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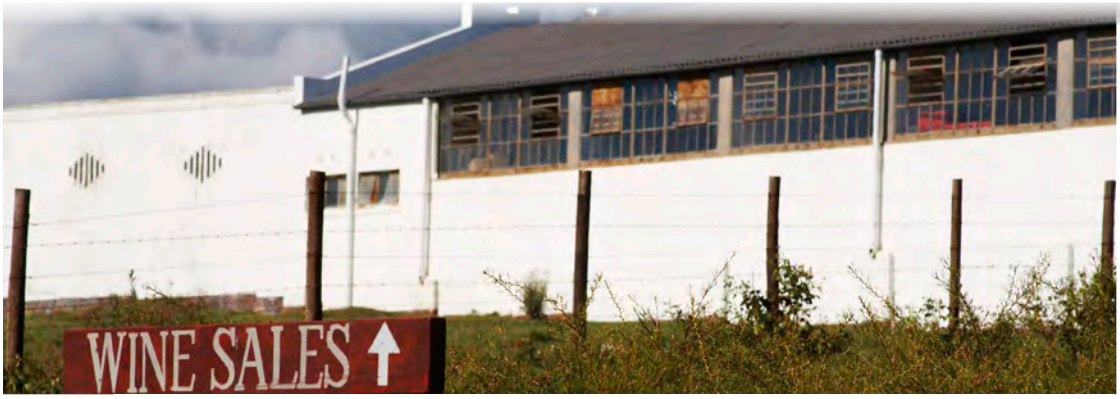

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A Report from the Economic Research Service

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Farm Activities Associated With Rural Development Initiatives

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Abstract

Since 2002, USDA's Rural Business and Industry (B&I) Loan Guarantee program has increased its emphasis on farm-related business activities associated with renewable energy, local/regional food, and value-added agriculture. Other new programs and program modifications also have focused on these and other farm activities and related industries, including the use of farm and ranch natural resources. This trend represents a relatively new direction for USDA's Rural Development programs, which have historically focused on nonfarm-related business. This report improves our understanding of the farm and farmer characteristics that may influence farm operator involvement in development-related activities, specifically by focusing on five farm activities: organic farming, value-added agriculture, direct marketing, agritourism, and energy/electricity production. The findings are based on descriptive data from USDA's 2007 Agricultural Resource Management Survey (ARMS) and estimates from logit models used to identify statistically significant factors associated with involvement in certain farm activities.

Keywords: Rural development, regional foods, local foods, direct marketing, organic farming, agritourism, value-added agriculture, renewable energy, electricity

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Contents

Summary

What Is the Issue?

Over the last 10 years, several USDA Rural Development programs, including the Business and Industry (B&I) Loan Guarantee program, have put increased emphasis on funding farm-related business activities associated with renewable energy, local/regional food industries, and the use of farm and ranch natural resources. In this study, we identified five farm activities: organic production; value-added agriculture (activities that add value to a farm product or service, such as the production of jam, jelly, wine, or cheese); direct marketing to consumers; agritourism; and renewable energy/electricity production. We examined farm and farm operator characteristics to explore factors that may be related to a farmer's decision to participate in these activities.

Previous research provided some information about specific farm activities, but it varied from one activity to another and mostly offered descriptive information with no attempt to identify factors that play an independent and statistically significant role in farm (and farmer) activities. This report represents an opportunity to gain a better understanding of the five types of farms that provide a product or perform a function related to USDA's recent rural development initiatives.

What Did the Study Find?

Farms whose owners pursue activities associated with rural development policy initiatives tended to differ from others in terms of several farm and farm operator characteristics, including farm size, net farm income, household income and net worth, and geographic location. For example:

- Farm operators involved with most of these activities were, on average, better educated, better advised, and had greater access to the Internet.
- Among the five activities evaluated, average farm household net worth was highest for agritourism farms ($2.0 million) and lowest for direct marketing farms ($631,000). Total household income was highest for energy/electricity farms ($164,000 annually) and lowest for direct marketing ($71,000 annually), on average.
- While a substantial percentage (39-60 percent) of the farms involved in these five farm activities qualify as rural residence farms, a higher percentage (65 percent) of all other farms fall into this rural residence farm category.
- Farms that focused on agritourism and energy/electricity production were typically larger in size, while direct marketing farms averaged fewer acres.
- Farm operator age and education, family net worth, farm size, farm ownership characteristics, farmland use and practices, farm typology, geographic location, farm management advice, and Internet access contribute to farmer involvement in one or more of the onfarm rural development activities.

- A rural or urban setting is statistically related to farmer involvement only in the direct marketing activity and not in the other onfarm activities studied.

While this study did not attempt to evaluate the costs and benefits to society resulting from growth in these farm-related activities, the findings may still have policy relevance. Public- and private-sector initiatives may have some influence on education, farm management advice, and Internet availability, all of which were found to be significantly related to the farm activities studied. The findings also indicate the types and location of farms engaged in one or more of the five farm activities covered in this report, or that would most likely be receptive to involvement if incentives were provided to do so.

How Was the Study Conducted?

Our data were based on USDA's 2007 Agricultural Resource Management Survey (ARMS), conducted jointly by the Economic Research Service (ERS) and the National Agricultural Statistics Service (NASS) and on the 2007 Census of Agriculture, conducted by USDA/NASS. ARMS collected data from 18,709 U.S. farms and identified farms involved in farm activities associated with local/regional foods, renewable energy, and other rural development emphases. These data provided descriptive information about farm and farm operator characteristics. A logit analysis identified characteristics and locations that were independently and significantly related to farmer involvement in each of the activities studied. Data on farm location, reflecting the geographic region and urban/rural characteristics of the county in which each farm is located, came from the decennial U.S. Census and other related sources.

Introduction

In this report, we examine several types of U.S. farms involved in economic activities that recently have been given special consideration in Federal rural development policies. These farms included those participating in organic farming, value-added agriculture (activities that add value to a farm product or service, such as the production of honey, wine, or cheese), and direct marketing—all of which contribute to the local/regional foods industry. Other farm types, including farms that produce energy or electricity and farms that provide agritourism,[1] are also of interest to USDA's Rural Development programs.

The local and regional foods industry has been the subject of several recent research projects, including studies by ERS. The most comprehensive study, *Local Food Systems: Concepts, Impacts, and Issues* (Martinez et al., 2010), includes a thorough review of local foods industry literature, including claims made regarding associated health, energy savings, and economic benefits from locally grown foods. Other recent ERS studies examined organic farming (Green et al., 2009) and agritourism (Brown and Reeder, 2007).[2] A 2011 report (Low and Vogel, 2011) examined farmer direct sales, including sales to local intermediaries, and provided a county-level econometric analysis of factors affecting direct sales levels. In addition, the findings of a 2009 survey of onfarm renewable energy production were recently published and provided additional support for our research (USDA/NASS, 2011). While we do not systematically restate the findings of these studies, we provide a list of selected research on each type of activity in the appendix (see appendix table 3). Our study is meant to complement previous research with a comprehensive descriptive analysis of farms involved in a select group of rural development-related onfarm activities and an econometric analysis that identifies factors associated with farmer involvement in each of these activities.

Recent USDA Rural Development Program and Policy Changes

Traditionally, most rural development programs in the United States have focused on the nonfarm economy, where most rural employees work.[3] Farm-related development benefited from only a few relatively small USDA Rural Development programs.[4] Several recent changes in USDA's Rural Development programs, most notably those involving treatment of renewable energy and the local/regional foods industries, have increased the focus on farm-related rural development.

The Farm Security Act of 2002 (the 2002 Farm Act) reauthorized the Nation's farm programs, and several new provisions were added to encourage more value-added agricultural production.[5] Rules were liberalized to allow value-added producers, firms, and cooperatives greater participation in the USDA Rural Development Rural Business and Industry (B&I) Loan Guarantee Program. Onfarm renewable energy systems, such as wind energy and anaerobic digesters, became eligible for B&I loans, and value-added agricultural businesses were made eligible to receive Rural Business Enterprise Grants.

[1]Farm-based recreation refers to a wide variety of onfarm recreational and entertainment-related activities, including hunting, fishing, petting zoos, horseback riding, and onfarm rodeos.

[2]For more information, see the ERS briefing room on Organic Agriculture http://www.ers.usda.gov/Briefing/Organic/.

[3]Between 1950 and 2000, total U.S. farm employment (including self-employed) dropped from about 8 million to 4 million (Torgerson, 2003, p. 49). As of 2007, 5.9 percent (1.5 million) of rural (nonmetropolitan) workers were employed in agriculture, with a somewhat smaller share of workers employed in closely related industries, such as agricultural services, processing, marketing, and inputs (USDA/ERS, 2009).

[4]For example, the Farm Labor Housing Loans and Grants program and the Rural Cooperative Development Grant program (established in 1990).

[5]In this section, the material covering the 2002 and 2008 farm acts was obtained from http://www.ers.usda.gov/FarmBill/2008/.

In the same legislation, the Value-Added Agricultural Product Marketing Development Grants pilot program that received some funding in 2001 was expanded and provided with annual funding. The 2002 Farm Act liberalized this program's eligibility provisions to increase farm participation and also contained provisions that benefited organic agriculture.[6]

The 2002 Farm Act also included several new or expanded programs promoting greater production and use of renewable energy: a competitive grant program to support the development of biorefineries; a renewable energy system and energy efficiency improvement loan program; and a biomass research and development program. These programs are administered by USDA Rural Development.

In the Food, Conservation, and Energy Act of 2008 (the 2008 Farm Act), more farm-related changes were made in the B&I program, giving special consideration to locally or regionally produced food projects with components benefiting underserved communities. At the same time, new provisions were made to facilitate the sale and use of renewable energy, and the renewable energy programs were modified, expanded, and extended. In addition, several new multi-State regional development commissions were authorized; the projects eligible for funding included renewable energy systems, recreation and tourism, resource conservation, and the preservation of open spaces. Farm-based recreation was promoted by the newly created Voluntary Public Access and Habitat Incentive Program (VPA-HIP).

This legislation also modified the value-added agricultural product market development grant program. The program allows funding for projects developing mid-tier food chains, which are local/regional supply networks that link independent producers with businesses and cooperatives that market value-added agricultural products. Funding priority was given to projects that increased opportunities for operators of small and medium farms and ranches structured as "family farms."[7] A portion of the funding was allocated specifically for beginning or socially disadvantaged farmers and ranchers. The 2008 Farm Act did not include any provisions for organic production in the Rural Development title, but it did provide organic provisions in six other titles and increased mandatory funding for organic research.[8]

Subsequent Rural Development policy initiatives—agency activities that typically use discretionary authority over existing programs to target assistance to achieve specific objectives—have also provided assistance to the farm-related business activities examined here. Most of these initiatives can be separated into two categories: farmer and food initiatives and regional innovation initiatives.

The farmer and food initiatives are not specific to Rural Development but include other agencies inside and outside USDA. For example, USDA's Know Your Farmer, Know Your Food (KYF2) aims to expand local and regional food systems, using Rural Development programs as well as other programs, such as those that support farmers markets, to achieve its objectives.

USDA's Rural Development mission area recently began two regional innovation initiatives: the Great Regions initiative and the Stronger Economies Together (SET) initiative. The Great Regions initiative makes use of the

[6]The organic provisions were part of the Miscellaneous Title of the legislation (USDA/ERS, January 2008).

[7]Family farms are farms in which ownership and control of the farm business is held by a family of individuals related by blood, marriage, or adoption.

[8]For more information on the National Organic Program, see http://www.ams.usda.gov/AMSv1.0/nop/.

existing Rural Business Opportunity Grants (RBOG) program to target intermediaries (nonprofits, tribes, etc.) that provide assistance to development strategies employing regional approaches to rural development objectives, with special consideration given to five USDA priority themes, including renewable energy and local/regional food systems.[9] The SET initiative encourages communities to use regional, collaborative approaches and shared assets to stimulate regional economic growth. The SET offers technical assistance by four USDA Regional Rural Development Centers that may benefit the farm-related activities examined here.

USDA is also involved in other regional initiatives, including the Partnership for Sustainable Communities (PSC)[10] and the Jobs and Innovation Accelerator Challenge (JIAC).[11] Although these initiatives do not focus specifically on agriculture or any other particular industry, both the renewable energy and local/regional foods industries might, in theory, benefit from them.

Another new multi-agency initiative promotes agritourism. America's Great Outdoors Initiative, undertaken jointly by USDA, the U.S. Department of the Interior, the U.S. Environmental Protection Agency, and the Council of Environmental Quality, emphasizes, "…bringing together farmers and ranchers, land trusts, recreation and conservation groups, sportsmen, community park groups, governments and industry, and people from all over the country to develop new partnerships and innovative programs to protect and restore our outdoors legacy" (White House, 2010). First among the initiative's goals is to "reconnect Americans, especially children, to America's rivers and waterways, landscapes of national significance, ranches, farms and forests, great parks, and coasts and beaches…" The VPA-HIP program provides a direct funding mechanism to support this initiative.

The Organization of This Study

Because these farm-related rural development initiatives are relatively recent, it may be helpful to gain a better understanding of the five types of farm activities that play an important role in local/regional foods, renewable energy industries, and other farm-related industries:

- Organic farming,
- Value-added processing,
- Direct marketing to the consumers,
- Agritourism, and
- Renewable energy/electricity production.

