

USDA

United States
Department
of Agriculture

RCS-11d-01
April 2011

Outlook



A Report from the Economic Research Service

www.ers.usda.gov

Consolidation and Structural Change in the U.S. Rice Sector

Katherine Baldwin, kbaldwin@ers.usda.gov

Erik Dohlman, edohlman@ers.usda.gov

Nathan Childs, nchilds@ers.usda.gov

Linda Foreman, lforeman@ers.usda.gov

Abstract

The U.S. rice farming industry experienced substantial structural changes from 1992-2007, with the average farm size more than doubling by 2007 and the number of rice farms dropping by almost half. In addition, a substantial share of production shifted from the high-cost Gulf Coast region to the more competitive Arkansas Non-Delta and Mississippi River Delta growing areas. Farm consolidation and regional shifts are being shaped by cost and productivity considerations, barriers to entry for new farmers, and competitive average net returns, which support continued production by existing operators. High startup costs, rice-specific production management skills, and risk exposure are likely the key factors deterring entry. Rice farms are the most capital-intensive row crop farms in the United States and have the highest national average land rental rate of all major crops. At the same time, returns to rice production are highly variable due to fluctuating input costs and volatility in farm prices. Though rice farming requires large investments in land and capital, lack of other economic opportunities and competitive average net returns support continued production by existing operators. In this report, we investigate the factors driving these structural changes and explore the implications of those changes for market efficiency and competitiveness of the U.S. rice industry. Recent trends and economic incentives point to continued consolidation and area shifts. Overall rice area is expected to average about 3.3 million acres over the next decade, above the 2000-2009 average of 3.1 million acres.

Keywords: rice, production, yields, harvested area, cost of production, farm size, farm numbers, net returns, consolidation, structural change, startup costs, barriers to entry, ownership arrangements

Acknowledgments

The authors would like to acknowledge the support of Donna Roberts, Chief, Food and Specialty Crops Branch, and Richard Stillman, Chief, Animal Products and Cost of Production Branch, both of the Market and Trade Economics Division, Economic Research Service, USDA. Additionally, we would like to thank all of our reviewers for their comments and insights, including: Bobby Coats and Brad Watkins, both of the

Contents

Introduction.....	3
Rice Farms Expand in Scale as Number of Farms Dwindles.....	5
Growth in Farm Size Partially Driven by Advantages of Scale.....	7
Differences in Cost Structures Spur Regional Production Shifts	10
Economic Factors Limit Rice Farm Entries and Shape Industry Structure.....	15
Economic Returns to Rice Production Remain Comparatively High	20
USDA 10-Year Baseline Projections Indicate Continued Farm Consolidation	23
Conclusions	27
References	28

Approved by USDA's
World Agricultural
Outlook Board

University of Arkansas; Steve Martin, Mississippi State University; Michael Salassi, Louisiana State University; Mark Simone, Farm Service Agency, USDA; and Andrew Aaronson, Rice Interagency Commodity Estimate Committee Chairman, Office of the Chief Economist, USDA. Thanks to the participants of the 2010 Rice Technical Working Group meetings in Biloxi, Mississippi, who provided guidance and suggestions on the preliminary research that became the foundation for this report, and to Priscilla Smith and Susan DeGeorge for editorial and design assistance.

Introduction

The past decade has been characterized by significant changes to the structure of the U.S. rice-farming industry. With demand from domestic consumers and export markets higher than previous years, U.S. rice production has risen. However, the number of rice farms has declined while the average size of the remaining rice farms has expanded substantially, according to the U.S. Census of Agriculture (see box, “Data Sources”). Between 1992 and 2007, the number of U.S. rice farms fell from 11,212 to 6,084, and average rice acreage per farm grew from 278 acres to 453 acres. The largest rice farms account for a growing share of rice production, with those larger than 1,000 acres of rice producing 36 percent of the U.S. crop in 2007, compared with 14 percent in 1992. The location of rice farms has also shifted. While the number of rice farms decreased in all major rice-producing States between 1992 and 2007, Arkansas and Missouri raised their share of rice production, largely because of lower production costs due to economies of scale, management expertise, infrastructure, and increased productivity. Meanwhile, California rice producers have been able to direct much of their production toward World Trade Organization (WTO) market access commitments since 1995. By contrast, price, climatic factors, and higher production costs combined to cause lost market share in other areas, with a particularly pronounced drop in farm numbers in Texas and the historic coastal region of Louisiana.

These changes raise three key questions:

- What factors drove these structural changes?
- What are the implications of these changes for market efficiency and for the competitiveness of the U.S. rice industry?
- Will these changes continue, and if so, what will the U.S. rice farming sector look like in a decade?

In this report, we evaluate the nature and causes of structural change in the U.S. rice-farming sector, highlighting the changing number, scale,

Data Sources

We used data primarily from the U.S. Census of Agriculture (1992, 1997, 2002, and 2007). To track major trends in U.S. agriculture, USDA’s National Agricultural Statistics Service (NASS) conducts a Census of Agriculture twice a decade. The census includes information on farm and producer characteristics, types of planted crops, acreage, yields, production, total assets, farm receipts, and producer demographics. Data are released on a State-by-State and national basis. By comparing the recently released 2007 Census of Agriculture with earlier ones, recent developments in the U.S. rice-farming industry can be analyzed.

Combining agricultural census data with detailed cost and returns information from the USDA rice Agricultural Resource Management Survey (ARMS) of 2000 and 2006 provides a more comprehensive and longer-term perspective on developments within the sector. ARMS is conducted for rice farms every 5 to 6 years, and is undertaken jointly by NASS and the Economic Research Service (ERS). The USDA 10-year baseline projections are the USDA consensus view of anticipated future market developments, given the policy and economic assumptions at the time of its publication (USDA, 2011).

and location of rice farms. The role of economic factors that deter entry into rice farming and other factors that support the ongoing operation of existing farms are emphasized. Past developments provide context for the USDA 10-year agricultural baseline projections, which identify the primary economic and policy factors likely to guide future industry trends (USDA, 2011).

Rice Farms Expand in Scale as Number of Farms Dwindles

Two of the most notable trends identified by the 2007 and earlier agricultural censuses are the ongoing decline in the number of rice farms and the steady rise in the average number of acres of rice on the remaining farms. Both trends are not unique to rice production (table 1).¹ The 6,084 U.S. rice farms reported in 2007 represent a 46-percent decline in farms since 1992. Over the same period, the average rice acreage per farm rose 63 percent.² Rice farms in 2007 had the second-highest average acreage of all farms that produced major field crops. Cotton farms had the largest average acreage (564 acres), followed by rice (453 acres), wheat (317 acres), corn (248 acres), and soybeans (229 acres).³

The distribution of farm size share has also changed markedly over the last three agricultural censuses, with larger farms now accounting for a greater share of the total number of rice farms than in previous years (table 2). Farms with 1,000 or more acres of rice accounted for a larger percentage of all rice farms in 2007 (10 percent) than in previous agricultural censuses.

Table 1
U.S. rice farm statistics

	1992	1997	2002	2007
Number of farms	11,212	9,627	8,046	6,084
Individual, family, or family-held corporation farms	8,291	6,525	5,749	3,848
Average all-farm rice acreage	278	328	397	453
Total rice acreage	3,117,718	3,161,576	3,197,641	2,758,792

Note: While "number of farms" and "total rice acreage" are updated in the Census of Agriculture subsequent to the original data release, farm classifications as individual or family farms are not. In the interest of including the most recent data available, we have included updated farm numbers and acreage in this table. However, farm classification data come from the original data release.

Source: USDA, NASS, Census of Agriculture, 1992, 1997, 2002, 2007.

Table 2
Distribution of rice farms by size

Harvested acres of rice	1992		1997		2002		2007	
	Farms	Rice acres	Farms	Rice acres	Farms	Rice acres	Farms	Rice acres
1-99	2,620	134,587	1,937	98,867	1,502	75,963	1,047	55,674
100-249	3,772	634,961	3,001	511,085	2,214	371,716	1,459	246,020
250-499	3,296	1,130,817	2,837	991,624	2,199	775,819	1,616	569,073
500-999	1,232	804,740	1,437	936,483	1,504	1,001,665	1,346	892,471
1,000+	292	412,613	415	623,517	627	972,478	616	995,554
Total	11,212	3,117,718	9,627	3,161,576	8,046	3,197,641	6,084	2,758,792

Note: For Table 2 and all of the following tables and figures, data for 1992 comes from the 1997 Census.
Source: USDA, NASS, Census of Agriculture, 1997, 2002, 2007.

¹In fact, the same holds true for corn, cotton, soybean, and wheat farms. Between 1992 and 2007, the number of farms growing each of these field crops declined by at least 25 percent, while the average acreage per farm of the specified commodity increased at least 50 percent.

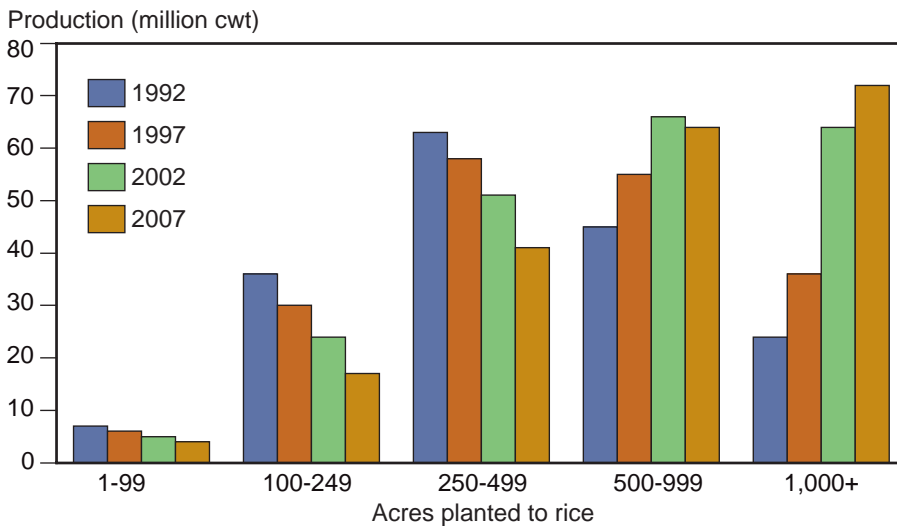
²While the number of rice farms and rice acreage declined between the 1997 and 2007 agricultural censuses, rice production was higher in 2007 because yield growth more than offset the decline in acreage. Between the 2002 and 2007 censuses, declining farm numbers more than offset the impacts of larger farm size and higher yields, resulting in a 6-percent decline in production—from 210 million hundredweight (100 pounds (cwt)) to 199 million cwt. Both area and production have increased since 2007, with 3.615 million acres harvested in 2010, producing a record 243.10 million cwt. Data on the number of farms will not be known until the next Census of Agriculture is taken in 2012.

