

Background

Structural Change

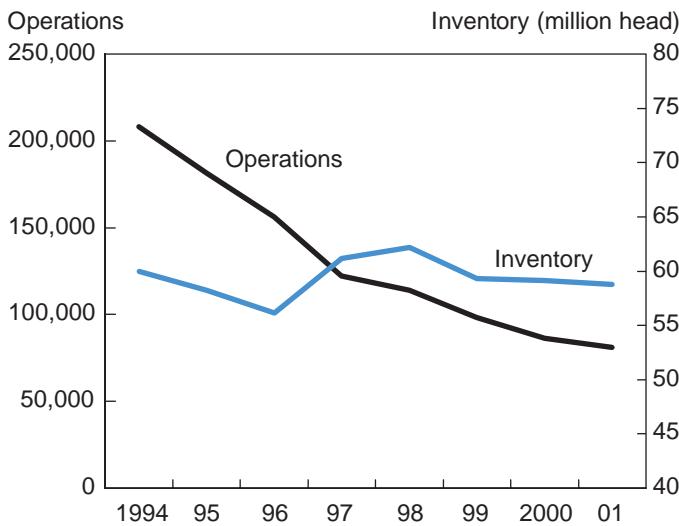
The number of farms in the U.S. remained fairly constant at about 2.2 million throughout the 1990s (USDA, NASS, *Farms and Land in Farms*). However, between 1994 and 1999, the number of hog farms fell by more than 50 percent, from over 200,000 to less than 100,000, and fell to just over 80,000 by 2001 (fig. 3). Despite fewer hog farms, the hog inventory remained relatively stable, averaging about 60 million head with cyclical fluctuations between 56 and 63 million head (USDA, NASS, *Hogs and Pigs*). Considerable consolidation occurred in hog production during the 1990s. Since 1994, the percent of the hog and pig inventory on farms with 2,000 head or more increased from 37 percent to nearly 75 percent (fig. 4). Also, just over half of hogs and pigs were on farms with 5,000 head or more in 2001, compared with about a third in 1996.

Much has been written about this rapid structural change in U.S. hog production. VanArsdall and Nelson were among the first to predict that "hog production will eventually be industrialized, breaking away from the traditional crop-livestock farm setting, as have fed beef and

Figure 3

Number of U.S. hog operations and hog inventory

Since 1994, the number of hog operations has fallen by more than 50 percent, while the hog inventory has varied between 56 and 63 million head.



An operation is any place having one or more hogs on hand at any time during the year.

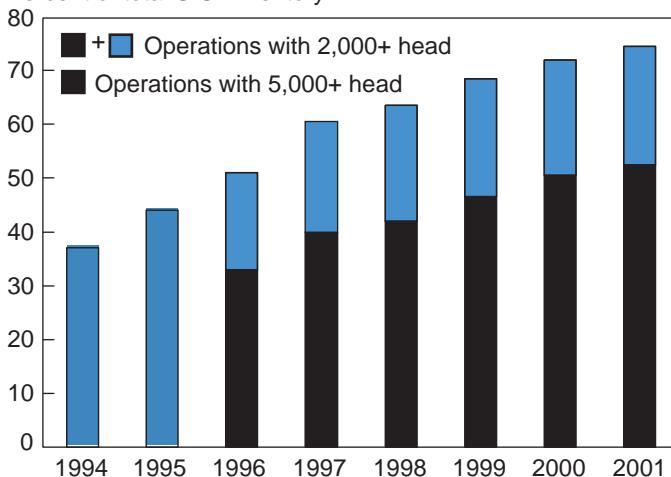
Source: USDA, NASS, *Hogs and Pigs*, various issues.

Figure 4

U.S. hog and pig inventory on largest operations

In 2001, farms with 2,000 head or more accounted for nearly 75 percent of total U.S. hog and pig inventory, double their 1994 share.

Percent of total U.S. inventory



Operations with 5,000+ head were not reported prior to 1996.

Source: USDA, NASS, *Hogs and Pigs*, various issues.

poultry..." Rhodes chronicled transition in the industry over the last quarter century, focusing on changes in firm size, organization, and location. Several forces driving structural change in hog production were identified, but Rhodes concluded that the primary forces are the same as those that have affected most sectors of agriculture, namely innovative profits and economies of size. He argued that the prospect of significant profits obtainable by those who utilize new technologies and practices has been the driving force. Technological change in hog production has been particularly rapid during the last decade in such areas as nutrition, health, breeding and genetics, reproductive management, housing, and environmental management (Boehlje).

