



Assessing Production Contracts in U.S. Hog Production

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ABSTRACT

Agricultural contracting has become increasingly common in the United States, creating challenges for survey design and data collection. In the U.S. hog industry, growth in the use of production contracts, in which the contractor exercises control over most production decisions and farmers are paid a fee for services rendered, has been particularly rapid. Hog operations with production contracts accounted for only 3 percent of U.S. hog operations and 5 percent of hog production in 1992, but grew to 51 percent of operations and 71 percent of production in 2009.

Production contracts govern one type of transaction in the industry—that with growers who raise hogs for the contractor, also known as an integrator. Some integrators are meatpackers that also own and operate slaughter and processing facilities, and transfer market hogs directly to those facilities from contract farms. Other integrators operate only in hog production, and use marketing contracts to govern transactions with meatpackers. Integrators often own and operate specialized farrowing facilities, but some buy weaned pigs in cash markets, and some obtain them through further contract arrangements. In short, production contracts form one link in a complex web of arrangements in the industry.

This paper indicates how data on agricultural contracts are collected in USDA's Agricultural Resource Management Survey (ARMS). Data collection issues highlight the proper definition of different contractual arrangements, the appropriate target respondents for different types of contract questions, and the benefits and costs of obtaining these data from farmers as opposed to contractors. The paper further discusses approaches to summarizing, reporting, and analysing these data, using the example of hog production contracts. Finally, we summarize ERS research on the impact of production contracts on the productivity of U.S. hog farms, indicate what this means for the structure of U.S. hog production, and discuss the implications for U.S. pork producers and consumers, and the environment.

Keywords: production contracts, hog production, Agricultural Resource Management Survey

Disclaimer: The views expressed herein are those of the authors and should not be attributed to the Economic Research Service or USDA.

1. USDA Surveys and the Identification of Contracts

The U.S. Department of Agriculture's (USDA) Economic Research Service (ERS) and National Agricultural Statistics Service (NASS) collect data about agricultural contracts in the annual Agricultural Resource Management Survey (ARMS). Over time, USDA has developed precise guidance for enumerators and respondents to use in providing responses to contract questions in the ARMS. Such guidance is necessary because different respondents have different conceptions of what constitutes a contract, as well as what constitutes a marketing contract and a production contract. The guidance is used to develop the text of questionnaires (that is, questions, placement, and parenthetical instructions), to train enumerators, and to provide enumerators and respondents with supporting information for filling out questionnaires.

USDA refers to an "agricultural contract" for purposes of the ARMS as an arrangement for the production and disposal of a commodity. Contracts for the acquisition of inputs are dealt with occasionally, but the proper identification of commodity contracts is of primary importance for the measurement of revenues and costs in ARMS. Contracts are defined as an agreement, reached prior to harvest or prior to the completion of a livestock production stage, which specifies a commodity, an outlet for delivery of the commodity, and a compensation arrangement. Contracts can be oral, as long as there is an implied commitment and it is understood that there will be penalties for breaching the agreement. Timing is important to this definition—agreements reached after crops are harvested or animals are raised are not contracts, but are classed as cash sales. The specified timing rule allows for clean delineation of a range of transactions.

USDA then distinguishes marketing from production contracts. Marketing contracts set a price or a pricing formula, as well as a marketing outlet, for a commodity. This guidance is specified in the questionnaire, while background documents tell enumerators that the farmer retains ownership of the commodity during production; that marketing contracts often tie price incentive to product attributes; and that the contracts may or may not specify precise quantities to be delivered. The background documents also provide examples of marketing contracts.

ARMS questionnaires define production contracts as setting terms, conditions, and fees to be paid by the contractor to the operation [the farmer] for the production of crops, livestock, or poultry. The questionnaire also states that contractors own the commodity during production, and often provide production inputs. Supporting documents provide examples of production contracts, and alert enumerators that they are widely used in poultry and hog production, and in the raising of dairy heifers.

Individual farms may have production and marketing contracts, and they may act as contractees and as contractors. For example, a dairy farm may market its milk through marketing contracts, and may also raise dairy heifers for other farms under production contracts. In each case, the dairy farm would be a contractee. A hog farm may produce pigs in farrowing facilities onsite, act as a contractor in production contracts with growers who raise the pigs to market weights, and may then sell the hogs to slaughter plants as the contractee under a marketing contract. ERS and NASS focus on issues of timing, contract definition, and contractor/contractee status in training materials developed for enumerators and staff.

