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**FACTORS AFFECTING OFF-FARM INVESTMENT OF FARM HOUSEHOLDS: A LOGIT  
ANALYSIS**

**ASHOK K. MISHRA AND MITCHELL J. MOREHART**

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**Ashok K. Mishra  
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\* The authors are agricultural economists, Economic Research Service, U.S. Department of Agriculture, Washington D.C. The views expressed here are not necessarily those of the Economic Research Service or the U.S. Department of Agriculture.

### *Abstract*

This investigation considers factors affecting off-farm investment of farm households. A national farm level survey was used to evaluate the effects of various farm and operator characteristics on the likelihood of off-farm investment. Results suggest differences in level of education, age of the operator, off-farm income, household net worth, farm size, farm diversification, management skills, and location influence off-farm investment decisions.

*Key words:* off-farm investment, farm household, logit

# Factors Affecting Off-Farm Investment of Farm Households: A Logit Analysis

## Introduction

Risks are widespread in agriculture. Unexpected climatic, biological, economic, and political events pose hazards to the continued viability of farm and ranch businesses. In general there are three types of risk faced by farmers; (1) production risk; (2) financial risk; and (3) price risk (Barry, 1984). Identifying the sources of risk aids in the choice of appropriate adaptive management strategies. Typical response to risk has involved either reducing risks within the business or transferring the risk outside the business. Examples of reducing risks within the business include: effective diversification of several types of assets, crop insurance, organization flexibility, avoidance of high-risk enterprises, and holding liquid reserves of cash and credit.

Responses to marketing risk include inventory management and forward and future contracts. Participation in government programs may be a response to production or marketing risks, or both, depending on the program. Financial responses to risk reflect the firm's capacity to bear risks in production and marketing, and mostly involve the management of leverage and liquidity. Other responses may focus on transferring the risks outside the business --such as hedging, forward or futures contracts for commodities or farm inputs.

Yet another strategy, that has not received much attention, is investing in nonfarm financial assets. By holding a portfolio of farm and nonfarm assets, farm households can diversify risk. Lins and Hofing point out that farm managers spend less time studying off-farm investments. However, the 1995 *Survey of Consumer Finance (SCF)* shows that off-farm investment by farm households in various forms has increased in recent years. The average farm household possesses both liquid and fixed assets, with fixed assets occupying a larger share (almost 90%) of the total. We also know that, aside from the business, the farm dwelling is the prized durable in the farm household. The most important component of the farm business is

land. Others assets include farm machinery (tractor, combine, and other implements), land improvements, buildings, and livestock. The total assets of an average household increased from \$741,652 in 1992 to \$854,945<sup>1</sup> in 1995 (SCF, 1992; 1995, Table 1) or 15% in nominal terms. The average debt level (total liability) for an average farm household increased slightly from \$50,737 in 1992 to \$56,875 in 1995 (a 12 percent increase). However, with rising asset values the debt to asset ratio between the two years has remained approximately unchanged.

The data in Table 1 show that, liquid assets of the average farm household are primarily comprised of checking and saving deposits. Average total financial assets of an average farm household increased from \$104,272 to \$157,755, a 51% increase between 1992 and 1995. These data also indicate that more money in 1995 was invested in stocks, bonds, and individual retirement accounts (IRAs) than in 1992. There is also a significant increase in the amount saved in the form of CDs and mutual funds. Average non-financial assets of farm households increased by only 9% (up from \$637,380 in 1992 to \$697,191 in 1995) during the 1992-1995 period.

The deregulation of U.S. financial markets has afforded farmers additional investment opportunities. Investments selected by individual farmers/farm households will have important implications for their financial well-being, the availability of venture capital for economic development of rural areas, and the competitiveness of financial institutions in rural areas. Furthermore, farmers/managers need to know their investment (both farm and off-farm) portfolios because many of their financial decisions have ramifications for liquidity, retirement, solvency, taxation, and profitability management. Little is known about the farm, operator's household, and socio-economics characteristics that affect off-farm investments. The objective of this study is to identify factors that affect off-farm investments by farm households and to quantify their relative importance to off-farm investment decisions by farm households.