While technological innovation during the 1990s created profit opportunities, organizational innovation enhanced the ability of firms to access the capital necessary to adopt these new technologies and to achieve economies of size. Production contract arrangements between contractors, often referred to as integrators, and individual producers, along with marketing contract arrangements between these integrators and packers, have been the major vehicle of organizational change in hog production. These arrangements allowed hog operations to achieve unprecedented size. The portion of hogs marketed by producers marketing 50,000 head or more increased from 18 percent in 1994 to 52 percent in 2000, while the portion of hogs marketed by operations marketing 500,000 head or more

increased from 10 to 35 percent (Lawrence, Grimes, and Hayenga; Lawrence and Grimes). Marketing contracts between packers and integrators help ensure a large and stable volume of uniform hogs for packers and may reduce the market price risk for integrators. To deliver the volume of hogs desired by packers, integrators typically have many grower operations producing hogs under production contracts.

The growth of contract hog production has also been a major force behind the changing location of hog production. The rapid increase in hog production in the Southeast, particularly in North Carolina, is due in part to the increase in contracting. Hog production in North Carolina developed around the need to find alternative sources of economic activity to replace the declining importance of tobacco production (Kliebenstein and Lawrence). A concerted effort was made by the State government, land-grant university faculty, and entrepreneurs to focus on hog production as one area for economic growth and to develop a pork industry that could compete on a national level (Jones). Given the lack of industry infrastructure, the model of large integrated producers contracting with many farmers came to the forefront for industry development. This model was easier to introduce in this area because of producer experience with poultry contracting (Martinez), and due to the willingness of lending institutions to provide financing for hog production units since much of the price risk was managed by large contractors. Also, environmental, zoning, and corporate farming regulations did not present insurmountable barriers to siting and building production units and processing plants in the region.

Public Policy Concerns: Market Conduct

In late 1998, producer prices received for hogs fell to the lowest level since 1972 and, when adjusted for inflation, were at the lowest level this century (Gants). Retail pork prices did not decline accordingly, resulting in a farm-to-retail price spread large enough to prompt a group of U.S. senators to urge the Secretary of Agriculture to investigate. The senators argued that "Enough evidence exists to raise strong suspicions that more than just the invisible hand is at work" (Gants). With a growing share of market transactions occurring through marketing contracts between large producers and packers, many hog producers were concerned that the cash market was being reduced to a residual market, to the financial detriment of producers trading on the cash market. The resulting public and legislative attention to the lack of market information from hog contract sales, and strong margins in the hog packing

sector, were important reasons for approval of the Livestock Mandatory Price Reporting (MPR) Act of 1999.

Prior to the MPR Act, USDA had been reporting market price information through its Market News system, but MPR differs in several important ways. For one, participation in the Market News system was voluntary whereas MPR participation is not. MPR also requires the reporting of price and quantity information in much greater detail. Packers must report the specific terms of formula and contract purchases, thereby revealing information previously treated as proprietary. Goals of the legislation are to increase transparency in livestock and meat sales, facilitate more informed marketing decisions, and promote competition in slaughter industries (Haley).

More recently, concerns about increasing packer control of the market for hogs and cattle through packer ownership and marketing contracts have brought calls for legislation to limit packer ownership and control of livestock (i.e., captive supplies) prior to slaughter. A concern is that the higher the percentage of livestock that is held in captive supplies by packers, the less incentive packers have to bid aggressively on livestock offered through cash markets. Packers argue that some control of livestock supplies is needed in order to secure a consistent supply of high-quality animals, to assure food safety, and to achieve operational efficiency (Lawrence, Schroeder, and Hayenga). Despite the concerns of packers and others who evaluated the proposals, an amendment that prohibits packer ownership of livestock for more than 14 days prior to slaughter was being considered as part of the 2002 Farm Bill (Fuez et al.). However, the amendment was deemed too controversial and was stripped in the final version.