2. Agricultural Production Contracts and Agricultural Statistics

Contracts covered 40 percent of the value of U.S. agricultural production in 2011, according to data gathered in the ARMS (MacDonald and Korb, 2011). Marketing contracts covered 60 percent of the value of agricultural production under contract, and were used to market many crop and livestock commodities, while production contracts, widely used in livestock production, covered 16 percent of all U.S. agricultural production in 2011.

Production contracts specify services to be provided by a farmer for a contractor, also known as an integrator, who owns the commodity while it is being produced. Contracts cover: 1)

specific services to be provided, 2) the manner in which the farmer is to be compensated for the services, and 3) specific contractor responsibilities for provision of inputs. Production contracts are especially prevalent in hog and poultry production, where integrators provide animals, feed, and veterinary services to growers who raise the animals under contract. Such contracts are also common in raising dairy heifers and in fed cattle production.

Production contracts present challenges for estimates and analyses of agricultural production because key information is dispersed among different groups. As a result, surveys must be carefully designed with close attention paid to the knowledge base of respondents, and statistical agencies may have to combine information from multiple sources to provide accurate estimates.

Contract growers can speak authoritatively about on-farm practices (for feeding, sanitation, and manure management, for example), and technologies (such as equipment and housing design). They can provide accurate information on quantities of production and of inputs used. However, they usually do not know the expenses associated with feed, chicks, feeder pigs, and veterinary supplies, since those are provided by integrators. Since integrators also dispose of the animals, either through sale to a meatpacker or transfer to the integrator's own processing facilities, growers possess only limited information on the value of those animals.

Integrators can provide detailed production and revenue data, and they can provide detailed expense information for the expenses that they bear. However, they cannot provide accurate information for the expenses associated with inputs that they do not provide, such as the labor and capital used, and they cannot provide farm-level information on grower practices and technologies unless directly specified in the production contract.

Packers can provide information on flows of animals to processing plants, and on their disposition in those plants. They can also provide transactions data on prices paid for animals, with details for different animal attributes and times of sale. But they can provide no information on farm production expenses and on-farm technologies, practices, and farm financial performance.

3. Production Contracts in U.S. Hog Production

Hog production contracts govern the relationship between growers (hog producers) and hog owners ("integrators," or "contractors"), specifying the inputs provided by each party (feeder pigs, feed, labor, capital, energy, transport, and veterinary services and supplies) and the compensation due to each. Contractors typically retain ownership of the hogs on contract operations and provide the feed fed to the hogs. Growers typically provide the production facilities and labor and are compensated based on a fee-for-service arrangement, often including incentives for feed efficiency, death loss, and/or other performance measures.

Such arrangements allow individual contractors to grow into substantial operations because the significant capital costs of hog production facilities are paid by contract growers. In 2009 and 2010 the 3 largest contractors owned about a quarter of the national sow herd (Successful Farming, 2010). Many of the largest contractors are also pork packers that are vertically integrated, obtaining hogs under production contracts directly with growers. Contract growers obtain economies of size by specializing in a single phase of production, and benefit from reduced risk exposure to changes in hog and feed prices. However, growers do face the risk of contractors failing or refusing to place pigs on their operations if there is a downturn in production.

Marketing contracts typically govern the relationship between hog owners and hog packers. Marketing contracts specify expected hog quantities and qualities, the location and timing of delivery, and compensation, expressed, as a hog price or a price formula. The same hog produced under a production contract between a contractor and grower can be sold to a packer under a marketing contract between the contractor and a packer.

4. Hog Production Contracts and the ARMS

USDA collects data from all three groups linked to production contracts—integrators, contract growers, and processors—via multiple channels. The ARMS, is the Department’s primary source of farm financial data, and a primary contributor to the agricultural component of the national economic accounts. The survey is also valued because it links farm and farm household financial outcomes to production decisions, resource use, and production practices. In this section, we describe how the ARMS, as applied to hog production contracts, is managed to reach its goals under the constraints imposed by dispersed information.

