The Growing Use of Contracts to Govern US Farm Production

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Abstract: The paper covers three related topics. First, it describes USDA efforts to track how farm production is governed (spot markets, contracts, vertical integration) through our large-scale annual farm survey, the Agricultural Resource and Management Survey (ARMS). Second, it summarizes trends in the use of agricultural marketing and production contracts in recent years, along with recent developments in contract design, relying on ARMS data. Third, we touch on a puzzling feature of agricultural contracts: the frequent use of short term contracts (a year or less) to govern long-term investments (10 years or more), particularly in hog and poultry production contracts. We summarize what we know about the issue, and offer a preliminary analysis of the variations in contract duration among producers.

Institutional economics has long found agriculture to be a ready source of examples and applications, and this year's conference is no exception. For example, we can find several papers on land tenure and sharecropping arrangements, long a staple of research on contract incentives, in the program. The program also offers a number of papers on irrigation and water rights, another topic that's drawn long-term interest in international as well as domestic applications.

Most research on these topics has been applied in the context of developing countries, with some considerable attention also paid to historical (pre-20th century) agricultural arrangements. But land contracts are the primary focus of the research on contemporary U.S. and Canadian farming reported in Allen and Lueck's *The Nature of the Farm*, and contemporary commercial agriculture offers a wide array of other organizational arrangements.

Consider the major ongoing structural change in U.S. agriculture: farm production in most commodities has been shifting steadily to much larger enterprises. Twenty years isn't a long time, but if we were to compare, in 2005 and 1985, the farms that produced the typical gallon of milk, bushel of corn, head of lettuce, chicken leg, or pork chop, we would find that the 2005 farms were larger, often several-fold larger, than the 1985 farms. Although larger, these "industrialized" farms aren't General Electric plants; they're almost always small businesses that are owned and managed by a small group of related people, and that employ somewhere between

five and twenty hired workers. Allen and Lueck devote a chapter in their book to the continued dominance of family businesses in U.S agriculture, a fascinating and still under-explored topic.

The farms referred to above usually engage in a wide variety of "make or buy" decisions. Livestock feed may be purchased or grown on the farm, and manure may be applied on-farm or transferred off-site. Some farmers typically hire custom service providers for some tasks (such as chemical applications, or harvesting), while others do it "in-house". Some specialize in a single stage of livestock production (such as feeding pigs to market weight), while arranging for the completion of other stages through contracts or joint ventures, freeing time for other commodity enterprises or off-farm employment. Some large commercial farmers run "virtual enterprises", in that they own no land, no structures, and no equipment, preferring to rent and lease everything.

These patterns can be observed in a large annual survey of U.S. farms, the Agricultural Resource Management Survey (ARMS).[1] In this paper, we use the ARMS data to focus on the methods used to govern transactions for agricultural commodities between farms and their buyers. We distinguish three—spot markets, vertical integration, and agricultural contracts.

Spot (or cash) markets provide the traditional means of transferring products and determining prices in agriculture. Producers are paid for their products at the time ownership is transferred off the farm, with prices based on prevailing market prices at the time of sale, under agreements reached at or after harvest. Farm operators participating in spot markets control production decisions, such as the types of farm inputs to buy, as well as when and how to apply them. Operators also make financing decisions (often in concert with their bankers) and arrange for selling their products, including finding a seller, determining a price, and delivering the product.

[1] These patterns and more are summarized in an annual USDA report (Hoppe and Banker, 2006).

Product transfers could also be organized through *vertical integration*. For example, many wineries own and operate vineyards, while citrus processors may own and operate orange groves. Some meatpackers also own hog farms or cattle feedlots.

Vertical integration within farming is still a major decision. For example, dairy farmers may choose to purchase feed or integrate the production of feed on-farm, while hog farmers may decide to purchase pigs for feeding or to integrate farrowing into the farm operation. But vertical integration that links farms with processors or retailers is still relatively uncommon, and it may be declining in importance.[2]

Farm product transactions are increasingly organized through agricultural contracts, agreements between farmers and buyers that are reached prior to harvest (or before the completion of a production stage, as in the case of livestock), and which govern the terms under which products are transferred from the farm.

In our surveys, we distinguish between two types of agricultural contracts--production contracts and marketing contracts. Under a *production contract,* the farmer provides a set of services to the contractor, who usually owns the commodity while it is being produced. For example, the farmer provides labor, equipment, and housing under many livestock production contracts, while the contractor provides other inputs such as feed, veterinary and livestock transportation services, and young animals. The farmer's (contractee's) payments usually resembles a fee paid for the specific services provided by the farmer, instead of a payment for the market value of the product. Under such contracts, farmers often cede substantial control over production decisions to contractors.

