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Contract Structure and Design in Identity Preserved Soybean Production

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Contract production and contract marketing are becoming increasingly important for organizing the agriculture supply-chain (Tsoulouhas and Vukina). Consumers are becoming more discriminating (Barkema). Producers trying to meet these discriminating consumer demands are developing new products and services and seeking more production efficiencies by more closely coordinating their buyer and supplier relationships (Drabenstott). We need look no further for evidence than the pork and beef industries. The trend in the United States over the last five years has been one of a rapid increase in the use of contractual arrangements for producing and marketing hogs (Grimes and Meyer; Lawrence, Grimes and Hayenga) and contractual cattle marketing (USDA).

Now, the introductions of specialty-trait corn, soy, and wheat varieties as well as other biotechnological innovations have created a need for more grain and oilseed supply-chain coordination than traditional grain/oilseed marketing arrangements afford, as evidenced by the StarLink™ situation in 2000.[1] Transactions that were traditionally defined primarily by price and quantity of broadly defined grades are becoming increasingly multidimensional, with various quality attributes becoming prominent. The need for segregating (preserving the identity of) these products based on their defining trait characteristics creates a need for coordinating infrastructure and resource management that is relatively new to many crop producers.

Previous analyses have discussed the theoretical and conceptual issues related to contract use (e.g., Sheldon; Harwood, et. al.; Harl, 1999) and its implications for agriculture structure (e.g. Harl, 2000; Barkema and Drabenstott, Rhodes). Numerous studies analyze the use of hog production contract arrangements (e.g., Lawrence et al.; Johnson and Foster; Parcell and Langemeier). However, despite the rapid adoption of contractual arrangements in agricultural production, little is known about the importance and impact of contract structure outside of the poultry industry (e.g., Knoeber; Knoeber and Thurman 1994, 1995; Goodhue; Goodhue, et al.). Indeed, little is known about the structure of these contracts itself, much less its significance. This is somewhat surprising given that Jesse and Johnson recognized the importance of contract specifications for prices received as early as 1970.

This paper provides a survey of contracts offered by DuPont Specialty Grains and Protein Technologies International, Inc. (PTI) under their identity-preserved, non-genetically modified soybean programs for the 1999, 2000, 2001, and 2002 crop years.[2] The contracts call for delivery of segregated, or identity preserved, GMO-free soybeans and pay a flat premium per bushel provided GMO content is below a specified threshold. The contracts include a list of production and management practices that are to be followed to prevent contamination from other crop types, particularly GMO crops, thus "preserving" the identity trait, and hence the premium value, of the soybeans. Some of the contracts call specifically for production of DuPont's STS ® soybeans, a non-GMO variety developed to be resistant to DuPont's Synchrony® herbicide, similar to Monsanto's genetically modified RoundUp Ready™ soybeans. Others do not specify a particular non-GMO seed variety or herbicide.

The purpose of this paper is to begin developing a taxonomy of contract structure for identity preserved crops in the context of the three fundamental components of economic transactions: the allocations of decision rights, value, and risk. Our objective is to provide a framework within which more systematic analyses of contract structure and contractual performance can be conducted. Specifically, we survey a sample of contracts to illustrate some interesting implications of contract terms and to provide suggestions for a future research agenda to analyze grain/oilseed production contracts.

The Economics of (Crop Production) Contracting

Fundamentally, every transaction has three basic elements: the allocation of value (or the distribution of gains from trade), the allocation of risk (when value is subject to uncertainty), and the allocation of decision rights.[3] A contract is simply an institutional construct that outlines the mutually agreed upon rules (and expectations) of how these fundamental elements will be addressed in the transaction relationship. Even the simplest spot transaction implicitly features each of these dimensions to some degree. However, as the element of time is introduced into the transaction, uncertainty becomes increasingly important and the interplay between risk, value and decision rights becomes clearer. As a result, how the terms of the contract treat those factors becomes increasingly important as well.

