United States
Department
of Agriculture

Economic
Research
Service

Economic
Research
Report
Number 36

Off-Farm Income, Technology Adoption, and Farm Economic Performance

Jorge Fernandez-Cornejo, with contributions from Ashok Mishra, Richard Nehring, Chad Hendricks, Malaya Southern and Alexandra Gregory

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National Agricultural Library Cataloging Record

Off-farm income, farm economic performance, and technology adoption.
(Economic research report (United States. Dept. of Agriculture.
Economic Research Service) ; no. 36)
1. Farm income—United States.
2. Farmers—Time management—United States.
3. Part-time farming—Economic aspects—United States.
4. Agricultural innovations—Economic aspects—United States.
5. Farms, Size of—Economic aspects—United States.
I. Fernandez-Cornejo, Jorge.
II. United States. Dept. of Agriculture. Economic Research Service. III. Title.

HD4966.F32

Photo credit: Bruce Fritz, USDA/ARS.

United States Department of Agriculture

Economic Research Report Number 36

January 2007

A Report from the Economic Research Service

www.ers.usda.gov

Off-Farm Income, Technology Adoption, and Farm Economic Performance

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Abstract

The economic well-being of most U.S. farm households depends on income from both onfarm and off-farm activities. Consequently, for many farm households, economic decisions (including technology adoption and other production decisions) are likely to be shaped by the allocation of managerial time among such activities. While time allocation decisions are usually not measured directly, we observe the outcomes of such decisions, such as onfarm and off-farm income. This report finds that a farm operator's off-farm employment and off-farm income vary inversely with the size of the farm. Operators of smaller farm operations improve their economic performance by compensating for the scale disadvantages of their farm business with more off-farm involvement. Off-farm work reduces farm-level technical efficiency, but increases household-level technical efficiency. And adoption of agricultural innovations that save managerial time is associated with higher off-farm income.

Keywords: Off-farm income, farm households, economic performance, managerial time, scale economies, scope economies, technical efficiency, technology adoption, farm size.

Acknowledgments

The authors thank James MacDonald, Keith Wiebe, Dayton Lambert, Carol Jones, and Utpal Vasavada, ERS, for the helpful comments provided on earlier drafts of the report. We also thank James Hrubovcak from the Office of the Chief Economist, Jane Schuchardt from the Cooperative State Research, Education and Extension Service, Bruce Gardner from the University of Maryland, and an anonymous reviewer. Finally, we are very grateful to Dale Simms for his valuable and prompt editorial assistance and Anne Pearl for cover design and document layout.

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Summary

U.S. farmers must make a host of decisions relating to their farms' operation, including what to grow, when to grow it, in what quantities, and by what methods. Often overlooked in this calculation, but factoring heavily in the diversity of U.S. farms and farm households, is the fact that most operators split their time between farm and nonfarm activities. Large farms are typically able to economize on inputs and better coordinate stages of production. Smaller farms, though often unprofitable from a farm business perspective, have endured by being part of household enterprises that combine farm and off-farm activities. Their operators' onfarm decisions, from choice of technology to choice of specialty, are often influenced by off-farm commitments and income.

What Is the Issue?

Onfarm and off-farm activities compete for limited managerial time (mainly of the operator and spouse). How farm operator households allocate their time largely affects production decisions (such as technology adoption), economic performance, and the household's economic well-being.

The extent of off-farm work and its relationship with farm economic performance may have important policy implications. For example, government policies for agriculture (via conservation, research and development, extension, and commodity programs) may affect farm households differently, depending on the relative importance of onfarm versus off-farm income. And the effectiveness of policies promoting adoption of farm technologies might be improved by taking into account the different demands on managerial time and the relative ability of the farm household to accommodate those demands.

What Did the Study Find?

Operators of smaller farms typically participate more in off-farm employment, work more hours off the farm, and have higher off-farm income than operators of larger farms. In 2004, farm households with farm sales less than $10,000 had average off-farm earned income of $54,600, while households with farm sales of $500,000 – $1 million averaged only $30,100. More than 58 percent of operators with farm sales less than $10,000 reported off-farm hours worked in 2004, versus less than 20 percent for operators of farms with sales of $500,000-$1 million.

As previous studies have shown, **off-farm work is less likely on farms with labor-intensive enterprises** such as dairy. Moreover, dairy farmers who do work off the farm tend to require higher compensation to do so than farmers producing other commodities. Off-farm work has also been shown to be positively related to urban proximity and to the education and experience of the operator and spouse.

Including off-farm income-generating activities improves the overall economic performance of the farm household. Off-farm income clearly adds to total household income, but it can also improve efficiency and other

measures of performance of the farm household. Our estimates for corn and soybean farms show that households engaged in off-farm income-generating activities together with the production of traditional farm outputs have cost savings of 24 percent relative to carrying out those activities separately. The savings likely arise from the sharing of managerial expertise (and its many components, such as accounting and information processing skills, sales expertise, administrative and technical know-how, etc.) between onfarm and off-farm activities. For example, management skills acquired in farming might be applicable to (and shared with) a nonfarm business, and vice-versa.

From a farm business perspective, operators of smaller farms have a greater **incentive to expand**. However, from a household perspective (including off-farm income-generating activities), operators of small farms have a reduced tendency to increase their farm size.

Large farms are generally more efficient than smaller farms in transforming farm inputs into outputs, given the technology at their disposal. But focusing on farm inputs and outputs alone is misleading because off-farm income-generating activities are increasingly important in determining economic performance of the farm household.

When off-farm activities are included, farm household-level efficiencies are higher than farm-level efficiencies across all farm sizes, and efficiency gains from integrating off-farm work into the output portfolio are relatively greatest for smaller farms. As a result, household-level efficiencies of smaller farms are comparable to farm-level efficiencies of larger farms. This suggests that households operating small farms have partially adapted to shortfalls in farm-level performance by increasing their off-farm income.

In addition to its links with the farm business, as traditionally examined, farmers' technology choices are closely related to off-farm income. Higher off-farm income is significantly related to the adoption of technologies that economize on management time (management saving such as herbicide-tolerant crops, conservation tillage). For example, a 16-percent increase in off-farm household income is associated with a 10-percent increase in the probability of adopting herbicide-tolerant (HT) soybeans. Household income from onfarm sources is not significantly associated with adoption of these technologies, but total household income (including income from off-farm sources) is. On the other hand, lower off-farm income is significantly related to adoption of managerially intensive technologies (such as precision farming). For example, an 8-percent decrease in off-farm income is associated with a 10-percent increase in the probability of adopting yield monitors, a key component of precision agriculture. These findings corroborate a tradeoff between household/operator time spent in onfarm and off-farm activities. Households operating small farms devote more time to off-farm opportunities and are more likely to adopt management-saving technologies.

How Was the Study Conducted?

To examine the relationships between off-farm income, farm and household characteristics, and economic performance of U.S. farm households, we developed econometric models and estimated them using USDA's Agricultural Resource Management Survey (ARMS) data for several years (1996-2001). To examine the relationship between off-farm work and economic performance of farm households (including economies of scale and scope, and economic efficiency), we compared estimates obtained using traditional farm-level models to estimates obtained using household-level models (including off-farm income-generating activities along with traditional farm outputs such as crops and livestock). To examine the relationship between off-farm income and technology adoption, we developed a model that incorporates the adoption decision into the agricultural household framework. We examined the interaction of off-farm work and adoption of agricultural technologies of varying managerial intensity, including herbicide-tolerant crops, precision agriculture, conservation tillage, and Bt (*Bacillus thuringiensis)* corn, after controlling for other factors.