[2] The Census of Agriculture reports on farms owned by nonfamily corporations with more than 10 stockholders. There were 1,075 such farms in the 2002 Census, and they accounted for 1.9 percent of all farm production, down from 3.0 percent in 1978.

Marketing contracts focus on the commodity as it is delivered to the contractor, rather than on the services provided by the farmer. They specify a commodity's price or a mechanism for determining the price, a delivery outlet, and a quantity to be delivered. The pricing mechanisms may limit a farmer's exposure to the risks of wide fluctuations in market prices, and they often specify price premiums to be paid for commodities with desired levels of specified attributes (such as oil content in corn, or leanness in hogs).[3] The farmer owns the commodity during production and retains substantial control over major management decisions, with limited direction from the contractor, and hence retains more autonomy of decision-making than is available under production contracts.

Data

Agricultural contracting data are drawn from USDA's Agricultural Resource Management Survey (ARMS), a complex annual survey applied to a stratified random sample of all U.S. farms; it is USDA's primary source of information on the financial condition, production practices, resource use, and economic well-being of U.S. farm households.

The survey draws some farms from a list frame of farms recorded from USDA programs, Internal Revenue Service filings, and commercial listings. But to ensure a representative coverage of US farms, USDA also develops an area frame, in which land uses in each of 11,000 geographic segments are classified in June of each year, and farmers in each segment who are not on the list frame are identified. The ARMS sample is drawn from each frame.

[3] Some crop marketing contracts tie input purchases and commodity delivery by setting price and delivery schedules for specified seed and chemical inputs, as well as prices and outlets for harvested crops.

The survey proceeds in three phases. The sample is screened for continued operation and commodity coverage in Phase I, conducted in the Summer of the reference year. Randomly selected Phase I farms are surveyed concerning their production practices and chemical use, for specified commodities and at the field or production unit level, in Phase II during the following Fall and Winter. Contracting data are drawn in Phase III, conducted in the Winter and Spring following the reference year; Phase III draws information at the whole farm level, and focuses on farm income and expenditures, farm financial transactions, and the farm operator household.

In recent years, we have distributed five versions of the Phase III survey. Some farms complete a "core" version of the survey, distributed and returned by mail; the four other versions of Phase III, all longer than the core, are completed through personal interviews with trained enumerators.[4] Three cover specific commodities (corn, oats, and dairy in the most recent reference year) and add a series of commodity-specific questions designed to uncover information on commodity production costs and marketing practices. The fourth (CRR) version covers all farms. The most recent Phase III survey was directed to over 32,000 farms, and yielded a overall response rate of just under 70 percent.

Each version asks farmers about the use of production or marketing contracts, and the volume of production, receipts, and unit prices or fees received for each commodity under contract.[5] The longer version includes more detailed questions on contractors, contract terms,

[4] Enumerators are hired by the National Association of State Departments of Agriculture (NASDA), and are trained and supervised by USDA's National Agricultural Statistics Service (NASS), through that agency's state offices. Enumerators usually have farm backgrounds, either as retired or active farmers, and extensive local connections.

[5] The decision to specify only two types of contracts is influenced by pragmatic considerations of survey design—how to ask questions that a broad cross-section of producers will understand, and that conform to other USDA surveys, in a limited space. However, we believe that the production-marketing distinction is a powerful one, and so far have not found another two-way classification, or any third general category, to be a compelling alternative.

and alternatives available to farmers. The detailed questions, and the short versions of those questions used in some of the tables in this report, are provided in the appendix. The annual nature of ARMS enables ERS to compare survey data across years, as well as against data provided in the predecessor to ARMS, the Farm Costs and Returns Survey (FCRS), which provides contracting information from 1991 to 1995. Further information on ARMS, including downloadable questionnaires, can be found at www.ers.usda.gov/Briefing/ARMS/.

Two original and primary uses for ARMS data are to help track the financial performance of farms, and to identify commodity costs and returns. The tasks are complicated because the income generated by an agricultural activity may flow to a variety of resource providers, such as custom service providers, lenders, contractors, and farm labor, in addition to farm operator households, and each group may also incur expenses. As a result, the survey's primary contract questions are designed to measure the quantity of production under contract; to track the expenses of contract production borne by contractors, contractee farmers, and others; and to track the division of the revenues from contract production among the same three groups. We have appended additional questions on contract terms, with general questions in the CRR version and some more commodity-specific questions in the commodity versions. Because we survey farm operators, we tailor the questions to things that they can answer.[6] Since we survey annually, we focus on annual flows, and beginning and end-of-year stocks, and not on individual transactions (such as a flock of broilers). Our survey format works better for growers who have single annual contracts, like a hog feeder, than for farms who have multiple contracts with many livestock owners, like cattle feedlots.