A concern about contracting in hog production is the matter of a disparity of market power, and hence bargaining power, between the parties in the contract arrangement. Contracting between parties of approximately equal or somewhat unequal bargaining power can work satisfactorily. However, contracting between parties of vastly unequal power, with one party more economically vulnerable, can potentially pose serious problems if the more powerful party uses market power to extract concessions from the weaker party (Hayenga, Harl, and Lawrence). If the weaker party (e.g., a grower) cannot shift to other enterprises without added costs or loss of income, the weaker party is economically vulnerable and has a potential problem. For example, a contract relationship between the only large producer or packer offering contracts in an area and growers

with a substantial fixed investment in production facilities may lead to a pattern of concessions by growers when contracts are up for renewal.

These concerns about the implications of consolidation and the expanding use of production contracts in the hog industry have generated calls for legislation to protect producers from unfair business practices. During May of 2001, a U.S. Senate Subcommittee on Agriculture heard testimony about the “risks of contracting” in agriculture that outlined the following concerns: 1) the disparity in bargaining power in contract arrangements, with contracts that are complicated, unclear, and offered on a “take it or leave it” basis; 2) the shifting of economic risks to growers who are required to make substantial capital investments; and 3) the loss of market transparency due to strict confidentiality clauses that restrict the ability to compare and negotiate contracts (Iowa Department of Justice).

Despite the concerns of policymakers, producer survey results suggest that both hog contractors and growers have been generally satisfied with contracting (Lawrence and Grimes). However, an amendment to the Packers and Stockyards Act was passed as part of the 2002 Farm Bill that prohibits certain activities of swine contractors, requires swine contractors to maintain certain records, and holds them responsible for the acts of their employees, officers, and agents (USDA, GIPSA). In addition, it gives swine production contract growers the right to sue contractors in Federal District Court.

Public Policy Concerns: The Environment

Another concern with the industrialization of hog production is the environmental impact posed by the large volume of hog manure concentrated on fewer operations. It is widely believed that a major reason for the hog manure problem is that adequate land for proper manure application is often not available near the manure source or under the control of the hog producer. The increasing size and consolidation of hog production has meant that operations are more specialized, separating animal production from the cropland. Gollehon et al. found the 2 percent of hog farms with more than 1,000 animal units had 35 percent of the national hog inventory, but controlled only 2 percent of the cropland and pastureland on hog farms.² In contrast, the 36 percent of small farms with 50-300 animal units had 32 percent of the hog inventory and 45 percent of the land on hog farms. Also, the regional distribution of production indicated a much greater separation of

hogs and cropland in the Southeast than in traditional production areas of the Corn Belt.

Manure management on hog operations is addressed in the Clean Water Act, under which the National Pollutant Discharge Elimination System (NPDES) program covers certain animal feeding operations (AFOs). NPDES permits are required by point sources (operations that discharge manure directly into water resources through a pipe or ditch) before they can discharge into navigable waters. AFOs may be considered a point source in the NPDES program and designated as concentrated animal feeding operations (CAFOs) if they meet certain criteria pertaining to size and other characteristics.³ In addition, total maximum daily load (TMDL) provisions of the Clean Water Act could affect animal feeding operations by limiting wasteload allocations for point sources within a watershed.

In 1999, USDA and the Environmental Protection Agency (EPA) announced the Unified National Strategy for Animal Feeding Operations (USDA, EPA), setting forth a framework for minimizing impacts to water quality and public health from AFOs and establishing a national performance expectation for AFOs. This coordinated effort grew from the perception that the Clean Water Act was inadequate for dealing with problems posed by the changing structure of livestock production. For example, the land disposal of manure is unregulated by the Clean Water Act because it is not considered as a discharge from the facility. Also, effluent discharge guidelines of the Clean Water Act were developed when facilities were a lot smaller (the 1970s) and are considered to be no longer adequate for addressing the current large operations.

The Unified Strategy outlines approaches to be taken by USDA and EPA to address the environmental concerns with AFOs, and presents a goal for all AFOs to have a nutrient management plan. To carry out the strategy, EPA is focusing on the large operations (CAFOs) that require a NPDES permit. EPA has proposed changing the effluent discharge guidelines, and is expecting CAFOs to develop comprehensive nutrient management plans (CNMPs) for properly managing animal waste, including onfarm application and off-farm uses. Inclusion of the CNMP as part of the NPDES permit means that, for the first time, the land application of manure will be part of a required Federal permit. USDA is using voluntary approaches to get CNMPs on AFOs not under EPA regulation. Therefore,

² Gollehon et al. defined an animal unit as 1,000 pounds of live animal weight.