The first three farm activities may involve the local/regional foods industry, to the extent that they are concerned with the production and sale of farm products to consumers within local or regional markets. Agritourism capitalizes on the natural resources and amenities available on farms and ranches. The fifth activity involves farms that produce energy or electricity from renewable energy sources, such as the sun, wind, and methane.[12]

[9]The other three priority themes include broadband and other infrastructure to help entrepreneurs and expand markets, access to capital, and innovative use of natural resources.

[10]PSC is an interagency partnership with the U.S. Department of Housing and Urban Development, U.S. Department of Transportation, and U.S. Environmental Protection Agency.

[11]JIAC is a multi-agency program funded by the U.S. Small Business Administration; the U.S. Department of Commerce's Economic Development Administration, National Institute of Standards and Technology, and Minority Business Development Agency; the International Trade Administration; U.S. Department of Labor; U.S. Department of Agriculture; U.S. Department of Defense; U.S. Department of Energy; U.S. Environmental Protection Agency; U.S. Department of Health and Human Services; U.S. Department of Housing and Urban Development; U.S. National Science Foundation; and U.S. Department of the Treasury.

[12]Farms that produce commodities for biofuels, such as ethanol, or sell crops or feedstock to companies that actually produce such biofuels at their industrial locations, were excluded because farmers themselves do not produce energy/electricity onfarm.

Our main objective is to present descriptive data from the 2007 Agricultural Resource Management Survey (ARMS) and provide a profile of the economic, geographic, and individual characteristics of the average farm or farmer involved in one or more of these targeted activities, as well as to make comparisons with farms not involved in any of these activities.[13] The purpose of this comparative analysis, and of the subsequent econometric analysis, is to gain insight into the unique characteristics of farms and farm operators that provide each kind of onfarm rural-development-related activity.

Although other farm-related activities could have been included in this study, we restricted our research to farmers who might have a pivotal role in the growth and innovation taking place in local/regional foods, recreation, and renewable energy industries. For example, we included farmers who produced renewable energy (such as those operating wind-generated electricity equipment) but excluded farmers who merely provided inputs (land, labor, capital, or crops) to those who produced the energy. In a similar fashion, we included farmers who operated agritourism activities on their farms, but excluded farmers who merely leased part of their farms to other organizations that undertook these activities.[14] We assumed that the farms and farmers who initiated these activities were, in some sense, unique, and that a better understanding of their behavior might be useful.

We included organic producers in our analysis because of their relationship with local/regional foods industries. Organic foods are sold in national and international markets as well as in local/regional foods markets. Although current data sources did not allow for us to say how much of this product is sold to consumers in local and regional markets, a 2004 ERS report concluded that "the demand for organic products is substantial and growing in many U.S. farmers' markets" and that this type of local/regional food market represents an important marketing outlet for many organic farmers (Kremen et al., 2004). We also included organic producers because organic foods have been covered in a number of special provisions in recent farm legislation, gaining the interest of USDA and Rural Development.

We examined farmers who produce value-added items, such as processed food, because of consumer interest in the many processed food items—ranging from wine to jelly—that are produced locally or regionally. Value-added agriculture also has received special consideration in recent farm legislation.

[13]When this report was first prepared, the 2007 ARMS data were the most current data available. We considered updating the analysis when the 2008 data became available, but the number of survey responses for our five farm categories was significantly higher in 2007 than in 2008 (only 83 farms involved in renewable energy/electricity production in 2008, and the number of agritourism farms dropped 362 to 195), making the 2007 data better for our analysis. We considered aggregating the data for the 2 years, but ruled this out because some of the key explanatory variables used in the logit analysis were not available in 2008. The number of renewable energy/electricity farms was only 121 in 2009, and this survey question was not asked in 2010. The survey question about value-added activity was ambiguous in the 2009 ARMS questionnaire and was not asked in 2010.

[14]This study also excluded off-farm activities by farmers or their families, because we were mainly interested in activities directly related to the farm.

Comparative Analysis

In this section, we present descriptive information on the farms and farm operators engaged in the onfarm rural development-related activities examined in this study, using data from the 2007 ARMS. The data we use are based on survey responses from 18,709 farms, representing about 2.2 million farms nationwide. (For more information about how the survey was conducted, see the appendix box, "Brief Description of ARMS Data.")

Identifying Farm Types

Before we can compare one farm type with another, we must first understand how the ARMS questions identified farms that fit our five categories. If the response to the survey question indicated that any amount of the specified activity was performed, then the farm was classified as that farm type. The questions used for this identification process are presented in the box, "2007 ARMS Questions Used To Identify the Five Farm Types," p. 6.

The language of these questions was particularly important when considering which farms to include. Most of the ARMS questions used in this report were fairly broad in scope. For researchers and policymakers who have a more narrow focus, this may be a potential drawback.

For example, the 2007 ARMS organic foods question asked if the farmer produced foods that met the official National Organic Standards definition of organic foods. This broad scope question resulted in a larger sample of organic producers than we would have seen if the survey asked which farmers had an official organic certification.[15] Consequently, researchers interested only in certified organic farmers may wish to examine other data.

The value-added question was also broad, including both food and nonfood items (e.g., floral arrangements). Researchers focused on value-added food items will require a more targeted question for their purposes.

Similarly, the agritourism question covered a wide variety of activities, ranging from hay rides to hunting and fishing. In some parts of the country, agritourism focuses on specific activities, so our analysis may appear overly broad. Additionally, farms that only sold food items to their visitors (e.g., pick-your-own operations) and did not offer other forms of recreation or entertainment would not be counted as agritourism providers. Such specialized agritourism operations would be identified in our study as direct marketers. Nevertheless, many agritourism farms providing recreational activities, such as hunting and fishing, often sell fruits and vegetables as well as value-added food items to visitors. These farms would be included in our study as agritourism farms, as direct marketing farms, and as value-added farms. In other words, a farm can be identified as more than one farm type in this study.

The question on renewable energy explicitly included farms generating power through methane digesters, wind and solar technologies, and some other possible (unspecified) sources. This ambiguity produced a significantly larger number of farms than what was obtained in a more recent NASS survey that

[15]The 2007 Census of Agriculture used a similar question to that found in the 2007 ARMS, yielding a total of 20,437 self-identified organic producers in that year. However, the 2008 Census follow-up Organic Production Survey counted 14,540 farms that were legally certified (or exempt) organic farms (http://www.agcensus.usda.gov/).

2007 ARMS Questions Used To Identify the Five Farm Types

Organic Farms

Question: Did this operation produce organic products (according to the National Organic Standards) for sale in 2007?

Farms responding affirmatively to this question were identified as organic farms.

Value-Added Farms

Question: At any time during 2007, did this operation produce and sell value-added crops, livestock, or products, such as beef jerky, fruit jams, jelly, preserves, floral arrangements, etc.?

Farms responding affirmatively to this question were identified as value-added farms.

Direct Marketing

Question: During 2007, did you produce, raise, or grow any crops, livestock, poultry, or agricultural products that were sold directly to individual consumers for human consumption? (Include sales from roadside stands, farmers markets, pick your own, door to door, direct Internet sales, etc. Exclude craft items and processed products, such as jellies, sausages, and hams).

Farms responding affirmatively to this question were identified as direct marketing farms.

Agritourism

Question: What was the amount received from agritourism and recreational services? (Such as farm or winery tours, hay rides, hunting, fishing, etc.)

Farms indicating positive income on this question were identified as agritourism farms.

Energy/Electricity

Question: At any time during 2007, did this operation generate energy or electricity on the farm using wind or solar technology, methane digester, etc.?

Farms responding affirmatively to this question were identified as energy/electricity farms.

sought to identify only those farms that used wind turbines, solar panels, and methane digesters, and excluded farms that only used small solar powered devices, such as "fence chargers" (USDA/NASS, 2011). The 2009 On-Farm Renewable Energy Production Survey also reported other information, such as year the technology was installed, generating capacity, installation costs, and dollar savings on utility bills, that was not available in the 2007 ARMS.

The direct marketing question may not be broad enough for some purposes because it only included direct sales to consumers—not direct sales to food-service institutions, such as schools, hospitals, or restaurants. In addition, the question excluded processed foods. As a result, it only accounted for part of the local food industry. More generally, none of the food-related questions

accounted for whether the agricultural products were sold locally or regionally.[16] Nevertheless, we believe that three of our basic farm types (direct marketers, organic producers, and value-added producers) were more likely to be involved in the local/regional food industry than most other farms. Hence, the information provided here is still relevant to the recent Rural Development policy initiatives related to this industry. For more information about these types of farm activities, including related activities not specifically identified by the ARMS, see appendix table 3 for select references.

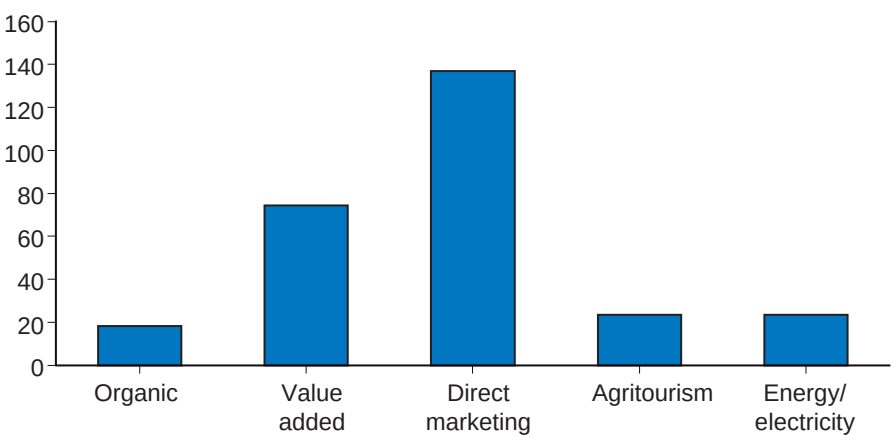
Number of Farms

Using 2007 Census of Agriculture data, we found that relatively few farms were involved in the onfarm rural development-related activities that are the focus of this study. The number of farms in each activity is as follows: 18,211 organic farms, 78,418 value-added farms, 136,817 direct marketing farms, 23,350 agritourism farms, and 23,451 energy/electricity farms (fig. 1). Of the five activities, direct marketing to consumers was the most common, accounting for about 6.2 percent of the total number of U.S. farms. The other four farm types accounted for substantially fewer farms. Organic farms accounted for 0.8 percent of all U.S. farms, while energy/electricity farms accounted for 1.1 percent, agritourism farms for 1.1 percent, and value-added farms for 3.6 percent of all U.S. farms.

Many farms undertook more than one of these activities, according to data from the 2007 ARMS, which produces somewhat different counts of farms.[17] This aspect was most notable for organic and value-added activities, which were both frequently involved with direct marketing to consumers; 46 percent of organic farms and 37 percent of value-added farms were involved with direct marketing of food for human consumption (table 1). Value-added farms actually accounted for a larger share of direct marketing farms (13.5 percent) because value-added farms significantly outnumbered organic farms. Agritourism farms (as we identified them) and energy/electricity farms were less likely to be involved in direct marketing (7.1 and 9.0 percent,

Figure 1

Number of U.S. farms by farm activity, 2007



Source: USDA, National Agricultural Statistics Service, Census of Agriculture, 2007.

[16]For example, many organic and value-added food items are sold in the national and international market. It is worth noting that all of these questions referred to activities that occurred on the farm and represented a product of the farm business operation. If a farmer had a business that operated separately from the farm, including businesses that operate off the farm, these businesses were excluded from our analysis. We also excluded activities by individuals or businesses that rented the farm's land or equipment to others.

[17]Despite the relatively small percentages of farms undertaking these activities, our ARMS estimates of the number of farms in each activity are considered reasonably accurate, as indicated by the coefficients of variation (CV) (table 1; see also note in table 1 on CV). However, they do differ (particularly in the case of value-added producers) from the counts provided by the 2007 Census of Agriculture.

Table 1
Farm category overlap, 2007

	Organic production	Value added	Direct marketing	Agritourism	Energy/electricity
			Number[1] (percent) of farms		
Organic production	**21,669** (100)	2,755 (6.1)	9,896 (8.0)	526 (1.5)	788 (2.9)
Value added	2,755 (12.7)	**45,474** (100)	16,721 (13.5)	1,550 (4.5)	4,559 (16.6)
Direct marketing	9,896 (45.7)	16,721 (36.8)	**124,092** (100)	2,429 (7.1)	2,483 (9.0)
Agritourism	526 (2.4)	1,550 (3.4)	2,429 (2.0)	**34,417** (100)	976 (3.5)
Energy/electricity	788 (3.6)	4,559 (10.0)	2,483 (2.0)	976 (2.8)	**27,498** (100)

Notes: Numbers in bold represent the total number of farms engaged in each type of farm activity. Numbers in parentheses are column percentages. Numbers not in parentheses represent the number of farms in each category. For example, in the first row under the value-added column, 2,755 represents the number of farms involved in both value-added and organic production, while (6.1) indicates that 6.1 percent of value-added farms were involved in organic production.

