

## Price and Nonprice Terms in U.S. Agricultural Contracts

Ahearn, Mary\*, David Banker\*, and Jim MacDonald\*

*Paper Prepared for presentation at the American Agricultural Economics Association Annual Meeting, Montreal, Canada, July 27-30, 2003.*

### **Abstract**

The industrialization of the food system is proceeding at a rapid rate and contracting is a key element in that industrialization. The purposes of this paper are to summarize contract terms in agricultural contracts for major commodities and to assess the determinants of variations in contract prices/fees in selected commodity contracts, with an emphasis on the nonprice contract terms.

\*Economists, Economic Research Service, U.S. Department of Agriculture

Disclaimer: The views expressed here are those of the authors and may not be attributed to the Economic Research Service or the U.S. Department of Agriculture.

## **Introduction**

As the business of American agriculture evolves, farms are getting larger, and many farm enterprises are becoming more specialized. Farm products are becoming more differentiated, and often tailored to buyers' specific needs. To meet the needs of these differentiated markets, farmers frequently must provide extensive product information, and as a result invest in more monitoring and record keeping technologies. In addition, first handlers downstream from farms are more explicitly focusing on better managing the supply of farm commodities to more efficiently meet consumer demands. In the midst of these developments, formal contracts are increasingly being used to govern the sales of farm products, rather than simple cash transactions.

Contracts are often categorized as either marketing contracts, which are most common in crop production, or production contracts, which are more commonly seen in livestock production. In both types, a grower-farmer contracts with a contractor to deliver a specified quantity and quality of product. For production contracts, the contractor makes most of the production decisions, owns the commodity, assumes the price risk, and pays the farmer a fee for the production service. For marketing contracts, the contractor does not make most of the production decisions nor own the commodity, but rather pays the farmer an agreed upon price for the product before it is produced. Approximately 50,000 farms in the U.S. have production contracts. Half are for poultry/egg production, with hog production a distant second. Poultry/eggs and hogs combined account for more than 60 percent of all production contracts in U.S. agriculture (USDA, ERS, 2003b). Production contracting now accounts for most of the agricultural production of some southern states (Ahearn, Jefferson, and Banker, 2003). More than 180,000 farms in the U.S. had

marketing contracts in 2001 (USDA, ERS, 2003b). Significant shares of the major grains are now marketed under such contracts, including 10 percent of corn, 9 percent of soybeans, and 5 percent of wheat in 2001 (USDA, ERS, 2003b and USDA, NASS, 2003).

Production and marketing contracts frequently provide farmers with important benefits, such as reducing production costs and uncertainty in income streams. They can ease the spread of new production technologies, such as advances in genetics, feed formulations, nutritional services, fertilizers, and pest control. Contracts can also provide food consumers with products of desired qualities at reduced prices. But contracts are sometimes controversial features of the industrializing agribusiness sector. They may lead farmers to exchange price risks in the market for unexpected contract risks. Under some circumstances, contracts may allow buyers of agricultural commodities to exploit market power, by serving as a device to deter entry by other buyers into a local market or by allowing the buyer to reduce prices paid to growers in related spot markets. This is a particular concern in livestock markets where the processing market is highly concentrated, and some political leaders have recently expressed concerns that grain markets not evolve as have livestock markets. The terms of contracts not only establish the “prices” growers receive for their product, but they are also important determinants of the ability of growers and processors to manage and share risks and minimize transaction costs. The purpose of this paper is to examine how price and other nonprice terms of contracts vary for major contracted commodities.

## **Relevant Literature**

The principal-agent model is the most common economic framework employed to consider why individuals contract. This framework can address the two most commonly cited reasons for parties entering into contracts, namely risk management and minimization of production and/or transaction costs. Empirical research is mixed on which is most important. Some of the literature has analyzed the choice to contract or not. For example, Key and McBride (2002) and McBride and Key (2003) found important increases in productivity resulted from contracting in the hog sector, compared to independent production. The principal-agent model is also useful in understanding the variation in risk management and contract price among those farms that have contracts. In the case of land contracts, Allen and Lueck (1995 and 1999) have provided evidence that risk management is not an important factor in explaining choice of land contracts. They find that several transaction costs (e.g., enforcement costs) are the more important factors. In a study of the poultry industry, Knoeber (1989) and Knoeber and Thurman (1994) found that the terms of broiler contracts could be explained largely by the incentives to produce more efficiently. Growers are often rewarded based on relative performance, i.e., relative to other growers. Most of the literature is commodity-specific, hence, there is not sufficient information yet available on contracting to understand what forces are unique to production and marketing of a single commodity and what forces are more general in nature.

## **Methods**

There is a great deal of variation in the extent of contracting across individual crop and livestock commodities, and the reasons for this are not well understood. Contract terms are likely to vary with the physical agronomic characteristics of the commodities and other commodity-specific

supply and demand factors. Hence, we have chosen to examine agricultural contracts at the commodity level for as many agricultural commodities as our data source will allow. For example, we define one commodity group as flue-cured tobacco, excluding burley tobacco. Nevertheless, we view our commodity groups as homogenous in only a very gross sense and expect there to be some quality variation in our commodity groups for which we cannot account. We have a two-stage approach to answering the question of how price and nonprice terms of contracts in agriculture vary. First, we begin by presenting descriptive statistics on the characteristics of agricultural contracts. Secondly, we develop a model of contract prices/fees to better understand the effects of nonprice contract terms, as well as other variables hypothesized to affect contract prices.

