I$ is the interest rate. Land values are used as a proxy for the returns to all resources used in agriculture, and reflect expected future earnings in agriculture. The overall impact of agricultural land values on agricultural out-migration is expected to be ambiguous. On the one hand, high land values provide benefits to owner-operators reaping capital gains and developing expectations about future agricultural profits, thus contributing to keeping owner-operators remain in agriculture. On the other hand, a land value increase raises input costs for renting farmers, and subsequent input substitution would cause out-migration of labor associated with this group of farmers.

Federal government payments consist of disbursements made directly to agricultural producers participating in various farm programs, and have long been an important part of farm income. The complex nature of various federal programs is also expected to have an ambiguous impact on agricultural out-migration. One the one hand, income stabilizing programs – such as direct price supports, and cash transfers to farm operators – are expected to stabilize agricultural employment. On the other hand, acreage reduction and conservation programs take farmland out of production, and reduce the demand for farm inputs and agricultural marketing services. Therefore, conservation programs are expected to contribute to agricultural worker out-migration. In addition, farm operators owning their land are able to receive a steady stream of income from conservation program participation. This allows them to spend time on off-farm work, resulting in additional off-farm income, thus keeping farmers from migrating. Hence, conservation payments and income support payments are introduced as separate explanatory variables to the migration equations.

Over the past half-century, multiple job holdings have become increasingly common among U.S. farms. In the mid 1940s, only one-fourth of all U.S. farm operators worked off-farm, whereas in 2000, nearly four-fifths did so (USDA, 2000). Consequently, off-farm income is an increasingly important component of total income earned among those reporting farming as their primary or secondary job. Therefore, agricultural out-migration is expected to decline as off-farm income increases.

A final variable in explaining agricultural worker migration is unemployment. High unemployment levels reduce the likelihood an individual can successfully acquire a job in the nonagricultural sector, so we expect an increase unemployment levels to be associated with decreased agricultural out-migration. Thus, we regress hired farm worker migration ($F$) and farm operator migration (*O*) on the ratio of the wage rate of hired farm workers over that of nonfarm workers (*FW*), the ratio of the average returns to farm operators to average nonfarm personal income (*RO*), the unemployment rate (*U*), average agricultural land values (*LV*), federal government conservation program payments received by farmers ($GP_a$), and federal price and income support program payments ($GP_b$).

The regressions of the total number of agricultural migrants (*M*) are similar to those specified for hired workers and farm operators. In this case, we use as independent variables the average product ratio of nonagriculture to agriculture (*D*), and alternatively the average nonfarm personal income to average farm income (*INC*) to represent the relative labor returns ratio of the two sectors. Other independent variables are off-farm income (*OI*), the total amount of government payments received, and alternatively, the separate effects of the government payment components ($GP_a$ and $GP_b$). All migration equations are estimated in a linear logarithmic form using ordinary least squares regression (OLS), and fitted to annual time series data observed between 1939 and 2004. To avoid simultaneity, all independent variables are lagged one year, so that the change in agricultural employment between years periods *t-1* and *t* is modeled as a function of the predetermined variables in period *t-1*. Finally, the error terms are assumed to be normally distributed. Table 1 summarizes variable definitions and their expected signs in estimating the migration equations.

**Data**

We utilize two major sources of farm labor data. One is the Current Population Survey (CPS), a monthly survey of about 50,000 households conducted by Bureau of the Census for the Bureau of Labor Statistics (BLS), and available at its LABSTAT website. The CPS is the primary source of information about U.S. labor force characteristics and provides detailed statistics on the agricultural labor force. The second data set is the Farm Labor Survey (FLS), conducted four times per year by the U.S. Department of Agriculture's National Agricultural Statistics Service (NASS). The FLS is based on a survey of about 14,500 farms in all states except Alaska, and provides annual estimates of agricultural employment in general, as well as hired farm workers employment, their average number of hours worked, and their average wage rate.

