

# Economic and Structural Relationships in U.S. Hog Production

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## Introduction

The U.S. swine industry is undergoing significant and unprecedented changes in its size and ownership structure. These changes are having profound effects on industry performance and on the appropriate strategies for dealing with change by virtually all associated with the industry. Even those not associated with the industry are affected by this change due to environmental risks, nuisance impacts, social implications for rural communities, and as consumers of pork products. As a result, information about structural characteristics and economic relationships in hog production and what these suggest for the future of hog farms has a broad appeal.

During the 1980s and 1990s, considerable attention was given to the notion that U.S. hog production had become more industrialized. Industrialization in this context generally refers to increases in farm size and specialization in production, and the increased coordination of production and marketing with the plans of food processors and retail firms. Rhodes chronicled transition in hog production over the last quarter century, focusing on changes in firm size, organization, and location, and concluded that the primary forces contributing to industrialization are 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 behind the trend toward greater industrialization. Technological innovation in hog production has been particularly rapid during the last decade in the areas of nutrition, health, breeding and genetics, reproductive management, housing, and environmental management (Boehlje). Organizational innovation in hog production has taken the form of contract arrangements that have enhanced the ability of firms to access the capital necessary to adopt these new technologies and to achieve economies of size.

Important indicators of structural change in U.S. hog production have been the increasing size and specialization of operations. The traditional approach of farrow-to-finish production, where gestation, farrowing, nursery, and growing-finishing phases (see Glossary, p. 43) of production are performed on one operation, has given way to

large operations that specialize in only one or two phases (see “A Primer on U.S. Hog Production,” p. 2). 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 phase of production (Kliebenstein and Lawrence).

## Factors Contributing to Structural Change

Production cost variation among U.S. hog producers has had important implications for industry structure. High-cost operations are vulnerable to declining hog prices, and are among the first to exit the industry when faced with a prolonged period of low hog prices. Government statistics show that more than 15,000 operations (about 14 percent) quit producing hogs between 1998 and 1999 (USDA, NASS, *Hogs and Pigs*), corresponding to a prolonged period of hog prices that were likely below the production costs of many operations. On the other hand, low-cost operations are in a better position to survive periods of low hog prices and to thrive when prices improve.

Economies of size are a form of cost variation among farms based on the premise that larger farms have lower per unit costs than smaller farms.<sup>1</sup> Therefore, farms will become larger over time as smaller farms exit the industry or expand to take advantage of the lower costs. The existence of economies of size is supported by empirical evidence that indicates an L-shaped relationship between costs and output (Hallam), and by the industry trend toward fewer and larger hog farms. However, economies of size are not the only explanation for structural change. Another view suggests that the existence of superior management and the desire to increase net income or wealth creates the opportunity for operations to expand in size (Seckler and Young).

Costs of production can also vary among farms due to factors that create a comparative advantage for one loca-

<sup>1</sup> Economies of size in hog production may exist because costs for capital items such as buildings and equipment can be spread over more units of production on larger operations, or because larger operations are able to negotiate price discounts from buying inputs in volume, among other reasons.

The production of hogs to be slaughtered for pork is a process involving four phases: 1) breeding and gestation (breeding females and their maintenance during the gestation period); 2) farrowing (birth of baby pigs until weaning); 3) nursery (care of pigs immediately after weaning until about 30-80 pounds), and; 4) finishing (feeding hogs from 30-80 pounds to a slaughter weight of 225-300 pounds). Hog producers are commonly classified into type categories according to the number of production phases conducted on the operation into either: 1) farrow-to-finish (all 4 phases); 2) farrow-to-feeder pig (phases 1, 2, and 3); 3) feeder-pig-to-finish (phase 4); 4) weanling-to-feeder pig (phase 3), and; 5) farrow-to-weanling (phases 1 and 2).

The majority of U.S. hog production has historically occurred on farrow-to-finish operations located in areas with an abundant supply of corn. Hog farmers typically fed corn produced on their operation as a relatively inexpensive source of hog feed, and then sold their hogs at local markets. The industrialization of hog production began in the 1970s with the rapid transition of hog production into partial or total confinement. Since then, a continuing series of advancements in technology and management have made a science of hog production in large factory-like units staffed with specialized labor (Rhodes). As part of

the industrialization of hog production, operations became more specialized, typically conducting only one or two of the production phases.