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<sup>1</sup> It should be pointed out that farm business, in the category of non-financial assets had the largest share. Farm business is defined as net equity if business were sold today plus value of personal assets used as collateral for a business loan.

## Background

The farm household maximizes expected utility by allocating initial wealth among competing investment alternatives. Farm households can invest in on-farm assets, such as land, machinery, and farm equipment, and off-farm assets (mostly financial assets) such as stocks, bonds, IRAs, CDs, and mutual funds (Figure 1). Penson concluded that investment in financial assets is an attractive means of diversification for many farmers. Bjornson and Innes point out that owners of agricultural assets have less diversified investment portfolios because farm assets are less correlated with systematic risks. They conclude that farmer-held assets tend to earn lower returns than comparable-risk nonagricultural assets. Robison and Barry show that new financial assets will substitute for each other if the covariance between asset returns is positive. Furthermore, asset diversification will continue to increase if either wealth or risk aversion increases.

Off-farm investment as such has not received much attention in the farm household literature. However, research has focused on efficient portfolios that generate the largest expected return for a given level of risk (Monke, Boehlje, and Pederson). Other researchers have analyzed various aspects of farm and nonfarm asset investment (Young and Barry; Irwin *et al.*; Moss *et al.*; Crisostomo and Featherstone; Weldon). Overall these studies conclude that off-farm financial diversification reduces exposure to risk. They also suggest that adding financial assets with higher levels of risk, but also higher expected returns can reduce overall risk associated with farm investments. Schnitkey and Lee conclude from their study that stocks and bonds reduced variability in farmland returns more effectively than Treasury bills. They also found a risk efficient portfolio should not have more than 50 percent of the value invested in farmland.

The literature provides the theoretical framework for risk efficient portfolios, but there has been limited research focusing on factors affecting investment in off-farm assets or type of

off-farm investments. LaDue *et al* in a survey study of New York producers found that gross income and age had a positive and negative significant effect, respectively, on farm reinvestments. However, it should be noted that their study did not consider off-farm investments by the producers. In another study, first of its kind, Gustafson and Chama identified the types of financial assets held by North Dakota farmers. They found that most respondents invested in liquid, low risk financial assets like savings and checking accounts and certificates of deposit. Further, approximately 31 percent of producers held investments in mutual funds, common stocks, and bonds.

The variables are defined in Table 2. The expected sign on age (OP\_AGE) is hypothesized to have a positive impact on off-farm investment. Young farmers are less risk averse and would be willing to take more risk by investing in risky investments (Young). Further, young farmers are more likely to take advantage of off-farm investment opportunities to increase wealth and expand their operation. On the other hand, older producers are more likely to disinvest and may even want to invest in accounts with greater liquidity. Producers with a higher level of education are more likely to study the complex investment markets (such as stocks, bonds, and mutual funds) and may feel more comfortable with these investments. Therefore, education (OP\_EDUC) is expected to have a positive effect on off-farm investment.

Household networth (HH\_NETW) is expected to have a positive impact on off-farm investment. It is assumed that a household/producer with greater equity would have greater financial resources to invest off-farm and may be more willing to invest in off-farm assets such as stocks, money market, and mutual funds. Almost 90 percent of farm households report off-farm income (OFF\_WORK). In this study farm households that received off-farm income in the form of wages and salaries are considered as working off the farm. Farm households that report off-farm income are expected to have a larger proportion of off-farm assets. The reasons being that many off-farm jobs have incentive savings in the form of join-contribution retirement



benefits and tax-deferred investments such as 401K plans as a part of the benefits package. Therefore, we expect a positive relationship between off-farm employment (OFF\_WORK) and off-farm investment.

The size of farming operation, as indicated by value of production (VAL\_PROD), is expected to have a positive effect on off-farm investment. Large-scale operations may have more capital available for off-farm investment than smaller farm operations. The U.S. farm sector consists of a highly diverse set of businesses and farm households committed to living in rural areas and engaging in farm economic activities. Since the early 1900's USDA analysts have sought to identify patterns in U.S. farming that might further the understanding of differences in financial performance of farms and the economic well-being of farm households.