[6] We do ask about contractor-borne expenses, which are important to the survey's primary mission, and which are generally not known to farmers (think about the expenses for the pigs,

The Use of Contracts in U.S. Agriculture

Table 1 provides data on recent trends contract use (both marketing and production contracts). Several distinct patterns stand out. First, only about 10 percent of U.S. farms hold contracts, with no clear change since the early 1990's. Second, nearly forty percent of the value of U.S. agricultural production was under contract in 2003, up about 10 percentage points since 1991-93.[7] Third, there's a clear linkage between broad commodity categories and contract types. Crops account for about two-thirds of the value of production under marketing contracts, while livestock accounts for over 90 percent of the value of production under production contracts.

Only about 10 percent of farms use contracts, but to place that in context, we need to think about what a farm is. In USDA statistics, a farm is any place that sells, or normally could have sold, at least $1,000 worth of agricultural commodities. That definition has been in place since the mid-1970's, and it has been effectively broadened over time, by inflation (the cutoff isn't indexed), and by the addition of more commodities. One thousand in sales isn't much—two steers, seven hogs, or 5 acres of corn will each easily exceed the cutoff. Under this definition, there were 2.12 million farms in the U.S. in 2003, but 58 percent had sales of less than $10,000; while those farms account for well over half of all farms, they account for less than 2 percent of farm production. Very few are commercial enterprises, or intended to be commercial enterprises.

Although there's a growing number of very small farms, production is shifting to larger farms; between 1989 and 2003, the share of farm production on very large farms (at least

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feed, and veterinary services that contractor provide to growers in contract hog operations). NASS state offices usually obtain expense data, on a statewide average basis, from contractors.

[7] Because earlier years of ARMS had smaller samples, we combine years to increase sample size. Contracting has been expanding for a long time—it appears that contracts covered about 12 percent of farm production in 1969 (MacDonald, et al, 2005).

$500,000 in inflation-adjusted sales) grew from 38 percent to 56 percent of total production, and the number of such large farms grew apace. Small commercially oriented operations are in decline—farms with between $10,000 and $250,000 in sales accounted for 25 percent of production in 2003, down from 40 percent in 1989, and their number fell by over 20 percent. Contracting is closely tied to farm size, and the expansion of contracting is closely tied to the growth of larger farm operations. Table 2 shows that the incidence of contract use rises sharply with farm size—larger farms are far more likely to use contracts. With growing numbers of very large farms, who use contracts, and very small farms, who don't, the overall share of farms who use contracts has remained unchanged. But with production shifting to large farms, and with strong relationship between a farms' share of production under contract and its total volume of production (table 2), the aggregate share of agricultural production under contract is growing.

Levels of contract coverage, as well as growth rates, vary sharply across commodities (figure 1). Major field crops, such as corn, soybeans, and wheat, are still largely sold through spot markets—agricultural contracts cover only 5-10 percent of production, and contracts are usually used for distinct varieties, such as high-oil corn or organic soybeans. At the other extreme for crops, nearly all sugarbeet production is governed by marketing contracts. Among livestock and poultry operations, about 90 percent of poultry and egg production is governed by contracts (and most of the rest is governed through vertical integration), while cattle sales still largely occur through spot markets.[8]

[8] Cattle production involves several distinct stages, each with important differences in governance relationships. Spot markets govern between 40 and 60 percent of the sales of fed cattle (largely beef breeds, that are transferred to meatpackers from feedlots), while 5-10 percent are governed by vertical integration. Feeder cattle sales, of smaller and younger cattle, are dominated by spot markets. Feedlots often custom-feed cattle under production contracts with cattle owners, and then sell the cattle to meatpackers, on the owners' behalf, under marketing

The figure also illustrates the sharp shifts in contracting that can occur—in fact, the apparent steady growth of contracting in agriculture really appears to reflect stability in most commodities, with sharp increases in a few. During the 1990's, the dramatic changes occurred in hogs, tobacco, and rice, with a sharp change also occurring in fed cattle (the figure shows an aggregate of all cattle sales).

The shift in hog production is particularly noteworthy. Until the 1990's most hog production in the U.S. occurred on "farrow to finish" operations: pigs were born to sows on the operation and fed to market weight with corn grown on the operation, supplemented with some purchased feed and supplements; and they were sold to meatpackers in spot market arrangements. Today pigs are birthed on very large and specialized operations; they are usually moved to other operations to be raised to "feeder pig" weight (30-50 pounds); and then are shipped to finishing operations to be fed to market weight. The transfers between farms are rarely accomplished through arms-length spot market transactions; rather an "integrator" usually owns the pigs and sows, and contracts with independent operations to grow the animals to market weight, whereupon they are transferred to a packer under a marketing contract between the integrator and the packer.[9] The integrator usually contracts with growers under production contracts, in which the integrator agrees to provide pigs, feed, and veterinary and transport services to the grower, who capital, labor, and energy. Under the contract, the grower is paid a fee for services, which may vary with production performance, but which is largely independent of market prices, and which varies considerably less than market prices.