The evolution of contract production has had a significant role in the industrialization of U.S. hog production. Contract production is an arrangement between a pig owner (the contractor) who engages a producer (the grower) to take custody of the pigs and care for them in the producer's facilities. The producer is paid a fee for the service provided. The type of contractor most responsible for the rapid growth in contracting is often referred to as an integrator, characterized as a large conglomerate or corporate organization that contracts with many growers to produce hogs. Integrators typically furnish inputs for growers, provide technical assistance, and assemble the commodity to pass on for final processing or marketing. Integrators typically market hogs through marketing contracts or other arrangements with slaughter plants. Input suppliers and packers are other distinct types of contractors that use contract production to vertically integrate business activities, such as feed or hog processing. Farmers can also be contractors that employ other farmers as growers in order to expand or specialize their hog operation.

tion over another. For example, hog production has historically been concentrated in Corn Belt States where an abundant supply of corn has provided a relatively low-cost source of hog feed. However, more recent expansion in hog production has occurred in other regions. Rapid growth in North Carolina has been attributed to the development and widespread use of contract production arrangements by a few large integrators. Contract production is believed to have aided the expansion of hog operations by facilitating the accumulation of capital necessary for operations to adopt new technologies and achieve unprecedented economies of size. An emphasis on product quality and the proximity of North Carolina to a large market for pork products have also been cited as important to the developing hog industry. The cost and other advantages allowed producers in the South to overcome the comparative advantage of producers in Corn Belt States.

### Implications of Structural Change

Rapid structural change in the hog industry has raised issues that are a source of concern for many associated with the industry and those affected outside the industry. A concern about the growing use of contracts in U.S. hog production stems from a perception that market control and power is increasingly concentrated among packers and large hog operations. Issues associated with contract

complexity, information and grower education, and grower risk of significant losses if a particular contractor decides not to renew a contract are of particular concern (Hayenga, Harl, and Lawrence). As contracts become more prevalent and as the hog industry becomes increasingly concentrated, it is possible that large operations may be able to use their relatively stronger bargaining position to extract more of the economic surplus from contract growers.

Because of these and other concerns with the rapid growth in contracting, efforts at various levels of government have been made to regulate contract production. These regulations may have significant social welfare costs or benefits. Production contracts offer several potential advantages over independent production that could explain their growing prevalence. Contracts may lower transaction costs associated with search, negotiation, and transfer; reduce differences in the information that growers and processors have about product quality; improve coordination of product delivery; and lower income risk for growers. In addition, contracting may raise farm productivity by improving the quality of managerial inputs, by speeding the transfer of technical information to growers, or by facilitating growers' access to credit, thereby permitting the adoption of newer, more efficient technologies.

Another concern with the rapid restructuring of U.S. hog production is the waste management problem posed by concentrating a larger number of animals on a limited land base. Expansion and consolidation in hog production has meant that the responsibility for managing hog manure has become more concentrated among fewer operations, and some of the risks of mismanaging manure are magnified. Among the risks involved with managing hog manure is the potential movement of nutrients into ground and surface water supplies due to leakage, seepage, and/or breakage of storage facilities and the misapplication of effluent to fields. Growing concerns over these risks has brought calls for additional regulations to protect the environment. However, little is known about how the environmental risks from hog manure vary across the sector, or about the ability of various farm operations to pay the costs associated with additional regulations.

## A Roadmap

The objective of this report is to provide an assessment of economic and structural issues that are affecting U.S. hog production. Much of this report uses information from previous research on economic and structural issues in hog production to establish a context within which to present information obtained from a recent national sur-

vey of U.S. hog producers. Hog producers were surveyed in 1998 as part of USDA's annual Agricultural Resource Management Survey (ARMS) to provide updated information on size, production costs, business arrangements, production facilities and practices, and farm operator and financial characteristics (see "The 1998 Agricultural Resource Management Survey," below).