In our first stage of developing descriptive statistics on contracting we focus on eight major contracted commodities. The contracts considered are marketing contracts for corn for grain, soybeans, wheat, upland cotton, flue-cured tobacco, and rice. We also consider production contracts for broilers and market hogs. We describe the distribution in contract price/fees and quantities contracted and the nonprice terms of the contracts. As an indicator of contractor market power, we also include a measure of the reported distance from the production location to an open market alternative.

In our second stage of determining if there is a relationship between contract terms and commodity contract prices/fees, we develop and estimate a reduced form model of contract price/fees separately for two commodity samples, marketing contracts for corn for grain and broiler production contracts. The determinants of contract price of special interest in our model

are nonprice contract terms, such as the length of the contract and inclusion of confidentiality clauses.

We specified the following empirical model:

$$P = X_1\beta_1 + X_2\beta_2 + X_3\beta_3 + \varepsilon$$

Where P expresses the contract price or fees paid by the contractor to the grower as a function of three sets of variables,  $X_1$ ,  $X_2$ , and  $X_3$ , hypothesized to influence P. The first set of variables,  $X_1$ , is a matrix of variables that capture the terms of the contract;  $X_2$  is a matrix of variables that captures whole farm financial characteristics relating to risk management and performance; and  $X_3$  is a matrix of variables that captures operator characteristics.

## **Data**

We use newly collected data on the terms of contracts, as reported on farmer surveys on the 2001 Agricultural and Resource Management Survey (ARMS), USDA. (See the ERS website briefing room on the ARMS (USDA, ERS, 2003a)). The ARMS is conducted annually and collects basic information on whole farm and selected commodity costs, returns, production and management practices, financial position, as well as farm operator household characteristics. Our analysis is limited by the sample size of commodities with marketing and production contracts available in the 2001 Agricultural and Resource Management Survey, version 1. Each surveyed farm represents a number of similar farms in the population as represented by its

survey weight. The sample design is a complex design accounted for in the survey weight. The weight, or expansion factor, was determined from the selection probability of each farm and thereby expands the sample to represent the target population. In recognition of the complex sample design, we will use jackknife procedures to calculate tests of statistical significance (see Dubman, 2000 and Kott, 1997).

### Marketing and Production Contracts Considered

We focussed our efforts on commodities for which ARMS had more than 30 observations on contracted commodities that were grossly homogenous. Hence, for marketing contracts we are able to analyze the following commodities: corn for grain, soybeans, winter wheat, flue-cured tobacco, upland cotton, and rice. Small sample sizes required us to exclude from consideration some crops that are primarily marketed under contracts, including fruits, nuts, dairy products, sugarbeets, and peanuts.

A slightly smaller share of the value of commodities are produced with the use of production contracts than with the use of marketing contracts, 16 compared to 20 percent, in 2001, and the large majority of production contracts cover livestock commodities. (Only 3 percent of the value of crops are produced under production contracts compared to 30 percent of the value of all livestock products.) Our sample size rules allowed us to examine production contracts for broilers and market hogs.

Our causal analysis in the second stage is limited to corn for grain marketing contracts and market hogs production contracts.

## **Basic Characteristics of Contracts for Major Contracted Commodities**

### Contract prices

Tables 1 and 2 summarize the distribution of prices/fees in marketing contracts and production contracts, respectively. Each table reports means, medians, and interquartile ranges for prices/fees and quantities, and also compares contract prices to mean nationwide commodity prices/fees.

Consider prices in marketing contracts (table 1). Two features stand out. First, contract prices exhibit considerable variation in most commodities, with the exception of tobacco. Tobacco contract prices cluster--the interquartile range in tobacco is only 4% of the median contract price. Interquartile ranges in wheat, corn, and soybeans are 12-20% of the median, while cotton and rice prices vary widely—the interquartile ranges are 45 and 60% of the median, respectively. Some of the variation in rice contract prices may reflect variety differences in contracts. For example, average market prices for medium and short grain rice is generally very close, but prices for long grain are about 10-15 percent higher. Contract wheat prices may be similarly affected by the heterogeneity of the commodity, although the evidence was not strong in our 2001 sample. The variation in upland cotton prices is not the result of variation in variety, as with rice. Contract price variation is largely the result of post-ginning cotton quality and market



conditions. In 2001, prices were higher in the beginning of the year and then declined with the very high yields experienced in that year; so when the contract was placed had a significant impact on contract price.