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contracts. Sales of dairy-bred cattle are usually handled through spot markets, although many dairy farms contract with specialized operations to raise heifers slated to be replacement cows.

[9] An integrator could be another farmer, a packer, a feed mill, or an independent entrepreneur. The integrator frequently owns the sow operations, but usually contracts for feeding to feeder pig and market hog weight.

The organizational transformation led to sharp increases in productivity (largely through increased feed efficiency and more intensive use of labor and capital) and a substantial consolidation of production on larger enterprises (Key and McBride, 2004). For feeders, the shift provides sharply reduced risk, and frees the operator to apply management time to other farm enterprises (feeders usually have 2-6 hog houses, several crops, and perhaps a cattle enterprise).

The hog industry's organization now resembles the poultry industry's organization. Poultry too relies on a system of integrators and contract growers (in contrast to the hog industry, poultry integrators almost always operate processing plants, hatcheries, and feed mills, while hog integrators may contract or rely on spot market exchanges with those entities).

Comparing Production and Marketing Contracts

Table 3 compares marketing contracts in field crop commodities with production contracts for hogs and for broilers (young meat-type chickens), to draw out some important distinctions between contract types, and to introduce a puzzle concerning production contracts.

Field crop marketing contracts usually cover only a fraction of a farm's crop production; at typical yields, it would take just 70 corn acres, 64 wheat acres, or 105 cotton acres to meet the median contract quantities—these are far below typical planted acreages of these crops. By contrast, growers with production contracts commit all their hog or broiler production to that contract. Moreover, field crop producers typically maintain limited relations with their contractors—corn and wheat growers report that they have worked with their current contractor for one year, on average, while cotton producers report 4 years. For field crop producers, marketing contracts form part of an overall risk-management strategy that also includes investment in storage, hedging in futures markets, and commodity diversification.

In hogs and poultry, growers and integrators each commit to long-term investments in physical and human capital. Growers typically invest upwards of several hundred thousand dollars in land, structures, and equipment, while contractors usually invest in nearby feed and processing, while also investing in or linking to a network of other growing operations. Such investments bind growers and contractors into long term relationships: contract broiler producers had typically contracted with their present contractor for 12 years (table 3). Hog producers report shorter relationships, but that reflects the more recent growth in hog contracting.

The data in table 3 also point up an interesting phenomenon: in spite of the substantial financial investments that hog and broiler operators make, many production contracts specify very short durations--the median length is just 12 months for broilers and for hogs (thus, growers typically recontract each year with the same contractor). However, there's another interesting pattern; while the typical contract is short-term, there's a wide variation in observed durations. Over 20 percent of broiler contracts and over 30 percent of market hog contracts do not specify a length. Such contracts typically cover a single flock of broilers or a single group of feeder pigs delivered to the producer. Over half of broiler contracts and over a quarter of hog contracts specify a short-term contract, of less than a year. But many producers have contracts with long durations; about 15 percent of broiler contracts and about 37 percent of hog contracts specify contract durations of 5 years or more. Several sample broiler contracts have 15-year durations.

Moreover, larger producers tend to have longer contracts—more than half (56 percent) of contract hog production occurred under contracts of at least 5 years duration. Similarly, one-quarter of contract broiler production occurred under long-term contracts. Nevertheless, most broiler contracts, covering two-thirds of contract production, are covered by contracts for a single flock or for short specified durations of less than a year. Since each producer makes

substantial long-term investments in structures and equipment (over 90 percent of poultry contracts have specific equipment investments specified in the contract), the short term specified in many contracts, the wide range of observed durations, and the differences between broiler and hog contracts, are quite striking. We now turn to an investigation of those contract durations. We focus on the variation in duration in broiler contracts, because we have large samples of broiler contracts in the 2003 and 2004 ARMS.

A Theory Framework--Transactions Costs and Contract Duration

There are thousands of broiler producers in US agriculture, and about 40 major processors—on the face of it, a competitive industry. However, transportation costs (including the mortality risk to chicks and broilers from truck transport) make for local markets in live poultry, greatly reducing the number of potential buyers.