³These figures refer to average acres planted to the specific commodity mentioned. Overall farm size is typically much larger, as many operations plant numerous crops or hold acreage fallow.

Production from larger farms continues to account for an increasing share of total production as shown by changes in the production distribution by farm size over time (fig. 1). In the latest Census of Agriculture, farms with over 1,000 acres of rice produced 36 percent of the overall crop, overtaking other farm sizes in production share. Similarly, as rice farms have consolidated into fewer, but larger entities, a greater proportion of these operations have become very high-grossing enterprises (fig. 2).⁴ However, along with increased size and specialization comes increased risk exposure. This topic will be revisited later in the report.

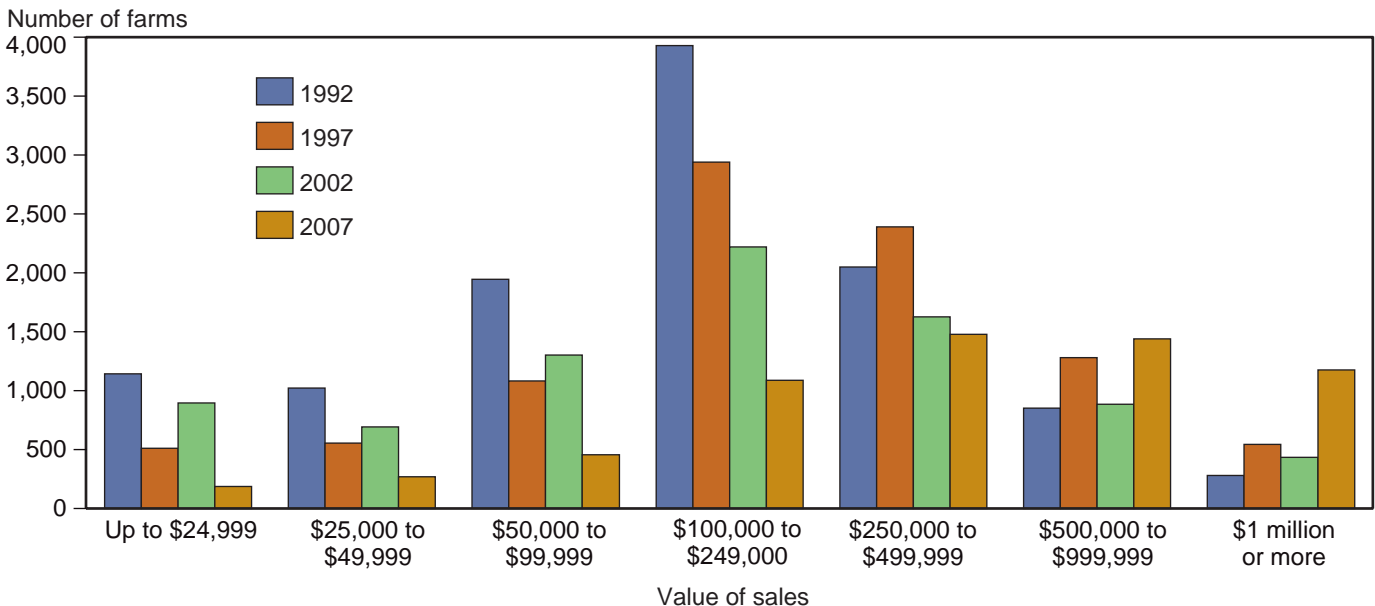
⁴Gross farm sales are calculated as a market value of agricultural products sold in addition to Government payments. For the three agricultural censuses preceding 2007, the largest share of producers earned \$100,000-\$250,000, with roughly equal numbers earning more or less than that amount. However, the latest Census of Agriculture showed that two-thirds of U.S. rice farms reported total sales of more than \$250,000, and nearly 43 percent of rice farms had gross sales of over \$500,000. This is up from 16.4 percent in 2002, almost 20 percent in 1997, and just 10.1 percent in 1992.

Figure 1
An increasing share of U.S. rice is grown on larger rice enterprises



Cwt = hundredweight (100 pounds).
 Source: USDA, NASS, Census of Agriculture, 1997, 2002, 2007.

Figure 2
More than two-thirds of U.S. rice farms have a sales value of more than \$250,000



Source: USDA, NASS, Census of Agriculture, 1997, 2002, 2007.

Growth in Farm Size Partially Driven by Advantages of Scale

The forces driving a decline in farm numbers and an increase in average farm size are primarily financial pressures and economic incentives. These factors are pushing rice producers to reduce per-unit costs by making more efficient use of resources through greater specialization or by creating enhanced economies of scale (efficiencies from increased size). Previous research found that farm size, changes in production technologies, and specialization were largely responsible for boosting productivity and lowering unit costs in the poultry, swine, dairy, and the livestock sector as a whole (MacDonald, 2008; Key and McBride, 2007; MacDonald et al., 2007; and MacDonald and McBride, 2009). For example, MacDonald et al. (2007) found that the smallest dairy herd sizes in 2005 had output per cow that was 25 percent lower than the largest herd-size category, and per-unit total costs that were 121 percent higher.

The link between farm size and reduced unit costs is not as strong in the crop sector as it is in livestock, with previous studies based on Agricultural Resource Management Survey (ARMS) data showing mixed results. Foreman (2006) found that total (operating, ownership, and economic) costs per acre were virtually identical for corn farms of varying size, but noted that higher yields provided greater returns per unit for larger farms than for smaller ones. Similarly, Brooks (2001) reported that the largest two among five size categories of cotton farms had similar, or even slightly higher, costs per acre than the smaller classes, but higher yields again produced greater per-unit returns to the larger farms. In contrast, the largest wheat and soybean farms had lower average yields than smaller farms producing the same commodity. However, only wheat farms showed a consistent decline in per-acre costs as farm size increased, which enhanced net returns for the larger farms. Soybean farms in the mid-sized ranges (250-499 acres and 500-749 acres) had, by small margins, lower costs and higher yields than the smallest and largest farms (Ali, 2002; Foreman and Livezey, 2002).

For rice, yield differences apparently played little role in promoting increased farm size. Average rice yields in 2000-09 were 17 percent higher than the previous decade. However, agricultural census data indicate that rice yields vary little by farm size, and that the gap between the yields from large farms and small farms has narrowed in recent years. In the 2007 census, farms exceeding 1,000 acres of rice achieved yields less than 1 percent higher than the average, while farms with less than 100 acres achieved yields 5 percent below average. In 2002, the smallest farms had yields 8 percent below the average, while yields among the largest farms were 1 percent higher than average. Farms in the intermediate-sized categories reported yields ranging from 2 percent less to 1 percent greater than the average.⁵

Previous research on farm consolidation suggested that the phenomenon was motivated by economies of scale based primarily on per-unit cost advantages, but this now seems to be less of a factor. At the beginning of the 1990s, Salassi (1992) found that, while per-acre variable cash expenses were similar among rice farms of different size classes, per-acre fixed cash expenses—such as farm overhead, taxes, and interest expenses—declined as farm sizes

⁵Farms with 250-499 acres had yields slightly higher than those with 500-999 acres, perhaps indicating some regional or varietal (long vs. short/medium grain) distinctions (e.g. with the former category clustered in regions with more favorable soil and climatic conditions).

increased. In the past, rice farms that grew in size—regardless of location or other characteristics—could become more competitive by spreading fixed costs over a larger area.

The relationship between rice farm size and lower unit costs is somewhat supported by the most recent ARMS evaluation of rice farm costs and returns (Livezey and Foreman, 2004).⁶ Livezey and Foreman (2004) reported wide variations in per-unit average costs between farms, although the differences in average unit costs by farm size were not statistically significant (table 3).⁷ Farms with less than 250 acres of rice had per-unit operating and ownership costs of \$6.41 per hundredweight, or 100 pounds (cwt). These costs fell to \$5.86/cwt among farms with 750 or more acres. On a per-acre basis, there was little difference in ownership costs (capital recovery of machinery and equipment, taxes and insurance) by farm size. However, operating costs were much higher for farms with fewer than 250 rice acres (\$364 per acre) than for farms of 250-499 acres (\$312 per acre), 500-749 acres (\$284 per acre), and 750 or more acres (\$298 per acre). The main reason for the higher operating costs for smaller farms were the custom operations associated with harvesting and drying. The smallest farms spent almost \$113 per acre on all custom operations, compared to \$48 to \$74 per acre for the other farm size classes.

Rather than a straightforward relationship between farm size and per-unit output costs, ARMS data—supported by data and trends from successive agricultural censuses—shows that regional variations in production practices and costs, farm and farm-operator characteristics, and growing conditions are all key factors influencing the structure and location of rice farms in the United States.

⁶Livezey and Foreman (2004) use data from the 2000 ARMS on rice production costs. A more recent survey was conducted in 2006, but due to time limitations, the data have not been vetted and tailored for the types of comparisons made with the data from the previous survey.

⁷Average costs ranged from \$3.99/cwt for the one-quarter of farms with the lowest costs to \$8.94/cwt for the quarter with the highest costs.