[1]Estimated number of farms in the 48 contiguous States. Organic, value-added, direct marketing, agritourism, and energy-producing farms accounted for 1.0, 2.1, 5.6, 1.6, and 1.3 percent of all farms, respectively. The coefficients of variation (CV = (standard error/estimate)*100) for the total number of farms for these five types of farms were 15.4, 14.5, 7.4, 13.6, and 14.5, respectively, or well below the 25 (or less) CV value generally considered a good level of accuracy.

Source: USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2007.

respectively), however, both were more involved with direct marketing than farms not engaged in any of these development-related activities.

Considerable overlap can be seen among other farm types (see table 1). Value-added farms accounted for a fairly high proportion (over 12 percent) of organic, direct marketing, and energy/electricity farms. Agritourism farms were generally the least likely to overlap significantly with any of the other farm types.

Economic Research Service's Farm Typology Categories

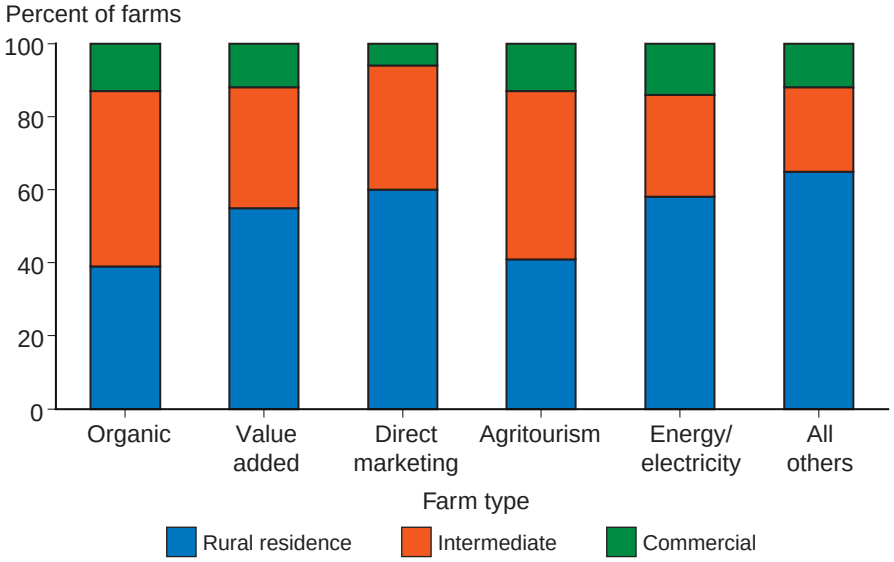
To determine how each of our five farm types differed from other farms, we first see where they fit into the ERS farm typology. The ERS farm typology identifies three basic categories of family farms: rural residence, intermediate, and commercial (fig. 2).[18] The first two categories include small farms (less than $250,000 in annual gross sales or cash farm income) and the third includes large farms ($250,000 or more in annual gross sales or cash farm income). Rural residence farm operators are either retired or report a primary occupation other than farming. Intermediate farms are small family farms where the principal operators report farming as their primary occupation.

Rural residence farms accounted for over half of the farms identified as value-added, direct marketing, and energy/electricity farms. Intermediate farms accounted for a larger share of farms defined as organic and agritourism. Compared with other farms, all five of our farm types were more likely to be intermediate farms and less likely to be residential farms. Direct

[18]This is the "collapsed" farm typology. Each of these three types includes subtypes. The typology also includes nonfamily farms. For more information about these typologies, see the glossary in ERS Briefing Room on Farm Household Economics and Well-Being at http://www.ers.usda.gov/Briefing/WellBeing/glossary.htm/.

Figure 2

Share of farms, by Economic Research Service farm typology, 2007



Source: USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2007.

marketing farms stood out, having the highest share of residential farms and the lowest share of commercial farms.

Because farm characteristics often vary among the farm typology categories, most of the tables in this report provide corresponding statistics for each of the three farm typology categories to facilitate comparisons with our five farm types.

Revenues From Specified Farm Activities

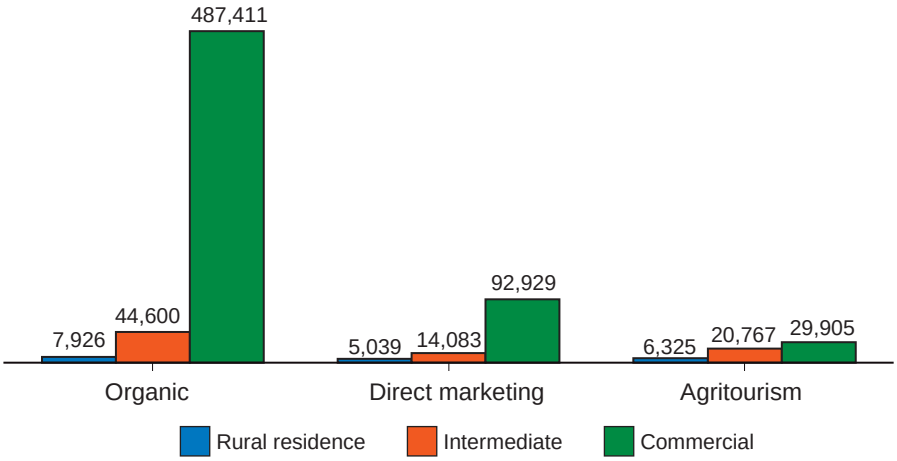
Research by Low and Vogel (2011) established that a farm's total sales revenues were directly related to the farm's direct sales; the larger the farm's total sales, the larger its revenues from direct sales. We found a similar pattern to be true in the 2007 ARMS data, where commercial farms (those with relatively large total sales revenues) had more direct marketing revenues than intermediate and rural residence farms (those with relatively small total sales revenues). We also found this relationship holds true for two other activities examined in this report: agritourism and organic production (fig. 3). Intermediate farms raised more revenues than rural residence farms, for all three of these activities. ARMS data on revenues for the value-added and energy/electricity activities were not available, so we could not show a similar relationship for these activities.

The relatively high gross cash income received by organic producers, especially for commercial farms, has several possible explanations. First, large organic farms are very large operations in general. Second, as measured by activity-related farm cash income as a percentage share of total farm cash income, these farms tend to be more specialized in organic production than direct-marketing farms and agritourism farms are specialized in direct marketing and agritourism, respectively (ARMS, 2007). Third, organic products often fetch premium prices (Greene et al., 2009). Fourth, organic

Figure 3

Gross income from selected development-related activities by farm typology, 2007

Average gross income, dollars



Source: USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2007.

products are sold in the local, regional, national, and even international markets, while markets for agritourism and direct marketing to consumers are primarily local or regional (Greene et al., 2009; Park and Lohr, 1996; Park and Lohr, 2010).

Geographic Location

The concentration of farms in specific regions of the country varied by activity, with organic farms being highly concentrated in the Northeast and Pacific regions and value-added and direct marketing farms being more geographically dispersed (table 2). The Mountain region had the highest concentration of energy/electricity production, while the Southern Plains had a high percentage of agritourism activity.[19]

Over half of the organic and direct marketing farms were in a metropolitan (metro) county, whereas the majority of the other three farm types were outside of metro counties. Energy/electricity and agritourism activities were most likely to be in noncore (more rural) nonmetropolitan (nonmetro) counties.[20] However, over half of the farms in all five farm types were within 5 miles of a city with a population of at least 10,000.

Acreage Operated and Land Tenure

Agritourism and energy/electricity farms stood out as being relatively large, as measured by total farm acreage (fig. 4). Agritourism farms were about six times as large as the "all other farms" category, which includes farms not belonging to any of our five farm types.[21] Only direct marketing farms averaged fewer acres than the all other farms category, probably reflecting their focus on fruit and vegetable production, which often occurs on smaller plots of land.

[19]Some of the most extreme variations in regional concentrations, such as the high percentage of organic farms in the Northeast and energy/electricity farms in the Mountain region, may reflect a higher degree of statistical error, as indicated by the relatively high coefficients of variation (CVs) for these estimates.

[20]Noncore nonmetropolitan means outside of both metropolitan (a county having a city with population of at least 50,000 or with significant commuting to such a city) and micropolitan areas. See footnote 36, p. 23, for a more detailed explanation of these terms.

[21]As shown earlier, however, most agritourism farms are small in terms of total agricultural sales. Thus, how you measure farm size (acres or agricultural sales) makes a difference.

Table 2

Geographic distribution of farm types, 2007

Location	Five types of farms					All farms, excluding five types of farms		
	Organic production	Value-added	Direct marketing	Agritourism	Energy/ electricity	Rural residence farms	Intermediate farms	Commercial farms
					Percent			
U.S. geographic regions[1]								
Northeast	*34.3	14.1	17.6	*12.3	7.5	6.0	7.8	5.2
Lake States	7.0	*8.5	18.1	4.8	2.4	8.7	10.7	11.4
Corn Belt	8.7	14.6	14.8	8.1	*14.9	19.2	17.8	23.9
Northern Plains	3.2	5.3	*2.6	8.0	*7.9	6.5	10.1	15.5
Appalachia	1.0	*8.9	7.5	#4.9	*12.8	16.1	10.8	6.9
Southeast	1.4	*4.8	4.8	#8.3	8.0	8.3	7.8	6.8
Delta	0.0	4.2	2.8	2.8	2.2	6.3	3.9	6.7
Southern Plains	2.0	10.4	6.0	28.9	4.7	17.0	15.1	9.6
Mountain	7.8	16.9	10.3	17.9	*29.4	5.8	8.7	5.7
Pacific	34.5	12.3	15.4	*4.1	10.4	6.0	7.3	8.3
ERS county type[2]								
Nonmetro noncore	28.4	29.7	25.2	44.1	48.7	35.4	37.2	41.9
Nonmetro micropolitan	19.8	21.8	22.7	21.5	*12.9	26.0	23.3	23.2
Metropolitan	51.8	48.6	52.1	34.5	39.1	38.6	39.4	34.9
Distance to nearest city with population of at least 10,000								
Less than 5 miles	50.4	60.7	52.0	54.2	51.7	48.5	61.3	66.4
5-20 miles	19.4	*14.5	22.5	21.8	18.3	23.9	17.3	13.4
20 or more miles	30.2	24.8	25.5	*24.0	*30.0	27.6	21.4	20.2
Average miles from city with population of at least 10,000	22	31	22	25	36	21	22	25

Notes: Based on 18,709 observations (17,465 households and 1,244 nonhouseholds). All 48 contiguous States were included in the sample. ARMS 2007 estimates possibly differ from other years because 2007 ARMS weights were calibrated to the 2007 Census of Agriculture. Coefficient of variation (CV) = (standard error/estimate)*100. The higher the CV, the less precise the estimate. Rounded percents may not add to exactly 100. Unless othewise indicated, the CV is 25 or less.

* = Indicates that CV is greater than 25 and less than or equal to 50.

= Indicates that CV is greater than 50 and less than or equal to 75.

[1]Northeast includes Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; Lake States include Michigan, Minnesota, and Wisconsin; Corn Belt includes Illinois, Indiana, Iowa, Missouri, and Ohio; Northern Plains includes Kansas, Nebraska, North Dakota, and South Dakota; Appalachia includes Kentucky, North Carolina, Tennessee, Virginia, and West Virginia; Southeast includes Alabama, Florida, Georgia, and South Carolina; Delta includes Arkansas, Louisiana, and Mississippi; Southern Plains includes Oklahoma and Texas; Mountain includes Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming; and Pacific includes California, Oregon, and Washington.

[2]Metropolitan counties are those associated with cities of more than 50,000 people. Nonmetropolitan (nonmetro) counties include smaller cities or no cities. Micropolitan counties are nonmetro counties associated with cities (urban clusters) of between 10,000 and 50,000 people. Noncore nonmetro counties had no cities (urban cluster) as large as 10,000 people. For further information, see the ERS Briefing Room on Measuring Rurality: Urban Influence Codes, at http://www.ers.usda.gov/Briefing/Rurality/UrbanInf/.

Source: USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2007.

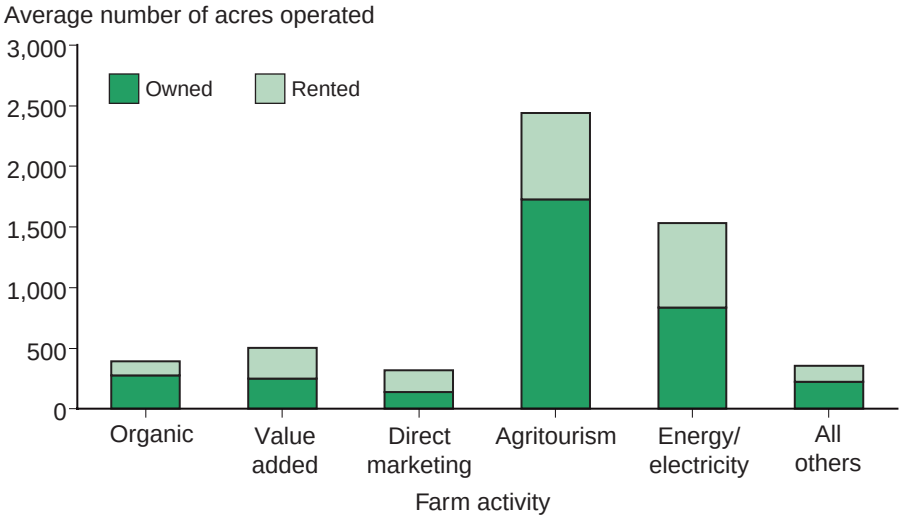
These five types of farms generally rented (or leased) a significant proportion of their farmland, but the amount varied considerably among them (see fig. 4). Agritourism and organic farms rented only about 30 percent of their land as a group while direct marketing farms rented 57 percent.[22]

All five types of farms were somewhat less likely to be full owners (and more likely to be part owners) than were operators in the all other farms category (fig. 5). Value-added farms were almost twice as likely to be full tenants as were operators of all other farms.