Investments in broiler houses are relationship-specific, in the sense that they have limited value in alternative uses. Most growers have few alternatives once they enter into a contract: only 40 percent of sample broiler growers report that there is another contractor in their area. Moreover, the investment can be significant: a modern broiler house (66 feet wide by 600 feet long), can cost $9.50 a square foot for grading, construction, and equipment. Growers rarely have a single house, and a common four-house complex will require an investment of over $1.5 million in addition to the commitment of the grower's human capital to learning the business.

Once the investment is made, growers face the risk of opportunistic behavior by integrators, who may have considerable monopsony power at that point. Without a contract, integrators may force prices down to just cover marginal expenses, thus appropriating

investments. With a short-term contract, integrators may adjust payment schemes, or hold up growers for additional investments, as a condition of renewal.

These combined factors, relationship-specific investments and opportunism, can limit the effectiveness of spot markets and lead to reliance on contract and vertical integration, and transactions-cost economics has had considerable success in using these concepts to explore choices among these different ways of organizing production and exchange (Williamson, 1985; Knoeber, 1987; Allen and Lueck, 2002). However, once market participants decide to rely on contracts to govern exchange, they still have a wide variety of choices to make when designing the contract.

Given the long-term nature of investments in broiler production, one would expect contracts to be long-term, in order to match the flow of revenues to that of the investment.[10] But there are alternatives to contract duration, that can also ensure commitment. For example, integrators can offer to pay, partially or fully, for growers' capital investments, through reimbursement or through facility ownership, thus reducing growers' risks. Conversely, contracts may commit growers to more investments beyond production facilities, increasing the risks from opportunism and requiring offsetting payments or guarantees through duration. Alternatively, the parties may develop trust through a long-term working relationship that limits the need to specify long durations.[11]

Our analyses in this paper are preliminary: we seek to explore whether and how elements of the investment and the contract affects choices of duration. We will focus on the debt incurred

[10] Pirrong (1993) uses that concept—investments that vary in specificity and the duration of the linkage—to explain differences in shipping finance and contracting across commodities.
[11] Allen and Lueck (2002) show that leases of cropland tend to be less formal when the parties have a prior relationship, and Corts and Singh (2004) explore tradeoffs between experience and contract specificity in offshore oil drilling.

by the grower, the size of the investment as indicated by annual production, the familiarity between grower and integrator (the number of years they have contracted), and contract features that complement or substitute for duration choices.

For this analysis, the specific survey question that frames our analysis is: "How long is the length of the contract?" (in months). Enumerators carry a manual that provides them with background on each question, and in this case they are given examples of lengths, and advised to enter the length of a typical production cycle if the contract is specified in that way (such as one flock of chickens), and to record zero if the contract doesn't specify a length. Responses to this question tend to cluster at zero, and at 1, 2, 3, 6, 12, 24, 36, 60, 120, and 180 months (the shorter intervals are probably specified in terms of production cycles).

Differences Among Short, Medium, and Long-Term Contracts

Table 4 summarizes our data, and begins to give some hints of the factors that may drive duration. We have sorted our samples into the three duration categories listed in table 3: short term contracts are 12 months or less; long term contracts are 5 years (60 months) or more; and medium term contracts fall in between, from 13-59 months.

Annual quantities rise, although not dramatically, with length of contract. Operators with long term contracts (5+ years) produce about 1/3 more birds, on average, than those with short term contracts, and quantities increase steadily across size classes. Similarly, debt appears to be associated with contract length: those with long term contracts have much higher levels of debt (at the median, almost four times as much) as growers with short term contracts, and debt also increases steadily across the three duration classes.

We asked respondents to list the number of years that they had grown for their existing contractor, and mean responses were much higher for growers with short-term contracts—12.5 years--as compared to 9 years for medium term contracts and 7 years for growers with long term contracts (here, means and medians were not far apart).

Because the survey covers the whole farm, we can also identify production from any of the farm's other agricultural enterprises. Here, the distinction between means and medians matters. Most operations specialize in broilers. At the median, nonbroiler receipts amount to only 2 percent of broiler receipts for operations with short term contracts and zero (completely specialized) for those with median term contracts, while operations with long term contracts appear to have some other relatively modest operations. But means are much larger than medians, suggesting that a few operations have large non-broiler farm enterprises.

We asked about several aspects of the contracts themselves, and report on those that showed some variation across duration classes. Only some contracts specifically require the producer to identify and access specified cropland for litter (manure) distribution, but long-term contracts are a little more likely to have that requirement. We also asked respondents if there were other contractors for the commodity available in their area; most responded that there were none, with a distinct difference in response (fewer reporting alternative contractor availability) among medium term respondents.