Differences between the CPS and FLS data are generally caused by different sampling techniques, alternative data collection and estimation methods, and varying definitions of what constitutes agricultural employment. One of the three principal differences between the two series is that the Census data are based on household surveys, whose respondents are heads of households, and household members are classified as either employed, unemployed, or not in the labor force. The USDA data are based on farm establishment surveys conducted among farm operators, so that individuals working on more than one farm during a survey week are counted more than once. Second, the CPS is based on workers of at least 16 years of age, whereas the FLS is not limited by age. This accounts for a large disparity between the two agricultural employment estimates. The third difference is that the CPS classifies individuals as employed in agriculture only if they do not do more work outside than in agriculture in the reference week, and if they meet a minimum work requirement. The minimum work requirement for an unpaid family member entails conducting work on a farm without pay for at least 15 hours. In contrast, the USDA includes individuals meeting minimum work requirements in the farm employment category, regardless of the amount of work done elsewhere.

Since its inception in 1940, the CPS series has undergone several employment definition changes and survey techniques, affected the comparability of the farm labor force data. Important changes resulted in series breaks, and occurred in 1947, 1953, 1960, 1962, 1972, 1973, 1978, 1986, 1994 and 2000. The USDA data have not been subject to such frequent definition and survey design changes as the Census data. Therefore, we utilize the USDA data to explain total agricultural migration, but use data from both sources for hired worker and farm operator migration, because the Census data of these subgroups do not appear to have been affected by definition changes as much as those of the total agricultural labor force.

CPS data analysis shows a substantial decline in farm employment levels in each year before the 1970s. Since then, the decline slowed, except in 1994 when farm employment increased, and again in 2000 when it dropped substantially. The two latter exceptions are likely due to changes in survey methodology and definitions. Each component of farm employment exhibits distinct patterns of change over the period of analysis. The number of hired farm workers declined overall between 1940 and 1970, but increased each year since 1971, except in 2000. The number of farm family workers declined steadily since 1943, except in 1994. Further, the number of self-employed workers declined over the entire period covered, except for three years in the mid-1940s and again in 1994.

The USDA series on farm employment divide agricultural employment into family labor and hired workers. Family labor includes farm operators plus other family members, and hired farm workers include all persons working on farms for cash wages. The FLS data show that farm employment declined consistently throughout the 1939-2004 period. Farm operators and unpaid family members were responsible for much of the decline, and the number of hired farm workers declined only slowly. Since the 1990s, the number of hired farm workers has leveled off and increased slightly in the late 1990s.

Nonagricultural employment data were taken from the Bureau of the Census. Further, data on the natural rate of increase in the farm population prior to 1970 were taken from USDA, and post-1970 from the Bureau of the Census. Unemployment data published by the Bureau of Labor Statistics were also used.

In regressing total migration, we utilize the ratio of the average products of labor in the two sectors, both of which are based on total output and the labor force of each sector. Value added data – representing total output – were obtained from the Council of Economic Advisors. The ratio of the average product of labor in agriculture to that of the nonfarm sector dropped to a historically low level of just over one in 1973, suggesting the average products in the two sectors were roughly equal in that year. Since then, the average product ratio showed an upward trend, suggesting a decrease in farm sector's labor productivity in comparison to that of the nonagricultural sector.

The alternative measure of relative labor returns used regressing total migration and farm operator migration is the ratio of average nonfarm personal income to average farm income. Nonfarm personal income is measured as the sum of earnings net of personal contributions for social insurance, and farm income comprises farm wage earner income and farm proprietor income. The Income data are obtained from the Bureau of Economic Analysis (2003).

A comparison of the two measures of relative labor returns indicates that before 1950, the average income ratio tracked the average product ratio very closely. However, since the 1950s, the average income ratio rose above the average product ratio. Further graphical analysis reveals a remarkable correspondence in variation of the two series, which is peculiar because the methodological bases for constructing the two series differs.