The climatic, soil, water, and topographical characteristics of geographic areas tend to constrain the number and types of crops and livestock that are well adapted. County clusters, based on types of commodity produced, have shown that a few select commodities tend to dominate the production landscape of geographic areas that cut across traditional political boundaries. To more carefully capture differences among farms and farm households, two classifications of farms have been developed to reflect resource, economic, and demographic attributes of farms and geographic areas. The regions used in this study merge information about characteristics of land areas with information about types of commodity produced to generate geographic areas that, while cutting across state boundaries, are more homogenous with regard to both resource and production activities. Based on this classification 9 regions were identified and 8 are used in the regression (Mississippi Portal region was used as benchmark region).

Risks are widespread in agriculture (Barry). Risks impose additional costs on the farmer. Farmers will engage in adaptive management activities if they think that they will be compensated for the added costs. Farm diversification (FM\_DIVERS) is one way to reduce risk. In this study we use an entropy measure of farm diversification (FM\_DIVERS). FM\_DIVER

takes a value of 1 when a farm is completely diversified and 0 when a farm is specialized (Samuelson, 1967, Theil 1972). Thus, a negative relationship is hypothesized between FM\_DIVERS and off-farm investment. If producers are using farm diversification as a response to risk, then the likelihood to invest off the farm is reduced. Additionally, farm diversification may require more capital/resources. Finally, it is our notion that management skills have some effect on off-farm investments. However, the effect of management skill on off-farm investment is unclear. Management skill could have a positive impact on off-farm investment because better managers may be more willing to explore off-farm investment opportunities to reduce income variability. On the other hand, good managers may view agricultural investments as providing high returns. In this study farmers who kept written records on income and expenditures are considered better managers (REC\_MGMT).

## **Data**

Data for the analysis are from the 1996 Agricultural Resource Management Study (ARMS, formerly known as Farm Costs and Return Survey (FCRS)). ARMS is conducted annually by the Economic Research Service and the National Agricultural Statistics Service. The survey collects data to measure the financial condition (farm income, expenses, assets, and debts) and operating characteristics of farm businesses, the cost of producing agricultural commodities, and the well-being of farm operator households.

The target population in the survey is operators associated with farm businesses representing agricultural production across the United States. A farm is defined as an establishment that sold or normally would have sold at least \$1,000 of agricultural products during the year. Farms can be organized as proprietorships, partnerships, family corporations, nonfamily corporations, or cooperatives. Data are collected from one operator per farm, the senior farm operator. A senior farm operator is the operator who makes most of the day-to-day management decisions. For the purpose of this study, operator households organized as nonfamily corporations or cooperatives were excluded.

The 1996 ARMS survey collected information on farm households in addition to information collected through the regular survey. It contains detailed information on off-farm hours worked by spouses and farm operators. The amount of money received from off-farm work, net cash income from operating another farm/ranch, net cash income from operating another business, and net income from share renting. Furthermore, income received from other sources such as disability, social security, and unemployment payments, and gross income from interest and dividends is counted. The section also contains information on farm household expenditures, risk preference measurement, financial difficulties faced by farm households and use of risk management strategies, such as contracting, credit reserves, and futures and options.

Summary statistics of each of the variables utilized in the analysis are presented in Table 2. Approximately 61% of the farm households received dividends from off-farm investments. The average age of the senior farm operator in the household was 54 years with thirteen years of education. Forty two percent of farm households had off-farm income with average earnings of \$26,100. The average household reported a net worth of \$525,000 with \$107,780 in non-farm assets. The 1996 ARMS data shows that average total household income was \$47,129 and average gross farm income was \$75,800. Finally, 49% of the producers reported keeping written records (general ledger and personal income record) of income and expenditures on farming operations.

## **Results**

The estimated logit model (equation 4), significance tests, estimated changes in probability, goodness-of-fit measure, and in-sample prediction for the probability of off-farm investment by farm households are presented in Table 3. The likelihood ratio (LR) chi-square statistic ( $-2 \text{ Log } L$ ), which tests the joint significance of the independent variables included in the model, is significant at the 1% level of significance.