Finally, we asked about equipment and structures, although the questions varied between 2003 and 2004. In 2003, we asked whether the contract required respondents to use specific types of equipment or structures; most responded that the contract did, with the requirement less likely to appear in short term contracts. In 2004, we asked a distinctly different question: did the contractor reimburse the respondent for equipment or structures expenditures specifically

required by the contract? Such reimbursement was common, but much more common among respondents with short term contracts.

Analysis of Contract Duration

For our initial exploration of the data, we sorted our responses into two duration classes—12 months or less (short-term), and more than 12 months. This approach splits the data in an interesting and feasible way, leaving a finer analysis of response clusters for later work. With the dependent variable specified as a (0-1) choice, with the "1' being a short-term contract, we used a logit model to examine the factors driving choice of a short-term contract.
We expect that that those growers, and their lenders, who have substantial sunk investments at risk in a relationship will want the protection of a long term contractual guarantee. Hence, we expect that grower debt and annual broiler quantity will each be negatively related to the choice of a short-term contract.

But contractors demonstrate commitment with alternatives to contract length. One alternative is demonstrated past commitment, and we expect that those growers who have had a long working relationship with their contractor will be less likely to require a long-term contract. Alternatively, contractors may signal commitment by providing partial or full financing for the grower's investment. In the 2004 survey, we asked respondents whether they had received reimbursement from the contractor for equipment or structures expenses, and we expect that those who did were more likely to carry a short-term contract.

We report our logit results, for combined data from the 2003 and 2004 surveys, in table 5, and they are quite promising. In equation (1), debt and annual production are inversely associated with the choice of short-term contracts, while familiarity (years contracting with

contractor) is positively associated with short-term contracts. The associations are statistically significant, and also substantively significant. Consider how predicted probabilities (that a contract will be short-term) relate to various combinations of explanatory variables. Where debt and quantity are relatively small ($50,000 and 300,000, respectively), and the grower and contractor have a long-standing relationship (15 years), the probability that the contract will be short term is quite high—79 percent (with other variables set to zero). As we successively change each of the three drivers, to 300,000 in debt, 500,000 in output, and a 4 year relationship with the contractor, the probabilities drop to 68, 65, and 55 percent, respectively.

Some contractual terms also have substantive impacts; for example, if the contract also specifically requires the grower to identify land that the grower can access for litter distribution, the short-term probability drops further, to 45 percent (from 55 percent, with relatively high debt and output and a short relationship). The effect appears to be statistically significant in equation 1, when we use two years worth of data, although it shrinks in size and significance when we restrict the sample to 2004 data only, in equation 3.

We did not ask about reimbursement of capital expenditures in 2003, so we limited the sample to the 2004 observations to assess that impact. Results from that estimation are reported in equation 3. Coefficients on contract quantity, and on grower debt and experience with the contractor, have the same signs as they had in estimations using the larger sample, and very similar magnitudes. The coefficient on capital reimbursement is positive, statistically significant and substantive—starting at the values for other variables noted above, a contract with capital expense reimbursement raises the short-term probability by 5-6 percentage points.

We explored an alternative specification in equation 2, by altering how the length of the grower-contractor relation might affect duration. Instead of using a continuous measure (years

holding contracts for this commodity with this contractor), we alter to a 0-1 measure (equal to 1 for a short relationship of five years or less). This specification implies that additional years of experience, after five years working together, have no extra impact on duration. The choice of a five year cut-off is arbitrary, and we will explore this choice in more detail in later analyses. We then interacted the dummy variable with debt and with output size, to allow the effect of each to vary with familiarity.

When we use the alternative specification, we can see that the coefficient on debt changes, and is substantially larger for less experienced growers—that is, less experienced growers with high debt loads are less likely to use short-term contracts and more likely to choose long term contracts. This is a suggestive finding, but one that we'll need to explore in greater detail as we consider alternative model specifications.

This is a preliminary look at the issue. We obtained some promising results—specified contract durations appear to be linked to the investment risks incurred by the grower, and they appear to be influenced by other aspects of contract design. The effects appear to be economically substantive. But a number of important issues remain to be explored. They include:

- Functional form. The logit model imposes a fairly restrictive functional form on the data, and forces our variables to be complementary in their impact on duration. That is, the impact of debt, for example, is greater, the greater are the values of quantity and years with the contractor. But the factors may actually substitute for one another in contract choice; as a result we need to explore the functional form of this simple model more closely.
- The measure of duration. At this stage, we've simply analyzed a two-way choice—long or short term contracts, with the split at 12 months or less. But our data cluster at

0 (no length specified), 1, 3, and 12 months, in addition to specific clusters among the long-term contracts. We need to assess whether those clusters are meaningful.