Marketing contract prices may diverge from reported national commodity market prices for several reasons.<sup>1</sup> Timing may be important, if prices vary through the year and contract prices are realized at times that don't precisely match spot sales. Product qualities, and precise product varieties, may also differ in ways that give rise to price differences, although we would generally expect contracts to commonly be offered for higher valued products. A second clear feature of the contract prices in marketing contracts (table 1) is that mean and median prices in corn, soybean, cotton, and rice contracts exceed nationwide commodity mean prices. Nationwide flue-cured tobacco prices slightly exceeded contract prices. In 2001, tobacco shifted dramatically toward almost complete reliance on contracts during the period. Finally, winter wheat contract prices fell noticeably below nationwide means.

Now consider fees in production contracts (table 2). They also vary widely across contracts—the interquartile range in broiler contracts covers 16 to 26 cents a head (44% of the median), while those in market hogs range from \$9.50 to 12.50 per head (28% of the median). Fees in production contracts in turn account for small shares of the market price. In broiler production, and in hog finishing operations, feed accounts for the largest share of costs, and that is commonly provided by the contractor. Contractors also provide young animals and veterinary

---

<sup>1</sup> We offer a caveat about nationwide mean commodity prices. NASS may adjust spot market prices for contract prices for some commodities and sometimes just for selected states, e.g., rice in California. In addition, there is not always a consistent understanding about what is a marketing contract and what is an open market sale.

services, such that the capital and labor provided by growers receives compensation that is 13% of the market price of broilers and 9% for market hogs.<sup>2</sup>

### Contract Quantities

Tables 1 and 2 also report median quantities and interquartiles. Many crop-marketing contracts cover strikingly small quantities. Consider corn, where the median contract quantity is only 9,161 bushels, compared to the median quantity of all corn produced by farms that have marketing contracts of 36,195. Corn producers that contract place only about one-third of the corn production under contract, and most of these (88%) do this with a single marketing contract. As the season progresses and they obtain more information about expected future prices, they then make additional decisions about how to market their corn. Similar judgements may hold for other crops, like soybeans. However, we expect some differences in the strategies used across commodities for a whole host of reasons.

Table 3 shows the differences in contracting by size of the contract and size of the farm for corn and rice farms that contract. We also compare those contracting farms to those that produce the commodities but don't use marketing contracts. First of all, corn farms are less likely to use marketing contracts than are rice farms (12% compared to 51%). But, since corn farms that use marketing contracts are more likely to be the large corn enterprises nearly one-third of the corn they produce is marketed with contracts. Rice farms are not only more likely to use marketing

---

Nevertheless, we find it useful to compare reported contracting prices to the NASS prices because the NASS prices are the "best" and most widely known prices available for comparison purposes.

<sup>2</sup> McBride and Key (2003) report that growers' share of the costs of production in contracts for market hogs in 1998 was 14%.

contracts, but when they do use marketing contracts, they also place a greater share of their production under marketing contracts than do corn farms with contracts (76% compared to 33%). The share placed under marketing contracts does not differ by size of corn farm, but the share placed under marketing contracts for large rice farms is somewhat greater than for small rice farms. Again, we expect a whole host of economic factors are at play in these differences in the use of marketing contracts.

Production contracts cover essentially all broiler and hog production by growers who contract, and contract quantities are quite substantial. The difference between crops and livestock may be because of the greater management input from contractors in livestock production contracts. Since controlling disease is a major management objective, contractors may not be willing to allow the greater risks associated with disease from additional production on the farm for which they do not have control.

### Nonprice Contract Terms<sup>3</sup>

In terms of nonprice contract terms, the majority did not include confidentiality clauses, whether marketing or production contracts. Broiler production contracts were the only type of contracts for which the majority of growers were held responsible for production loss due to poor weather or animal death. The majority of contracts for all 6 types of crops did require that the producer deliver the commodity to an off-farm delivery point. The large majority of the two livestock producer groups reported that they retained responsibility for manure management. The majority of broiler producers also reported that they were required to make major long-term asset

investments, in contrast to the market hog growers. The length of contracts varied across the commodities. Upland cotton, flue-cured tobacco, rice, broilers, and market hogs all had median contract lengths of 12 months. The median length of soybean and corn marketing contracts was only 6 months and wheat 9 months. While there was variation in the distance to the off-farm delivery site across commodities, none of the average or median distances were excessive. The producers of most of the crop commodities reported good access to open market alternatives. Significant shares of flue-cured tobacco and upland cotton producers reported no open market alternatives, although access to an open market was still reported by a majority of those producers. In contrast, the majority of the two livestock producer groups reported no open market access.

More commodity-specific detail is presented below:

Corn Marketing Contracts. Approximately 373,000 farms produced corn for grain in 2001, and about 44,000 (or 12 percent) of these had marketing contracts for corn. The corn for grain marketed under a marketing contract in 2001 was about 11 percent of the total produced. This share of the corn crop marketed under marketing contracts has been relatively constant since 1991, the first year for which data are available. Corn farms that contract, place about one-third of their corn under contract, although that share is somewhat higher for smaller farms. The median quantity produced under a marketing contract was 9,161 bushels. The average open market price for corn in 2001 was \$1.89 per bushel. The average contract price was \$2.13 per bushel. The contract price at the 25<sup>th</sup> percentile was \$2.00 and the 75<sup>th</sup> percentile contract price was \$2.25.

