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# **Agricultural Policy and Its Impact on Labor Migration from Agriculture**

Jeremy D'Antoni and Ashok K. Mishra

*Correspondence to:*

Ashok K. Mishra

Associate Professor

Department of Agricultural Economics and Agribusiness

Louisiana State University

226 Ag. Admin. Bldg.

Baton Rouge, LA 70803

Tel: 225-578-0262

Fax: 225-578-2716

E-mail: amishra@lsu.edu

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## **Introduction**

The implication of direct government payments slowing the migration of labor from agriculture is considerable. An average of \$18.2 billion has annually been distributed by the federal government to farmers in the form of direct government payments over the last 10 years. Over the same period, government payments have comprised nearly 30% of farm net income on average (USDA, 2009). These payments are clearly important to the recipient farmers, but are policymakers achieving the desired outcome of sustainable agricultural production?

A concerning trend in agriculture is the aging of the farm population which threatens to further weaken the industry over the long-term. According to Gale (1994), entry into farming by the 'next generation' holds a place of central importance in the determination of industry structure and the total number of farmers and farm families. Currently, these young and beginning farmers are receiving a minority share of direct government payments. Mishra et al (2002) shows government assistance is most often received by larger, wealthier farms that are less likely to work off-farm. Effective government policy could be a viable option to slow the drift of younger, more educated workers from the farm labor force if government payments were increasingly redistributed to this important demographic.

The farm sector is also dependent upon a lengthy biological production process, with the byproduct being considerable physical and financial risks. The daily stressors of farm management and considerable uncertainty in yearly income may exceed the tolerances of some participants in the farm labor market. Mishra

and El-Osta (2008) found that government policy may be responsible for keeping farms in business by reducing market risk and creating a disincentive for farmers to leave the industry. Government policies aimed at decreasing the volatility of annual income, such as direct payments, can be effective tools to decrease the migration of labor from agriculture.

The effects on farm labor have not been limited to a demographical shift in the labor force. Farm labor has declined over 50% in just under 50 years, from total employment of 5.5 million in 1960 to 2.1 million in 2007 (BEA 2009). This trend coincides with technological developments in the past eight decades contributing to declining demand for labor in the agricultural sector. Cochrane (1993) describes a structural change in U.S. agriculture. He notes a long-run trend of declining inputs of human labor, increasing inputs of mechanical power, machinery, and agricultural chemicals, and relatively stable farm real estate values. This trend still holds in agriculture both domestically and abroad; therefore, substantial downward pressure on agricultural labor from multiple sources still remains.

Barkley (1990) found that government payments do not directly slow the migration of labor from agriculture; rather, their impact on real land values may indirectly influence the outflow of labor. Such a result bodes poorly for the prospects of direct government payments effectively reducing the outflow of young and beginning farmers from agriculture, reducing market risk, and counteracting technological trends. This necessitates a need to build upon the prior research to gain further insight into this important issue and the viability of the current policy options.

This research analyzes the problem of labor migration from agriculture, as Barkley (1990) initially proposed, with the advantage of an additional 22 years of data. An alternative method of estimation is also used to explore the sensitivity of the results to differing techniques. Rather than estimate the migration equation using ordinary least squares, an autoregressive distributed lag model will be used allowing for the lag of the dependent variable to be included as an explanatory variable. Further adjustments are made to correct for non-stationary data as well. These changes ultimately result in direct government payments accounting for a substantial role in the reduction of labor migration from agriculture.

## **Background**

This research follows Barkley (1990), who concluded that government intervention may have slowed the rate of migration from agriculture indirectly through higher land prices, but government intervention has not been directly successful at halting migration. Barkley's work examined the effects of relative returns to employment in agriculture, the relative size of the labor force, probability of employment in the non-farm sector, real land values, and government payments on labor migration from agriculture for the years 1940 to 1985. Labor migration is the dependent variable and is defined (Barkley, 1990; Mundlak, 1979):

$$M = \frac{(L_{(t-1)} - L_t)}{L_{(t-1)}}$$

In this equation, L is defined as farm employment. The independent variables are lagged one period, under the assumption that farmers make their decision to

migrate in the current period based on experiences from the prior period. The lag model is estimated using a semi-log, least squares procedure.