³ Swine CAFOs are operations with a capacity of 2,500 head or more or operations with 750-2,500 head that discharge pollutants directly into navigable waters. An animal feeding operation of any size may also be designated as a CAFO if the permitting authority determines it to be a source of impairment.

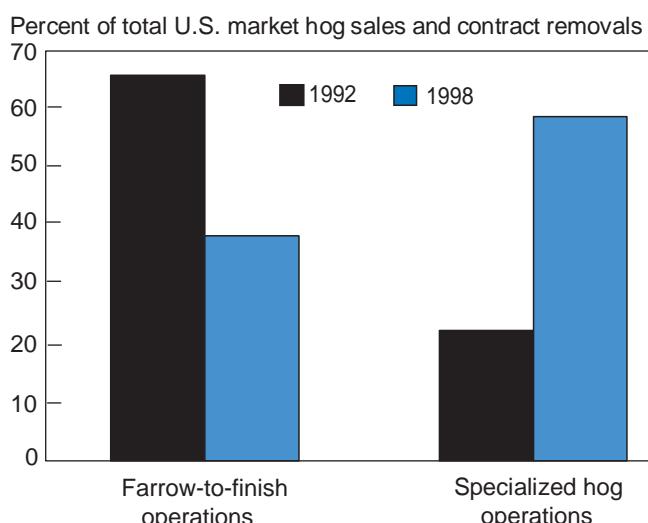
the Unified Strategy outlines a general goal for all animal feeding operations to have a nutrient manure management plan, and the proposed EPA CAFO regulations and the USDA manure management strategy are the means by which the Unified Strategy goal is to be met.⁴

Indicators of Structural Change

In addition to the rapid growth in the size of U.S. hog operations, another important indicator of structural change has been the increasing degree of specialization. The traditional approach of farrow-to-finish production, where gestation, farrowing, nursery, and growing-finishing phases of production (see Glossary, p. 43) are performed on one operation, has given way to large operations that specialize in only one or two phases. The coordinated production approach, where large integrators contract out production with many growers, has allowed individual producers in the system to grow to unprecedented size by specializing in one area of production (Kliebenstein and Lawrence). Increasing specialization in U.S. hog production is illustrated in table 1 and figure 5. The proportion of total hog operations using the farrow-to-finish

**Figure 5
U.S. hog and pig production by producer type,
1992 and 1998**

The proportion of total market hogs produced from farrow-to-finish operations fell from 65 to 38 percent between 1992 and 1998, while production from specialized hog operations increased from 22 to 58 percent.



Source: 1992 Farm Costs and Returns Survey; 1998 Agricultural Resource Management Survey.

⁴ For more detail on Federal law pertaining to manure management see Gollehon et al.

The 1992 Farm Costs and Returns Survey

Changes in hog production during the 1990s are identified by comparing hog production and cost data from the 1998 Agricultural Resource Management Survey (ARMS) to similar data collected in the 1992 Farm Costs and Returns Survey (FCRS). USDA conducted the 1992 FCRS of hog producers in 20 States, mainly in the North Central and Southeast, representing 94 percent of 1992 U.S. hog and pig sales. Estimates from the 1992 FCRS are particularly useful for comparing to estimates from the 1998 ARMS because both surveys: (1) had a broad national coverage; (2) represented the same target population (i.e., operations with 25 head or more); (3) involved a complex sampling scheme designed to represent the target population; (4) were conducted with an identical approach (i.e., hand enumerated) by the same organization (i.e., NASS), and; (5) collected much the same information in a similar format. Also, the definitions of various types of hog producers were identical in 1992 and 1998. Detail on the 1992 FCRS of hog producers, along with the estimates used to compare with 1998, can be found in McBride.

approach declined 5 percent (54 to 49 percent) between 1992 and 1998, but the proportion of total market hogs produced from these operations declined from 65 to 38 percent (fig. 5). The number of operations that specialized in finishing hogs increased from 19 to 31 percent of hog farms, and production increased from 22 to 58 percent of all market hogs sold or removed under contract.⁵

As discussed in the previous section, technological and organizational innovations were important forces behind structural change in hog production during the 1990s. This section looks at key indicators of organizational and technological innovation in hog production, and how they changed between 1992 and 1998 (see “The 1992 Farm Costs and Returns Survey,” above).