[22]Note that the statistics cited here and elsewhere in this section refer to the entire farm, not just the part of the farm devoted to a particular activity. In addition, acreage rented out by farm operators is not reflected in rented acres unless it is rented to other farm operators.

Figure 4

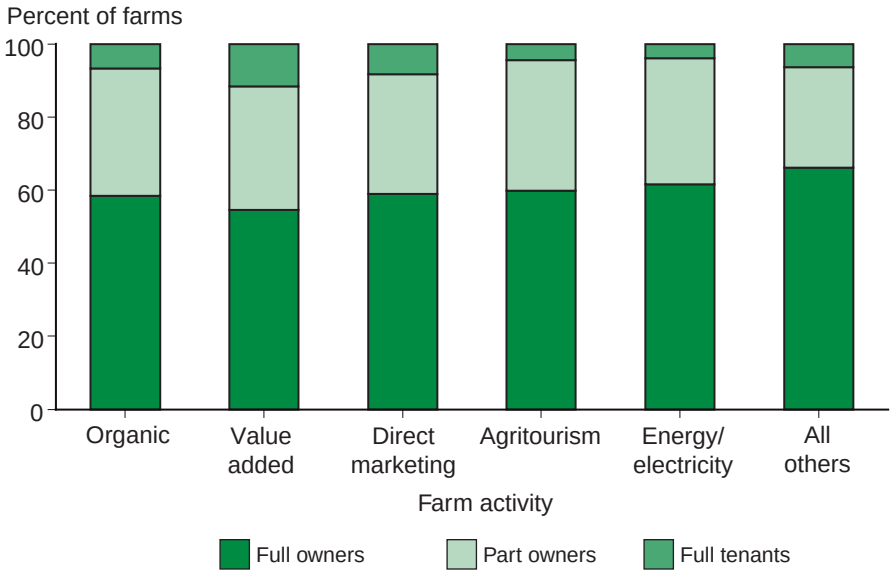
Average number of owned and rented acres, by farm activity, 2007



Source: USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2007.

Figure 5

Land tenure characteristics, by farm activity, 2007



Source: USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2007.

Total Gross and Net Farm Income

Average gross and net farm incomes were highest for organic farms, with energy/electricity ranked second on both measures (table 3).[23] At the other extreme, direct marketing farms had the lowest gross and net farm income. Net farm income varied significantly among agritourism farms, making their estimated average net farm income less precise than those for other farm types.

[23]Net farm income equals gross farm income minus cash and noncash production expenses.

Farm Household Net Worth and Household Income

Household wealth and income are standard economic measures of household well-being. They are also important indicators of financial capacity, or the ability to make financial investments in farm activities. As seen in table 3, average farm household net worth was highest for agritourism farms ($2.0 million) and lowest for direct marketing farms ($631,000).[24]

[24]Agritourism farms' average net worth was comparable with that of commercial farms, reflecting the fact that both were relatively large, on average.

Total household income exhibited a different pattern and was highest for energy/electricity farms ($165,000 annually) and value-added farms ($90,000 annually), on average. The other three farm types had substantially lower average household incomes (ranging from $71,000 to $75,000 annually) compared with about $88,000 for all other farms (fig. 6).

Source of Household Income

All five farm types typically received most of their household income from off-farm sources (fig. 7). Off-farm wages were the largest source of income for organic, direct marketing, and energy/electricity farms, on average, while "nonwage off-farm income" was typically more important to value-added and agritourism farms.[25] Farm income provided only a small fraction of total household income to these farm types, on average, and except for organic farms, farm income was less important (as a percentage of household income) than for all other farms. The amount of household income from farming was actually negative for most agritourism farms.[26]

[25]"Nonwage off–farm income" consists of nonfarm business income, Social Security and other nonfarm transfer payments, off-farm interest and dividends, and other sources (undefined).

[26]Farm income to the household (FARMHHI) is different from net farm income (NFI) in various ways, including how wages paid to operators and other family members are counted, plus income households receive from operating other farms and from renting out farm land (excluded from NFI; included in FARMHHI). However, the factor that explains the substantially lower FARMHHI than NFI is that depreciation expenses and decline in asset values are subtracted from FARMHHI but not from NFI.

Age and Education

With the exception of agritourism farms, younger farmers (under 45 years of age) were more likely to operate development-related farms than they were for all other farms (fig. 8). Young operators were most common on energy/electricity farms (26 percent). Older farmers (65 years of age and older) played a larger role as operators of agritourism farms (40.4 percent) than for the other farm activities.

With the exception of direct marketing farms, the operators of the development-related farms we examined were generally more educated than operators of all other farms (fig. 9).[27] Roughly 70 percent of farmers in agritourism had at least some college education, and the other three types of development-related farm operators accounted for a higher share of farmers with college degrees (5-7 percentage points higher) than all other farms.

[27]The proportion of direct marketing farm operators with a college degree was 2 percentage points lower than the proportion of all other farm operators.

Table 3
U.S. farm economic indicators, by farm activity, 2007

Indicator	Five farm activities					All farms, excluding five types of farms		
	Organic	Value-added	Direct marketing	Agritourism	Energy/ electricity	Rural residence farms	Intermediate farms	Commercial farms
Total number of farms	21,669	45,474	124,092	34,417	27,498	1,285,165	460,566	236,156
Average number of acres farm operated	*394	504	318	2,439	1,534	149	391	1,436
Average family/unpaid labor (FTE days)	572	521	420	481	450	202	423	670
				Dollars (average)				
Farm household net worth	1,163,475	900,063	631,255	2,020,308	1,477,992	484,229	794,103	2,145,882
Gross farm income	*342,598	206,606	88,459	184,876	242,659	22,264	74,906	849,031
Variable cash expenses on production	225,166	127,732	53,824	123,919	*137,426	11,783	41,160	464,171
Total fixed cash expenses	*37,808	28,441	13,996	29,560	35,967	5,189	12,800	93,794
Net farm income	*63,046	*38,269	14,224	#18,453	53,920	3,161	14,483	241,945
Government payments	*2,200	4,499	1,799	7,403	5,053	1,264	3,503	20,200
Household farm income	#12,685	3,260	412	-1,531	#12,701	-5,344	920	149,513
Total off-farm income	62,600	86,983	70,712	73,895	*151,824	91,729	47,804	45,165
Total household income[1]	75,285	90,243	71,123	72,364	164,525	86,385	48,724	194,678

[1]Total household income equals household farm income plus total off-farm income.

Notes: Based on 18,709 observations (17,465 households and 1,244 nonhouseholds). All 48 contiguous States were included in sample. Coefficient of variation = (standard error/estimate)*100. The higher the CV, the less accurate the estimate. Unless otherwise indicated, the CV is 25 or less.

* = Indicates that CV is greater than 25 and less than or equal to 50.

= Indicates that CV is greater than 50 and less than or equal to 75.

FTE = Full-time equivalent.

Source: USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2007.

Use of External Resources

The ARMS asked a number of questions regarding the farmer's use of (or access to) external resources, such as information from the Internet, management advice, and Government program assistance. These indicators may be useful to assess a farmer's capacity to use available resources to thrive in today's complex economy.

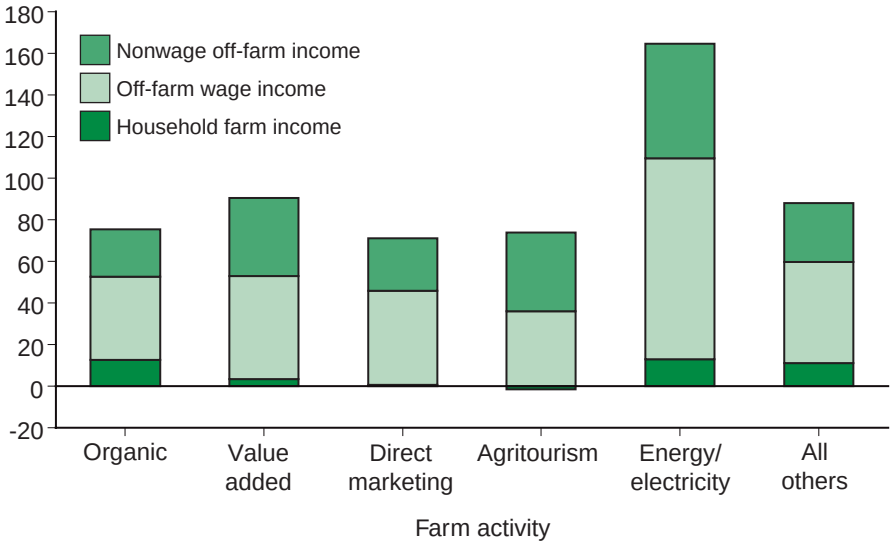
All five of our farm types had greater access to the Internet (including high-speed Internet), than did residential or intermediate farms in general. Organic farms had the most Internet access (table 4). Three of these farm types also made more use of purchased farm management advice than the typical residential or intermediate farm. Energy/electricity farms used free management advice most,[28] while direct marketers made the least use of both the Internet and free farm management advice.

[28]This form of external management advice was more commonly used by organic and agritourism farms than by the other three farm types we examined.

Figure 6

Farm household income, by farm activity, 2007

Average annual income, 1,000 dollars

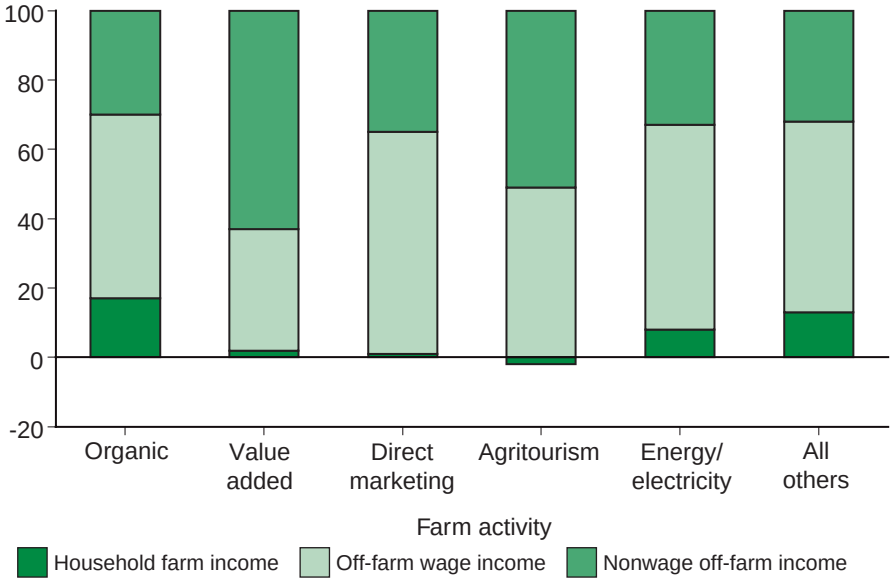


Source: USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2007.

Figure 7

Sources of farm household income, by farm activity, 2007

Percent of farm household income



Source: USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2007.

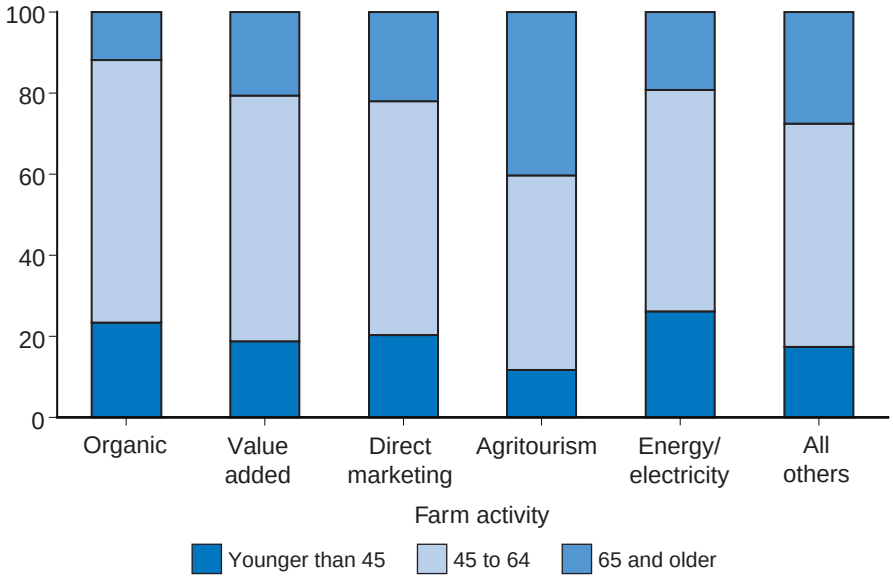
Involvement in Federal commodity payment programs can provide access to financial assistance and risk management options. With the exception of agritourism, our five farm types were less involved in commodity programs than other intermediate or commercial farms.[29] Conversely, agritourism farms had the highest participation rate (20 percent) in the USDA Conservation Reserve Program, while organic and direct marketers had the lowest (5-6 percent). Relatively few of our five farm types bought crop insurance.