For example, if at harvest a producer shows up at the local elevator with a truck full of soybeans, accepts the current cash price, and simultaneously transfers title and physical possession of the beans to the elevator, there is little uncertainty with regard to the transaction. However, if the same producer contracts with the elevator prior to the day of delivery for the same truckload of soybeans, several factors now become important. First and foremost to many producers is the volatility of prices. Depending on the pricing terms (distribution of value) of the contract, the producer may be exposed to various sorts of price uncertainty. If the contract sets the price as the cash price on the day of delivery, both parties are subject to whatever price changes occur between the time of contract and the time of delivery.[4] The longer the period of time between contracting and delivery, the greater the price uncertainty and risk of adverse price movements. If the contract specifies a fixed price, neither party faces uncertainty with respect to the unit price, but may have to forego any favorable price changes in the interim (an implicit opportunity cost of the contract). While there are many marketing (and risk management) possibilities, each with its own sources of uncertainty and types of risks, the purpose here is simply to illustrate the point that the structure of the value distribution (pricing terms) affects the allocation and nature of risk between trading partners.

The effect of price uncertainty may in turn be affected by the allocation of decision rights regarding delivery. If the producer chooses when to deliver in a cash price settlement arrangement, then the producer can strategically opt to deliver when prices move in a favorable direction or to meet cash flow constraints or debt obligations. If the elevator holds the delivery decision rights, then it can strategically call for delivery when prices (or storage limits/costs, etc.) appear favorable. Either decision rights scenario represents a real option for whichever party holds the decision right—an option with very real value.[5] This is just one example; any of a series of decisions affecting the final gross value of the transaction (e.g., input choices, quality sorting, field management, etc.) will hold similar value.

Contractual Incompleteness

While the legal essence of a contract is that of a "legally enforceable promise"[6], from an economic perspective the contract serves as a governance mechanism, outlining the agreed upon and expected allocations of value, risk, and decision rights associated with the transaction. In short, the contract outlines the agreed upon "rules of the game." There is a large literature examining the completeness—or rather, incompleteness—of contracts in the presence of positive transaction costs, bounded rationality, and information asymmetry (e.g., Crocker and Reynolds; Williamson; Hart; Mahoney). The general conclusion is that contracts are necessarily incomplete. That is to say, it is impossible to write a contract that fully specifies all of the rights and responsibilities of both parties to a contract in the event of every possible contingency such that neither party will ever have an opportunity to take advantage of some "loophole" or ambiguity to the detriment of the other.

Both contractual incompleteness and costly (or imperfect) monitoring and enforcement of contract terms give rise to the possibility of ex post opportunism. In the case of contractual incompleteness, either party may take advantage of ambiguity in the contract's language or of situations that may arise which the contract does not explicitly cover to improve his ex post payoff. Costly or imperfect monitoring and enforcement may create incentives for either side to take advantage of information asymmetries and shirk in their contractually defined responsibilities. Contracts that are written in such a way as to minimize the ex post costs of opportunism subject to the ex ante costs of contract design and negotiation—where the marginal benefits and costs of completeness are equal—are considered economically efficient (Crocker and Reynolds). Thus, even economically efficient contracts leave potential for opportunistic behavior.

Separability, Programmability, and Specificity

Mahoney offers a framework that synthesizes concepts from new institutional economics and strategic management to prescribe governance structures that mitigate such ex post hazards. He argues, "the choice of organizational forms…depends upon the degree to which nonseparable team effort is required, the ability to program tasks and the level of asset specificity" (p. 577). *Outcome separability* and *task programmability* are measurement characteristics of a transaction and reflect both the asymmetry of information between parties and the costs of monitoring or verifying individual performance. *Asset specificity* reflects the transaction-specific value of an asset (i.e., the difference between the value of an asset in its current use over its next best employment). This specificity creates a bilateral dependence between parties as well as a quasi-rent (the surplus over the opportunity cost) that increases the potential for opportunistic behavior (Williamson).