Table 3

Rice farm costs and returns, 2000

Item	Fewer than 250 acres	250-499 acres	500-749 acres	750 or more acres
Number of farms	3,070 ^{CD}	2,339 ^C	*913 ^{AB}	^a 742 ^A
Rice acreage				
Percent of rice acres	*15.5	*31.4	19.6	#33.4
Percent of rice production (cwt)	*16.3	*31.7	19.0	^a 33.0
Yield in cwt per acre				
Expected	74.2	71.1	69.5	70.3
Actual	70.8	68.2	65.4	66.7
Operating & ownership costs/cwt				
Expected	6.12	5.76	5.54	*5.56
Actual	6.41	6.00	5.88	*5.86
Per acre costs of rice production				
Gross value of production (in \$/acre)	380.57	372.33	360.14	364.60
Operating costs (in \$/acre)	363.66	312.33	283.92	#298.49
Seed	24.89	23.05	21.97	23.61
Fertilizer	51.16	44.30	#43.01	*48.91
Soil conditioners	*0.01 ^D	*0.03 ^{CD}	*0.01 ^B	^a 0.00 ^{AB}
Manure	0.00	0.00	0.00	0.00
Chemicals	55.59	50.54	43.88	48.24
Custom operations—drying	30.05 ^C	24.94	19.11 ^A	DI
Custom operations—harvesting	19.06 ^{BCD}	*5.53 ^{AD}	#2.53 ^A	DI
Custom operations—other ¹	63.67	43.53	39.30	35.43
Fuel, lube, and electricity—irrigation	*33.59	44.06	*40.21	*44.71
Fuel, lube, and electricity—other ¹	13.91	14.49	14.96	18.83
Repairs	18.18	19.43	20.53	*18.55
Purchased irrigation water	*18.58	10.10	^a 6.93	^a 11.08
Interest on operating capital	9.30 ^B	7.89 ^A	7.09	*7.38
Hired labor	*25.68	24.44	*24.39	^a 29.41
Ownership costs (in \$/acre)	90.13	96.90	100.60	92.52
Capital recovery of machinery and equipment	74.13 ^C	79.04	86.49 ^A	*78.09
Taxes and insurance	16.00	17.86 ^D	14.11	14.43 ^B
Operating costs (in \$/acre)	363.66	312.33	283.92	#298.49
Operating and ownership costs	453.79	409.22	384.52	*391.00
Total costs	658.61	604.96	546.79	*536.19
Value of production in \$/acre less				
Operating costs	^a 16.91	60.01	#76.22	^a 66.12
Operating and ownership costs	*-73.22	*-36.89	^a -24.39	^a -26.40
Total costs	-278.04	-232.63	*-186.66	^a -171.59

¹Statistical significance not evaluated for these categories.

Cwt = hundredweight.

Coefficient of variation = (standard error/estimate)*100. * 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. ^a indicates that CV is above 75.

Letters A, B, C, and D indicate significant column difference tests based on pairwise two-tailed [$H_0: B_1=B_2$] delete-a-group Jackknife t-statistics at a 90-percent confidence level or higher. A=column 1, B=column 2, etc.

DI = Data insufficient for disclosure.

Source: USDA, NASS and ERS, 2000 Agricultural Resource Management Survey. (Based on 607 observations that are weighted to represent the planted rice acres in the surveyed States. Coverage includes 5 States: Arkansas, California, Louisiana, Mississippi, and Texas.)

Differences in Cost Structures Spur Regional Production Shifts

Reduced unit costs associated with farm size may have motivated some of the overall farm consolidation, but a significant and closely related factor is the shift of production to lower-cost production areas, particularly within the Southern rice-growing region, which consists of the Arkansas Non-Delta, the Mississippi River Delta, and the Gulf Coast production region. The industry in California, the fourth rice-growing region, supplies a much different high-quality medium-grain market and is discussed later (see box, “U.S. Rice Industry Overview”).

Though States in all regions have lost farms over the past few decades, total acreage is a more appropriate measure of geographical industry shifts than farm numbers, especially in light of the farm consolidation issue discussed above. Changes in total acreage have been especially pronounced in the Gulf Coast States of Louisiana and Texas, with the region losing almost 50 percent of its rice area between 1992 and 2007 (table 4). Acreage within the Arkansas Non-Delta and the Mississippi River Delta regions declined 5 percent, well within the normal year-to-year range of planted acreage variation.

More Farm Exits for High-Cost Gulf Coast Region

The geographical shifts in production are closely related to regional differences in production costs (table 5). In the South, for example, production costs in the Gulf Coast were 15-16 percent greater than in the other two regions (Arkansas Non-Delta and Mississippi River Delta) in 2009, with operating costs being the main distinguishing factor.⁸ One of the biggest differences in operating costs comes from Gulf Coast producers’ planting method. Along the Gulf Coast, rice is typically aerial-seeded to control red rice (a persistent weed common in cultivated rice fields in the South that reduces crop yield and quality). This seeding method requires more seeds per acre and also results in higher costs for custom operations. Additional chem-

⁸ARMS data from 2000 found that 60 percent of the country’s low-cost farms were in the Arkansas Non-Delta region, while 14 percent were located in the Mississippi River Delta. Conversely, 37 percent of the Nation’s high-cost farms were located on the Gulf Coast, with just 15 percent in the Mississippi River Delta. Salassi (1998) found that the three regions had identical dollars-per-acre production cost rankings. Low-cost rice farms were defined as the quartile of total U.S. rice farms with the lowest costs, while high-cost farms were defined as the quartile with the highest costs.

Table 4
Rice planted area comparisons: 1992-2007¹

	1992	1997	2002	2007	1992-2007
	-----Planted acres-----				Percent change
Louisiana	630	585	540	380	-40
Texas	353	260	206	146	-59
Gulf Coast	983	845	746	526	-46
Arkansas	1,400	1,400	1,516	1,331	-5
Mississippi	280	240	255	190	-32
Missouri	117	122	190	180	54
Other South	1,797	1,762	1,961	1,701	-5
California	396	518	533	534	35
United States	3,176	3,125	3,240	2,761	-13

¹Area losses in Louisiana in 2007 may be exaggerated due to lingering salt water intrusion effects from Hurricane Katrina in 2005. However, the long-term trend of area loss in Louisiana is well-established.

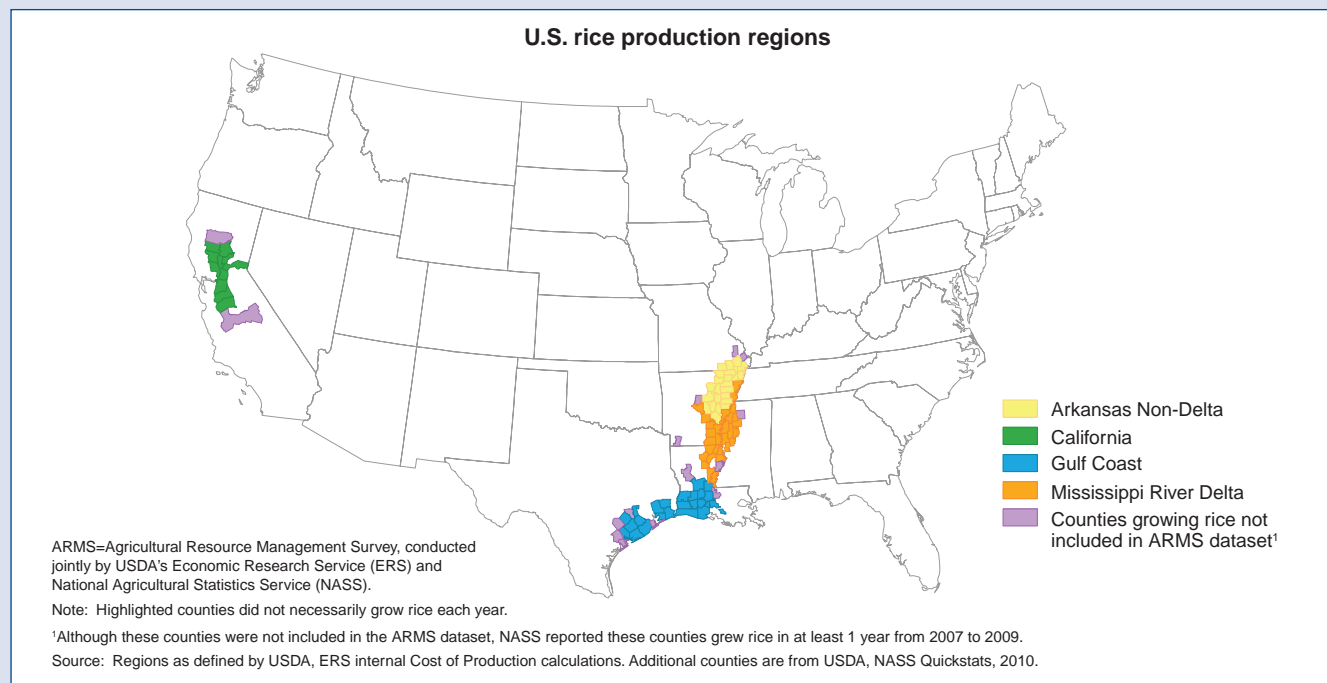
Source: USDA, NASS, Quickstats, 2010.

U.S. Rice Industry Overview

Rice production is limited to certain areas within the United States, based on the physiological needs of the rice plant. Abundant irrigation water, whether from surface-water sources like rivers, bayous, or canals, or pumped from groundwater aquifers, is required. All U.S. rice acreage is irrigated. Soil type is also important, as rice can only be economically grown in soils that are able to retain water or hold a shallow flood. Rice fields need to be reasonably level in order to maintain uniform water depth, and, increasingly, rice fields are leveled with precision laser technology for this reason. Lastly, rice requires warm temperatures during critical growing stages, as cool temperatures cause plant sterility. Currently, the U.S. production areas in Arkansas, California, Louisiana, Mississippi, Missouri, and Texas provide the best balance of climate and topography.

U.S. rice production is divided into four regions based on soil classifications and other characteristics (see map). The Arkansas Non-Delta, comprised of most counties in Northeastern Arkansas, as well as the Bootheel of Missouri and the Arkansas Grand Prairie. The Mississippi River Delta region includes counties in Southeastern Arkansas (primarily adjacent to the Mississippi River), as well as all production in Mississippi and Northeast Louisiana. The Gulf Coast production region is split between Southern Louisiana and counties on the Coastal Plain of South Texas. These three production areas in the South account for about 80 percent of U.S. rice acreage and production, with the fourth region, California, accounting for the balance.

California grows almost exclusively high-quality medium- and short-grain rice varieties, both for the domestic and export markets. The Southern production areas grow nearly all of the long-grain rice produced in the U.S. The South also produces a varying share of medium- and short-grain rice, depending upon market conditions, with Southern medium-grain primarily used in processed products such as cereal.¹



The U.S. is a net rice exporter, annually exporting approximately 45 percent of production, and typically ranks as the fourth- or fifth-largest exporter. A large share of U.S. rice exports (typically between 30 and 40 percent) consists of rough (unmilled or paddy) rice. The United States is the primary global source of rough rice. All other major exporters ship milled rice to protect their domestic milling industries. Mexico, Central America, Canada, the European Union, Haiti, Japan, and Saudi Arabia are a few of the larger export destinations of U.S. rice. Imports currently account for around 15 percent of domestic use, and their market share increased sharply from the early 1980s through 2007/08.² Imports expanded largely because of a growing immigrant population and a certain amount of diversification in the tastes and preferences of American consumers. The United States typically imports high-quality aromatic rice from Asia, such as Thai Jasmine and Basmati varieties from India or Pakistan. These specific Asian varieties are not currently grown in this country.

¹Given that there are only a handful of exporters of medium- and short-grain rice—Australia, China, and Egypt aside from the United States—California plays a prominent role in the global medium/short-grain market.