[29]A lower percentage of organic farms had base acreage in Government programs, and program participation by direct marketing farms was comparable with that of other residential farm categories, but energy/electricity, value-added, and agritourism farms all had higher program participation rates.

Figure 8

Percent of farms by operator age class, 2007

Percent of principal farm operations

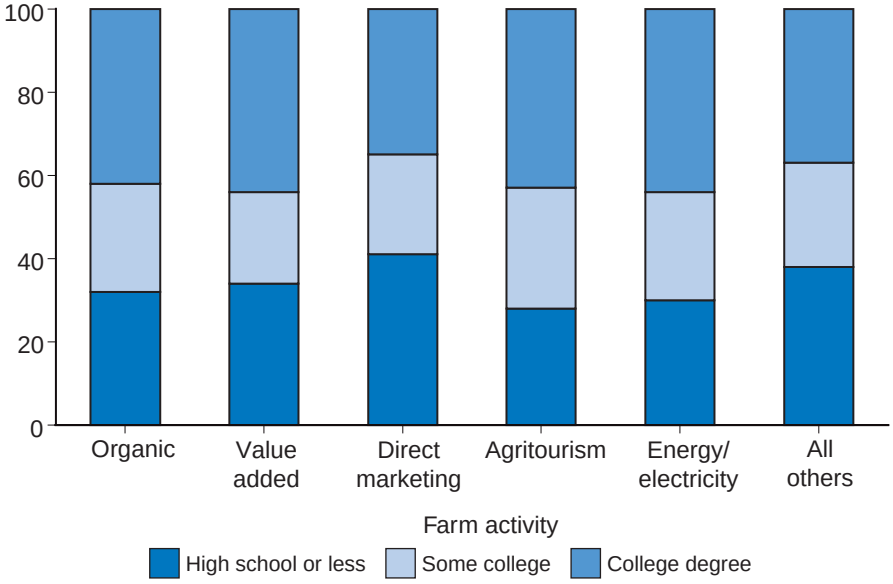


Source: USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2007.

Figure 9

Farm operator education, by farm activity, 2007

Percent of principal farm operations



Source: USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2007.

Table 4

External resource and program participation indicators, by farm activity, 2007

Indicator	Five types of farms					All farms, excluding five types of farms		
	Organic production	Value-added	Direct marketing	Agritourism	Energy/ electricity	Rural residence farms	Intermediate farms	Commercial farms
				Percent				
Access to the Internet	86.5	80.1	66.6	73.2	73.4	60.2	54.1	75.0
Access to high-speed Internet	61.5	53.3	38.5	49.0	53.4	35.1	30.0	51.2
Purchased farm management advice	72.5	57.5	54.3	70.4	45.6	45.8	56.5	73.7
Free farm management advice from NRCS	8.8	*15.0	6.0	*11.5	*18.7	3.2	4.1	9.5
Free management advice from other sources	10.1	11.3	5.3	*6.7	*13.7	2.0	2.6	5.4
Base acreage in Government programs	4.2	11.7	6.7	19.5	10.0	6.5	13.3	21.2
Enrolled in USDA Conservation Reserve Program	4.7	*13.1	5.7	20.3	13.3	14.7	15.5	23.1
Purchased crop insurance	*11.5	*10.7	9.5	14.0	18.3	6.3	24.6	54.8

NRCS = USDA, Natural Resources Conservation Service.

Notes: Based on 18,709 observations (17,465 households and 1,244 nonhouseholds). All 48 contiguous States were included in the sample. Coefficient of variation = (standard error/estimate)*100. The higher the CV, the less accurate the estimate. Unless otherwise indicated, the CV is 25 or less.

* = Indicates that CV is greater than 25 and less than or equal to 50.

Source: USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2007.

Factors Associated With Farmer Involvement in Selected Onfarm Activities

Factors That May Affect Farmer Involvement

Three kinds of factors may affect a farmer's decision to use farm-based resources to diversify:

- The farmer's personal characteristics (net worth, age, education, experience, and use of management advice);
- Farm characteristics (farm size and type, farm practices, farm amenities); and
- Geographic factors (multistate region and urban/rural location).

Personal Characteristics

Research on farm diversification and entrepreneurship indicated that personal or household characteristics varied from the monoactive farmers (those involved only in normal production agriculture) to farmers involved in diversification activities and niche specializations similar to those examined in this study. For example, Carter (1998) found that "a gradation can be seen between groups based on training, business experience, available resources, and managerial, entrepreneurial, and strategic sophistication" (Carter, 1998, p. 27). Monoactive farmers were generally older and lacked training and experience outside agriculture, while the more diversified farm operators were younger and had more training in both agriculture and management. The more diversified farmers also tended to have a greater resource base (e.g., finances, land, equipment, etc.).

Consistent with our understanding of how farmers adopt a more diverse array of activities, our study hypothesized that farm operator household net worth was related to farmer involvement in these activities because household wealth helps farmers raise start-up capital. Household net worth might significantly contribute to farmer involvement, particularly for activities that require substantial up-front capital. Household wealth can also serve as a financial cushion to help the farm overcome short-term financial downturns (Brown and Reeder, 2007).

Formal education, skill, training, and agricultural and/or management experience might increase a farmer's ability to search for, interpret, analyze, and adapt information for practical economic decisionmaking (Schultz, 1975; Becker, 1975). Similarly, acquired skills related to innovation, management, and accessing the market can enhance decisionmaking skills and reduce the risk associated with adopting new activities. Internet access aids searching for, processing, and comprehending relevant information. Farmers can also utilize additional farm management information from public and private sources. Thus, we hypothesize that all of these factors could improve the probability that a farmer might become involved in our five farm activities.

Farm operator age may have a variety of effects. A relatively young farmer may have more robust health and a longer planning horizon and pay-off period for

personal and farm investments. A young farmer might also be more optimistic and enthusiastic about future possibilities, more aggressive about starting and expanding the farm business, more willing to take risks, and more receptive to new ideas, technologies, and opportunities. Older farmers, however, usually have more experience and practical knowledge and, as a result, may be more efficient decisionmakers and managers. Older farmers may have had more time to pay off loans and accumulate wealth, so farm household net worth could work in their favor, enabling them to finance more investment for new activities.[30] Because of these potentially different effects, age-related factors may not offer a clear picture of farmers adopting our five farm activities. Based on Carter's research, however, younger farmers may be more likely to be involved with most of these activities.

[30]We separated out this wealth factor for our analysis.

Farm Characteristics

Farm size (measured by acres, sales, or gross farm income) may affect adoption of new technology or activity for various reasons. For example, a larger farm may benefit from economies of scale that reduce costs per unit of output, making some activities more profitable than on a smaller farm. But it is unclear how these particular activities would compare with other activities available to large farm operators or to predict if these activities would be adopted. In contrast, for small farm operators, farm survival is more likely to be the main issue when an operator chooses to adopt a new activity. If a new activity is necessary for the farm to survive, then the farmer may have little choice but to adopt. We hypothesize that small farm operators are more likely to adopt these activities, particularly those with households dependent primarily on farm income.

The share of farmland in crops or livestock may also affect the operator's decision to adopt a new activity (e.g., producing fruits and vegetables may be associated with using direct marketing). How a farm is defined based on ERS farm typology (rural residential, intermediate, or commercial) might also be associated with the likelihood of participating in an activity because this typology tends to be associated with a variety of different farm characteristics. A farm's involvement in Government programs, such as Federal conservation programs, could be associated with the adoption of some activities, such as agritourism/recreation based on wildlife and a natural setting. Other factors may be associated with agritourism and natural amenities, such as sales of forest products and whether the farmer allows public access to the farm. Other farm characteristics, such as the share of farmland that is rented or owned or whether the farmer is a sole proprietor or tenant farmer, could make a difference for some of these activities, though it is not obvious what the effects would be.[31]

[31]Recent research by Park and Lohr (2010) included several of the factors expected to contribute to an organic farmer's participation in local sales, including farm typology, percentage of land leased, the mix of farm products produced, use of Internet and farm management advice, and whether a farm was a sole proprietorship or family owned.

Geographic Characteristics

Location (geographic region and proximity to urban areas) can affect the economic viability of farm activities, thus affecting a farmer's decision to adopt a new activity. A farm's geographic location reflects soil quality, natural amenities, and climate, which in turn can affect a variety of farm activities, including the farmer's choice of crops and livestock production. Location also affects farm access to local and regional transportation systems, exposure to State and local taxes, cooperative extension service activities, and regional

development strategies. Geographic regions may therefore be associated with varying likelihood of adopting each of the five activities. Urban versus rural location can also make a difference, particularly for farm activities that rely heavily on urban consumers. For example, a more urban location could be an advantage for farm activities related to the local foods industry.

The Econometric Analysis

We estimate logit models encompassing the various factors that we hypothesize might be associated with a farmer's participation in each of the activities highlighted in this report. Each logit model and analysis (explained in more detail in the appendix) includes all the farms in the ARMS and estimates the statistical relationship of various factors with the probability of participation in each of the five farm activities. The results are summarized in tables 5, 6, and 7 (more detailed tables, including estimated coefficients, measures of the estimated models' performance, and odds ratios can be found in the appendix). It should be noted, however, that not all of the models were equally successful in predicting whether a farmer was involved in a specified activity. For organic farms, the model correctly predicted farmer involvement about 85 percent of the time, while only 63 percent of the predictions were correct for both the value-added and energy/electricity models. Our discussion of all five activities focuses on the relationships we found to be statistically significant (referred to as "significant" throughout).

Farmer Effects

The characteristics of individual farmers and their families, including access to and use of information, were significant factors for farm involvement in all five activities, though the significant factors varied depending on the activity (table 5).

Table 5
Estimated effects of farmer characteristics on farm activity involvement, 2007

	Farm activity				
Farmer characteristics	Organic production	Value-added	Direct marketing	Agritourism	Energy/electricity
Age	(-)	(-)	-	+	(-)
Has at least some college education	(+)	+	+	+	+
Family net worth			- #	+	+
Access to the Internet	+	+		+ #	(+)
Purchased advice	+			+ #	
Received free advice[1]		+	+		+

Notes: The signs + and – indicate positive and negative effect, respectively. Unless otherwise indicated, these effects are statistically significant at the 5-percent or less probability of error level. Signs followed by # indicate only marginal statistical significance (10-percent level). Signs in parentheses indicate that factors were included in the estimated models but the coefficients were not significantly different from zero. Blanks in each model show that these variables were included in the early stages of analysis but because their t-vales were less than 1.0 in the final estimation, these variables were left out of the estimated equations.

[1]Advice came from advisory groups other than USDA, Natural Resources Conservation Service.

Source: USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2007.

Table 6

Estimated effect of farm characteristics on involvement in farm activity, 2007

Farm characteristics	Farm activity				
	Organic production	Value-added	Direct marketing	Agritourism	Energy/electricity
Farm size (acres)	(+)	(-)	(+)	+	(+)
Farm ownership:					
Sole proprietor	(+)			-	
Full owner of farmland		- #			
Rented share of total land				-	
Farmland use/practices:					
Cropland share of total land			-	-	- #
Allows public access to farm				+	
Conservation program use				+ #	
Sells forest products	+ #	+	+		+
Farm typology:					
Intermediate	+	+	+	+	
Rural residence			+		

Note: The signs + and – indicate positive and negative effect, respectively. Unless otherwise indicated, these effects were statistically significant at the 5-percent or less probability of error level. Signs followed by # indicate only marginal statistical significance (10-percent level). Signs in parentheses indicate that factors were included in the estimated models but the effects were not significantly different from zero. Blanks in each model show that these variables were included in the early stages of analysis, but because their t-vales were less than 1.0 in the final estimation, these variables were left out of the estimated equations.

Source: USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2007.

Table 7

Estimated effect of location on involvement in farm activity, 2007

Location	Farm activity				
	Organic production	Value-added	Direct marketing	Agritourism	Energy/electricity
Rural (noncore) location[1]			-		
Region:[2]					
Northeast	+	+			
Lake States	+		+		-
Corn Belt	+ #				
Southern Plains			-	+	-
Mountain	+	+		(+)	+
Pacific	+	+	+		

Note: The signs + and – indicate positive and negative effect, respectively. Unless otherwise indicated, these effects were statistically significant at the 5-percent or less probability of error level. Signs followed by # indicate only marginal statistical significance (10-percent level). Signs in parentheses indicate that factors were included in the estimated models but the effects were not significantly different from zero. Blanks in each model show that these variables were included in the early stages of analysis, but because their t-vales were less than 1.0 in the final estimation, these variables were left out of the estimated equations.

[1]Rural (noncore) refers to a nonmetropolitan county that is not in a micropolitan area. These counties lack any city or urban cluster with populations as large as 10,000 and do not have a significant share of residents commuting to cities this size or larger.

[2]Other regions not determined to be significant location factors were the Northern Plains, Appalachia, Southeast, and Delta. See table 2 for a list of States in each region.

Source: USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2007.