The ARMS is used to track farm-level use of technologies and management practices, and in the case of hogs to provide information on manure management practices in the industry. The survey is also used to fulfill demands for farm and farm household financial information. Each of those features can only be met by surveying the hog contract growers themselves.

The ARMS is also used to meet a Congressional mandate for ERS to produce estimates of the costs of production (COP) for major field crop and livestock commodities. Hog contract growers can provide some, but not all of the necessary information—in fact, no single group has all of the information needed. Finally, the ARMS is used to support ERS estimates of aggregate net farm income for the sector; again, contract growers can provide some but not all of the information.

Hog producers appear in the survey in each year, but USDA designs a survey version that is specific to hog producers, and has administered it in 1998, 2004, and 2009 (with an earlier 1992 version appearing as part of a predecessor survey). The specific version, with detailed questions focused on the hog enterprise, supports COP baseline estimation and analyses of on-farm practices and technologies.

The hog version focuses on commercial producers, and therefore aims to avoid surveying operations that raise hogs as a hobby, for home consumption, or for show. To that end, the target population is farms with 25 or more hogs on the operation at any time during the year. Thus, the sample includes contract growers, farmer-integrators who had hogs on their operated acreage, and non-contract operations that had hogs on their operated acreage.

Farms are selected from a list frame of operations, developed with information from other USDA surveys and administrative data, producer association membership lists, and other sources. Earlier in the year, operations selected for inclusion are approached to determine if they are still in business and still producing hogs. To improve the efficiency of survey administration and estimates derived from the survey, farms are selected for the sample with a probability that varies with farm size, location, and production specialty.

NASS uses trained local enumerators to approach producers and elicit their cooperation in responding to the survey. Enumerators receive specific training in contracts in order to ensure that questions are well understood and consistently interpreted. Enumerators are supervised by NASS staff in State and regional field offices. Field office staff are expected to approach and develop relationships with integrators in each State.

Large-scale integrators usually operate processing facilities and feed mills, but may not operate farms, and may therefore not be in the ARMS universe for sampling purposes. Nonetheless, they are important to agriculture, and are important sources of information as well as users of estimates. NASS field staff obtain estimates of average integrator expenses, by State, stage of production, and type of animal, and apply those average expense estimates to the responses for growers, who are unlikely to provide estimates of integrator expenses in the survey. ERS obtains state-level estimates of average prices for animals from other surveys, and applies it to the value of animals removed from contract grower operations. In this way, ERS is able to develop COP and farm sector income estimates from ARMS and supplemental sources.

5. Hog Survey Findings

Each surveyed farm in the ARMS represents a number of similar farms in the population as indicated by the surveyed farm's weight. The survey weight is determined from the farm's selection probability and thereby expands the sample to represent the target population. The expanded samples in each of the four hog specific surveys represented more than 90 percent of the hog and pig inventory on U.S. farms in each survey year (USDA, NASS, 2010, 2006, 1995-99). However, the hog samples expanded to cover only about a third of the farm operations that had any hogs or pigs due to the 25-head threshold. Thus, the share of farms with fewer than 100 head is significantly lower in ARMS than in NASS statistics. But, while these small hog operations represent about 70 percent of U.S. hog farms, they include less than 1 percent of the hog inventory.

Estimates from the four hog surveys (1992, 1998, 2004, and 2009) are comparable because of the consistent way in which they were conducted and processed. Each survey had broad national coverage, represented the same target population (operations with 25 head or more), involved a complex sampling scheme designed to represent the target population, was conducted the same way (hand enumerated) by the same organization (NASS), and collected much the same information in a similar format. Specialized hog finishing operations (feeder-to-finish) are the focus of this study because they represented about three-fourths of finished hog production in 2004 and 2009 (table 1), and very few non-specialized hog finishing operations (farrow-to-finish) produced hogs under contract.