Although Mahoney refers specifically to the case of team effort, the concept of outcome separability applies more generally as the ability to evaluate an agent's effort just by observing his output. This issue is not specific to the teamwork context, but arises in any multiple-input setting. For instance, how effectively can we evaluate a grain producer's effort in a given crop year simply by measuring the number of bushels he produces? If yields are exceptionally low, can we fairly attribute blame to poor management? If yields are exceptionally high, does it necessarily indicate better management? Depending on where that yield is reported, we might even ask how accurate the yield measure is (i.e., how do we know that the reported number of acres harvested is accurate when we calculate yield). In short, how much of the quality of the product is measurably attributable to the producer's management efforts?

If outcomes are very closely correlated with effort, then designing a reward (value) system based on observable outcomes will be an efficient allocation of value and risk, and the allocation of decision rights would be one of operational independence, since the producer's incentives would be closely aligned with the buyer's. If outcomes and effort are not closely correlated, then outcome-based rewards provide poor, or weak, incentives, since the payment the producer would receive would not necessarily depend on or reflect the amount of effort expended. That would also leave room for opportunistic behavior, as the producer could blame poor performance on factors other than his effort level.

Task programmability is the flip side of the evaluation process. In short, it reflects how closely output (or output quality) is tied to specific input decisions and observable management practices. If a production process is highly task programmable, and if the cost of monitoring the tasks is relatively low, then one might more efficiently control the quality of the outcome by specifying what steps should be taken throughout the production process. The producer-manager could be more accurately compensated since task performance and output would both be observable.

The resulting contract structures implied by these two measurement characteristics are markedly different. If the quality of the output is highly separable (i.e., it correlates highly and uniquely with producer effort), then we would expect contracts to allocate more decision rights to the producer and provide rewards for wisely exercising those rights by linking compensation entirely to the quality (value) of the output. If separability is relatively low but task programmability is high, then we would expect contracts wherein more decision rights (in terms of production decisions) are allocated to the buyer in the form of task requirements and the producer would experience less autonomy under the contractual relationship. The differences in these contracts might also be considered as different degrees of completeness: how detailed (or complete) are instructions regarding either individual's expected behavior?

The tasks involved in agricultural product segregation are generally programmable—particularly those related to identity preservation. Planting buffers, input specifications, and handling and storage processes all lend themselves to managerial checklists that producers may be required to follow. Although it may be costly to monitor or verify that each individual step was conducted appropriately, having producers sign statements that all steps were followed puts a legal onus on producers that may encourage compliance and accurate reporting. Phenotypic expressions of genetic traits, on the other hand, are largely influenced by factors beyond the individual producer's control, such as weather. This weakens the incentive power of payment systems based on environmentally-sensitive phenotypic quality traits since such payment systems place a greater deal of uncertainty on producers' returns to managerial effort. To the extent that such structures are required, one might expect the payment schedule to provide a more uniform and broader performance schedule (i.e., a more linear premium schedule over a broader range of trait levels such as oil content) than would be the case if the outcome was more highly separable.

Asset specificity also plays a role in agricultural contracting, and enters in through several different dimensions of the transaction. To simplify discussion, we will focus on two particular forms of specificity: specificity of the value-adding attribute in the product itself, and specificity of the assets employed in production and handling. The latter is more widely recognized and discussed in the popular press, particularly in the context of poultry and hog production where contracts frequently call for the construction and maintenance of building facilities conforming to the contractor's specifications. Even in crop contracting, however, terms of the contract may necessitate physical capital investment, whether for storage facilities or drying and handling equipment. In a buyer's-call contract, for instance, the producer must have access to sufficient dedicated storage, whether owned or leased, to hold the grain or oilseed until the contractor calls for delivery. Investment in specific assets on the part of producers may create the opportunity for the contractor to behave opportunistically; for example, enabling the contractor to offer prices or volumes that are lower than originally suggested while still covering the producer's opportunity costs of continued operations.

The question arises, however, just how specific such assets really are; and if they are specific in some way, is it to the individual contractor or to a broader industry or market. For instance, just how large is the quasi-rent associated with a broiler house built for a Tyson contract or a storage bin built to hold identity preserved soybeans? Could those assets be used to sell to another contractor in the industry at a comparable return? What is the value of those assets in their next best use? Is it in fact markedly lower than their value under the contract at hand? To our knowledge, these questions have not been well addressed.