- Age of the farmer was significant only for direct marketing and agritourism (negative for direct marketing and positive for agritourism).[32]
- Educational achievement was significant and positive for all activities except organic farming.
- Wealth (family net worth) was a significant positive factor for agritourism and energy/electricity activities but had an inverse relationship with direct marketing activities, although only marginally.
- Internet access had a significant positive relationship with organic and value-added activities and was marginally positive for agritourism.
- Farm management advice was significant for involvement in all five activities, although the form of advice differed among activities: purchased advice was significant for organic and agritourism activities (only marginally for the latter), while free advice was significant for value-added, direct marketing, and energy/electricity activities.

Most of the statistically significant factors had the expected signs, as most of the individual factors (education, wealth, access to information) were thought to be positively related to adoption of innovative activities. The only exception in our analysis was the marginally negative wealth coefficient (family net worth) for involvement in value-added activities. This result could reflect situations in which farm households attempt to increase the value of their onfarm activities when their ability to earn off-farm income or income from the sale of additional farm commodities is constrained. The age coefficients were mixed, and this result was not unexpected given ambiguous expectations for this factor.

Farmer involvement in agritourism was associated with the greatest number of these farmer characteristics (four out of five), while organic production was associated with the least number (two out of five). Our data, however, did not provide any information on farmer personality or attitude, which might also help explain involvement in some activities.[33]

Farm Effects

Only a few farm characteristics were significant enough to explain farmer involvement in more than one or two of the farm activities examined (table 6):

- A relatively larger share of cropland was negatively associated with involvement in all but organic and value-added activities (this effect was only marginally negative for energy/electricity).
- Sales of forest products were positively associated with all but agritourism activities (this effect was only marginally positive for organic farms).
- Intermediate farms, as defined by the ERS farm typology, were positively associated with participation in all activities except energy/electricity production.[34]

Only three farm activities were significantly associated with any of the other farm characteristics:

- Agritourism was associated with five farm characteristics: farm size (positive effect), sole proprietorship (negative effect), rented share of total

[32]The age variable had a negative, though nonsignificant, effect on farmer participation in the other three activities.

[33]For example, adoption of these activities might be associated with a farmer's attitude toward risk when entering a new enterprise; willingness to learn how to do something different or how to use a new technology; willingness to have greater contact with the public; and eagerness to make more money, either to enable the farm to survive or to add to the family's resources in general. Attitudes toward altruism may also play a role in some cases, such as a desire to provide urban and regional residents with more fresh, natural, or tasty food (direct marketing, organic producers, value-added processing); produce less negative environmental externalities (organic producers, renewable energy); educate urban residents about agriculture; and provide local and regional residents access to the farm's land for hunting, fishing, and other forms of recreation (agritourism).

[34]Use caution when interpreting the estimated coefficients associated with the ERS farm typology classifications. The typology includes three classifications for family farms: rural residence, intermediate, and commercial. In econometric analyses, such as this one, when only one or two of these classifications were used to estimate the model, the estimated coefficients were interpreted *relative to those classifications not included in the model*. Thus, in the case of organic, value-added, and agritourism farms, the significant positive coefficient of the dummy variable for the intermediate classification meant that involvement in these activities was more likely to occur than for rural residence and commercial farms. However, the model for direct marketing farms included dummy variables for both rural residence and intermediate farm classifications, and thus the positive coefficients for the rural residence and intermediate farms were in comparison with commercial farms (the only excluded farm typology classifications).

land (negative), public access to the farm (positive), and conservation program use (marginally positive).

- Value-added activity was associated with one other farm factor: being a full owner of the farmland (marginally negative).
- Direct marketing was associated with one other farm factor: being a rural residence farm (positive).
- Most of the farm characteristic effects either fit with our expectations or were not very surprising.[35]

Location Effects

Our findings on the importance of location may be a bit more surprising (table 7). Proximity to urban customers was considered an advantage for most of these activities. Consequently, being in a remote rural area (specified in our model as a noncore nonmetropolitan county, or outside metropolitan areas and not in a micropolitan area) would be a significant disadvantage for most of our activities.[36] We found this to be true, however, only for direct marketers, which suggests that many providers of the development-related activities we examined had no particular advantages related to urban/rural setting.

Organic farms are highly concentrated in the Northeast and on the Pacific Coast, and our statistical analysis confirmed that such locations are associated with farmer involvement in organic farming. However, organic farms also appeared to have an advantage when located in the Lake States, Corn Belt, and Mountain regions.[37] In addition, farms involved in agritourism were strongly associated with only one regional location, the Southern Plains. It is important to recognize, however, that outdoor recreation activities, including hunting and fishing, were the main agritourism-related activities, at least as defined in the ARMS (Brown and Reeder, 2007). These activities were quite popular in the Southern Plains (Texas and Arkansas), which enjoy some climate advantages over other regions for such outdoor recreation activities.

The regional effects for value-added activity seemed similar to those for organic production, which was not unexpected given the amount of processed organic foods (meat, wine, etc.). The regional effects for energy/electricity might correspond to wind and climate patterns. The findings for farms marketing directly to consumers were also not unexpected, though we also might have expected the Northeast to have a positive coefficient for that activity.

The econometric analysis also provides information about the magnitude of the effects. For example, our estimates indicate that the farms with access to the Internet compared to farms without access to the Internet have three times the likelihood of engaging in organic production, and double the likelihood of participating in value-added activity. In addition, some large variations in the size of effects are found with regard to regional locations. For instance, farms located in the Northeast and Pacific regions have much greater likelihood of engaging in organic production than farms located in any other region. The appendix provides more detailed information about the magnitude of the effects of all the explanatory factors examined in this study.

[35]We found that selling forest products was positively related to involvement for all our farm types except agritourism. Selling forest products implies the presence of an amenity—forest land—that might be particularly conducive for agritourism. However, the empirical models for this study were limited in the number of variables that could be used. Because many other factors were significant for agritourism, the sale-of-forest-products variable was left out of the final model.

[36]Metropolitan counties were associated with cities of more than 50,000 people. Nonmetropolitan (nonmetro) counties included smaller cities or no cities. Micropolitan counties included nonmetro counties associated with cities (urban clusters) of between 10,000 and 50,000 people. Noncore nonmetro counties had no cities (urban cluster) as large as 10,000 people. For further information, see the ERS website Briefing Room for Measuring Rurality: Urban Influence Codes at http://www.ers.usda.gov/Briefing/Rurality/UrbanInf/.

[37]This may be explained partly by a concentration of processed organic production in the Lake and Corn Belt States (Eades, 2006). Since the coefficients of these regional dummy variables were interpreted as the difference from the excluded regions, this may reflect the relative absence of organic production in some of the excluded regions, such as in Appalachia, Southeast, and the Great Plains. (See appendix table 2 for the coefficients and definitions associated with the regions used in this analysis).

Conclusions

Our objective was to provide comparable information about several types of farms that are engaged in activities emphasized by recent rural development initiatives in the United States. The farm types we examined, using 2007 ARMS data, were organic producers, value-added producers, direct marketers, agritourism farms, and renewable energy/electricity producing farms.

The findings from our comparative analysis showed that some characteristics of the typical farm involved in the five rural development-related activities we examined varied greatly, including the number of farms, farm size, household income, net farm income, operator age, and education. We also found a great deal of variation in the regional distribution of farms involved in the five farm activities examined.

The findings from our econometric analysis further illustrated factors with the potential to influence a farmer's decision to undertake one of these activities. While we did not attempt to establish causality, the logit analysis we present identified statistically significant relationships that may be worth further exploration. For example, our econometric analysis indicated that farm management information was an important (statistically significant) to farmers' involvement in all five activities, and education was important for all but organic farmers. This is understandable, because these activities typically involve adoption of distinctly different or complex production and marketing practices. While the farm operators involved in these activities tended to be more educated and made more use of farm management advice from various sources than other farm operators, many still lacked any college education. Also, most did not make use of free farm management advice, though most paid for relevant advice.

To the extent that the positive relationship between education/advice and involvement in RD-related activities reflected the benefits of information to those considering expanding their onfarm activities, improving access to managerial advice or technical assistance could affect the number of farmers willing to become involved in these new activities. Direct marketers might be particularly affected since evidence suggests that they use free management advice less frequently than the other four farm types, but that direct marketing was one of three activities found to be statistically related to free management advice.

Among our other findings, access to the Internet was statistically associated with the adoption of most of the farm activities we examined (direct marketers and energy/electricity farms are the exceptions). Although most of the farmers involved in our five activities had access to the Internet, many did not. Hence, ongoing efforts to improve Internet access throughout rural America might lead to increased farmer participation in these activities. For example, over a quarter of agritourism farms lacked access to the Internet, and half lacked access to broadband in 2007.

Our analysis revealed that a farm family's financial situation appears to affect adoption of some, but not all, of these activities. Specifically, we found that family net worth was positively associated with agritourism and energy/

electricity farms, but not organic production and value-added farms, and it was negatively related (marginally) to direct marketing farms.

The size and category of a farm also played a part in whether farms were involved in these activities. Because it is often difficult for small farm operators to make a living selling farm commodities, we might expect that small-sized farms were more likely than large farms to become involved in some of the activities covered in this study. Our analysis found that farm size as measured by land area was only a significant factor in the case of agritourism, where larger farms were more likely to be involved, other things being equal.

However, when we defined farm size in terms of sales, we found evidence that small farms were more likely than large farms to undertake most of these activities. For example, ERS-defined intermediate farms (those with annual gross sales below $250,000 with operators that report farming as their primary occupation) were more likely than other farms to be involved in these activities. Thus, for operators whose primary occupation was farming, small (sales) farm operators were more likely to adopt these farm activities. Two exceptions must be noted. First, both intermediate and rural residence farms were more likely to participate in direct marketing than other farms. Rural residence farms, as defined by ERS, had relatively low gross sales, but their farm operators did not consider farming their main occupation. So for direct marketing farms, the principal occupation of the farm operator did not appear to be particularly important. Second, energy/electricity farms were not particularly favored by any of the ERS farm types.

Our study also revealed that some location-related advantages appear to exist for the five farm activities. Our analysis showed that a rural location was not a significant advantage for any of these activities, but an urban location was not generally an advantage either. The only exception was found for farms located in highly rural (nonmetro noncore) counties; they were significantly less likely to participate in direct marketing to individual consumers than farms located elsewhere.

The Northeast, Mountain, and Pacific regions appeared to offer locational advantages for organic and value-added activities. Each of the other three activities seemed to have its own geographic tendency. Direct marketing appeared to have a locational advantage in the Lake States and Pacific regions and a locational disadvantage in the Southern Plains. In contrast, the Southern Plains was a favored location for agritourism farms. Energy/electricity producers appeared to have a locational advantage in the Mountain region and were less likely to be located in Lake States and Southern Plains regions. In addition, organic producers appeared to have a locational advantage not only in the Pacific and Northeast, where our descriptive analysis showed a high concentration, but also in the Lake States, Mountain, and Corn Belt regions, where they were less concentrated.

Information on the magnitude of the estimated effects of various characteristics can also be gleaned from this study. For example, we found that Internet access adds more to the probability that a farm is involved in organic production than it does for farm involvement in value-added production or agritourism. These variations in magnitude of effects can be

particularly large for regional location characteristics, as was the case for participation in organic production.

We should emphasize that this study faced certain data limitations due to how the 2007 ARMS questions were structured. Our findings did not reflect all possible rural development-related activities. For example, we examined only farms marketing products directly to individual consumers, excluding those who sold to institutions. Our study also excluded forms of agritourism that involved only the sales of products to visitors. In other cases, our coverage may have been too broad, such as with organic producers, where we examined all who reported themselves as organic producers, though some may lack official certification as organic farmers. Nor does this study address all of the factors that could affect farmer involvement in any of these activities.

This report represents an opportunity to gain a better understanding of the five types of farms that provided a product or performed a function related to USDA's recent rural development initiatives. Our comparative analysis using ARMS data showed that these types of farms were different from "all other farms" in various ways. Moreover, the report's identification and estimation of factors related to farmer involvement in these activities could support the work of various entities in both the public and private sector as they interact with these farms.

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Appendix: The Logit Model, Estimation, and Discussion of Results

Theoretical Framework Underlying the Decision To Use the Logit Estimating Model

A farmer's decision to adopt a new technology or a new activity, such as organic production, value-added processing, direct marketing, agritourism, and energy and/or electricity production, could be viewed as a choice between a new and a traditional technology (activity). Choice models in consumer theory provided guidance for understanding innovation (or activity) adoption decisions (Fernandez-Cornejo, 1996). In this framework, the farmer is supposed to make the choice (to adopt or not to adopt) that will maximize the farmer's expected utility derived from the expected net income or profit from the adoption or nonadoption. This choice is affected by various farm and farmer characteristics. Since errors of perception, judgment, and optimization occur, the utility function is assumed to be random.

Following Mishra and Goodwin (2003), we wrote:

$$(1) \qquad \text{Max } \{E(U(\pi_i)) = f(\mathbf{X}i) + \varepsilon_i\}, \qquad i = 1,\ldots,n,$$

where $U(\pi_i)$ is i^{th} farmer's expected or perceived utility of adoption or nonadoption. f ( ) is a function of $\mathbf{X}_i = x_{i1}, \ldots\ldots, x_{ik}$, which is a $(1 \times k)$ vector of observable characteristics specific to the i^{th} farmer, the farm and the farm business, and ε_i is a random term representing a proxy for errors in farmer's perception and measurement of utility, unobserved characteristics or attributes and preferences, and instrumental variables (Ben-Akiva and Lerman, 1985; Fernandez-Cornejo, 1996).