The scope of this report is limited to an analysis of structural change in U.S. hog production. Change has occurred in many other segments of the U.S. pork industry, including considerable consolidation in the meatpacking and retailer segments. These changes are briefly mentioned throughout the report within the context of how they have affected U.S. hog production. Readers interested in a broader perspective on the structure of the U.S. pork industry are encouraged to see Martinez, and those seeking information on structural change in meatpacking should see MacDonald et al.

The report is divided into three main sections. The first section presents background material on structural change in U.S. hog production, focusing on the issues associated with industrialization and survey indications of structural change. In the second section, several factors contributing to structural change are explored. The importance of pro-

## The 1998 Agricultural Resource Management Survey

A detailed survey of U.S. hog producers was conducted in 1998 as part of USDA's annual Agricultural Resource Management Survey (ARMS). The survey collected information from a cross section of U.S. hog operations, including measures of size, production costs, business arrangements, production facilities and practices, and farm operator and financial characteristics. The sampling resulted in 1,633 responses from 22 States (fig. 1). Hog producers in Northeast and Far West States were not surveyed because of their minor share of hog production and because of limited survey funds.

Hog farms surveyed in the 1998 ARMS were chosen from a list of farm operations maintained by the National Agricultural Statistics Service (NASS). Farmers were contacted during the summer of 1998 to determine how many hogs were on the operation in 1998. The ARMS target population was farms with 25 or more hogs on the operation at any time during 1998. A primary purpose of the hog producer survey was to collect the information necessary to estimate the average cost of production for hog operations. Screening out farms with a hog inventory below 25 head was done to exclude farms with only a few hogs for on-farm consumption or those with hogs for other noncommercial activities such as youth projects. The sample included operations with hogs located on the acres operated, regardless of who owned the hogs, and thus included independent hog operations and growers who produced hogs under con-

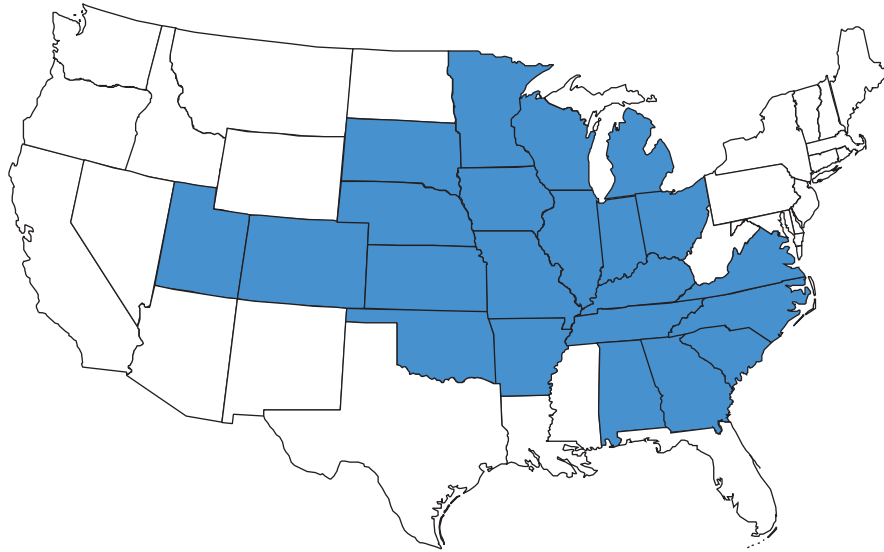
tract (i.e., contractees). Therefore, results of the survey are not directly comparable with surveys of hog owners (for example, see Lawrence, Grimes, and Hayenga; Lawrence and Grimes). The survey was administered during March and April of 1999.