²Does not include seed use.

ical inputs are also required to control for water weevils, and preplanting seed treatments may be necessary, further raising chemical costs. A greater percentage of producers in this region also purchase irrigation water, further increasing those costs. Finally, the region has the highest pumping costs in the country, largely because of the need to sink deep wells in order to find fresh water.

In addition to operating costs, overhead costs for the Gulf Coast region are also higher, particularly because of the opportunity cost of land. High land-rental rates reflect land-use competition in urbanizing parts of the Greater Houston area.⁹ Growers in the Gulf Coast region are also subject to wider variation in income due to the practice of harvesting a ratoon crop (a partial second crop grown from the stubble of the main-crop harvest). Growers must get their fields planted early to successfully grow a ratoon crop. Good

⁹As discussed later, these high land costs may limit the ability of young farmers to acquire land from retiring generations of producers.

Table 5
Rice production costs, 2008-09¹

Item	United States		Ark Non-Delta		California		MS River Delta		Gulf Coast	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
<i>Dollars per planted acre</i>										
Operating costs:										
Seed	45.09	65.48	42.19	61.20	50.81	73.72	48.29	70.05	43.05	62.45
Fertilizer ²	110.80	108.59	94.09	92.40	125.92	123.66	107.39	105.46	136.01	133.55
Chemicals	68.68	76.92	60.25	67.39	96.48	107.91	59.56	66.61	71.53	80.01
Custom operations	44.91	49.03	29.34	31.95	86.13	93.80	35.76	38.95	51.18	55.74
Fuel, lube, and electricity	138.96	91.80	147.76	97.94	91.71	60.79	139.95	92.75	160.01	106.05
Repairs	27.96	28.50	29.38	29.95	27.03	27.56	26.49	27.00	27.25	27.78
Purchased irrigation water	11.32	12.42	0.19	0.21	45.17	49.19	0.00	0.00	16.78	18.28
Commercial drying	27.60	19.03	18.33	12.33	50.66	34.79	14.80	9.81	39.89	28.88
Interest on operating capital	3.31	0.63	2.98	0.55	3.87	0.78	3.09	0.58	3.74	0.70
Total, operating costs	478.63	452.40	424.51	393.92	577.78	572.20	435.33	411.21	549.44	513.44
Allocated overhead:										
Hired labor	19.52	20.08	20.99	21.44	25.38	25.94	21.16	21.62	9.82	10.04
Opportunity cost of unpaid labor	44.40	45.42	37.80	38.62	69.75	71.28	30.97	31.65	49.82	50.91
Capital recovery of machinery and equipment	110.87	118.33	113.17	120.75	116.24	124.02	103.06	109.97	109.24	116.56
Opportunity cost of land (rental rate)	139.71	159.66	106.17	120.72	278.00	316.10	100.26	114.00	130.52	148.41
Taxes and insurance	19.26	21.66	19.84	22.27	16.66	18.70	24.09	27.04	15.47	17.37
General farm overhead	25.28	25.86	20.32	20.71	36.60	37.31	28.56	29.12	22.71	23.15
Total, allocated overhead	359.04	391.01	318.29	344.51	542.63	593.35	308.10	333.40	337.58	366.44
Total costs listed	837.67	843.41	742.80	738.43	1,120.41	1,165.55	743.43	744.61	887.02	879.88

¹Developed from USDA, NASS and ERS, Agricultural Resource Management Survey, base year, 2006.

²Commercial fertilizers and soil conditioners.

Ark Non-Delta = Arkansas Non-Delta, most counties in Northeastern Arkansas; MS River Delta = counties in Southeastern Arkansas (primarily adjacent to the Mississippi River), as well as all production in Mississippi and Northeast Louisiana.

Source: USDA, ERS, Cost of Production Dataset, 2010. The cost of production estimates are developed using base year 2006 ARMS data. The base year estimates are updated to the current year through the use of price indices, acreages, yields, and other factors.

growing season weather and a dry harvest are also required. This increases risk and production variability for producers in the region.

Rice production methods in the Arkansas Non-Delta and the Mississippi River Delta are similar, a finding reinforced by a comparison of regional production costs. For example, most producers in both regions do not have to purchase irrigation water, but declining aquifers in some production areas may force a shift to purchased irrigation surface water in future years. Though total costs between the two regions differ by less than one percent, some differences are apparent within certain categories. Both regions utilize drill-seeding for planting, but seed and fertilizer costs were higher in the Mississippi River Delta region. Additionally, fuel costs are lower for the Mississippi River Delta region, likely because producers there either use surface water or are accessing a much shallower water table.¹⁰ Lastly, more producers in the Mississippi River Delta region have onfarm drying facilities, lowering total average commercial drying costs.

Relatively lower operating costs per acre in the Arkansas Non-Delta and the Mississippi River Delta regions may also help explain differences in farm sizes between the Southern regions. In the 2006 ARMS, harvested rice acres per farm were highest in the Mississippi River Delta, which is the region with the lowest land-rental rate. Farms in the Arkansas Non-Delta averaged around 10 percent less rice acreage than farms in the Mississippi River Delta. Gulf Coast farms, with a land-rental rate 30 percent higher than in the Mississippi River Delta, had the smallest average farm size in the Southern region.

Farm Policy Reinforces Shift of Rice Farming Away From Gulf Coast

Changes in the farm payment structure introduced in the 1996 Freedom to Farm Act also likely played a role in the reduction of farms in the Gulf Coast region by decoupling payments from current production levels and prices through the issuance of direct payments (previously called production flexibility contract payments, or PFCs).¹¹ Specifically, the 1996 Farm Act provided direct PFC payments to eligible contract holders (landowners). Landowners with PFC contracts could even idle their land, provided it was environmentally maintained, which typically required little additional expense. As a result of these program changes, in years of low prices many contract holders, especially in high-cost producing areas, found it more profitable to idle their rice land.

Within the Gulf Coast region, Texas was especially vulnerable to area contraction because of the State's high production costs, lack of alternative crops, and high levels of tenant farming. From 1992 to 2007, Texas rice acreage declined 59 percent, with much of this land being idled. In some cases, the landowners did not sell the land on which rice had previously been grown because of their eligibility for direct payment income.¹²

Differentiated Market Distinguishes Californian Rice Production

California's rice production and cost situation is vastly different from the South. In 2009, California rice producers had the highest operating costs

¹⁰New Mississippi State regulations governing all irrigation and aquaculture wells drawing on the Mississippi River Alluvial Aquifer came into effect on January 1, 2011, requiring that all wells be metered and users must have certain conservation practices in place.

¹¹The payments are now the product of (1) the annual payment rate, (2) the farm's historic program acreage reduced by 16.7 percent for flexibility, and (3) the farm's fixed program yield. These payments were essentially fixed each year for eligible contract holders, and had virtually no direct impact on production decisions. Indirectly, the payments often raised the rental price or value of the land, increased the wealth of the landowner, reduced risk, and provided capital for operations and debt financing. The PFC payments were continued in the 2002 and 2008 Farm Acts and are referred to as direct payments. Additional payments, called market loss assistance (MLA) payments, were added by Congress for crop years 1998-2001 due to low market prices. Similar to the PFC payments, contract holders did not have to grow rice or any other program crop to receive them. The 2002 Farm Act replaced the MLA payments with counter-cyclical payments (CCP), which are decoupled from current production levels, but not from current prices.

¹²Payment limitation adjustments and income eligibility caps were included in the 2008 Farm Act, but it is too soon to evaluate their impacts on the structure of U.S. rice farming.

in all but three of the categories shown in table 5, with total operating costs 11 percent higher than the Gulf Coast, the second highest-cost production region. High costs for seed, custom operations, and chemical use were a result of aerial seeding in this region. Californian producers also paid substantially more for irrigation water than producers in other regions—nearly four times as much as the average U.S. rice farm. When ownership costs are included, production costs per acre for California are 25 percent higher than those for any other region. Most significantly, land ownership costs in the California rice-growing area are nearly three times those of the Mississippi River Delta region. These high land costs likely contribute to the region's small average farm size of 407 harvested acres of rice per farm as compared to the national average of 453.¹³

While California is a high-cost region, rice acreage there has increased since the early 1990s. This apparent contradiction can be explained by several factors that differentiate Californian rice production from its counterparts in the South. First, while costs are higher on a per-acre basis, Californian rice producers are able to spread these costs over a much larger production quantity since their average yields are the highest in the nation, reaching 8,600 pounds per acre in 2009, or 21 percent higher than the U.S. average. In addition, California almost exclusively produces high-quality medium/short-grain rice (with a substantial amount grown for the WTO market access commitments), which is often sold at a premium of \$2 to \$3 per hundred-weight over long-grain varieties (the premium has risen in recent years and was more than \$10 per cwt in 2008).¹⁴ The drought-induced contraction of Australian medium-grain exports, as well as continued export restrictions by Egypt, have supported California's prices in recent years. This difference in production value, combined with the lack of alternative crops for most growers in the Sacramento Valley, indicates that rice acreage in California is not expected to decline in the near term, despite rising per-acre costs.

¹³ While average farm size in California is smaller than the U.S. average, it is important to note that farm size and operation size are not identical. Many operators rent additional farmland or farm in tandem with a family member or other partner in order to spread operating costs over a greater area.

¹⁴ The season-average farm price for long-grain rice averaged \$11.01/cwt between 2005/06 and 2008/09, while medium/short-grain rice—including medium/short-grain rice produced in the South—averaged \$15.25/cwt.

Economic Factors Limit Rice Farm Entries and Shape Industry Structure

Similar to other crop and livestock sectors in the U.S. agricultural system, the rice industry has adapted to changing market conditions and competitive pressures by concentrating production in specialized, larger scale operations. The share of production accounted for by smaller producers and those in higher cost regions has diminished. As the number of producers declines, questions about the future number, size, location, and characteristics of rice farms hinge on economic and policy factors affecting the mobility of farmers into and out of the rice sector.

Even if annual economic returns are comparable or superior to other farm activities, entry decisions can be affected by factors such as large financial outlays to acquire suitable land and equipment to operate on a scale that provides both profits (per-acre or per-unit returns above costs) and household income above the next best alternative. These investments are startup costs that are typically financed by loans and involve a long repayment period. Similarly, once investments are made, decisions to switch farming activities, or to exit entirely, are affected by potential returns to other commodities, lost value to specialized equipment, or how off-farm income compares to farm income for an operator with a given set of skills and education. Entry barriers and incentives (disincentives) for existing farmers to remain in (exit) production affect not just the number of farms, but characteristics such as the ownership structure and age of their operators. Those entering rice farming generally have rice-farming parents or the support of another rice farmer—typically a relative (Coats, 2009).