---

<sup>3</sup> The ARMS briefing room includes the questionnaire. See USDA, ERS (2003a), ARMS 2001, version 1, CRR.

Confidentiality clauses are not common in corn marketing contracts. The usual corn-marketing contract requires the producer to deliver the final production to an off-farm delivery point. The average distance to the delivery point is 21 miles, somewhat farther than the distance to the nearest open market delivery point. Distance to an open market does not appear to be a barrier to engaging in open market activity, as 93 percent of producers with a corn-marketing contract reported having an open market alternative. About one-quarter of the corn marketing contracts hold the farmer responsible for production loss due to bad weather. The average contract length is 7 months, although about 18 percent are for 1 year or more.

Soybean Marketing Contracts. Slightly less of the soybean producing farms have marketing contracts than do corn producing farms. About 10 percent of soybean producing farms had marketing contracts and these contracts accounted for about 8 percent of soybean production in 2001. The average open market price for soybeans in 2001 was \$4.37, compared to the higher average contract price for marketing contracts of \$4.82. There was a 75-cent spread between the 25<sup>th</sup> and 75<sup>th</sup> percentile contract prices, proportionately larger than for corn. The nonprice contract terms are similar between corn and soybean marketing contracts, which is likely a reflection of an overlap of these grower and contractor populations.

Wheat Marketing Contracts. Marketing contracts for wheat are relatively uncommon, less than 6 percent of producers of all wheat market their wheat through contracts. The average contract price for wheat was \$2.96 per bushel net price in 2001. The median contracted quantity for winter wheat was under 4,000 bushels. The majority of contracts required the producer to

deliver the wheat to an off-farm delivery point. Over half of the contracts were for 12 months or less. The distance to an open market alternative was the same on average as the distance to the delivery point for marketing contracts.

Flue-cured Tobacco Marketing Contracts. Unlike for the grains, there has been a recent major increase in the volume of flue-cured marketed under marketing contracts. The survey indicates that just over half of the production for all types of tobacco was marketed under marketing contracts in calendar year 2001. Other sources report 80 percent of flue-cured tobacco was marketed under marketing contracts for the 2001 production year (July 2001-June 2002), compared to 9 percent for the 2000 production year. The average marketing contract price for flue-cured was \$1.79/lb., compared to a market price of \$1.87/lb. Fewer marketing contracts for tobacco require the grower to deliver the output to an off-farm deliver point than for grains. The contract length is also longer for tobacco marketing contracts than for grains. More than 85 percent are for at least 1 year. With this very recent surge in marketing contracts has come less access to open markets. One-third of producers reported not having access to an open market. However, for those that reported having access to an open market, the distance to this alternative was a shorter distance on average than the distance to the contract delivery.

Upland Cotton Marketing Contracts. About half of the farms that produced cotton used marketing contracts in 2001 to market cotton of all types. The average contract price in 2001 for upland cotton was \$0.43/lb., or 5 cents more than the average open market price. A significant amount of variation was reported in the contract price. The 25<sup>th</sup> percentile price was \$0.34 and the 75<sup>th</sup> percentile price was \$0.52/lb. The median quantity of a marketing contract for upland

cotton was 105,000 pounds. Several of the nonprice contract terms we examined were less commonly reported for upland cotton than for the other commodities we examined. Upland cotton contracts were less likely to have confidentiality clauses and to hold the producer responsible for production loss due to bad weather or to require the producer to deliver the product to an off-farm location. Most marketing contracts for upland cotton were for a year in length, although 21 percent were for something less than 1 year. Three-quarters of producers with cotton marketing contracts reported having an open market alternative, with the average distance being 31 miles.

Rice Marketing Contracts. Half of rice-producing farms, accounting for 38 percent of the rice produced in 2001, had marketing contracts for rice. The average contract price was \$2.91/bu., compared to the open market price of \$2.30/bu. The median contract quantity was 36,350 bushels. More rice producers reported having contracts with confidentiality clauses, 36 percent, than producers of any other commodity, including those with hog production contracts. About one-quarter of producers were responsible for production loss due to poor weather conditions and more than 80 percent of contracts required the producer to deliver the product to an off-farm location. The most common contract length was for 12 months, although nearly one-quarter of contracts were for less than a year. More than 80 percent of rice producers reported having access to an open market alternative, and the average distance to an open market was comparable to the average distance they reported to the required contract delivery point.