Organizational Innovation

Evidence of significant reorganization in hog production during the 1990s is indicated by the change in average production per farm. Hog sales and contract removals per farm nearly tripled between 1992 and 1998, from 945 to 2,589 (table 1). Growth in the average size of hog operations (see Glossary, p. 43) was most dramatic on specialized operations, where sales/removals from feeder pig operations grew by an average of about 400 percent and

⁵ Farrow-to-feeder pig and weanling-to-feeder pig operations provide the feeder pigs that are finished to a market hog weight on feeder pig-to-finish operations. Hog finishing operations may also have obtained feeder pigs from other countries. The number of hogs imported for finishing from Canada has grown significantly in recent years (USDA, ERS).

Table 1—Characteristics and performance by type of hog producer, 1992 and 1998

| Item | Farrow -to- finish | Farrow -to- feeder pig | Feeder pig -to- finish | Weanling -to- feeder pig | All hog and pig producers |
|---------------------------------------|--------------------------|------------------------------|------------------------------|--------------------------------|---------------------------------|
| Characteristics: | | | | | |
| Hog operations ¹ | | | | | |
| 1992 (percent) | 54 | 8 | 19 | nr | 100 |
| 1998 (percent) | 49 | 6 | 31 | 1 | 100 |
| Market hogs sold/removed ¹ | | | | | |
| 1992 (percent) | 65 | - | 22 | - | 100 |
| 1998 (percent) | 38 | - | 55 | - | 100 |
| All sales/contract removals | | | | | |
| 1992 (head) | 886 | 1,440 | 804 | nr | 945 |
| 1998 (head) | 1,239 | 7,272 | 2,756 | 23,758 | 2,589 |
| Contract operations | | | | | |
| 1992 removals (percent) | id | 8 | 22 | nr | 5 |
| 1998 removals (percent) | 3 | 83 | 62 | 100 | 40 |
| Land area | | | | | |
| 1992 (acres operated) | 634 | 291 | 556 | nr | 548 |
| 1998 (acres operated) | 464 | 199 | 496 | 536 | 443 |
| Performance: | | | | | |
| Farrowing | | | | | |
| 1992 (litters per sow) | 1.75 | 1.92 | na | na | 1.76 |
| 1998 (litters per sow) | 2.08 | 2.18 | na | na | 2.12 |
| 1992 (pigs per litter) | 8.72 | 9.08 | na | na | 8.85 |
| 1998 (pigs per litter) | 9.25 | 10.71 | na | na | 9.59 |
| Weaning | | | | | |
| 1992 (pigs per litter) | 7.54 | 8.07 | na | na | 7.70 |
| 1998 (pigs per litter) | 8.32 | 9.59 | na | na | 8.65 |
| 1992 (pigs per sow) | 13.22 | 15.48 | na | na | 13.59 |
| 1998 (pigs per sow) | 17.33 | 20.92 | na | na | 18.36 |
| Feed efficiency | | | | | |
| 1992 (lbs per cwt gain) | 416 | 527 | 383 | nr | 419 |
| 1998 (lbs per cwt gain) | 374 | 318 | 282 | 229 | 325 |
| Labor efficiency | | | | | |
| 1992 (hrs per cwt gain) | 1.13 | 1.81 | 0.89 | nr | 1.21 |
| 1998 (hrs per cwt gain) | 0.72 | 0.83 | 0.24 | 0.27 | 0.50 |
| Production costs ^{2,3} | | | | | |
| 1992 (1992 \$ per cwt gain) | 46.78 | 90.82 | 55.59 | nr | 51.56 |
| 1992 (1998 \$ per cwt gain) | 52.21 | 101.36 | 62.04 | nr | 57.54 |
| 1998 (1998 \$ per cwt gain) | 43.56 | 79.00 | 46.93 | 62.54 | 48.54 |

Notes: id indicates insufficient data for legal disclosure; nr indicates not reported in 1992 data; na indicates not applicable.

Source: 1992 estimates from McBride, 1998 estimates from the ARMS survey of hog producers.

¹The sum of operations and sales/removals for the specific producer types will not equal 100 percent because some producers could not be classified into one of the categories.

²Operating and ownership costs, where 1992 costs are deflated to 1998 dollars using the national GDP implicit price deflator (Bureau of Economic Analysis).