Limited Availability of Suitable Land and High Startup Costs Deter Entry

As the scale of the average rice farm continues to grow, potential entrants face two major challenges: Limited area suitable for rice production and high startup costs. These constraints affect the number of new entrants as well as the business arrangements and other characteristics of existing rice farmers.

Land Constraints—As explained in the box, “U.S. Rice Industry Overview,” only a few States have areas that are physiologically suited to growing rice. Aside from certain areas in the Mississippi River Delta that could expand rice production, there is limited suitable land left that is not already in a rice cropping rotation. This shortage of additional rice land has helped to drive up the cost of land in current rice-producing areas.

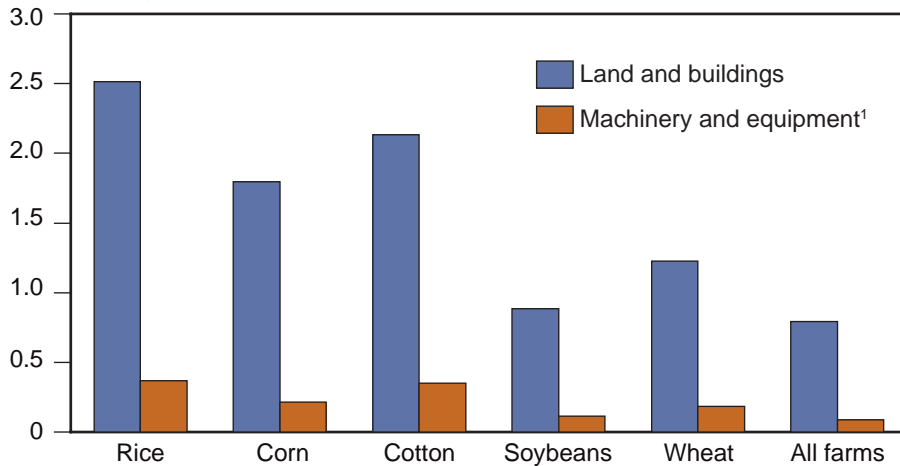
Startup Costs—Given the scale of operation needed to be profitable, new rice farmers must make significant investments in both land and equipment. The 2007 agricultural census identified rice farms as having the highest value of land, buildings, machinery, and equipment (including irrigation equipment) per farm of all major commodities on a national level (fig. 3).¹⁵ High land values on rice operations are due to the large size of the average rice farm and the high average value of farmland per acre when compared with other operations. Even if a farmer

¹⁵These comparisons vary slightly by State, but in all rice-growing States, outlays for land/buildings and machinery/equipment for the average rice farm was either the highest of all field crops, or second only to cotton farms. Louisiana proved the only exception, where machinery/equipment values are a close third behind corn and cotton outlays.

Figure 3

Rice farms have the highest per farm asset value among major field crops

Asset value (million \$)



¹Includes irrigation equipment.

Source: USDA, NASS, Census of Agriculture, 2007.

chooses to rent land rather than buy, comparatively high rental rates can be cost prohibitive. In addition, extensive irrigation and drainage systems, land laser-leveling equipment, and on-farm drying equipment also raise the level of investment required for rice production.

High Land Costs Contribute to High Tenancy Rates

High land costs play a role in the ownership arrangements of rice farms. Averaged annual cost of production data from 2005 to 2009 show that nationally, the rental rate on rice land is the highest of all the major field crops at \$131.95 per acre. That is 31 percent higher than corn’s rental rate, and nearly three times the rental value of wheat land (table 6). To spread potential debt exposure and to lower capital investment requirements, the strategy adopted by the majority of principal operators on rice farms has been to operate as either part-owners or tenants.¹⁶ Compared with other field crops, rice has the lowest overall percentage of farms under full ownership and the highest share of tenant farms, which is attributable to the high unit cost of rice land, the quantity of land required for a profitable farm, and efforts to manage total farm business risk exposure (fig. 4).

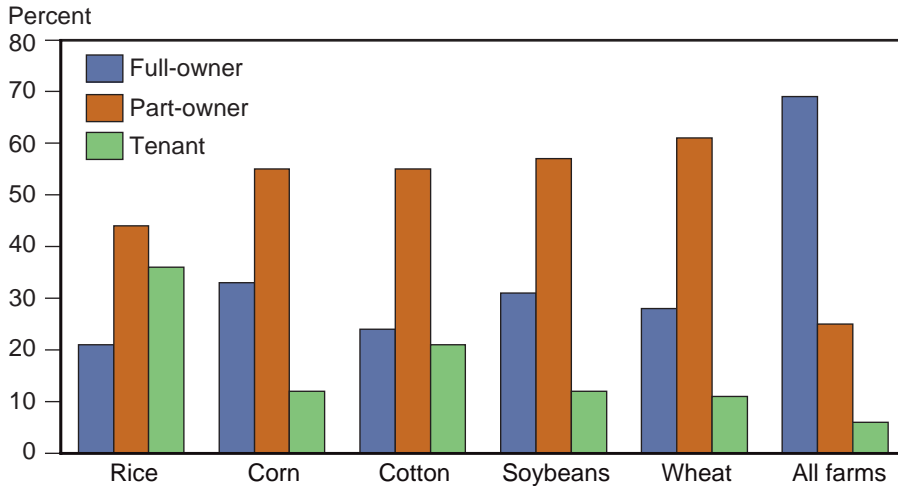
The share of farms under part-ownership increased from 41 to 44 percent between 1992 and 2007 (fig. 5), while the share under full-ownership dropped from 24 percent in 2002 to 21 percent in 2007 (although it is slightly higher than in 1992). In contrast, the percent of farms under rental arrangements decreased over the period from 40 to 36 percent, though there was an increase in the percentage of farms rented from 2002 to 2007.

Data specific to type of farm organization suggest that many of the part-owned rice farms are family farms (fig. 6).¹⁷ In 2007, 53 percent of rice farms were classified as “individual or family,” meaning that the farm could be owned by either one or multiple persons. A further 35 percent were operated under a partnership, with 10 percent operated as family-held corporations. Thus, taking into account the tenancy situation, just 40 percent of the

¹⁶The term “full owner” implies that the principal operator owns all land used in the farm operation, while a principal operator who is a part-owner owns a share of the land used in the farm operation and a tenant rents all of the farmland.

¹⁷A family farm is defined as any farm organized as a sole proprietorship, partnership, or family corporation, excluding farms organized as nonfamily corporations or cooperatives, as well as farms with hired managers.

Figure 4

Just one-fifth of rice farms are fully owned by the operator

Source: USDA, NASS, Census of Agriculture, 2007.

Table 6

Average U.S. production costs and returns for selected field crops, 2005-09¹

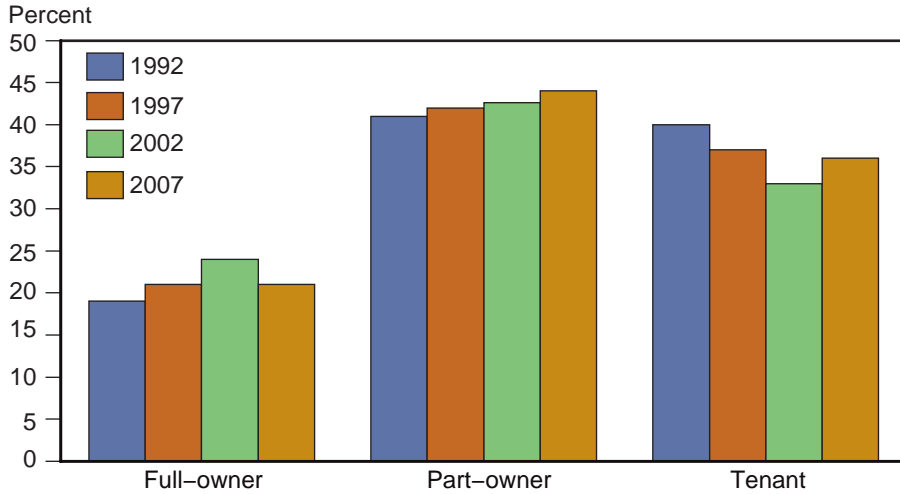
	Corn	Cotton	Rice	Soybeans	Wheat
	<i>Dollars per planted acre</i>				
Total, gross value of production	454.36	477.88	846.33	352.71	208.32
Operating costs:					
Seed	54.40	62.74	43.13	40.86	11.63
Fertilizer	102.87	65.35	85.17	17.65	40.19
Chemicals	24.85	63.82	66.93	15.21	9.12
Custom operations	10.89	23.52	50.35	6.58	7.17
Fuel, lube, and electricity	31.71	45.41	108.48	15.21	19.24
Repairs	14.87	28.77	26.61	12.32	12.91
Purchased irrigation water	0.13	2.36	11.27	0.12	0.34
Interest on operating capital	3.08	4.11	22.31	1.80	1.32
Other operating costs ²	0.00	105.96	5.32	0.00	0.00
Total operating costs	242.81	402.04	415.11	109.74	101.91
Allocated overhead:					
Hired labor	2.26	14.80	21.41	1.98	2.58
Opportunity cost of unpaid labor	24.14	29.14	44.49	16.35	22.41
Capital recovery of machinery and equipment	71.67	100.90	104.46	64.40	55.14
Opportunity cost of land (rental rate)	100.96	55.13	131.95	93.00	45.76
Taxes and insurance	7.76	8.17	18.06	8.64	8.07
General farm overhead	13.72	16.26	25.18	13.69	8.77
Total allocated overhead	220.51	224.40	345.55	198.05	142.72
Total costs listed	463.33	626.44	760.66	307.79	244.63
Value of production less total costs listed	-8.96	-148.56	85.67	44.92	-36.32
Value of production less operating costs	211.55	75.85	431.22	242.97	106.41

¹Excludes Government payments.²“Other operating costs” include ginning for cotton and commercial drying for rice.

Source: USDA, ERS, Cost of Production Dataset, 2010. The Cost of Production Dataset accounts are developed using base year 2006 Agricultural Resource Management Survey data. The base year estimates are updated to the current year through the use of price indices, acreages, yields, and other factors.