Using two alternative methods, the returns ratio is calculated using average products of labor and personal disposable income, respectively. The first method uses the ratio of average products of labor from the non-agricultural sector and the average product of labor from the agricultural sector; while the second uses the ratio of personal disposable income from the non-agricultural sector and the personal disposable income from the agricultural sector. Both methods are expected to be positively related to labor migration from agriculture.

Barkley (1990) found average product of labor produced stronger results than the ratio of personal disposable income. One possible explanation for this result stems from the difficulty measuring personal income (Moore et al, 2000). There may be measurement error and/or downward bias in the reported income of non-farm and farm workers. Average product of labor is a more robust measure than personal disposable income in this regard.

The labor force ratio is the number of nonfarm employees relative to farm employees. The larger this ratio, the greater degree to which farm labor can be absorbed into the non-farm labor force; therefore, the labor force ratio is expected to be positively related to labor migration. Nonfarm unemployment is included in the model to measure the probability of obtaining a job outside the agricultural sector. As non-farm unemployment rises, the probability of obtaining work in the non-agricultural sector declines (Herzog and Schlottman, 1984).

Real land prices were included in the model to reflect the future expectations of farmers. Assuming efficient markets for farm land, real land prices reflect farmers' expectations and all available information on future cash flows from agriculture. It's hypothesized that increases in real land values reflect a positive outlook on the industry and result in decreased migration from agriculture.

Government payments were included as the ratio of direct government payments to net farm income. From 1960 to 2007, direct government payments have increased nominally from \$3.8 to \$11.2 billion per year, while annual net farm income has increased from \$60.3 to \$66.7 billion (USDA, 2009). Direct government payments have increased at a higher rate than net farm income, implying the government payment ratio has trended upward. It is expected that increases in the government payment ratio will be negatively related to the out-migration of farm labor. This expectation is theoretically acceptable because increases in the government payment ratio are largely driven by increasing government payments rather than declining farm net income.

Zhang and Van der Sluis (2006) extended the research of Barkley by updating the years of study. Their research covered the years 1939 to 2004 and included additional forms of government payments. Similar to Barkley (1990), the effects of government intervention were still found to be negligible. These works provide the basis for the current research and provide a benchmark for highlighting the alternative methods and considerations addressed hereafter.

One issue that will be addressed in more detail is non-stationarity in the data. After reviewing these previous works, there is evidence of non-stationarity in

some variables. The addition of data points by Zhang and Van der Sluis (2006) did not sufficiently “smooth” the data to remove these affects. Additionally, previous period migration can be hypothesized to affect migration from agriculture; therefore, prior period migration will be included as an explanatory variable in the following model. Finally, dummy variables for Farm Bill legislation years were included. This is used to determine whether the presence of impending farm legislation has a significant impact on slowing migration of labor from agriculture.

### **Data Sources**

Data for the years 1940 to 2007 were compiled from multiple sources, providing 67 data points of study for each variable (with the exception of migration). The farm employment data used for the migration equation was obtained from the Bureau of Labor Statistics (United States Department of Labor, 2009). This data was also used in the calculation of the labor force ratio. Also from the Bureau of Labor Statistics, the unemployment rate for the non-farm sector was obtained.

As defined by Barkley (1990), the returns ratio using average product of labor is calculated by using the measures of non-agricultural and agriculture average products of labor in the numerator and denominator, respectively. Agricultural average product of labor is defined as the gross domestic product from agriculture divided by the employment in agriculture. The same method applies to Non-Agriculture, respectively. The measures of gross domestic product were obtained from Bureau of Economic Analysis (United States Department of Commerce, 2009). The alternative measure of relative returns, using disposable income, replaces the gross domestic product with personal net income for agriculture and non-



agriculture. The personal income related data is obtained from Regional Economic Information System (REIS) courtesy of the Bureau of Economic Analysis (BEA, 2009).