The relative returns ratio for hired farm workers is derived by comparing the average wage rate observed in agriculture and that in the nonagricultural sector. Hourly earnings of nonfarm workers were taken from the Bureau of Labor Statistics. The nonfarm wage rate data are compared to wages of production workers in natural resources and mining and manufacturing, construction workers in construction, and non-supervisory workers in the service-providing industries, which may serve as viable alternatives of employment for migrating hired farm workers. Hourly wage earnings data for hired farm workers were taken from USDA data, but those prior to 1964 are unavailable. Further, the 1981 annual wage rate for hired farm workers was not reported, causing a break in the series in that year. Starting in 1974, the method for estimating wage rates changed from payment-based to the type of work performed, causing a jump in the observed wage rate for 1974 and subsequent years. The general trend of the wage rate ratio has been upward, corresponding with a closure in the gap between farm and nonfarm worker wages.

We use the share of farm household income from off-farm sources to represent off-farm income trends, because off-farm income data are only available for farm operator households and not for individuals. The USDA's Agricultural Resource Management Study (ARMS) and the Farm Costs and Returns Survey (FCRS) provide data on the nonfarm portion of total farm household income, but no data were collected prior to 1960. Off-farm income received by farm households includes off-farm wages and salaries, net income of any off-farm businesses, interest and dividends, and any other off-farm cash income received by household members. U.S. household income data were obtained from the Current Population Survey (CPS), conducted by the Bureau of the Census.

The share of off-farm income almost consistently increased since 1960, and has been a major factor in narrowing the gap between farm and nonfarm income. In fact, average off-farm income of farm households generally outweighed the average U.S. household income since 1998.

Government payment data were derived by dividing the total amount of direct farm program payments by net farm income. Price and income support payments are approximated by total government payments, less conservation payments. Government price and income support payments include production flexibility contract payments, fixed payments, loan deficiency payments, marketing gains, ad hoc and emergency payments, and miscellaneous program payments. Conservation programs include the Conservation Reserve Program, the Farm Land Protection Program, the Wetland Reserve Program, and other programs providing conservation payments to producers. Conservation payments have remained fairly stable over time, and most of the variation in total government payments is attributed to changes in price and income supports.

Average farm real estate values per acre were obtained from the U.S. Department of Agriculture, and the consumer price index was obtained from the U.S. Department of Labor. Land values are calculated by deflating the value of average farm real estate per acre by the consumer price index for all urban consumers (CPI-U), where 1982-84 = 100. Farmland values increased rapidly during the 1970s, followed by a sharp decline during the 1980s, and an upward trend beginning in the 1990s.

**Results**

The hired farm worker regression results for both USDA and Census data are reported in table 2. Dummy variables were used for years in which Census definitions changed, but only the 2000 definition change significantly affected the hired worker measure. Results from both data sets confirm that high wage rate differentials between the farm and nonfarm sectors cause out-migration of hired farm workers.

The linear logarithmic form of the regression equations allows for calculating the elasticity of hired farm worker migration with respect to the relative wage ratio:

$$(11) \quad E(H, FW) = [d(H) \div d(FW)] \times [(FW) \div (H)] = \{d(H) \div [d(FW) \div FW]\} \times (1 \div H) = \beta_1 \times (1 \div H),$$

where $\beta_1$ is the parameter estimate for wage ratio *FW* as listed in table 2, and *H* is the mean value of hired farm worker migration between 1940 and 2004. The resulting value of 11.74 suggests hired farm workers are very responsive to economic incentives provided by changes in the nonfarm-farm wage rate differential. By comparison, the elasticity of hired farm worker migration with respect to the average product ratio (nonfarm to farm) over the 1939-1985 period reported by Barkley (1985) was 7.31.