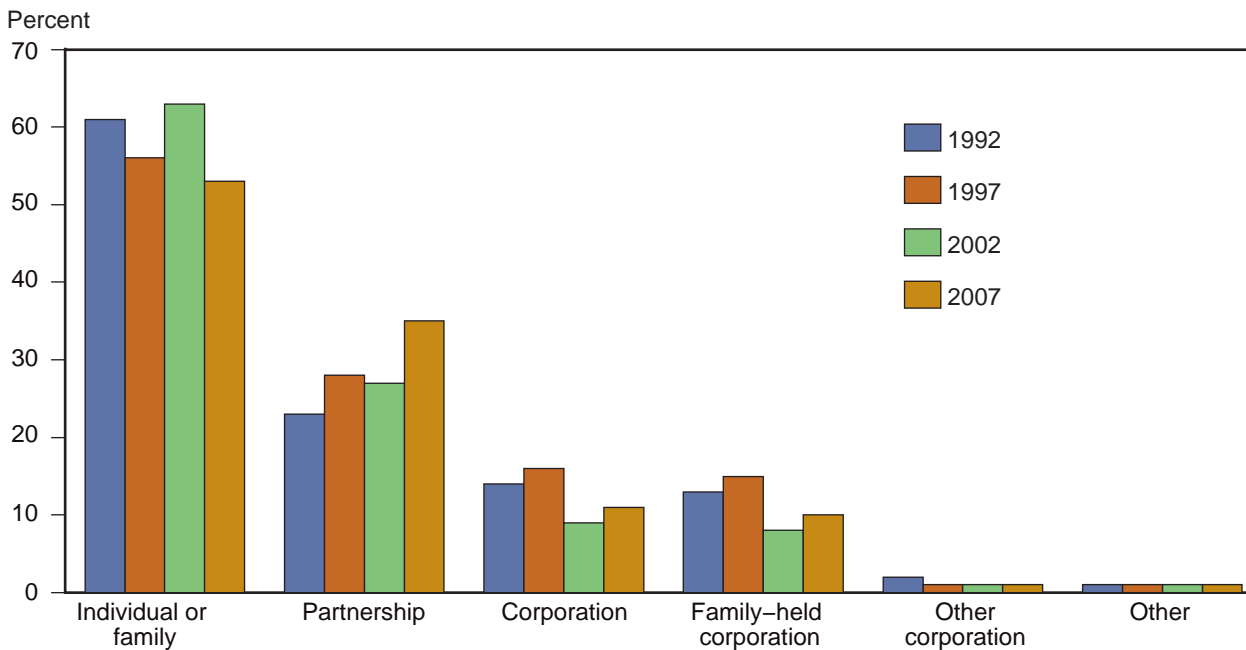
farms reported as “individual or family” operations are run by a sole owner. While there has been no clear trend regarding changes in farms reported as individual, family, or family-held corporations since 1992, the share of partnerships has increased from 23 to 35 percent. The increased frequency of partnerships is likely a means to defray costs and reduce debt burden on individual owners. This is further supported by a comparison of the average size of farms organized under different arrangements—“Partnership” farms reported an average size nearly double that of “Individual/Family” farms.

Figure 5
Part-ownership arrangements are becoming more common for rice producers



Source: USDA, NASS, Census of Agriculture, 1997, 2002, 2007.

Figure 6
More than half of all rice farms are owned by individuals or families



Source: USDA, NASS, Census of Agriculture, 1997, 2002, 2007.

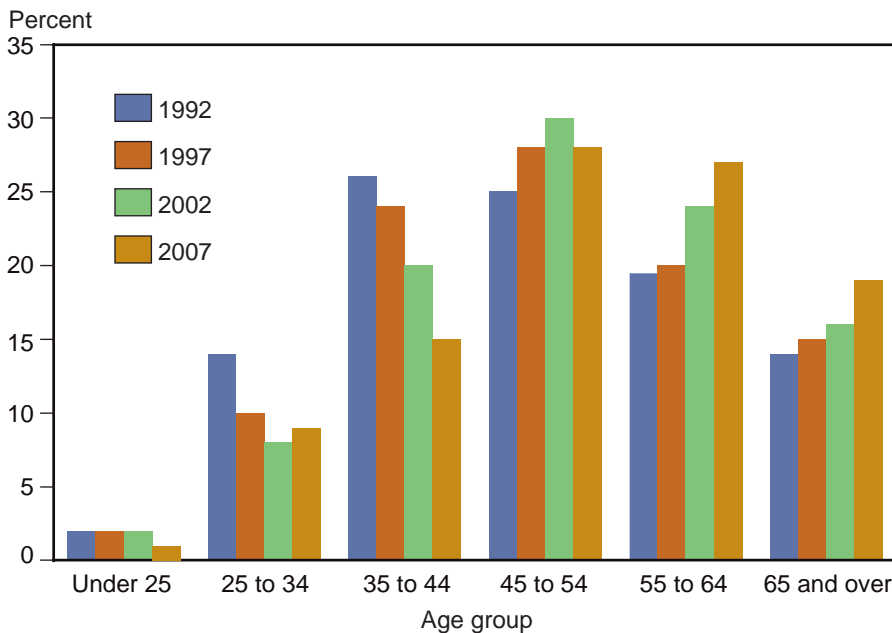
High Costs of Rice Farming May Play a Role in Skewed Farmer Age Distribution

The changing age characteristics of rice farmers also suggest that the high costs of obtaining farm assets and lack of available land are deterring new entrants into the rice-farming industry (fig. 7). Since 1992, the age distribution of rice farmers has consistently shifted towards older operators, indicating that new entrants are either older than previously and/or that existing operators are exiting at a slower rate than the pace of new entrants. In 1992, 34 percent of rice farmers were over the age of 55. By 2007, that number had increased to 47 percent.¹⁸ The role of high startup and overhead costs on entry decisions and the age structure of rice farmers is reinforced by data on debt-to-asset ratios from the 2006 ARMS. Rice farmers under the age of 50 have debt-to-asset ratios of 22 percent—double the average debt-to-asset ratio of farmers in the 50-64 year-old demographic. Furthermore, producers under 50 have an average farm size 15 percent lower than farmers in the 50-64 year-old age group.

Previous studies on beginning farmers argue that one reason why there are declining numbers of younger farmers is that many are going to college to obtain skills that will help them make more educated business decisions in the operation of their enterprise (Ahearn and Newton, 2009). For rice farmers, the youngest age grouping had the highest share of operators who had attended at least some college (35 percent), but the lowest share of operators who had actually completed college (24 percent). Farmers in this age group were just as likely to diversify their production as their counterparts in the other categories, evidenced by the same average number of commodities produced per farm.

¹⁸Rice farmers are on average much older than the working population at large. There are several possible explanations for this difference. First, young or beginning rice farmers must acquire substantial amounts of land and capital to establish their business as a profit-making venture. One manner in which younger farmers acquire large amounts of land is through inheritance (Ahearn and Newton, 2009). However, since the older generations of farmers are living and working longer, inheritance decisions are being delayed.

Figure 7
The average age of U.S. rice farmers is increasing



Source: USDA, NASS, Census of Agriculture, 1997, 2002, 2007.

Economic Returns to Rice Production Remain Comparatively High

Despite the considerable challenges confronting potential rice farmers or those wishing to expand the scale of their operations, ARMS data indicate that economic incentives for existing rice farmers to remain in operation remain comparatively strong among major U.S. field crops. Along with some exit barriers that may limit alternatives even for some less profitable rice enterprises, this suggests that rice acreage is likely to remain relatively stable in the future. Additionally, increased productivity and more efficient resource use through improved agronomic management practices have allowed many producers to lower per-unit costs on existing rice area in order to remain competitive.

As with other field crops, returns to rice fluctuate depending upon global market conditions. In fact, rice producers stand to make substantial returns if international markets are favorable, despite the significant investments needed for rice production and the substantial operating costs per acre (rice operating costs per acre were 5 to 250 percent higher than those of other major field crops in 2009) (table 7).¹⁹ When global prices were high in 2009, rice producers netted \$229 per acre on average after accounting for total production costs and not including Government payments. Producers of soybeans, the next most profitable crop on a per acre basis, earned \$79 per acre.

Moreover, the large difference in returns among major field crops in 2009 was not a unique occurrence. Taking a 5-year average of value of production per acre less total costs from 2005-2009 (keeping in mind that annual variation in rice yields is small), rice is still the most profitable crop per acre, with net returns to rice production nearly double those of soybeans, and well above cotton, wheat, and corn (which all had negative returns).²⁰

However, national average net returns to rice production were highly variable over the period, with a coefficient of variation at least twice as large as those for wheat, soybeans, and cotton. This variability in returns can be directly attributed to the volatility of input prices and rice farm prices, not to any large variation in yields. Such a high variability in returns suggests that while rice farming is a profitable enterprise on average, a significant share of producers faced negative returns over the period, likely due to management decisions that significantly altered input costs structures and marketing choices. Additionally, the variability in net returns is substantially reduced when only operating costs are considered in lieu of total economic costs. It is important to note that the returns presented here for rice and all other crops are averages for nationwide data. In some production regions, returns to rice production may be the least variable option as a result of cost structure and/or productivity of alternative crops.

Even among rice farms that do not typically cover total economic costs, a number of factors may encourage rice farmers to continue growing rice for an extended period. These factors include ability to cover operating costs,

¹⁹Operating costs for rice farms are high largely because of energy costs for irrigation. Rice farmers are particularly vulnerable to high energy costs because of the need to run irrigation pumps to keep fields flooded. Because large quantities of water are needed (typical flood after sprouting is 2-4 inches deep over the entire field), rice producers also have the highest costs for purchased irrigation water (for those producers who need to purchase water), nearly four times higher than per-acre costs for cotton. Additionally, a large portion of growers must incur commercial drying costs before they are able to sell their rice, though an increasing percentage of producers are investing in on farm drying facilities to reduce these costs.

²⁰While value of production per acre less total costs was negative for three of the five main field crops, value of production minus operating costs was positive for all five, ranging from \$75.85 for cotton to \$431.22 for rice. These returns do not include Government payments.

limited availability to diversify farm operations, and lack of off-farm employment opportunities, discussed below.

Ability to cover operating costs—In marketing year 2000, ARMS data indicate that only 43 percent of U.S. rice farmers were able to cover both operating costs and costs of asset ownership at that year’s average price of \$5.61/cwt, not adjusted for inflation. However, 78 percent of rice farms were able to at least cover operating costs in that year.²¹ Furthermore, Livezey and Foreman (2004) report that in 2000, nearly 97 percent of rice operators were able to cover operating costs with the addition of government payments, with 84 percent covering total economic costs as well.²² Since 2000, both operating costs and ownership costs have risen substantially. The percentage of rice farmers that are now able to cover total economic costs at today’s prices and costs is unknown.