- Location. Markets for growers are local. In locations where growers have more alternatives, contractors may have to offer more assured deals. We have information on the location of growers, but have not exploited that data yet.
- Contractors. We do not know the identity of contractors, and we do not know which growers have the same contractors. Some contractors may simply follow idiosyncratic contracting strategies, irrespective of the factors listed above. With these data, we cannot focus on contractor-specific decisions.

Conclusion

The primary goals of our large scale annual farm survey are to measure and track farm sector income and farm household well-being. But the questions developed in that effort also help us to track and analyze the striking ongoing changes in the ways farming is organized. One of those ongoing changes is the shift to more formal contractual linkages among farm enterprises, their input and service providers, and their buyers. We've outlined those changes in this paper, and explored one element in contract design, with the hope of stimulating interest in accessing and using the data.

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Table 1: The Use of Agricultural Contracts in U.S. Agriculture

	1991-93	1996-97	2001-02	2003
Share of farms with contracts		*Percent*		
Any contracts	10.1	12.1	11.1	9.6
Marketing contracts	8.2	10.2	9.0	7.8
Production contacts	2.1	2.2	2.6	2.1
Share of production under contract				
Any contracts	28.9	32.1	37.8	39.1
Marketing contracts	17.0	21.5	19.7	21.7
Crop	11.0	12.2	12.7	14.8
Livestock	6.0	9.2	7.1	6.9
Production contracts	11.8	10.6	18.0	17.5
Crop	0.9	1.0	1.6	0.6
Livestock	10.9	9.6	16.4	16.9

Source: MacDonald and Korb (2005)

Table 2: Farm Size and the Use of Contracts

Farm Sales Class ($)	Distribution of Farms	Distribution of Farm Production	Farms with Contracts	Production Under Contract
	Percent of US Farms		*Percent of Sales Class*	
<250,000	92.5	29.1	6.2	19.9
250,000-499,999	4.1	15.1	43.5	31.3
500,000-999,999	2.1	15.1	59.1	42.6
>1 million	1.3	40.7	64.2	53.4

Source: Farm and Production Distributions: ARMS data, from ERS website at www.ers.usda.gov/Data/ARMS/. Contract data: MacDonald and Korb (2005).

Table 3: Some characteristics of agricultural contracts in 2003

	Marketing Contracts			Production Contracts	
Item	Corn	Cotton	Wheat	Market Hogs	Broilers
Annual Contract Quantities	*Bu.*	*Lb.*	*Bu.*	*Head*	*Head*
Median	10,000	180,000	6,375	4,555	345,000
25th percentile	5,000	76,000	3,000	1,689	210,000
75th percentile	26,000	402,500	16,220	9,600	582,000
			Dollar value		
($ Value of median)	23,200	111,600	20,846	433,207	540,000
Contract durations			*Years*		
Median years with contractor	1	3	2	4	12
			Months		
Median length of contract	4	12	4	12	12
			Percent of contracts		
No length specified	-	-	-	30.1	21.5
Short term: 12 months or less	-	-	-	27.9	55.7
Medium term: 13-59 months	-	-	-	5.1	8.1
Long term: 60 months or more	-	-	-	36.9	14.7

Source: MacDonald and Korb (2005)

Table 4: Contract and Grower Differences by Length of Contract

Contract & operator characteristics	Length of Contract		
	Short	Medium	Long
Annual quantity removed		*Broilers (000)*	
Mean	414	505	560
Median	360	390	484
Debt (000)		*Dollars (000)*	
Mean	188	284	387
Median	74	243	287
		Years (mean)	
Experience with contractor	12.5	9	7
Farm Business Diversification		*nonbroiler/broiler receipts*	
Mean	.27	.47	1.08
Median	.02	.00	.11
		percent of contracts:	
Land requirement for litter	18.4	20.0	23.8
Other contractors available	40.5	21.5	39.6
Contract specifies equipment[a]	88.0	100.0	98.6
E&S reimbursement[b]	82.0	56.3	45.9

Source: Data developed by author from 2003 and 2004 USDA Agricultural Resource Management Surveys.

[a]Only asked in 2003—Does the contract require you to use specific types of equipment or structures?