Real land values are also used in the model. The nominal land values are from the “Farm Income Data” produced by ERS (USDA, 2009). These values are then deflated using the Producer Price Index (PPI) for Farm Equipment (BLS, 2009). This measure is used rather than the PPI for farm products because like equipment, farm land is an input in the production process. It is more consistent to use the rate of inflation for other inputs, rather than output, to deflate the value of land. The data on direct government payments and net farm income were also obtained from the “Farm Income” dataset (USDA, 2009). Zhang and Van der Sluis (2006) provide additional discussion on the attributes of the data.

### **Analytical Framework**

The conceptual model used in this study borrows from Barkley (1990). Empirically, the current research aims to compliment the previous literature and explore alternative methods to analyze labor migration from agriculture. A more favorable view of government intervention in the agricultural sector results from these considerations.

An autoregressive distributed lag model was used to estimate the labor migration equation. Augmented Dickey Fuller tests were used to determine whether the data was stationary. All variables, with the exceptions of real land values and the labor force ratio, were found stationary. The first difference of real

land values and the labor force ratio were found to be stationary; therefore, the labor equation used for estimation is an AR(1) model of the following form.

$$M_t = \alpha_1 + \alpha_2 Yr1973 + \alpha_3 Yr1985 + \alpha_4 Yr1996 + \alpha_5 Yr2002_1 + \beta_1 \Delta LF + \beta_2 \Delta Land + \beta_3 M_{t-1} + \beta_4 U_{t-1} + \beta_5 GOV_{t-1} + \beta_6 Ret_{t-1} + \varepsilon_t$$

Explanatory variables included in the migration equation were dummy variables for each year of Farm Bill legislation, the lag of farm labor migration ( $M_{t-1}$ ), the first difference of the labor force ratio and real land values ( $\Delta LF$  and  $\Delta Land$ ), the lag of non-farm unemployment ( $U_{t-1}$ ), the lag of government payments ( $GOV_{t-1}$ ), and the lag of the return ratio ( $Ret_{t-1}$ ). A separate migration equation was constructed using the ratio of disposable incomes and the ratio of average products of labor as measures of the return ratio. Using the Breush-Godfrey test and residual correlogram, no evidence of autocorrelation was detected for either labor migration equation estimated.

## Results and Discussion

Separate migration equations were estimated using average product of labor and personal disposable income to calculate the relative returns of farm labor (Table 1). Considerably different results stemmed from each equation. Like Barkley (1990) and Zhang and Van der Sluis (2006), the migration equation using average product of labor produced significantly stronger results.

The estimated return ratio coefficient using personal disposable income was not significant; whereas, the coefficient for the return ratio variable using average product of labor was 0.0219 and was significant at 1%. This result supports the hypothesis that as returns in the non-agricultural sector rise relative to the

agricultural sector out-migration will increase. Migration from agriculture is expected to continue until the net returns from agriculture and non-agricultural sectors reach equilibrium. One shortcoming of this reasoning is the qualitative and cultural attributes of farm labor not included in the returns measure. These values could hold significant value to the farmer and prevent exit from farm labor in spite of higher monetary returns to labor in other sectors.

The coefficients for government payments were  $-0.0813$  (significant at 1%) and  $-0.0542$  (significant at 10%) for the models using average product of labor and disposable income, respectively. Both are of the expected negative sign, implying increased direct government payments relative to net farm income slow the migration of labor from agriculture. From a policy perspective this is a striking result. When farmers decide whether to seek employment in the non-agriculture sector in the current period, they consider the direct farm payments received from the government in the prior period. This result is consistent with the findings of Mishra, El-Osta (2008) that government payments create a disincentive for farmers to leave the industry. Fearing the certain loss of income from direct government payments more than they value the potential gains from higher paying non-agricultural jobs, farmers may choose to continue working on the farm rather than elsewhere.