Limited ability to diversify farm operations—As with other major U.S. field crops and agricultural farms, rice farms did not have a single crop dominating total acreage. U.S. rice farms in 2006 had an average of 1,580 acres, of which 504 acres (harvested) was devoted to rice.

²¹The negative average net returns from 2005 to 2006 suggest that a large portion of producers were unable to cover total economic costs in those years while positive average net returns from 2007 to 2009 suggest the opposite.

²²In 2000, Government payments accounted for more than half of total revenue received by the U.S. rice farming sector. However, since 2005, rice farmers have only received direct payments.

Table 7
Net returns measures for corn, cotton, rice, soybeans, and wheat, 2005-09

Average value of production less total costs					
	Corn	Cotton	Rice	Soybeans	Wheat
<i>Dollars per acre</i>					
2005	-126.45	-87.54	-234.50	0.18	-74.77
2006	-57.87	-170.46	-57.83	-23.25	-72.77
2007	24.97	-29.20	42.15	58.26	-27.88
2008	99.98	-195.97	449.69	110.32	56.43
2009	14.55	-259.62	228.85	79.10	-62.59
5-year average	-8.96	-148.56	85.67	44.92	-36.32
Standard deviation	86.27	90.87	263.63	55.39	55.16
Coefficient of variation	9.62	0.61	3.08	1.23	1.52
Average value of production less operating costs					
	Corn	Cotton	Rice	Soybeans	Wheat
<i>Dollars per acre</i>					
2005	74.06	107.43	94.02	174.36	53.23
2006	145.89	28.15	256.66	161.43	59.00
2007	239.95	200.33	376.85	252.12	111.08
2008	333.67	45.56	808.73	318.66	208.15
2009	264.18	-2.23	619.86	308.29	100.57
5-year average	211.55	75.85	431.22	242.97	106.41
Standard deviation	102.11	80.28	285.14	73.20	62.21
Coefficient of variation	0.48	1.06	0.66	0.30	0.58

Note: Government payments not included.

Source: USDA, ERS, Cost of Production Dataset, 2010. The Cost of Production Dataset accounts are developed using base year 2006 Agricultural Resource Management Survey (ARMS) data. The base year estimates are updated to the current year through the use of price indices, acreages, yields, and other factors.

Farms with larger rice enterprises tended to have about the same level of commodity diversification as farms with smaller rice acreage with an average of 2.3 commodities per rice farm. Soybeans and wheat were the most commonly reported alternative or rotation crops, though corn and cotton were also important in certain regions. (For comparison, the average corn farm in 2001 had 236 acres of corn, 667 total operated acres, and an average of 3.6 commodities per farm). However, commodity diversification for rice farms varied substantially by region, with those in the Arkansas Non-Delta and Mississippi River Delta each averaging 2.7 commodities per farm in 2006, while those on the Gulf Coast averaged only 1.6 commodities and those in California 1.4 commodities. In California, 68 percent of rice farms grew only rice, and the same was true of 55 percent of rice farms on the Gulf Coast. In contrast, more than 95 percent of rice farms on the Mississippi River Delta and the Arkansas Non-Delta grew at least one alternative or rotation crop.

This lack of diversification in California and Gulf Coast rice farms is primarily due to the lack of a viable alternative crop. In the California rice-growing area, the soil types are unsuitable for most other crops, although some farms can rotate rice with certain vegetable crops—particularly tomatoes. The Gulf Coast’s heavy rainfall, extremely hot, long summers, and periodic hurricanes limit the adaptability of other crops to the area. The Gulf Coast also lacks the infrastructure necessary to make alternative crops economically viable, although nearly a quarter of rice farms in the region raise cattle as well as produce rice.

Lack of off-farm employment opportunities—Exits may also be delayed because rice farming generates higher income compared with most other opportunities in rural areas. In the 2006 ARMS, average net cash income generated from a U.S. rice farm was reported at \$142,000.²³ In the rural communities where rice is produced, there are few other employment opportunities that offer the potential of such high earnings, especially given that only 32 percent of rice farmers hold college degrees. Furthermore, there is evidence that exit delays are more common among farmers (as compared to non-farmers) since they often live at the site of their business (Ahearn and Newton, 2009). Continued farming by older operators is also facilitated by increased mechanization and technological innovation, which make rice farming much less labor-intensive than in past generations for many producers.

Rather than completely retire, many producers chose to continue farming on a reduced scale—whether through a joint-operator arrangement, renting out land, or scaling back operations—until well after the average U.S. worker would have retired. In 2006, operators over the age of 65 farmed the fewest average acres of the three age groups identified and had the highest percentage of operators who owned their land. Farmers in this category also had the highest average number of operators per farm, suggesting that at least some production decisions or farm operations had been entrusted to another individual. Farms in this category also had the lowest debt-to-asset ratio, but earned less on average than farms run by younger operators.

²³ERS defines net cash income as the cash earnings realized within a calendar year from the sales of farm production and the conversion of assets, both inventories (in years in which reduced) and capital consumption, into cash. Unlike net farm income, net cash income does not include the value of home consumption, changes in inventories, capital replacement, and implicit rent and expenses related to the farm operator’s dwelling. Net cash income is a solvency measure representing the funds that are available to farm operators to meet family living expenses and make debt payments.

USDA 10-Year Baseline Projections Indicate Continued Farm Consolidation

Results of the USDA 2011 long-term baseline projections to 2020 indicate a continuation of many of the previously described trends in characteristics and structure of the U.S. rice farming industry (USDA, 2011). The most important trends expected to continue over the next decade are:

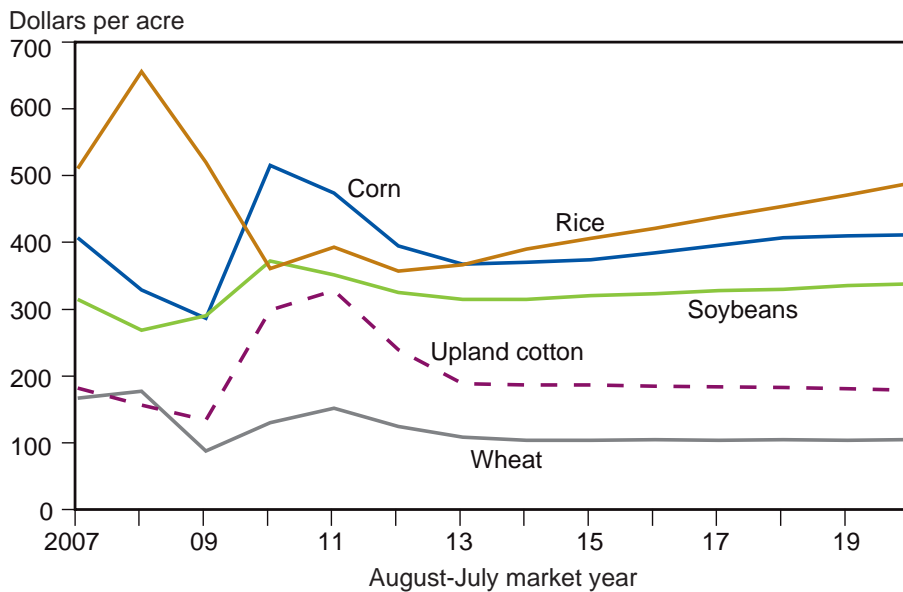
- increasing concentration of rice acreage and share of total output in the Delta and away from the Gulf Coast
- steady yield growth
- increasing area and production after 2012
- declining rice farm numbers and increasing average farm size
- greater specialization in varieties grown and market outlet
- rising per-acre and per-hundredweight production costs
- greater reliance on market returns
- increased investment in building and equipment for rice production
- continued heavy reliance on the global market for sales

The 2011 baseline projections indicate U.S. rice acreage over the next decade will average slightly less than 3.3 million acres per year, well below the record 3.8 million acres planted in 1981, but close to the nearly 3.3-million acres planted on average each year from 2001 to 2005. After declining in 2011 and 2012 from 2010's near-record level, U.S. rice acreage is projected to increase each year from 2013 through 2016 and then stabilize at around 3.3 million acres. From 2013-16, U.S. rice farm prices are projected to be high enough to pull additional land into rice production, given expectations regarding production costs and net returns for rice and other planting options (fig. 8). In fact, despite rising costs, net returns to rice are expected to increase each year in the baseline period after 2012—mostly due to higher prices. Although rising rice prices more than offset the steady increase in costs, net returns are projected to remain well below 2007-09 levels throughout the projection period. From 2014 onward, net returns per acre to rice exceed other planting options by an increasing margin, encouraging a small boost in rice acreage in competitive regions. Strong competition in the global market—especially in the long-grain milled market—and only modest expansion in the U.S. rice market limit the increase in rice acreage.

With rice acreage projected to stabilize around 3.3 million acres by 2016 and production costs projected to steadily increase throughout the baseline period, it is likely that the average rice acreage per rice farm will increase as smaller rice farms continue to exit the industry due to production cost inefficiencies. The rate of decline in the number of rice farms is projected to slow, as smaller farms with less than 100 acres of rice now account for just 17 percent of total rice farms and 2 percent of U.S. rice acreage. Additionally, the emergence of higher value niche markets (such as organic or other specialty rice varieties) may provide new business opportunities for small rice farms, allowing them to remain in the industry.

Figure 8

Rice farming is projected to remain more profitable than alternative planting options¹



¹Net returns over variable costs.
 2011 to 2020 = forecast.
 Source: USDA, *USDA Agricultural Projections to 2020*, February 2011.

Gulf Coast Expected To Lose More Rice Acres

The high-cost rice producing areas along the Gulf Coast are expected to continue losing rice acres, although the rate of decline will likely be slower than in the previous decade. Prices are not projected to be high enough for all current producers on the Gulf Coast to cover their total production costs (fixed and variable) and remain in rice farming over the long-term. While prices are projected to be sufficient to cover variable costs for most operators, they will not cover full production costs—including opportunity cost of land and ownership, taxes, interest on debts, and capital costs. Farm exits will continue to occur for many producers in areas that no longer have a competitive advantage in rice production.

By contrast, rice acreage is expected to increase in the lower cost Arkansas Non-Delta rice growing area, with Missouri and Northeast Arkansas likely to gain the most acreage. The California rice area is expected to remain nearly unchanged over the baseline, as growers in this State have few alternative planting options. Prices for medium- and short-grain rice are projected to remain well above long-grain prices over the baseline.

Though acreage is expected to stabilize after 2016, average U.S. yields are expected to rise 1 percent a year over the next decade. The increasing yields are largely due to further adoption of new high-yielding varieties in the South and improved management practices in all regions. The higher yields help offset rising per acre production costs and help the U.S. to remain competitive in certain global markets. Higher yields are critical for many U.S. growers to remain economically viable.