Broiler Production Contracts. Production contracts are more common in poultry production than any other commodity. More than 80 percent of the value of poultry is produced with production

contracts, although a smaller share (48%) of poultry producing farms use production contracts. Because of the greater involvement in production management and input provision than for marketing contracts, the contract price, or “fee,” is generally significantly less in a production contract than the open market price. The average fee for broilers under contract in 2001 was \$0.233 per head, compared to the open market price of \$1.797 per head. The median quantity under contract was 336,000 head. Confidentiality clauses were relatively uncommon in broiler contracts, even slightly less common than for grain marketing contracts. About half of the broiler contracts held the producer responsible for production loss and the large majority of contracts held the producer responsible for manure handling (90%) and required asset investment (84%). In addition, 11% of contracts required that producers purchase inputs from a specific input supplier. There was significant variation reported in broiler contract length. Nearly fifty percent of the contracts were for 12 months or longer, with the average contract length of 13 months. Most of the contracts with a length of less than a year were actually for 3 months or less. This short-term production commitment is in spite of the long-term investment commitment that is commonly required of broiler growers. Broiler producers are the least likely of all commodity producers with contracts to report having an open market alternative. Less than one-quarter of producers had an open market alternative to their production contract.

Market Hog Production Contracts. Like the recent increase in marketing contracts for tobacco there has been a recent increase in the use of production contracts for hogs. The share of the value of hogs that are produced with production contracts has nearly doubled since the mid-1990s. Currently, 53 percent of hogs are produced under production contracts. (Comparable statistics are not available for only market hogs.) The average contract fee for market hogs in



2001 was \$10.71 per head, compared to the average open market price of \$115.18. More than one-quarter (27%) of production contracts for market hogs had confidentiality clauses. The vast majority required the grower to retain responsibility for manure management (96%) and 30% specified investments by the grower. The contract length for market hog contracts was relatively long, the average length was 30 months, although the median was 12 months. Growers with production contracts for market hogs were more likely than broiler growers to report open market alternatives, but still the majority reported no open market alternative. For those that reported an open market alternative, the average distance was 35 miles.

### **Determinants of Contract Price/Fee**

We now turn to the regression results for the contract price/fee for two types of contracts: corn for grain marketing contracts and broiler production contracts. We specified a linear regression model. Table 4 provides variable definitions and regression results. As mentioned above, we had three sets of independent variables, the specific variables in each set differ somewhat for the two types of commodities.  $X_1$ , the matrix of variables that capture the terms of the contract for corn marketing contracts included: the length of the contract, penalties for production loss, and producer responsibility for delivery; for broiler contracts these included: the quantity under contract, the length of the contract, inclusion of a confidentiality clause, penalties for production loss, grower required investment in facilities and grower required purchases from a specific input supplier, and contractor's fee paid per head.  $X_2$ , the matrix of variables that captures whole farm financial characteristics for corn marketing contracts included: participation in government farm programs, use of genetically modified seed, participation in crop insurance programs, and the

ratio of cash expenses to gross cash returns; for broiler contracts, the whole farm financial variable included is the ratio of cash expenses to gross cash returns. The whole farm measure of efficiency is a general farm performance indicator, however, in the case of broilers it offers broiler-specific information, as well. This is because broiler operations are commonly specialized and have only one contract (Perry, et al. 1997). The variables in  $X_3$ , the matrix of variables that captures operator characteristics, were the same for the corn and the broiler model and included: a self-reported high acceptance of risk,<sup>4</sup> a major occupation off the farm, and years farming.

As mentioned above, we use statistical delete-a-group jackknife procedures to accurately test for parameter significance, given the complex sample design of ARMS. In our models, this procedure generally resulted in parameter estimates that were less significant than under standard statistical calculations, which do not reflect the survey sample design.

The most notable observation about the regression results is the low level of significance of the variables hypothesized to affect contract prices/fees. We also found that the magnitudes of the significant variables were much greater in the corn marketing contract price model than they were in the broiler production contract fee model. We were especially interested to see how the nonprice terms of contracts might trade off with the contract price or fee in these two types of contracts. We found that generally terms of contracts were not very important with a couple of notable exceptions discussed below. We also found that the only variable found to be significant in explaining prices or fees in both types of contracts was whether or not the grower-farmer had

---

<sup>4</sup> We classified operators as risk-lovers if they rated themselves as a 5 or higher on a scale of 0-10, where 0 was "Avoid risks as much as possible" and 10 was "Take risks as much as possible."

an off-farm job as a major occupation. The magnitude of the major occupation effect was significantly greater for corn marketing contract prices than it was for broiler production contract fees. Other studies have shown that having an off-farm job as a major occupation leads to a greater probability of contracting (e.g., McBride and Key). Presumably, this is because of the greater rigidities in managing more than one career and the lessening of the marketing burden for an operator with a marketing contract. Our results show that if a farmer's major occupation was not farming, then the contract price/fee tended to be lower than if the major occupation was farming. Hence, this represents a trade-off some farm operators choose to make in securing a major occupation off the farm.