Let $y_i = 1$ if the i^{th} farmer adopts, and $y_i = 0$ if i^{th} farmer does not adopt new technology. As the probability of a given farmer adopting is bounded by zero and 1, a limited dependent variable model like logit or probit is relevant. If ε_i is a random variable, is independently and identically distributed, and has a Weibull density function,[1] which is similar to the normal density function, but with greater kurtosis, or thicker tails, then the logit model is an appropriate choice model (McFadden, 1974 and 1981; Maddala, 1983). In the logit model, the probability of the i^{th} farmer adopting an activity is based on:

$$(2) \qquad P_i = P(y_i = 1 \mid \mathbf{X}_i) = 1/[1 + \exp - f(\mathbf{X}_i)],$$

where P_i is the i^{th} farmer's probability of adopting the activity, given the explanatory variables – $\mathbf{X}_i$ (Amemiya, 1981). Since the exact functional form of $f(\mathbf{X}_i)$ is not known, *a priori*, following Mishra and Goodwin, a linear form ($f(\mathbf{X}_i) = \mathbf{X}_i\beta$) is assumed, where β is a vector of $(1 \times k)$ coefficients. Since the β's have a nonlinear relationship with the probabilities (P_i), these coefficients do not have an easy interpretation. But these coefficients can be estimated and interpreted easily by taking the logarithm of the ratio of the probability of adoption to the probability of nonadoption:

$$(3) \qquad \ln (P_i / (1-P_i)) = \mathbf{X}_i'\beta,$$

[1]The most general form of the Weibull distribution has the three-parameter (β, η, γ) form, where, β is the shape or slope parameter, η is a scale parameter, and γ is a location parameter on the x-axis representing the time of the event or failure of occurrence. The parameter γ may assume all values and provide an estimate of the earliest time a failure may be observed, and may represent units such as hours, miles, cycles, actuations, etc. The Weibull distribution is versatile, capable of taking on the characteristics of other types of distributions, such as, normal distribution, two-parameter exponential distribution, etc. (Zanakis and Kyparsis, 1986).

where $X_i'\beta$ is the nonstochastic part of the model and is given by:

$$(4) \qquad \ln (P_i / (1-P_i)) = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \ldots.. + \beta_k x_{ki}$$

We used this form of the empirical model to estimate the farm and farmer's characteristics' effects on, or association with, the i^{th} farmer's probability or likelihood of adopting an activity.[2] The estimates of this model are shown in appendix table 1.

Estimating Standard Errors Using Jackknife Method

We relied on the jackknife method to estimate standard errors because:

- The estimation of the logit model does not provide a log-likelihood function for the fitting criterion and hence no matrix to yield standard errors of the estimated coefficients (Greene, 1990).
- The Agricultural Resource Management Survey (ARMS) data are based on a complex survey.

Both these traits require that standard errors for the coefficients be estimated via bootstrapping or jackknife methods.

ARMS is based on a complex survey design to select a farm sample representative of U.S. farms in the 48 contiguous States. So, the selected farm sample is not a simple random sample (see appendix box). This original sample of farms from which data have been collected is then divided by National Agricultural Statistics Service (NASS) into 15 almost equal and mutually exclusive subgroups of farms. First, NASS creates a vector showing the full sample weight (W) of the original survey, and then, using a resampling method with replacement, creates 15 vectors of replicate weights. These 15 vectors, plus the vector of full sample weights (W), are then used in 16 runs to estimate regression coefficients. The first estimated vector of regression coefficients (b) is based on W that provides full sample b of a given variable. The remaining 15 regressions of the same variable are based on the 15 vectors of the replicate weights, which yield a set of 15 β_k, (k=1,…., 15). The final step in the derivation of the jackknife variance for each regression coefficient is:

$$\mathrm{Var}(\hat{\beta}) = S \sum_{k=1}^{15} (\hat{\beta} - \hat{\beta}_k)(\hat{\beta} - \hat{\beta}_k)',$$

where $\mathrm{Var}(\hat{\beta})$ is a 15 x 15 matrix, S is a scalar as the adjustment factor to the degrees of freedom for the jackknife method and is equal to 14/15, $\hat{\beta}$ is an estimate from the full sample, and $\hat{\beta}_k$ is an estimate of the k^{th} jackknife sample. The square roots of the diagonal elements of $\mathrm{Var}(\hat{\beta})$ yield the proper jackknife standard errors of the regression coefficients of the explanatory variables (Dubman, 2000).

[2]In this appendix, we will use the word "effect" to describe the relationship between a farm or farmer characteristic and the probability of the farmer participating in a particular farm activity. Although the term "effect" suggests a particular direction of causality, the analysis actually only identifies a statistical association between the characteristics and the probability of participation, hence the direction of causality remains somewhat ambiguous.

Brief Description of ARMS Data

The Agricultural Resource Management Survey (ARMS) is conducted annually for U.S. farms in the 48 contiguous States by USDA's Economic Research Service and National Agricultural Statistics Service. For this survey, a U.S. farm is defined as any farm establishment, except institutional farms, that sold or normally would have sold at least $1,000 worth of agricultural products during the year.

This report used the 2007 ARMS Phase III survey, which was based on a probability-based stratified multiple frame sample of the U.S. farm population. Phase III, conducted during late winter and early spring of the year following the survey year, collected detailed data on the farm business, the farm operator, and the farm operator's household. ARMS also collected data on commodity and farm business practices and the production costs of targeted livestock commodities. Phase III included a small component "area frame," which may account for around 5 percent of the total sample (Banker et al., 2001). In Phase III for 2007, about 36,000 contacts were made and, out of those, a little over half were targeted for personal visits by enumerators to individual farmers for data collection. The rest of the sample was administered through mailed questionnaires. Out of these, 18,709 usable questionnaires were obtained in 2007 (Banker, 2007).

Model Performance Measures

Several model performance measures are presented at the end of appendix table 1. These measures indicate that our model performed satisfactorily for each of the five activities:

1. The F-value is significant at the 1-percent level for energy/electricity farms; at the 5-percent level for organic farms, value-added, and direct marketing farms; and at the 10-percent level for agritourism farms. A relatively large number of observations[3] for each activity helps improve the performance measures.
2. The McFadden R^2 serves as a measure of the extent of variation in the dependent variable that is explained by the model. Although we generally expect a value of 0.2 or above for this measure in a well-performing model, our model estimation is plagued by a dependent variable that is "overwhelmed by zeros," meaning that relatively few farms adopt each of these five activities, so the magnitudes of this measure are not too low to be viewed as problematic.
3. Chi-squared values are also large and highly significant at well below the 1-precent level, indicating that the models have performed well.
4. The percent of concordant values equals the correct predictions made by the estimated model. "Percent concordant" is the sum of percentages for the 0 and 1 predicted values by the model, and perfectly match the observed 0 and 1 values for each farm in the sample. The higher the percent of concordant (predicted) values, the more reliable the estimated model. Percent concordant values for estimated models

[3]The number of usable sample responses representing adoption in each model is indicated by "Sample" at the bottom of the appendix table 1 (p. 38), ranging from 333 responses for energy/electricity production to 1,115 responses for direct marketing. The total number of usable farm survey responses, including those that did not adopt, is 18,709, so the n is quite large.

for value added as well as energy/electricity farms is about 63. Future research should take a hard look at these models to respecify them for higher percent of concordant values.

Interpreting Coefficients of Dummy Explanatory Variables

There are a number of 0, 1 dummy variables (variables equal to 1 for meeting a condition and 0 for not meeting that condition) in our estimated models. For most of these dummy variables, that coefficient is interpreted as the effect of meeting the condition compared with not meeting the condition. For example, the positive and significant coefficient for the "Conserve" variable in the agritourism model indicates that farms engaged in conservation programs, compared with farms not engaged in conservation programs, are significantly more likely to be involved in agritourism. In cases where a set of three or more dummy variables are mutually exclusive, such as the ERS farm typology and geographic regions, the regression coefficient of the dummy variable(s) included in the estimated model is interpreted relative to the excluded variable(s) from that set of dummy variables.

For example, there are 10 regional dummy variables—one for each of 10 U.S. geographic regions. In the equation for value-added farms, we dropped seven regional dummy variables, keeping only three regional dummy variables (Northeast, Mountain, and Pacific). Thus, the coefficient for Northeast should be interpreted relative to the seven regional dummy variables that were dropped from the equation. The same holds for the coefficients of dummy variables for Mountain and Pacific regions.

Interpretation of Odds Ratios

The coefficient estimates ($\hat{\beta}$'s) presented in appendix table 1 are natural logarithms ($\log_e$) of the odds of the farmer participating relative to not participating in a niche farming activity, such as, organic production, value-added, direct marketing, agritourism, and energy or electricity production. To make it easier to interpret $\hat{\beta}$'s and compare them for various explanatory variables, we transform them into odds ratios, which refer to the effect of a change in an explanatory variable on the likelihood (odds) that the farmer participates in a given niche activity. Mathematically, the odds ratio for variable $X_k e^{\beta_k}$ = the odds (probability) of farmer involvement after X_k is increased by one unit / the odds of farmer involvement before the unit increase in X_k (Long and Freese, 2006). Odds ratios are presented in appendix table 2.

The odds ratio for a continuous explanatory variable represents the amount of change in the probability of occurrence for the dependent variable that will be caused by a unit change in that explanatory variable, keeping all other explanatory variables at their means. For example, the odds ratio for farm size in case of agritourism is 1.007 (see appendix table 2). This means that a 1-unit (100 acres) increase in farm size will increase the probability of participating in agritourism by 0.007 or 0.7 percent. Similarly, a 1-year increase in farm operator's age will decrease the probability of engaging in direct marketing by 0.012 (=1-0.988) or 1.2 percent, other things being equal.

The interpretation of odds ratios for most of the (0,1) categorical variables used in our model is also straightforward.[4] In case of organic production, the odds ratio for the categorical variable MngtAdvice (=1 if purchased farm management advice, = 0 otherwise) is 2.167. This means that a farmer who uses purchased management advice is 2.167 times more likely to be involved in organic production than a farmer who does not use purchased farm advice. In the case of value added activity, the odds ratio of a full owner is 0.662. This means a full owner has, other things being equal, two-thirds the probability of engaging in value-added activity compared to those who are not full owners (part-owners and full-tenants).

Interpreting the results for categorical variables involving more than two categories, such as the ERS farm typology and the region location variable, is slightly different from that of a typical (0,1) categorical variable, in that the effect is interpreted in relation to those categories excluded from the empirical model. For example, in the organic model, the intermediate farm type is included in the model, but the other two farm types (commercial and residential/lifestyle) are excluded. This means the 2.531 odds ratio for the intermediate farm variable would be interpreted as follows: an intermediate farm has 2.531 times greater likelihood of engaging in organic production as compared with a farm that is not an intermediate farm (a farm that is either commercial or residential/lifestyle). However, in the case of the direct marketing model, two of the farm types were included in the empirical model: intermediate and residential/lifestyle. Hence, the 2.495 odds ratio for the intermediate farm variable is interpreted as: an intermediate farm has 2.495 times greater likelihood of engaging in direct marketing compared with a commercial farm (since only the commercial farm category was excluded from the analysis).

The regional variables are interpreted in similar fashion. For instance, in the organic model, 5 of the 10 regions were included in the model: Northeast, Lake States, Corn Belt, Mountain, and Pacific. This means that the 24.96 odds ratio for the Northeast region variable is interpreted as follows: a farm located in the Northeast, other things being equal, is 25 times more likely to be engaged in organic production than farms located in the regions excluded from the model (Northern Plains, Southern Plains, Southeast, Delta, and Appalachia). Because a different set of regions is excluded from each model, comparisons of odds ratios of regions from one model to another for a particular variable are not recommended.

The odds ratios that are not significant at least at the 10-percent level are not reliable. For example, the odds ratio for the Corn Belt region in the model for organic production is quite large (3.02) but it is not significant at even the 10-percent level.

Direction for Future Research

Our models provide a good first attempt at a comparative analysis of the factors related to adoption of these five onfarm activities. This topic could certainly benefit from additional research.

Instead of the rural county measures used in our study, future research might experiment with other county-based demographic measures that correspond to rurality. These measures might include such county characteristics as

[4]Categorical variables in case of only two categories, such as 0 and 1, are referred to as dummy variables.

population density, population size, share of county population that is urban, share of workers commuting to metro counties, or even various measures of transportation access to large cities.

Future study could also use pooled data from many years of ARMS, potentially to identify growth in adoption and any structural or technological changes over the years. While true panels may be difficult to develop because ARMS does not typically survey the same farmers each year, pseudo panels may be useful. Additional future research may recognize the importance of bundling among the five activities. As noted earlier (see table 1, p. 8), we found substantial overlap because some farmers who adopt one activity may also adopt one or more of the other four activities.

Finally, future research may use other data sources. For example, the 2007 Census of Agriculture includes questions about activities similar to the ones asked in the 2007 ARMS. Using these data to estimate spatial econometric models, future research may yield a better understanding of the importance of various locational factors to explain adoption of some activities. When modeling farmer participation in energy or electricity production, another, potentially even more useful data source may be found in data from the USDA survey of renewable energy producers that was released in 2011.