The coefficients of operators' education (OP\_EDUC) and age (OP\_AGE) have the expected sign and are statistically significant at the 1% level of significance. Results suggest that producers with a higher level of education are more likely to invest in off-farm opportunities. The marginal effect (0.017) indicates that an additional year of schooling would increase the likelihood of off-farm investment by 1.7%. Results also indicate that the impact of age on off-farm investment is small (marginal effect =0.004). The life-cycle theory of investment implies that investment should increase with age up to that age where farmers start to consider retirement in their planning and then investment should decline. Our finding is consistent with the theory.

As expected, farm households that have off-farm income are more likely to invest off the farm. The marginal effect (0.022) indicates that households with off-farm income are much more likely to invest in off-farm opportunities, *ceteris paribus*. One factor that possibly explains this behavior is that many off-farm jobs have some fringe benefits that provide incentives for investments in plans like 401K, IRA, and other tax-deferred savings plan. The coefficients on household net worth (HH\_NETW) and value of agricultural production (VAL\_PROD), a proxy for farm size, are positive and statistically significant at the 5% and 1% level of significance, respectively. However, their marginal effect is very small. Results suggest that households with more equity are more likely to invest off the farm. Likewise, larger farms are more likely to invest off the farm.

Farm diversification is one way to spread risk and stabilize income. The coefficient on farm diversification (FM\_DIVERS) is negative and statistically significant at the 1% level of significance. Results suggest that producers who spread risk through farm diversification are less likely to invest off the farm. The marginal effect (-0.035) indicates that farmers who diversify in farming operations (i.e., farm diversification) are less likely to invest in off-farm opportunities, *ceteris paribus*. This is in accordance with the fact that if the producer uses funds to diversify the farming operation, there is less likelihood that a producer will have funds available for off-farm investment. The coefficient on management skills (REC\_MGMT) is positive and statistically significant at the 1% level of significance. The relatively large marginal effect (0.097) indicates that better managers are much more likely to invest in off-farm opportunities, *ceteris paribus*. A possible explanation for this is that better producers/managers who keep track of their income and expenditures from farming operations have better control of their money/funds. Further, in order to reduce income variability better managers are more willing to study off-farm investment opportunities. Finally, results show regional differences in off-farm investment behavior. Farm households located in the Heartland, Northern Great Plains, and Basin and Range regions are less

likely to invest off the farm when compared to, the benchmark, Mississippi Portal region. On the other hand, farm households located in the Prairie Gateway and Southern Seaboard are more likely to invest in off-farm opportunities when compared to the benchmark Mississippi Portal region.

## **Conclusions**

The purpose of this study was to investigate factors that affect off-farm investment of farm households. A logit analysis was used on the data from the 1996 ARMS survey to analyze the effect of various farm, operator, and regional characteristics on off-farm investment decisions by farm households. Operators' level of education and age had expected positive signs and were significant in explaining off-farm investment decisions. Household net worth, farm size, and off-farm involvement had expected positive effects on off-farm investment. In the case of farm size, results suggest that large farms are more likely to be financially diversified than small farms. Results suggest that increased farm diversification reduced the likelihood of off-farm investment by farm households. Better managers are more likely to invest off the farm. Finally, farm household located in the Heartland, Northern Great Plains, and Basin and Range regions are less likely to invest in off-farm opportunities. On the other hand, farm households located in the Prairie Gateway and Southern Seaboard are more likely to invest off the farm.

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**Table 1: Financial Characteristics of Farm Families in the U.S., 1992 and 1995**

Item	1992	1995
Average farm acres	275	265
Av. Hours worked per week on the farm	44	46
Av. Gross farm sales	68,097	74,453
Av. Net farm income	23,022	17,015
Av. Total assets	741,652	854,945
Av. Total financial assets	104,272	157,755
Checking and savings account	27,063	18,531
CDs	3,271	9,937
Mutual funds	6,820	12,612
Stocks	16,918	34,159
Bonds	15,035	32,485
IRAs	10,954	21,880
Saving bonds	514	2,013
Cash value of life insurance	8,303	9,195
Other financial assets	15,392	16,941
Av. Non-financial assets	637,380	697,191
Vehicles	18,273	17,316
Dwelling	98,522	58,348
Farm Business	441,888	512,035
Other	4,834	4,092
Av. Total liabilities	50,737	56,875
Housing debt	35,150	25,644
Other lines of credit	34	2,719
Other real estate debt	9,153	21,253
Credit card	1,347	556
Installment loans	3,669	6,057
Other debt	1,385	645
Av. Net-worth	690,915	798,070
Debt/Asset ratio	0.068	0.066
Number of farm households	368	423

Source: Calculated from the *Survey of Consumer Finances*, 1992 and 1995. The data in these survey are generally collected for the preceding year.