Each surveyed farm represents a number of similar farms in the population as indicated by its expansion factor. The expansion factor, or survey weight, was determined from the selection probability of each farm and thereby expands the sample to represent the target population. The sample represents approximately 97 percent of the hog inventory on U.S. farms at the end of 1998 (USDA, NASS, *Meat Animals Production, Disposition, and Income*). However, the hog sample expands to represent only about 54 percent of farm operations that had any hogs or pigs during 1998 (USDA, NASS, *Hogs and Pigs*) due largely to the 25-head threshold. A comparison of hog farms and inventory by size group from the 1998 ARMS and 1998 NASS hog and pig statistics is shown in figure 2. Because farms with only a few hogs are screened out of the ARMS, the number of farms and the hog inventory on farms with fewer than 100 head is significantly lower in the ARMS. While these small hog operations represent over half of U.S. hog farms, they include only 2 percent of the hog inventory. Among the other size groups, the ARMS sample of hog farms and inventory is distributed much like that in the NASS statistics (fig. 2).

Figure 1

**States surveyed in the 1998 ARMS of hog producers**

Producers in the surveyed States (shaded) accounted for about 97 percent of the hog and pig inventory on U.S. farms at the end of 1998.



Source: 1998 Agricultural Resource Management Survey.

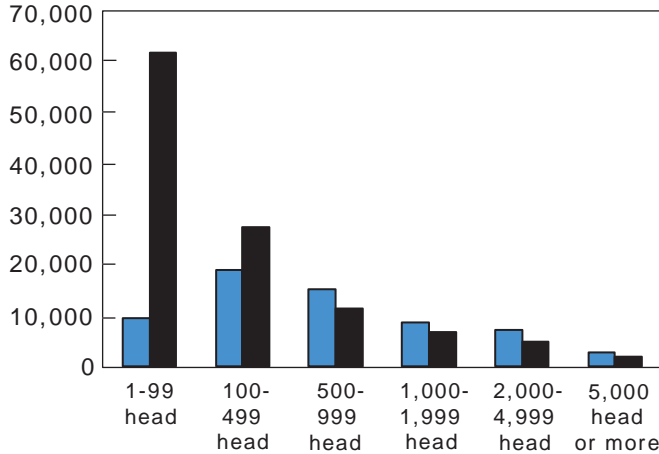
Figure 2

**U.S. hog farms and inventory by size of operation, 1998**

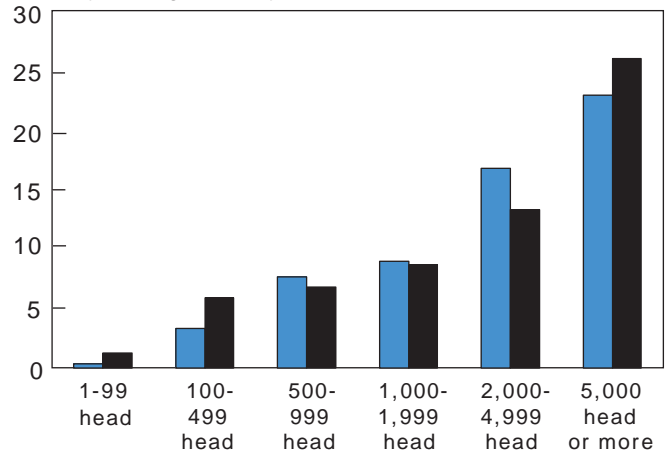
Because of screening, the ARMS represented a small portion of farms with fewer than 100 head.

However, ARMS and NASS statistics are similar for hog inventories in most size groups.

Number of farms



End-of-year hog inventory (million head)



■ 1998 ARMS

■ 1998 NASS statistics

Source: USDA, NASS, *Hogs and Pigs*, 1999; 1998 Agricultural Resource Management Survey.

Note: Both the ARMS and NASS estimates are based on surveys of farms with hogs on the operation. Thus, differences between the estimates are primarily due to the screening out of farms with less than 25 head of hogs in the ARMS, and the sampling and nonsampling error in each survey. The NASS estimates are based on a sample of about 14,200 operations, while the ARMS is based on a sample of 1,633 operations.

duction cost variation, economies of size, regional diversity, and contract production is developed. The third section looks at the implications of structural change for industry performance and the environment. Research examining what the expanded use of production contracts

in hog production has meant for industry productivity and the returns to production is presented. Also discussed are structural and economic dimensions of the problems associated with managing hog manure in an increasingly concentrated industry.