Appendix table 1

Logit model estimates of participation in different types of farm activities, 2007

Farm/farmer characteristics	Farm activity				
	Organic production	Value-added	Direct marketing	Agritourism	Energy/ electricity
	Estimates of coefficients				
Intercept	-7.802*** (1.334)	-4.628*** (0.533)	-2.638*** (0.300)	-6.6158*** (0.6041)	-4.028*** (0.796)
ACRES: farm size in acres (100)	0.00018 (0.0033)	-0.0023 (0.0055)	0.0012 (0.002)	0.00695** (0.0026)	0.00038 (0.0018)
Farm family net worth ($10,000)			-0.0011* (0.0006)	0.00027** (0.000146)	0.00026** (0.0001)
Share of cropland to total land			-0.441*** (0.168)	-1.0803*** (0.2985)	-0.972* (0.587)
Share of rented land to total land				-0.0001*** (0.00003)	
Sells forest products (=1 if sells forest products, else =0)[1]	1.452* (0.820)	0.987*** (0.430)	1.058** (0.362)		0.0001** (0.00005)
Full owner (=1 if farmer owns all land in operation, else =0)		-0.413* (0.223)			
Sole proprietor (=1 if sole proprietor, else 0)	0.460 (0.353			-0.8035*** (0.2676)	
Access (=1 if free public access to farm, else =0)				2.1782*** (0.2879)	
Conserve (=1 if farm participates in conservation programs, else =0)				0.4895* (0.2745)	
Farm operator's age	-0.017 (0.015)	-0.004 (0.010)	-0.012** (0.005)	0.0248** (0.0119)	-0.013 (0.011)
Operator education (=1 if operator has at least some college education, else =0)	0.403 (0.458)	0.444*** (0.164)	0.423*** (0.103)	0.7882*** (0.2601)	0.673*** (0.251)
Sources of information for farmers:					
Internet (=1 if farmer has access to Internet, else =0)	1.070*** (0.403)	0.702*** (0.170)		0.4272* (0.2166)	0.350 (0.285)
MngtAdvice (=1 if farmer purchased farm management advice, else =0)	0.773*** (0.275)			0.5477* (0.2843)	
Other Advice (=1, if farmer received free farm management advice from source other than Natural Resources Conservation Service, else =0)		1.091*** (0.246)	0.596*** (0.215)		1.463*** (0.400)
Farms according to farm typology:					
RuResidence (=1 if rural residence farm, else =0)			0.397*** (0.155)		
Intermed (=1 if intermediate farm, else =0)	0.928*** (0.296)	0.374*** (0.180)	0.914** (0.129)	0.9706*** (0.2366)	
Farm location in rural area:					
Noncore (=1 if farm is in Nonmetro-noncore county, else =0)			-0.455*** (0.138)		

—continued

Appendix table 1

Logit model estimates of participation in different types of farm activities, 2007—Continued

Farm/farmer characteristics	Farm activity				
	Organic production	Value-added	Direct marketing	Agritourism	Energy/ electricity
	Estimates of coefficients				
Geographic region[2] where farm is located:					
NEAST (=1 if farm is in Northeast, else =0)	3.217***	0.807***			
	(0.573)	(0.186)			
LAKESTATES (=1 if farm is in Lake States, else =0)	1.378**		0.847***		-1.240***
	(0.636)		(0.206)		(0.373)
CORNBELT (=1 if farm is in Corn Belt, else =0)	1.105*				
	(0.676)				
SPLAINS (=1 if farm is in Southern Plains, else=0)			-0.936***	0.8938***	-1.318**
			(0.255)	(0.2813)	(0.572)
MOUNTAIN (=1 if farm in Mountain region, else=0)	1.806***	1.092***		0.5165	1.287***
	(0.697)	(0.426)		(0.3503)	(0.433)
PACIFIC (=1 if farm is in Pacific region, else =0)	3.368***	0.778***	0.843***		
	(0.464)	(0.274)	(0.204)		
	F(13, 2)	F(11,4)	F(13, 2)	F(14, 1)	F(11, 4)
F-value	21.96	7.97	22.86	60.75	15.58
Prob > F	0.044	0.023	0.043	0.100	0.009
-2 Log likelihood (restricted)	243,294	442,665	954,253	354,380	295,569
-2 Log likelihood	189,472	413,574	895,227	289,887	265,300
McFadden R^2	0.221	0.066	0.062	0.182	0.102
Chi-squared	54,822	29,091	59,026	64,494	30,269
Correct predictions (percent)	84.6	62.8	68.8	71.3	63.0
Sample	429	555	1,115	362	333
Weighted sample	21,669	45,474	124,092	34,417	27,498

Notes: Numbers in the parentheses are jackknife standard errors. ***, **, and * indicate that the coefficient is significantly different from zero at the 1-percent, 5-percent, and 10-percent level, respectively. Blanks in each model show that these variables were included in the early stages of analysis, but because their t-values were less than 1.0, in the final estimation, these variables were left out of the estimated equations.

[1]For energy/or electricity farms, "sells forest products" represents actual value of sales from forest products not a dummy variable. For agri-tourism, when "sells forest products" (dummy variable) was included in the this model, the "sells forest products" coefficient was positive but not significant even at the 10-percent level. We dropped this variable because its inclusion raised the number of explanatory variables to 15 and, since the 2007 ARMS data supplies only 15 replicate weights, there are not enough degrees of freedom available to calculate the F-statistic via the delete-a-group jackknife method.

[2]There are 10 geographic regions in the 48 contiguous United States—Northeast, Lake States, Corn Belt, Northern Plains, Appalachia, Southeast, Delta, Southern Plains, Mountain, and Pacific. See the footnote 1 to table 2, p. 11, for a list of States in each region.

Source: USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2007.

Appendix table 2

Logit model estimates of odds ratios on the participation in five farm activities, 2007

Farm/farmer characteristics	Farm activity				
	Organic production	Value-added	Direct marketing	Agritourism	Energy/ electricity
			Odds ratios[1]		
ACRES: Farm size in acres (100)	1.0002 (0.05)	0.998 (-0.42)	1.0012 (0.69)	1.007** (2.67)	1.0004 (0.22)
Farm family net worth ($10,000)			0.999* (-1.88)	1.0003* (1.86)	1.0003*** (2.45)
Share of cropland to total land			0.643** (-2.62)	0.3395*** (-3.62)	0.378 (-1.65)
Share of rented land to total land				0.9999*** (-3.24)	
Sells forest products[2] (=1 if farm sells forest products, else =0)	4.273* (1.77)	2.682** (2.30)	2.88*** (2.92)		1.0001** (2.19)
Full owner (=1 if farmer owns all land in operation, else =0)		0.662* (-1.85)			
Sole proprietor (=1 if sole proprietor, else=0)	1.584 (1.30)			0.448*** (-3.00)	
Access (=1 if free public access to farm, else =0)				8.83*** (7.57)	
Conserve (=1 if farm participates in conservation programs, else =0)				1.632* (1.78)	
Farm operator's age	0.983 (-1.16)	0.996 (-0.38)	0.988** (-2.44)	1.025** (2.08)	0.987 (-1.21)
Operator education (=1 if operator has at least some college education, else =0)	1.496 (0.88)	1.559** (2.70)	1.527*** (4.10)	2.2*** (3.03)	1.961*** (2.68)
Sources of information for farmers:					
Internet (=1 if farmer has access to Internet, else =0)	2.916** (2.66)	2.018*** (4.13)		1.533* (1.97)	1.419 (1.23)
MngtAdvice (=1 if farmer purchased farm management advice, else =0)	2.167** (2.81)			1.729* (1.93)	
Other Advice (=1 if farmer obtained unpaid farm management advice from source other than Natural Resources Conservation Service, else =0)		2.976*** (4.43)	1.814** (2.77)		4.318*** (3.66)
Farms according to farm typology:					
RurResidence (=1 if rural residence farm, else =0)			1.488** (2.56)		
Intermed (=1 if Intermediate farm, else =0)	2.531*** (3.14)	1.453** (2.08)	2.495*** (7.08)	2.64*** (4.10)	
Farm location in rural area:					
NONCORE (=1 if farm in Nonmetro-noncore county, else =0)			0.634*** (-3.30)		

—continued

Appendix table 2

Logit model estimates of odds ratios on the participation in five farm activities, 2007—Continued

Farm/farmer characteristics	Farm activity				
	Organic production	Value-added	Direct marketing	Agritourism	Energy/ electricity
			Odds ratios[1]		
Geographic region[3] where farm is located:					
NEAST (=1 if farm is in Northeast, else =0)	24.96***	2.240***			
	(5.61)	(4.34)			
LAKESTATES (=1 if farm is in Lake States, else =0)	3.967**		2.333***		0.289***
	(2.17)		(4.12)		(-3.32)
CORNBELT (=1 if farm is in Corn Belt, else =0)	3.02				
	(1.64)				
SPLAINS (=1 if farm is in Southern Plains, else=0)			0.392***	2.444***	0.268**
			(-3.67)	(3.18)	(-2.30)
MOUNTAIN (=1 if farm is in Mountain region, else=0)	6.083**	2.979**		1.676	3.622***
	(2.59)	(2.56)		(1.47)	(2.97)
PACIFIC (=1 if farm is in Pacific region, else =0)	29.02***	2.176**	2.324***		
	(7.26)	(2.84)	(4.13)		
Predicted probability by the model	0.0099	0.0207	0.0565	0.0157	0.0125
Sample	429	555	1,115	362	333
Weighted sample	21,669	45,474	124,092	34,417	27,498

Notes: Numbers in the parenthses are t-values derived from jackknife standard errors. ***, ** and * indicate that the odds ratio is significantly different from zero at the 1-percent, 5-percent, and 10-percent level, respectively. Blanks in each model show that these variables were included in the early stages of analysis, but because their t-values were less than 1.0, in the final estimation, these variables were left out of the estimated equations.

[1]For a dummy variable, odds ratio shows change when a dummy variable is equal to 1 relative to when that dummy variable is equal to 0.

[2]For energy/electricity farms, “sells forest products” represents actual dollar value of sales, not a (0,1) dummy variable.

[3]There are 10 geographic regions in the 48 contiguous United States—Northeast, Lake States, Corn Belt, Northern Plains, Appalachia, Southeast, Delta, Southern Plains, Mountain, and Pacific. See the footnote 1 to table 2, p. 11, for a list of States in each region.

Source: USDA, Economic Research Service and National Agricultural Statistics Service, Agricultural Resource Management Survey, 2007.

Appendix table 3

Information sources, by farm activity

Farm activity	Topic and source of information
Organic	• The U.S. organic industry, perceived benefits and emerging issues (Greene et al., 2009) • National standards for organic certification (Greene and Kremen, 2003) • Factors influencing organic involvement in local sales, and effects on organic farm incomes (Park and Lohr, 2010) • Bottlenecks in organic markets (Martinez et al., 2010) • Logit analysis of factors related to farmer involvement in organic activities (Oberholtzer et al., 2008) • 2007 Census of Agriculture (http://www.ers.usda.gov/Briefing/Organic/) • Surveys of organic producers (Fernandez-Cornejo et al., 1998; Walz, 1999)
Value added	• General information on value-added activities and their potential benefits to farmers and the rural community (Lewis, 2002) • Organic farmers involved in value-added activities (Waltz, 2004; Oberholtzer et al., 2008)
Direct marketing	• Barriers to local food-market entry and expansion, and possible solutions to these problems (Martinez et al., 2010) • Characteristics of local food suppliers, including statistics and map using data from 2007 Census of Agriculture (Martinez et al., 2010) • More on characteristics of local food suppliers (Hunt, 2007; Starr et al., 2003) • Relationship between direct sales and other farm entrepreneurial activities (Martinez et al., 2010) • Importance of direct sales to intermediaries, and factors related to inter-county variations in the level of direct sales activity (Low and Vogel, 2011)
Agritourism	• General information about agritourism (Barnardo et al., 2004; Brown and Reeder, 2007) • Importance and effects on other farm activities (Veeck et al., 2006; Carter, 1998) • Growing importance in Europe and worldwide (OECD, 2009) • U.S. survey of farm visitation, part of the 2000 National Survey on Recreation and the Environment http://www.srs.fs.usda.gov/; (Hellerstein, 2003) • Reasons why farmers are involved and successful in agritourism (Nickerson et al., 2001; Mace, 2005; McGehee and Kim, 2004; Rilla, 2000) • Statistical studies identifying factors related to agritourism (Barnardo et al., 2004; Brown and Reeder, 2007; Barbieri and Mshenga, 2008) • A U.S. county-level map and accompanying text using 2007 Census of Agriculture data (Bagi and Reeder, 2011; http://www.ers.usda.gov/AmberWaves/March11/Indicators/OnTheMap.htm/)
Energy/electricity	• Survey of renewable energy production on farms (USDA/NASS, 2011) • USDA programs supporting renewable energy (USDA, 2010) • Definition of renewable energy (Oregon Department of Energy, 2006) • The need for research on costs relative to environmental gains (Islam, 2007) • Methane digesters (The Minnesota Project; Lazarus and Rudstrom, 2004; Zinkand, 2006; Islam, 2007)