The conservation payment (GPa) coefficient is positive and statistically significant using both data sets, supporting our expectation that conservation program payment increases contribute to hired farm worker out-migration. However, the federal income and price support coefficient is not statistical significant using either data set. This suggests price and income support payments fail to slow hired farm worker out-migration, perhaps because they do not affect hired worker incomes directly.

The analysis of the USDA data shows that increased agricultural land values would add to the flow of hired farm workers out of agriculture, and the elasticity of 5.47 suggests hired farm workers are responsive to an agricultural land value increase. However, in the analysis of the Census data, the land value coefficient is not statistically different from zero, perhaps reflecting two counteracting effects. On the one hand, periods of high land values enable investments by owner-operators and increase input demand, including the demand for hired farm workers. High land values also reflect optimistic expectations about the future of agriculture, and further contribute to the investment cycle. On the other hand, high land values results in high rental rates, which increase operating expenditures for renting farm operators and cause a decline in the demand for input such as farm workers.

The unemployment variable is meant to capture the probability of obtaining employment in the nonfarm sector. However, the USDA data regression results indicate hired farm worker out-migration increases during periods of high unemployment. When using Census data, the unemployment coefficient has the expected sign, but it is not statistically different from zero. While mixed results associated with the unemployment variable are commonly found in migration studies, its reasons need further exploring.

Table 3 reports the farm operator migration results. The results support our hypothesis that periods of high operator returns in comparison to nonfarm personal income stem operator out-migration. The elasticities with respect to the returns ratio are much lower than those reported for hired workers, suggesting farm operators are comparatively less responsive to changes in the relative returns between the two sectors.

Neither the conservation payments nor the income support payments have statistically significant impacts on farm operator migration, although both have the expected signs. Nevertheless, the two types of federal farm program payments may indirectly influence farm operator out-migration, because both are capitalized into land values, as discussed below.

The negative and highly significant land value coefficient indicates land value increases reduce farm operator migration, and suggests that optimistic expectations about future agricultural earnings – as reflected in the high land prices – dominate any counteracting effects discussed earlier. Further, dummy variables 1972, 1994 and 2000 are included in the farm operator migration analysis to account for changes in Census definitions of the agricultural labor force in those years.

Table 4 reports the regression results for farm family worker migration based on USDA data. The results suggest that increased relative returns to farm operators help keep family workers in agriculture. The family worker migration elasticity with respect to relative labor returns is comparatively small, and similar to the farm operator migration elasticity with respect to the relative returns to labor. In line with expectations, conservation payments slow agricultural out-migration for both farm operators and their family members. Further, neither government income support payments nor the unemployment rate influence family worker migration.

The land value coefficient in the regression of family worker migration has a negative sign, but unlike in the farm operator migration regression, it is not significantly different from zero. Thus, farm family workers' occupational migration decisions do not appear to be linked closely to expectations about future agricultural earning opportunities.

Table 5 reports the results of regressing total agricultural labor migration on the independent variables, based on USDA data. Similar to agricultural sub-group out-migration, the flow of total labor out of agriculture is associated with economic incentives, as summarized in the ratio of labor returns. The value of the elasticity indicates that if the ratio of average nonfarm-to-farm product increases by one percent, agricultural out-migration is on average expected to increase by 2.26 percent.

Off-farm income contributes to keeping people in agriculture. That is, off-farm income not only helps to narrow the sectoral income gap, but also plays a crucial role in suppressing total agricultural labor out-migration. None of the other explanatory variables affect total agricultural labor out-migration in a statistically significant way.

In table 6, we report the results of regressing total agricultural employment migration using the average product ratio compared to the average income ratio as measures of relative labor returns in the two sectors. Both labor returns and off-farm income coefficients have the expected signs and are statistically significant. Also, the effect of off-farm income on agricultural labor out-migration is robust irrespective of which labor returns ratio is used, suggesting these incomes slow total agricultural labor out-migration. The government payment, land value, and unemployment variables are not statistically significant in the two regressions of total agricultural labor migration.