³A comparison of costs across producer types is not recommended because of differences in the methods used to compute costs. For example, the price used to value feeder pigs has a significant impact on hog finishing costs, but not on the costs for other types of producers. Also, differences in the size and ownership structure of farms would also affect their relative costs.

hog finishing operations grew about 240 percent. Off-site nurseries (weanling-to-feeder pig) were substantial operations in 1998, averaging more than 20,000 head of pigs. In contrast, average sales/removals from farrow-to-finish operations grew about 40 percent between 1992 and 1998, but by 1998 the average unit size was much smaller than that on specialized hog operations.

The reorganization of hog operations is also evident by substantial growth in coordinated production through the

use of contracts. In 1992, only 5 percent of total hog production was through contracts. By 1998, contract removals accounted for 40 percent of total production (table 1). Expanded use of contract production occurred almost exclusively on specialized hog operations. Production contracts on specialized feeder pig operations grew from 8 to 83 percent, and from 22 to 62 percent on specialized hog feeding operations. All of the production from off-site nurseries surveyed in 1998 was removed under contract. However, very little production on far-

farrow-to-finish operations was removed under contract in either 1992 or 1998.

Hog production also became more separated from the land base during the 1992-1998 period. Average acres operated by hog producers dropped by 100 acres, nearly 20 percent, from 1992 to 1998 with a similar trend across producer types. This means that less acreage was available on hog operations in 1998 to produce hog feed and thus more was acquired from off-farm sources, common among coordinated operations. Also, less acreage was available for manure disposal.

Technological Innovation

Technical change in hog production includes such advances as improved genetics, nutrition, housing and handling equipment, veterinary and medical services, and management that improves the performance of hogs and the efficiency of the operation, and/or reduces production risk. Evidence of technical change between 1992 and 1998 is indicated by significant improvements in farrowing and weaning performance (table 1). Pigs farrowed and weaned per litter increased by 8 and 12 percent, respectively, over the 1992-98 period. Average litters farrowed per sow rose 20 percent to 2.12 in 1998, while pigs weaned per sow improved 35 percent from less than 14 to more than 18 (fig. 6). Productivity gains were similar among the producer types, but specialized feeder pig operations continued to outperform farrow-to-finish operations, weaning three more pigs per sow in 1998.

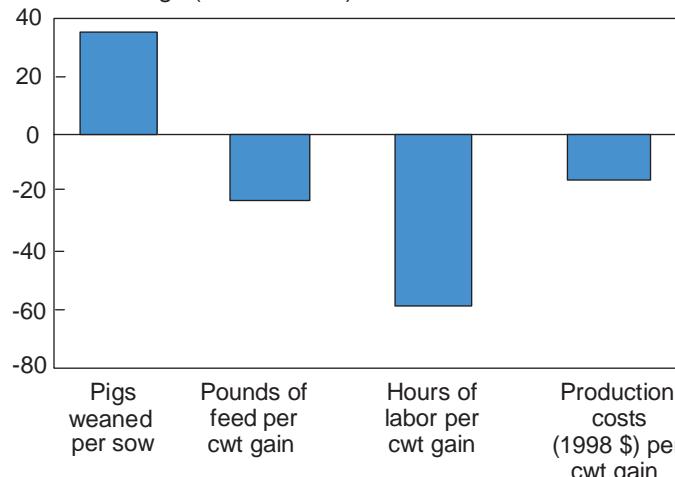
Feed and labor efficiency (see Glossary, p. 43) gains were also substantial during the 1992-98 period. The feed efficiency of U.S. hog production improved by more than 20 percent between 1992 and 1998, an average annual gain of 3.7 percent. Labor efficiency on hog farms was nearly

Figure 6

Change in performance on U.S. hog operations, 1992 to 1998

The weaning, feed, labor, and cost efficiency of U.S. hog operations improved dramatically between 1992 and 1998.

Percent change (1992 to 1998)



Source: 1998 Agricultural Resource Management Survey.

60 percent higher in 1998 than in 1992, averaging a 9.8-percent annual gain. Both feed and labor efficiency improved the most on specialized hog operations.

Gains from technological innovation in hog production also contributed to a decline in real production costs during the 1992-98 period. Average operating and ownership costs (see Appendix I, p. 49) per hundredweight (cwt) of gain, expressed in 1998 dollars, were about 16 percent lower in 1998 than in 1992 among all U.S. producers. This amounts to a 2.6-percent annual rate of reduction (fig. 6). Real costs declined the most for the specialized producers, more than 20 percent, compared with 17 percent among farrow-to-finish operations.