Table 1: *Structural characteristics U.S. feeder-to-finish hog producers, 1992 to 2009*

Producer/Item	1992	1998	2004	2009
Operations (percent of operations)	19	31	40	47
Finished hogs sold/removed (percent of hogs)	22	55	77	73
Finished hog sales/removals (head per farm)	804	2,756	4,730	7,222
Production contract operations:				
Percent of operations	11	34	50	74
Percent of production (head sold/removed)	22	62	73	79
Head removed under contract per farm	1,696	5,154	6,988	7,850
Non-contract operations:				
Percent of operations	89	66	50	26
Percent of production (head sold/removed)	88	38	27	21
Head sold per farm	696	1,452	2,486	5,440

Source: McBride and Key, 2013

Hog operations with production contracts accounted for only 3 percent of overall U.S. hog operations and 5 percent of U.S. hog production (sales and removals) in 1992, but grew to 48 percent of operations and 71 percent of production by 2009. Nearly three-fourths of feeder-to-finish operations and 79 percent of production on feeder-to-finish farms were under production contracts in 2009 (table 1).

The average size of hog finishing operations increased fastest from 1992 to 2004 for those producing under contract. Contract feeder-to-finish operations averaged 1,000 more head produced in 1992 than did non-contract operations. By 2004, the difference had reached 4,500 head. Between 2004 and 2009, the increasing size of contract operations slowed, while the average size of non-contract hog finishing operations more than doubled.

High feed prices during 2008-2009 created an incentive for small higher-cost hog finishing operations to exit the hog industry by 2009, and may be an important reason for the shift to much larger non-contract feeder-to-finish operations. Many small non-contract hog finishing operations also produce corn and soybeans and at crop prices during 2008-09 they may have decided to sell crops directly as opposed to feeding hogs. Contract hog finishing operations were less affected by

higher feed prices possibly because of their larger size and lower production costs, and because large integrators are better able to handle input price risk.

In 2009, the average farm value of production on contract feeder-to-finish operations was nearly \$300,000 greater than on non-contract operations. Contract operations produced about \$400,000 worth of hogs more than what was sold from non-contract operations. However, average net farm income on non-contract operations was about \$60,000 per farm higher than on contract operations. Much of farm income on contract operations was earned from fees paid by contractors, comprising a small percentage of the total value of hogs produced. Despite having smaller operations, non-contract producers earned the total value of hogs sold plus earned more income from crops produced and sold.

6. Hog Contracts and Farm Productivity

Production contracts offer several potential advantages over independent production that help explain their growing use: contracts can reduce information asymmetries between growers and processors, improve coordination and timing of product delivery, and lower income risk for growers. Production contracts also may raise farm productivity by improving the quality of farm management decisions, speeding the transfer of technical information to growers, improving growers' access to credit, and facilitating the adoption of more efficient technologies.

ERS research has shown a link between the use of production contracts and hog farm productivity. Using the 1998 ARMS survey of feeder-to-finish hog farms, Key and McBride (2003) compared the productivity of similar independent operations and contract operations, controlling for unobservable differences that might be associated with the decision to contract. The authors found that production contracts were associated with an average increase in total factor productivity of about 23 percent. In a second study using the 2004 ARMS data, Key and McBride (2008) used an instrumental variables technique to isolate the effect of contracts on productivity. As in the earlier study, the authors found that contract operations were substantially more productive than similar independent operations. A 10-percent increase in the prevalence of contracting would increase average total factor productivity by 5 percent. Estimates of this magnitude suggest that these productivity advantages contributed to the growth of production contracting in the hog industry during the 1992-2009 period.

7. Scale of Operation and Farm Productivity

Increases in scale of hog operations contributed significantly to productivity gains between 1992 and 2009 as farms grew in size to take advantage of increasing returns to scale. Estimates of returns to scale provide insight into farmers' incentives to further expand farm size and integrators' incentives to expand the size of contract grower operations.

The top half of table 2 shows the change over time in the share of hog production from feeder-to-finish farms in various farm-size categories. This period is characterized by a shift in production towards the largest operations. Farms producing at least 5,000 head represented less than 10 percent of total production in 1992. By 1998, these operations accounted for nearly 65 percent of total production, and their share rose to about 80 percent by 2004 and to over 90 percent by 2009.

The bottom half of table 2 reports the estimated scale elasticity for farms in various size categories and the mean scale elasticity for all farms in each survey year. The scale elasticity indicates the improvement in productivity from an increase in the scale of production. Scale elasticities decline as farm size increases—large farms obtain smaller gains from increasing scale than do small farms. In every year the mean scale elasticity was greater than one, implying increasing returns to scale in all periods and incentives for farms to become larger. However, as farm size increased between 1992 and 2009, the share of farms in the larger size categories increased, which caused the mean scale elasticity to decline over time from 1.15 to 1.04. The mean

scale elasticity of 1.04 in 2009 indicates that a 10-percent increase in hog production inputs used results in a 10.4 percent increase in hog production for the “typical” farm.