As expected, changes in agricultural land values have a mixed effect on total agricultural migration. As reported earlier, increased agricultural land values foster hired worker out-migration but lessen farm operator migration, so the two forces offset each other in explaining total agricultural migration.

These results suggest that national agricultural policies encompassed by the farm program payments have overall been largely ineffective in staving off agricultural labor out-migration. An important reason is the internally offsetting effects of government payment programs. One the one hand, we demonstrated that increased conservation payments increase hired farm worker out-migration, but on the other hand, the payments decrease family worker migration.

A second reason for ambiguous effect of government payments on total agricultural labor out-migration is that the payments indirectly affect migration through other explanatory variables. For example, income support payments are capitalized in current land prices, so government intervention may have affected migration through land prices.

Another explanation for relative ineffectiveness of government policies with respect to agricultural out-migration is the declining share of income derived from farming. Earnings from farming only account for 11 percent of the average farm household's total income (USDA ARMS, 2003).

**Conclusion and Recommendations**

On the basis of national U.S. annual time series data from 1939 to 2004 of U.S. farm labor using OLS, we found that differences in expected returns in the composite nonagricultural sector relative to those obtained in agriculture are a major determinant in agricultural out-migration. This is in line with the established literature on agricultural labor migration. A major contribution of this study is the finding that off-farm income suppresses total agricultural labor out-migration. Off-farm income permits individuals to continue farming by supplementing family household income, and its increased importance helps explain the slowdown of agricultural labor out-migration over the past two decades – a period during which the income gap between the nonfarm and the farm sectors appeared to have increased. The notion that off-farm income helps retain people in agriculture is contradicts earlier results of Goetz and Debertin, who found off-farm employment did not affect the number of farmers leaving the agricultural sector between 1987 and 1997.

In accord with Goetz and Debertin, our results suggest that neither changes in government payments nor in land values have detectable effects on total agricultural labor out-migration. The reason may be that periods of high land values are associated with internally offsetting effects on farm exits and employment. Also consistent with earlier findings by Tweeten, Barkley (1985), and Goetz and Debertin (1996), is our results that farm program payments failed to stem agricultural labor out-migration.

Based on the important role of off-farm income in keeping people in agriculture and the concern that government program payments have little impact on agricultural employment levels, our findings suggests the need for alternative government policies – such as those directly affecting job creation and rural economic developing efforts – to stem farm employment losses and to maintain the rural economic viability.

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Table 1. Summary of variable definitions and their expected signs

| Label | Definition | Expected sign |
|---|---|---|
| *M* | Total migration | |
| *F* | Hired worker migration | |
| *O* | Farm operator migration | |
| *D* | Average product ratio, nonfarm to farm | + |
| *INC* | Nonfarm personal income to farm income | + |
| *FW* | Wage rate ratio, farm to nonfarm | – |
| *RO* | Farm operators' return to nonfarm personal income | – |
| *OI* | Off-farm income | – |
| *GP* | Government payment | indeterminate |
| $GP_a$ | Conservation program payment | indeterminate |
| $GP_b$ | Government price and income support payment | – |
| *LV* | Land value | indeterminate |
| *U* | Unemployment rate | – |

Table 2. Hired farm worker migration regressed on the independent variables

| | USDA Data | | | Census Bureau data | | |
|---|---|---|---|---|---|---|
| Explanatory Variable | Parameter Estimate | t-statistic | Elas-ticity | Parameter Estimate | t-statistic | Elas-ticity |
| FW | -0.2948 | -4.54*** | -11.74 | -0.1360 | -1.68* | -9.10 |
| $GP_a$ | 0.0595 | 4.50*** | 2.37 | 0.0268 | 1.65* | 1.79 |
| $GP_b$ | 0.0030 | 0.39 | | -0.0008 | -0.08 | |
| LV | 0.1373 | 2.82*** | 5.47 | 0.0894 | 1.52 | |
| U | 0.0522 | 1.92* | 0.90 | -0.0527 | -1.55 | |
| DUM 2000 | | | | 0.2576 | 5.68*** | |
| Adj. $R^2$ | 0.4169 | | | 0.5631 | | |

All explanatory variables are lagged one period and are expressed in logarithms;

Levels of significance: '***'= $P \leq 0.01$, '**'= $P \leq 0.05$, '*'= $P \leq 0.10$.