The change in real values and labor force ratio were also significant. Both models yielded similar results for each variable. The change in the labor force ratio was significant at 1% for both models and coefficients were  $0.0181$  and  $0.0196$  for the average product of labor and disposable income models, respectively. The

coefficients for real land values were  $-0.0015$  and  $-0.0017$  (both significant at 5%). Similar to the findings of Barkley (1990), a positive change in the real value of farm land signals a more positive outlook on the prospects of farming—assuming efficient land markets. This in turn results in decreased migration of labor from agriculture. When there is a positive difference in the labor force ratio from one period to the next, farm laborers can increasingly be absorbed into the non-agricultural sector, resulting in greater migration of labor from agriculture.

These results for the labor force ratio and real land values also demonstrate the consequences of adjusting for non-stationarity in time series data. The relative importance of these variables in the current migration equation is considerably lower than previously estimated by Barkley (1990). Inclusion of a non-stationary explanatory variable complicates the analysis by introducing a stochastic trend which amplifies the causal relationship between the explanatory and dependent variables (Hill et al, 2008). The results provided here can be considered more conservative estimates of the determinants of labor migration because the stationarity has been accounted for rather than assumed to exist.

Unemployment was also found to be a significant predictor of labor migration in the APL model. The coefficient is  $-0.3220$  and is significant at 5%. Higher unemployment in the non-agricultural sector is a signal to farmers that the probability of obtaining work off-farm is lower. Therefore, greater unemployment in the non-agricultural sector results in lower migration of labor from agriculture.

For both estimated models, dummy variables for Farm Bill legislation years were insignificant. The expectation was that these years would be negatively

correlated with labor migration from agriculture. From these results, it can be concluded that impending farm legislation does not provide significant reason for farmers to remain in the agricultural industry. Prior period labor migration was also found to have no predictive value in determining current period migration. Meaning, a farmer's decision to leave agriculture is not significantly influenced by the choice of other farmers in the previous period.

### **Conclusion**

A farmer's decision to exit the agriculture industry is significantly influenced by direct government payments. These payments provide a guaranteed income stream to the farmer which must be foregone if the farmer leaves the industry. Not only do direct government payments provide a disincentive to leaving the industry, but this assistance also helps decrease the income variability of current farmers. Increased stability in farm income from government payments decreases the likelihood that farmers will seek employment in other industries (Mishra and El-Osta, 2008). Direct government payments increase the risk adjusted return to farming and prove effective in retaining farm labor.

Table 1: Estimation Results for Determinants of Farm Labor Migration

Variable	APL Model	Income Model
Government Payments	-0.0813*** (0.0208)	-0.0542* (0.0295)
Return Ratio	0.0219*** (0.0069)	-0.0056 (0.0048)
Labor Force Ratio (Diff)	0.0181*** (0.0014)	0.0196*** (0.0015)
Real Land Values (Diff)	-0.0015** (0.0006)	-0.0017** (0.0006)
Unemployment	-0.3220** (0.1275)	-0.1824 (0.1465)
Migration (t-1)	0.0931 (0.0627)	0.0786 (0.0712)
Year 1973	0.0058 (0.0201)	-0.0065 (0.0221)
Year 1985	0.0064 (0.0215)	-0.0069 (0.0228)
Year 1996	-0.0220 (0.021)	0.0003 (0.0224)
Year 2002	0.0135 (0.0208)	0.0176 (0.0223)
Constant	-0.0021 (0.0130)	0.0383*** (0.0109)
N	67	67
R-Squared	0.8093	0.7805
Breush-Godfrey (p-value)	0.1636	0.2203
Standard errors in parentheses		
* significant at 10%, ** significant at 5%, *** significant at 1%		

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