### Corn Marketing Contracts

Nearly three-quarters of all corn for grain marketing contracts are between farmers and co-ops or grain elevators. These are the major purchasers of corn on the spot market, as well. A major motivation for a farmer to enter into such a contract is to avoid price risk and income variability, and a major motivation for the contractor to enter into a contract is to ensure a steady supply of product. Both farmers and downstream handlers are motivated by the incentives to produce the product at a low per-bushel cost. Since crop prices vary significantly over the growing season, we hypothesized that contract length would have a positive impact on contract prices. Having longer contract lengths did indeed tend to contribute to higher contract prices, as much as 20 percent higher for contracts of 12 months or longer. We also found that when the operation produced genetically modified corn for grain, the contract price was lower. We expected to find that result because of the continuing concerns about marketability of GM corn, especially

internationally, that pays non-GM corn a premium. We also included two additional risk-management related variables in the corn model—participation in the government farm programs and having crop insurance—neither of which were significant. As mentioned above, the nonfarm major occupation was significant and this is certainly related to risk management from the farm household perspective. The human capital variables of the corn model—operator experience and farm expense ratio—were not significant in the model. Again, this is consistent with the emphasis of a corn marketing agreement being largely focussed on providing a consistent product for a set price. Yield-risk is with the producer, and has no effect on negotiated contract price.

### Broiler Production Contracts

Analyzing the terms of broiler contracts is challenging because of the performance-based features that are commonly part of these contracts. Under these types of contracts, commonly called tournaments, growers are paid basic, and relatively standard, per-head fees and in addition are paid bonuses based on their performance relative to other growers in the tournament. Depending on the contract, they may also be paid a penalty for death loss. Our measure of contract fee is intended to capture all of these returns. (However, precise measurement of the terms and the relevant implications of these tournaments are likely not fully available in our data source. For example, bonuses, the most important variable in the contract fee, may not be paid in the same year as the production or known at the time of data collection.) Because contractors contribute significant shares of the inputs and reward growers for the efficient use of these inputs under performance-based systems, we have included two variables which allow us to capture

how contractor-provided expenses might trade off with grower fees received. We expected the contractors' expenses per head to be negatively related to the contract fee. However, it was not significant. We also included an indicator of whole farm expenses, the ratio of expenses to gross cash returns, in the model as an indicator of grower efficiency. Generally speaking, the higher the value of this ratio, the lower the grower efficiency. It was significant and had the expected sign, indicating that less efficient growers received a lower contract fee. We explain these two results regarding expenses with reference to the prevalence of tournament contracts. The contractor share of expenses covered per head is relatively constant across contracts, hence we did not find the contractor expenses per head to be significant in explaining contract fee. However, under the performance-based system, growers are paid bonuses for exceptional efficiency, hence we did find the whole farm measure of expenses to returns to be significant.

The only nonprice contract term that was significant, and positive as expected, was the growers responsibility for death loss. The dummy size variable for the smallest quantity class was significant and positive. We expected to see a negative relationship between the grower fees and this small size class because we would expect contractors to realize some pecuniary diseconomies with managing small contracts. Perhaps we found this result because the small operations are providing a higher valued broiler, but we don't have the data to explore this further. Besides the grower reporting a major occupation as an off-farm job as discussed above, growers' years of experience in agriculture was another personal farmer characteristic that was significant in explaining contract fee. However, the sign of this variable was opposite to what we hypothesized. Growers with more experience in agriculture tended to receive a lower contract fee. This may be an indication of more experienced growers having less alternatives off the farm

and more on-farm investment, allowing market power of the contractors to offer them lower contract fees. Alternatively, this may simply be that the experience measure is a poor indicator of human capital of the grower. However, McBride and Key (2003) found that grower experience in hog production had a positive impact on contract fees in market hogs, where our measure of experience was the more general years in agricultural production. Again, we don't have the data to explore the causes of this negative sign of experience for broiler contracts with confidence.

## **Conclusions**

The discussion preceding the most recent farm bill included concerns about contracts in agriculture, such as regarding the use of confidentiality clauses and allowance of so-called “captive supplies.” While the decision to contract is voluntary, some in the profession and in the larger policy arena have argued that many producers effectively have no alternative but to contract in some production locations. However, the empirical support for this has been largely anecdotal. The analytical findings reported in this paper suggest that in 2001 the lack of an open market alternative was not a widespread issue for crop producers who contract, but may be of concern for producers of broilers and market hogs in some areas. The paper has also shown that the majority of contracts do not include confidentiality clauses, and at least for broiler contracts, when controlling for other factors, confidentiality clauses were not a significant factor affecting contract fees. We found quite a bit of variation in nonprice terms of contracts but not strong evidence that these nonprice terms are critical in determining contract prices or fees. This was even the case for broiler contracting with a decades-long history to allow contracts to mature.

However, because the supply chain is evolving rapidly, we expect contract terms to change continuously in the near future. Of course, this dynamic will present a significant challenge in the collection of farm-level data for economic research in this area. The creative incentives incorporated into contracts to meet even higher efficiency goals--such as the performance-based incentives of many poultry contracts--or the costs of record-keeping requirements necessary as part of a consumer-driven demand for traceability, coupled with the longstanding sensitivity of collecting contractor expenses, are but the obvious examples. Access to meaningful commodity prices will continue to be of major interest to all producers and contractors, and a challenge to statisticians and researchers, in light of the rapidly changing market arrangements.

## References

Ahearn, M., K. Jefferson, and D. Banker. "Contract Terms in the Production of Poultry, Hogs, and Cattle." Poster presented at the Southern Agricultural Economics Association, Mobile, AL, February 2-5, 2003.