Table 2: *Share of production and scale elasticity estimates by farm size for U.S. feeder-to-finish hog producers, 1992 to 2009*

Size category ¹ (hog sales/contract removals)	1992	1998	2004	2009
	<i>Share of total production (percentage)</i>			
Less than 500 head	14.7	1.9	0.5	0.1
500-1,249 head	35.0	6.7	3.0	1.0
1,250-4,999 head	41.0	26.5	16.7	8.0
5,000-12,499 head	9.3	29.2	36.3	46.1
12,500 head or more	id	35.7	43.4	44.8
	<i>Scale elasticity²</i>			
Less than 500 head	1.20	1.23	1.21	1.26
500-1,249 head	1.12	1.14	1.14	1.13
1,250-4,999 head	1.06	1.08	1.07	1.07
5,000-12,499 head	1.05	1.04	1.03	1.01
12,500 head or more	id	0.97	0.96	0.97
All farms (mean)	1.15	1.13	1.09	1.04

¹Size categories shown in the source were presented as a measure of hundredweight gain. This was converted to the approximate number of head using an average of two hundredweight gain per head.

²See Key and McBride, 2007, for the methods used to compute the scale elasticities.

id=insufficient data for legal disclosure.

Source: McBride and Key, 2013.

In 2009, farms producing less than 5,000 head could still improve productivity substantially by increasing their scale of production. However, beyond about 5,000 head the productivity gains from expanding farm size appear limited. Farms producing between 5,000 and 12,500 head had an average scale elasticity of 1.01 in 2009. The technology used by farms in the largest size category exhibited slightly negative returns to scale. About 91 percent of hog production from feeder-to-finish operations in 2009 originated on farms producing at least 5,000 head. Hence, there appears to be little scope for additional productivity gains from increases in scale for feeder-to-finish operations using current technologies, including production contracts.

8. Conclusions

The U.S. hog industry underwent a dramatic restructuring during the 1990’s and 2000’s toward larger operations that were more specialized and more tightly linked together through contracts. The shift affected the industry’s performance, but also created new challenges for USDA surveys. This paper describes how USDA designs a survey and supporting data-gathering efforts to develop the information needed for industry monitoring and policy-making. Data collected in USDA’s Agricultural Resource Management Surveys of U.S. hog producers are used to illustrate the issues associated with data collection, summary, and analysis in an industry that has seen rapid growth in the use of production contracts.

The share of U.S. market hogs produced under contract from feeder-to-finish operations increased steadily from 1992 to 2009. At the same time, the size of these operations increased dramatically to take advantage of scale economies. However, scale economies available to U.S. market hog producers were estimated to be mostly exhausted by 2009. Consequently, there appears to be limited scope for further productivity gains in U.S. market hog production from using production contracts on increasingly larger operations, with current technologies.

ARMS data are collected from operations (i.e., sites) that had hogs and not from the hog owners that include large multi-state, multi-packer integrators. Most of the market hogs produced on the feeder-to-finish operations were produced under contract for large integrators. The limited scope for productivity gains from larger hog operations found in this study pertain to the grower operations and not to the integrators. Findings suggest that integrators are more likely to expand hog production by expanding the number of operations (i.e., sites) producing hogs, rather than expanding the scale of current or new hog operations.

Productivity gains from contracting and the increasing size of hog operations have likely benefited U.S. consumers in terms of lower pork prices and enhanced the competitive position of U.S. producers in international markets. Evidence of this is seen in relatively flat pork retail prices and expanding pork exports during 1992-2009 (McBride and Key, 2013). The environmental impact of these structural changes are less clear. Environmental risks posed by concentrating hogs on larger operations with limited land for manure application, such as those from excess nutrient runoff or manure storage leakage, are increased. These may be offset to some extent by less nutrients excreted due to improved productivity resulting from improvements in feed efficiency. Also, concentrating manure sources in fewer locations potentially affects fewer people and may also make some manure treatment technologies feasible (e.g., energy from bio-waste, or processing into concentrated fertilizer).

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