Table 3. Farm operator migration regressed on the independent variables, Census data

| Explanatory Variable | Parameter Estimate | t-statistic | Elasticity |
|---|---|---|---|
| RO | -0.0362 | -1.88* | -1.13 |
| GPa | -0.0080 | -1.08 | |
| GPb | -0.0072 | -1.11 | |
| LV | -0.0916 | -2.54*** | -2.86 |
| U | -0.0110 | -0.47 | |
| DUM 1972 | -0.0630 | -2.23** | |
| DUM 1994 | -2.23 | -9.32*** | |
| DUM 2000 | 0.2050 | 7.14*** | |
| Adj. $R^2$ | 0.8164 | | |

All explanatory variables are lagged once and expressed in logarithms;

Levels of significance: '***'= $P \leq 0.01$, '**'= $P \leq 0.05$, '*'= $P \leq 0.10$.

Table 4. Farm family worker migration regressed on the independent variables, USDA data

| Explanatory Variable | Parameter Estimate | t-statistic | Elasticity |
|---|---|---|---|
| RO | -0.0530 | -2.98*** | -1.74 |
| GPa | -0.0244 | -3.48*** | -0.80 |
| GPb | -0.0067 | -1.05 | |
| LV | -0.0441 | -1.26 | |
| U | -0.0127 | -0.61 | |
| Adj. $R^2$ | 0.3294 | | |

All explanatory variables are lagged once and expressed in logarithms;

Levels of significance: '***'= $P \leq 0.01$, '**'= $P \leq 0.05$, '*'= $P \leq 0.10$.

Table 5. Total agricultural employment regressed on the independent variables, USDA data

| Explanatory Variable | Parameter Estimate | t-statistic | Elasticity |
|---|---|---|---|
| D | 0.0657 | 2.24** | 2.26 |
| OI | -0.0717 | -2.95*** | -2.47 |
| GPa | -0.0010 | -0.12 | |
| GPb | -0.0034 | -0.65 | |
| LV | 0.0258 | 1.01 | |
| U | 0.0190 | 1.02 | |
| Adj. $R^2$ | 0.3294 | | |

All explanatory variables are lagged once and expressed in logarithms;

Levels of significance: '***'= $P \leq 0.01$, '**'= $P \leq 0.05$, '*'= $P \leq 0.10$.

Table 6. Summary results of regressing total agricultural employment – USDA data

| | Average Product Ratio (D) | | Average Income Ratio (INC) | |
|---|---|---|---|---|
| Explanatory Variable | Parameter Estimate | t-statistic | Parameter Estimate | t-statistic |
| D | 0.06472 | 2.43** | | |
| INC | | | 0.04294 | 1.75* |
| OI | -0.07268 | -3.88*** | -0.09859 | -5.50*** |
| GP | -0.00379 | -0.66 | -0.00491 | -0.70 |
| LV | 0.02639 | 1.15 | -0.00005 | -0.00 |
| U | 0.01888 | 1.05 | -0.00568 | -0.33 |
| Adj. $R^2$ | 0.4741 | | 0.4288 | |
| E (M, D) | 2.23 | | | |
| E (M, INC) | | | 1.48 | |
| E (M, OI) | -2.50 | | -3.40 | |

All explanatory variables are lagged once and expressed in logarithms;

Levels of significance: '***'= $P \leq 0.01$, '**'= $P \leq 0.05$, '*'= $P \leq 0.10$.