Allen, D. and D. Lueck. "Risk Preferences and the Economics of Contracts." *AER*, vol. 85, May, Papers and Proceedings, pp. 447-51, 1995.

Allen, D. and D. Lueck. "The Role of Risk in Contract Choice." *J. of Law and Econ. Quarterly*, vol. 15, no. 3, pp. 704-36, 1999.

Dubman, R., W. *Variance Estimation with USDA's Farm Costs and Returns Surveys and Agricultural Resource Management Study Surveys*. ERS Staff Paper, AGES 00-01, April 2000.

Key, Nigel and William McBride. "Production Contracts and Productivity in the U.S. Hog Sector." *American Journal of Agricultural Economics*, forthcoming 2002.

Knoeber, C. "A Real Game of Chicken: Contracts, Tournaments, and the Production of Broilers." *J. of Law, Econ., and Organ.* 5(1989): 271-92.

Knoeber, Charles R. and W.N. Thurman. "Testing the Theory of Tournaments: An Empirical Analysis of Broiler Production, *Journal of Labor Economics*, 12(1994): 155-179.

Kott, P.S. "Using the Delete-a-Group Jackknife Variance Estimator in NASS Surveys." U.S. Dept. Agr., National Agricultural Statistics Service, 1997.

McBride, W. and N. Key. "Economic and Structural Relationships in U.S. Hog Production." USDA, ERS, AER No. 818, Feb. 2003.

Perry, Janet, M. Morehart, D. Banker, and J. Johnson. 1997. "Contracting—A Business Option for Many Farmers." *Agricultural Outlook*, (May): pp. 2-5, Wash, D.C.: USDA, ERS.

USDA, ERS. 2003a. ERS Briefing Room on the Agricultural and Resource Management Survey. <http://www.ers.usda.gov/Briefing/ARMS/>.

USDA, ERS. 2003b. ERS Briefing Room on Farm Structure. <http://www.ers.usda.gov/Briefing/FarmStructure/Questions/Contract.htm>.

USDA, NASS. "Corn, Soybeans, and Wheat Sold Through Marketing Contracts, 2001 Summary." USDA, NASS, Sp Cr 10 (03). Feb. 2003.



**Table 1. Marketing Contracts, 2001**

	<b>Unit</b>	<b>Corn for grain</b>	<b>Soybeans</b>	<b>Wheat</b>	<b>Flue-cured tobacco</b>	<b>Upland cotton</b>	<b>Rice</b>
<b>Contract adoption</b>							
Share of producing farms with contract	Percent	11.8	9.1	5.2	29.8	49.7	50.7
Share of value under contract	Percent	10.8	7.9	4.7	49.6	50.6	37.9
<b>Contract price</b>							
Average	Dollars	2.13/bu.	4.82/bu.	2.96/bu.	1.79/lb.	0.43/lb.	2.91/bu.
Coefficient of variation	Percent	1.41	5.24	7.58	2.23	10.39	9.62
25th percentile	Dollars	2.00	4.25	2.35	1.80	0.34	1.84
Median	Dollars	2.10	4.60	2.79	1.85	0.40	3.10
75th percentile	Dollars	2.25	5.00	3.04	1.87	0.52	3.70
<b>U.S. market price</b>	Dollars	1.89	4.37	2.77	1.87	0.38	2.30
<b>Contract:market price</b>	Ratio	1.13	1.10	1.07	0.96	1.13	1.27
<b>Contract quantity</b>							
Average	Quantity	19,842	8,385	9,430	56,807	267,340	48,911
25th percentile	Quantity	5,000	2,018	2,200	21,000	15,840	26,100
Median	Quantity	9,161	5,000	5,000	52,920	105,000	36,350
75th percentile	Quantity	21,000	10,000	10,000	75,000	310,949	68,600
<b>Nonprice terms</b>							
Confidentiality clause	Percent	16.3	17.9	8.0	na	10.2	36.2
Farmer responsible for: production loss	Percent	23.6	15.4	12.6	na	9.1	25.2
delivery off farm	Percent	86.4	83.2	79.5	66.9	56.9	83.1
<b>Contract length</b>							
Average	Months	7	7	7	14	11	10
Median	Months	6	6	7	12	12	12
12 months or more	Percent	18.0	23.8	27.5	85.3	72.9	70.1
Less than 12 months	Percent	66.1	56.7	57.1	7.5	17.9	21.1
6-11 months	Percent	35.4	22.8	17.6	na	na	na
6 months or less	Percent	48.8	49.0	46.1	na	na	na
3 months or less	Percent	21.0	25.7	37.3	na	na	na
None reported	Percent	15.9	19.5	15.5	7.2	9.2	8.8
<b>Distance to contract delivery</b>							
Average	Miles	21	27	28	29	8	20
Median	Miles	10	10	10	22	6	10
<b>Open Market alternatives:</b>							
Open market reported:	Percent	92.8	92.9	89.1	66.5	76.1	84.4
None reported	Percent	7.2	7.1	10.9	33.5	33.9	15.6
<b>Distance to open market:</b>							
Average	Miles	13	13	12	22	31	24
Median	Miles	9	9	7	15	33	20
<b>Sample size</b>	Farms	213	158	92	58	135	63