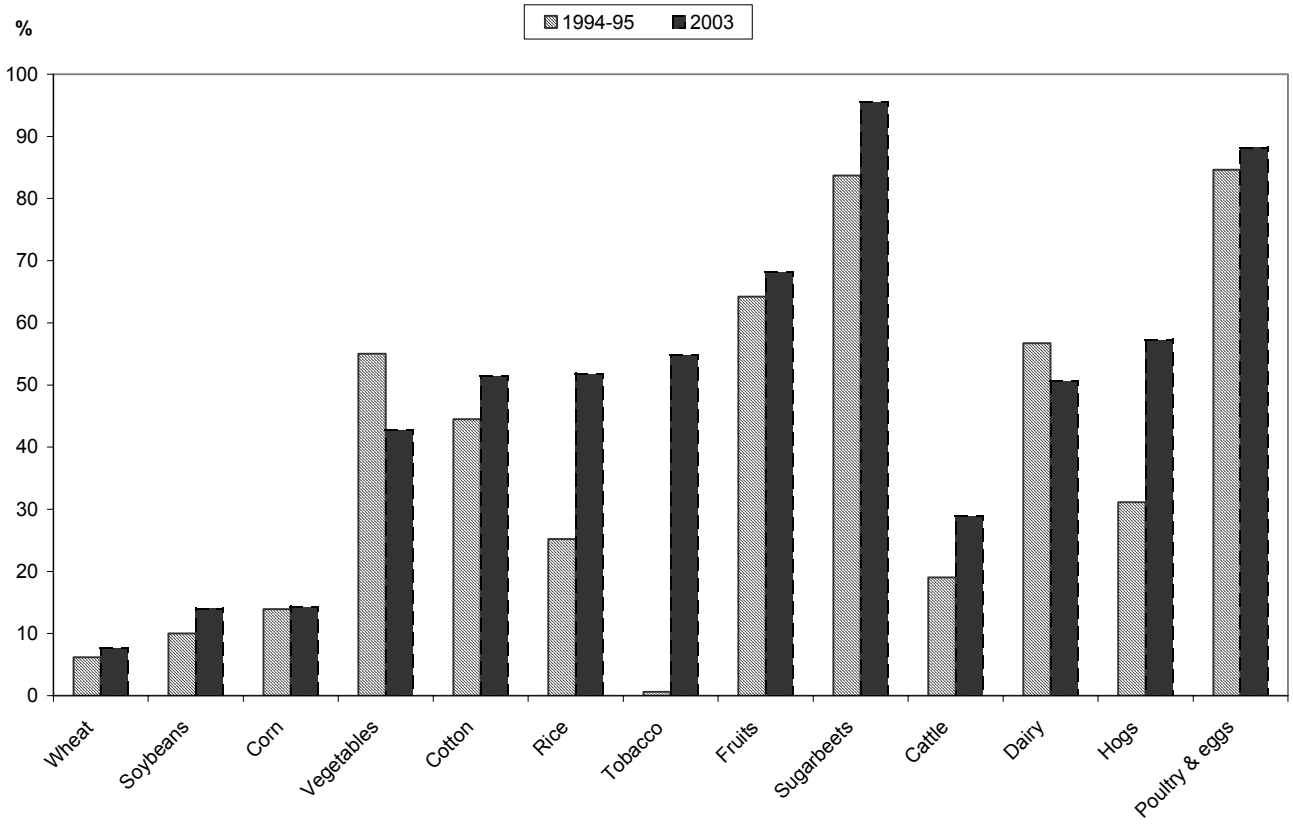
[b]Only asked in 2004—How much did the contractor reimburse you this year for current or previous equipment or structures expenditures specifically required by the contract?

Table 5: Logit analysis of incidence of short term contracts

Variables	2003 & 2004	2003 & 2004	2004 only
	Coefficients and standard errors		
	(1)	(2)	(3)
Intercept	7.845	13.6569	8.3062
	(2.0034)	(2.3306)	(3.4645)
Contract quantity (log)	-0.3151	-0.7898	-0.3145
	(0.1203)	(0.3411)	(0.1519)
Debt (log)	-0.3104	-0.2206	-0.3177
	(0.0503)	(0.1073)	(0.0488)
Years with contractor (log)	0.2961		0.4764
	(0.0885)		(0.0969)
5 years or less with contractor (0-1)		-11.7669	
		(4.2941)	
Interacted with quantity		1.2509	
		(0.4332)	
Interacted with debt		-0.3856	
		(0.1429)	
Another contractor (0-1)	0.4420	0.4724	0.7660
	(0.2007)	(0.2021)	(0.3853)
Diversification	-0.0850	-0.0760	-0.3879
	(0.0536)	(0.0538)	(0.1637)
Land requirement (0-1)	-0.4259	-0.5012	-0.1108
	(0.1124)	(0.0991)	(0.0964)
Low off-farm income (0-1)	0.2198	0.2890	0.1406
	(0.0758)	(0.0911)	(0.0848)
2004 (0-1)	0.9126	0.9701	
	(0.1593)	(0.1617)	
Capital Reimbursement (0-1)			0.2374
			(0.0577)
Number of observations	906	906	487

Source: Analysis, by authors, of 2003 and 2004 USDA ARMS data

Figure 1: Share of Production Under Contract, By Commodity



Source: MacDonald and Korb (2005)