Average Farm Size Projected To Continue Increasing

Rising production costs and benefits from economies of scale will continue to promote larger farm sizes, and because total rice area is not expected to increase much, the number of rice farms will decline. With rough-rice farm prices expected to rise less than 2 percent a year from 2015 to 2020—about the same as the annual projected increase in per acre variable costs for producing rice—growers will remain under pressure to cut costs by boosting acreage and making greater investments in capital equipment.

Larger farms and expanded rice acres per farm will allow fixed costs to be spread over more output, as well as justify increased investment in expensive—but potentially cost-reducing—equipment. Modern rice machinery—such as 18-row planters and harvesters, irrigation and pumping facilities, and water recycling systems—is only cost-effective if utilized on substantial acreage. While higher yields will continue to lessen the impact of rising production costs for growers in all size categories, the larger farms will have increasing advantages due to lower per-unit costs.

Even in the low-cost Arkansas Non-Delta rice-growing area, rising irrigation costs will favor producers who are more efficient with water use. This could favor either producers whose farms have access to a shallow water table (such as those in Missouri and along parts of the Mississippi River) and/or those who make investments in water management structures and equipment. Over the past two decades, Arkansas' historic rice production regions (particularly the Grand Prairie) have increasingly struggled with adequate ground water availability, due to increasing irrigated row crop production and rapidly rising urban demands for water, particularly around the Jonesboro area in the Northern Arkansas Non-Delta. While additional irrigation water can be found in the deeper Sparta aquifer (covering South Arkansas and North Louisiana), the costs of pumping these water reserves is cost prohibitive for most producers. Increased water scarcity is not unique to the Arkansas Non-Delta; for all rice-growing regions, access to water could become a constraint as farmers are forced to compete with urban areas for declining water resources.²⁴

Market Factors Will Drive the Rice Industry

USDA's long-term baseline indicates that both domestic and global rice prices will remain well above levels that would make growers eligible for either counter-cyclical payments or marketing loan benefits. However, under the 2008 Farm Act, direct-payment contract holders will still receive annual payments that are decoupled from current production levels and prices. As annual rice prices rise after 2012, market returns as a share of total farm revenue from rice will increase, making the industry very responsive to market signals. By contrast, from 1999-2002 total direct payments accounted for more than half of annual rice enterprise revenues, allowing some less efficient growers to remain in operation.²⁵

The U.S. rice-farming industry is expected to continue growing for specific markets, such as for U.S. table rice, processed foods, beer, rough-rice exports, milled-rice exports, and aromatic rice. Many sales in the U.S. are variety-specific, aimed at a particular end product. This encourages more specialization and contracting.

²⁴The struggle between competing water uses is already a major issue in California. The State has a complicated system of water regulations that stipulate who may use certain water resources, when the water can be used, and at what price. Though most rice producers in the Sacramento Valley have senior claims with first rights to the water, recent droughts have called these rights into question. In some cases, it is more profitable for rice growers to sell their water rights to urban centers rather than use them for growing rice. For more information on water rights in California, see the California Division of Water Rights webpage at <http://www.waterboards.ca.gov/waterrights/>.

²⁵Direct payments are now defined as the total of fixed annual payments, counter-cyclical payments, and marketing loan benefits. A decade ago, direct payments consisted of PFC payments, marketing loan gains, and market loss assistance payments.

The industry is expected to remain bifurcated, with the South growing almost all of the long-grain rice, and California growing almost exclusively medium- and short-grain rice. Southern medium- and short-grain rice is expected to continue being used in processed products and for shipment to specific medium-grain export markets. To date, growers in the South have been unable to produce medium-grain varieties comparable in quality to California's Calrose variety due to climate and soil conditions, which helps to support California's prices.

The development of a high-quality aromatic variety that could compete with imported Asian rice would have a major impact on the structure of the U.S. rice farming industry as well. Historically, U.S.-grown aromatics have not been identical in quality to imported varieties. Researchers in the South are currently developing aromatic varieties that may substitute for these high-priced imports in the U.S. market. The recently released Jazzman rice variety may become a viable substitute for imported jasmine rice from Thailand.

Export Markets To Remain Vital for U.S. Growers as Domestic Market Growth Slows

The domestic rice market is expected to expand about 1.1 percent annually from 2011 to 2020, well below the almost 5-percent annual expansion achieved in the 1980s, the 3- to 4-percent rate achieved in the 1990s, and the more-than-2-percent achieved in the early 2000s. Per capita U.S. rice consumption doubled between 1980 and 2000 mostly because of demographic changes (especially immigration of Asian and Hispanic groups for whom rice is a cultural staple food) and a host of new rice products offered in an era of low farm- and wholesale-rice prices. These growth rates in the domestic market will not likely be repeated because of diet diversification by second- and third-generation Asian-Americans, higher rice prices, and intense competition in the food industry for new products.

With slowed domestic sales, U.S. rice producers are projected to become increasingly dependent on the export market as a source of sales. Over the next decade, slightly more than half of the U.S. rice crop is forecast to enter the global market, as the domestic market is not expected to expand at a rapid enough pace to absorb a larger share. Currently, about half the crop is exported each year. The growing dependence on exports prevents U.S. rice prices from substantially rising above global levels, since a wide price difference would reduce foreign demand.

Although the United States was the largest rice-exporting country 30 years ago, in 2011 it is projected to be the third-largest exporter, behind Thailand and Vietnam. The U.S. accounts for about 11 percent of global exports, but this share is expected to drop to just over 10 percent by 2020, despite a slight expansion in U.S. shipments each year. The U.S. is expected to be the fourth-largest exporter over the next decade, with India overtaking the U.S. by 2012. U.S. prices are not projected to be high enough over the next decade to attract sufficient additional acreage for the U.S. to maintain or increase its global market share. Higher U.S. prices would make the U.S. uncompetitive in the global market.

Conclusions

This report drew on the most recent data available to identify structural changes in the U.S. rice-farming industry, particularly the declining number of U.S. rice farms. We argue that the falling number of rice farms does not signal a decline in the industry. While the number of farms has declined, average farm size has increased, and total harvested area typically fluctuates around 3.1 million acres. There are now more rice farms planting over 1,000 acres of rice than ever before. These very large farms account for an increasing share of production and sales.

As farm sizes have increased, cost structures have changed. Increased farm size is correlated with efforts to reduce unit costs in a very high fixed-cost industry. Yield differences between small and large farms are small. Additionally, increased concentration of rice production in lower-cost production areas of the South is further evidence of the importance of lowering unit costs in the effort to remain competitive. Production costs among Southern rice-growing regions are highest along the Gulf Coast, and this region has lost the most farms and experienced the largest reduction in total rice area over the past decade.

High barriers to entry for beginning farmers, principally the high fixed-cost investments required for rice farming, may be exacerbating the reduction in net farm numbers, as acquiring the land and capital to generate sufficient profits and household income can be financially challenging. Beginning farmers often start out with the financial backing of a parent, family-member, or mentor.

Despite the high costs associated with rice farming, comparatively high returns to rice vis-à-vis other crops have kept total rice acreage stable over most of the period. However, rice farmers have and likely will continue to experience large variation in input costs and price volatility.

Consolidation and high fixed costs will likely persist in the U.S. rice industry. The USDA 2011-20 baseline projections anticipate the continuation of farm consolidation and regional industry shifts. In the long-term, total rice area is projected to remain stable as net returns to rice production remain higher than returns for other major field crops. However, year-to-year fluctuations in area will occur due to weather phenomena and the potential for interventionist policies by many of the world's largest rice-consuming countries.

References

- Ahearn, Mary, and Doris Newton. 2009. *Beginning Farmers and Ranchers*, EIB-53, USDA, Economic Research Service, May 2009. Available at: <http://www.ers.usda.gov/publications/eib53/>.
- Ali, Mir. 2002. *Characteristics and Production Costs of U.S. Wheat Farms*, SB-974-5, USDA, Economic Research Service, July 2002. Available at: <http://www.ers.usda.gov/publications/sb974-5/>.
- Brooks, Nora. 2001. *Characteristics and Production Costs of U.S. Cotton Farms*, SB-974-2, USDA, Economic Research Service, October 2001. Available at: <http://www.ers.usda.gov/publications/sb974-2/>.
- Coats, Robert. 2009. Personal Interview. University of Arkansas Extension, August 2009.
- Foreman, Linda. 2006. *Characteristics and Production Costs of U.S. Corn Farms, 2001*, EIB-7, USDA, Economic Research Service, February 2006. Available at: <http://www.ers.usda.gov/Publications/eib7/>.
- Foreman, Linda, and Janet Livezey. 2002. *Characteristics and Production Costs of U.S. Soybean Farms*, SB-974-4, USDA, Economic Research Service, March 2002. Available at: <http://www.ers.usda.gov/publications/sb974-4/>.
- Livezey, Janet, and Linda Foreman. 2004. *Characteristics and Production Costs of U.S. Rice Farms*, SB-974-7, USDA, Economic Research Service, March 2004. Available at: <http://www.ers.usda.gov/publications/sb974-7/>.
- MacDonald, James, and William McBride. 2009. *The Transformation of U.S. Livestock Agriculture: Scale, Efficiency, and Risks*, EIB-43, USDA, Economic Research Service, January 2009. Available at: <http://www.ers.usda.gov/publications/eib43/>.
- MacDonald, James. 2008. *The Economic Organization of U.S. Broiler Production*, EIB-38, USDA, Economic Research Service, June 2008. Available at: <http://www.ers.usda.gov/publications/eib38/>.
- MacDonald, James, Erik O'Donoghue, William McBride, Richard Nehring, Carmen Sandretto, and Roberto Mosheim. 2007. *Profits, Costs, and the Changing Structure of Dairy Farming*, ERR-47, USDA, Economic Research Service, September 2007. Available at: <http://www.ers.usda.gov/publications/err47/>.
- Salassi, Michael. 1992. *Characteristics and Production Costs of U.S. Rice Farms, 1988*, AIB-657, USDA, Economic Research Service, October 1992.
- U.S. Department of Agriculture. 2011. *USDA Agricultural Projections to 2020*, OCE-111, February 2011. Available at: <http://www.ers.usda.gov/publications/oce111/>.
- U.S. Department of Agriculture, National Agricultural Statistics Service. 2010. Quickstats 1.0, accessed July 2010. Available at: http://www.nass.usda.gov/data_and_statistics/quick_stats_1.0/index.asp/.