Source: 2001 ARMS, USDA

Contract adoption statistics are for all tobacco, and cotton, not just flue-cured tobacco, and upland cotton, respectively.

na = Insufficient data for disclosure

**Table 2. Production Contracts, 2001**

	Unit	Broilers	Market Hogs
<b>Contract adoption</b>			
Share of producing farms with contract	Percent	47.9	14.2
Share of value under contract	Percent	81.3	53.4
<b>Contract fee</b>			
Average	Dollars	0.233/head	10.71/head
Coefficient of variation	Percent	4.29	6.35
Median	Dollars	0.229/head	10.72/head
25th percentile	Dollars	0.16	9.5
75th percentile	Dollars	0.26	12.5
<b>U.S. market price</b>	Dollars	1.797	115.18*
<b>Contract fee:market price</b>	Ratio	0.13	0.09
<b>Contract quantity</b>			
Average	Quantity	398,332	5,483
25th percentile	Quantity	214,281	1,700
Median	Quantity	336,000	5,483
75th percentile	Quantity	516,000	13,000
<b>Nonprice terms</b>			
Confidentiality clause	Percent	15.4	27.2
Farmer responsible for:			
production loss	Percent	53.2	Na
specified investments	Percent	83.5	30.1
specified input suppliers	Percent	10.8	Na
manure	Percent	90.2	95.9
<b>Contract length</b>			
Average	Months	13	30
Median	Months	12	12
12 months or more	Percent	48.6	82.7
Less than 12 months	Percent	39.7	17.3
3 months or less	Percent	36.5	Na
None reported	Percent	11.7	
<b>Open Market alternatives:</b>			
Open market reported:	Percent	23.0	44.1
None reported	Percent	77.0	55.9
<b>Distance to open market:</b>			
Average	Miles	33	36
Greater than 50 miles	Percent	20.5	35.4
Sample size	Farms	326	45

Source: 2001 ARMS, USDA

Contract adoption statistics are for all poultry and hogs.

na=Insufficient data for disclosure

\*=Based on a market hog weighing 260 lbs.

Table 3. Quantities marketed under contract for corn and rice farms, 2001

Variable	Corn farms		Rice farms	
	With contract	No contract	With contract	No contract
Share of commodity farms	12%	88%	51%	49%
Share of commodity production	32%	68%	51%	49%
Average acres in commodity per farm	400	148	389	376
Farms' commodity production under marketing contract as a share of all production on farm	33%	0	76%	0
Small farms <sup>1</sup>	34%	0	65%	0
Large farms <sup>1</sup>	33%	0	77%	0
Sample size	1181		159	

<sup>1</sup>Small farms are those with less than \$250,000 in total value of farm production. Large farms are those with \$250,000 or more.

Source: 2001 ARMS, USDA

Table 4. Regression Results for Contract Price/Fee for Corn and Broiler Contracts, 2001

Variables	Definition	Parameter Estimate	
		Corn	Broiler
Intercept	Intercept	2.3582***	0.2032***
Quantityquartile1	Dummy variable = 1 when quantity contracted is in lower quartile of quantity distribution	--	0.0326*
Quantityquartile2	Dummy variable =1 when quantity contracted is in second quartile of quantity distribution	--	0.0107
Length6_11	Dummy variable =1 when contract length is 6-11 months	0.1381**	--
Length12_plus	Dummy variable =1 when contract length is for 12 months or more	0.2048***	0.0089
Confidentiality	Dummy variable =1 when contract had a confidentiality clause	--	0.0021
Prodloss	Dummy variable =1 when contract required grower to accept responsibility for production loss	0.0036	0.0180*
Required_delivery	Dummy variable = 1 when contract required grower to deliver commodity off the farm	-0.0750	--
Required_invest	Dummy variable = 1 when contract required grower to invest in long term assets	--	0.0028
Required_input	Dummy variable = 1 when contract required grower to purchase inputs from specified provider	--	0.0230
Govtprogram	Dummy variable = 1 when farmer participates in government commodity programs	-0.1797	--
Gmseed	Dummy variable = 1 when farm produced GM corn crop	-0.1310*	--
Cropinsurance	Dummy variable = 1 when farm business has crop insurance	-0.1104	--
Cont_paid_expense	Contractor input expense per head	--	0.0438
Expenseratio	Ratio of farm variable expenses to farm gross cash returns	0.1241	-0.0254*
Risklover	Dummy = 1 when farmer's self rating of acceptance of risk is at the high end of a Likert scale	-0.0247	0.0095
Off-farmwork	Dummy = 1 when farmer's major occupation is an off-farm job	-0.2076**	-0.0180*
Operatorexperience	Years operator has been engaged in agricultural production	0.0015	-0.0010*
R-square		0.2419	0.2562
Adjusted R-square		0.2094	0.2225
F value		7.44***	7.61***

\* Denotes significance at 10%; \*\* Denotes significance at 5%; \*\*\* Denotes significance at 1%.