**Table 2: Variable Definition and Summary Statistics of Variables used in Logit Regression**

Variable	Description	Mean	Standard Deviation
<i>Operator/Household Characteristics</i>			
OP_EDUC	Farm operators' education level	13.0	1.82
OP_AGE	Operators' age	54.26	13.86
WORK_OFF	Off-farm income (=1 if the household receives income from off-farm employment through wages and salaries)	0.42	0.49
HH_NETW	Farm households' net worth (includes both farm and non-farm network, 000 dollars)	525.0	1054.50
<i>Farm Characteristics</i>			
VAL_PROD	Value of agricultural production sold by the farm (000 dollars)	79.35	231.0
FM_DIVERS	Entropy measure of farm diversification	0.15	0.14
REC_MGMT	Management indicator (=1 if the farm kept record on income and expenditures, 0 otherwise)	0.49	0.50
<i>Region</i>			
H_LAND	=1 if the farm is located in the Heartland region, 0 otherwise	0.13	0.33
N_CRESENT	=1 if the farm is located in the Northern Crescent region, 0 otherwise	0.10	0.29
N_GREATP	=1 if the farm is located in the Northern Great Plains region, 0 otherwise	0.04	0.19
P_GATE	=1 if the farm is located in the Prairie Gateway region, 0 otherwise	0.13	0.28
E_UPLAND	=1 if the farm is located in the Eastern Upland region, 0 otherwise	0.08	0.29
S_SBOARD	=1 if the farm is located in the Southern Seaboard region, 0 otherwise	0.09	0.32
F_RIM	=1 if the farm is located in the Fruitful Rim region, 0 otherwise	0.06	0.24
B_RANGE	=1 if the farm is located in the Basin and Range region, 0 otherwise	0.05	0.20
OF_INVEST	Farm household investing in off-farm opportunities (=1 if the household received dividends, 0 otherwise)	0.61	0.49
<i>Sample Size</i>			3,993

Source: 1996 Agricultural Resource Management Study (ARMS), ERS, USDA

**Table 3: Logit Regression Results for Off-Farm Investment Decisions by Farm Households**

<b>Explanatory Variables</b>	<b>Parameter Estimate (Std. Error)</b>	<b>Change in Probabilities</b>
Intercept	-3.366 (0.027)***	--
OP_EDUC	0.125 (0.001)***	0.017
OP_AGE	0.029 (0.003)***	0.004
AGE_SQE	-0.0001 (0.008) x 10 <sup>-4</sup> ***	0.0001
WORK_OFF	0.089 (0.004)***	0.022
HH_NETW	0.001 (0.0006) x 10 <sup>-4</sup> ***	0.0002
VAL_PROD	0.0001 (0.00001) ***	0.0001
FM_DIVERS	-0.158 (0.013)***	-0.035
REC_MGMT	0.391 (0.004)***	0.097
H_LAND	-0.356 (0.109)**	-0.089
N_CRESENT	0.024 (0.124)	0.006
N_GREATP	-0.332 (0.173)**	-0.083
P_GATE	0.639 (0.006)***	0.159
E_UPLAND	0.097 (0.127)	0.024
S_SBOARD	0.209 (0.118)*	0.052
F_RIM	-0.221 (0.146)	-0.055
B_RANGE	-0.232 (0.009)***	-0.058
<b>Log Likelihood ratio(LR)=[-2LogL]</b>		<b>230.11***</b>
<b>Correct Predictions (%)</b>		<b>66.23</b>

Numbers in parenthesis are the standard errors. Single, Double and Triple asterisks indicate statistical significance at 10, 5, and 1 percent level. Source: 1996 Agricultural Resource Management Study (ARMS), ERS, USDA.