The other form of asset specificity has received less attention, i.e., how specific is the value-enhancing attribute of the product to the contractor? If a contractor for high-oil corn, for instance, reneges—or threatens to renege—on the original terms, are there other buyers that value the high-oil attribute, and at what price? Is the producer's only alternative to sell the crop at the base grade commodity price, or will the specific trait actually create a discount against even the base grade price? While most value traits currently on the market are not very specific on a national market level, local markets may be very different. Given the relatively low per unit premiums currently being offered, transportation costs to the next consumer of the particular attribute may create geographic specificity rents. If agrobiotechnology fulfills its promise of more advanced—and more specific—value enhancing traits, this dimension of product value specificity will likely become more prominent in discussions of contracting.

Uncertainty Revisited

As argued above, uncertainty is a key underlying factor in any transaction with a temporal dimension. Nowhere could this be more obvious than in the agricultural sector, where price uncertainty, technical production uncertainty (including uncertain growing conditions), market access, and relationship uncertainty are all concerns raised in discussion. Each of these, but particularly price uncertainty and associated risks, has been addressed in a variety of ways in the agricultural economics literature. However, the relationship between uncertainty and transaction costs, and thereby the structure of governance mechanisms, is less well understood.

Mahoney acknowledges the potential importance of uncertainty in his analytic framework—particularly demand and technological uncertainties—but declines to discuss its implications for vertical integration decisions due to conflicting arguments between Williamson and Harrigan. Given Mahoney's objectives and the narrowly defined sources of uncertainty he highlights, such an oversight may be understandable. Because uncertainty is such a pervasive and multidimensional issue, it is difficult to prescribe the appropriate governance response without understanding the specific dimensions by which uncertainty affects a given transaction.

However, dismissing the discussion altogether necessarily ignores the more important point: without uncertainty, none of the other elements of Mahoney's framework is relevant. Indeed, despite its repeated emphasis on asset specificity, Williamson's transaction cost economics (TCE) from which Mahoney draws so much is driven by the existence of uncertainty. In the absence of uncertainty, contracts would be written that would perfectly cover the known future outcomes and eliminate incentives (or opportunities) for opportunistic behavior, regardless of the level of asset specificity. The basis of Mahoney's framework is some degree of uncertainty either in determining the contribution of value from individual inputs (i.e., outcome separability), in the production process (i.e., task programmability), or both. The relative degree of uncertainty in those particular dimensions of the transaction relation, and the relative costs associated with reducing the uncertainty related to each, is the crux of the theory.

Regardless of the prescriptive ability of uncertainty, generally defined, in determining the optimal governance structure, specific sources of uncertainty can be addressed more directly. Moreover, because the governance structure (contract terms) itself establishes the ways in which various types of uncertainties are allocated among trading parties, and because exposure to different sorts of uncertainties may affect either party's behavior with respect to the transaction, understanding the sources of uncertainty and the role they play in the transaction is a critical dimension of contracts research.

Summary

Every transaction entails a division of value, uncertainty, and decision rights between the parties to the exchange. The structure of contract terms related to any one of those dimensions has potential implications for the other two. Understanding these inter-relations and the economic underpinnings for different term structures is important for understanding how changes in product attributes, market forces, and supply chain coordination may affect the structure of exchange at any given level of the agrifood system. We now turn to examining the structure of soybean segregation (identity preservation) contracts in light of these theories of contracts structure and design.

Survey of Identity Preserved Soybean Contracts

A major stumbling block in contracts research generally is the lack of contract documents available for analysis. There is no central repository of a large collection of contracts; at best, they are scattered among the individual producers, making collection costly.[7] Large purchasing organizations have access to substantial collections, but generally treat the documents as proprietary. At worst, not only are the contracts widely dispersed, but they may also include confidentiality language that precludes producers from sharing that information with researchers. Without access to contracts, researchers cannot begin to bring empirical evidence to bear on a growing theoretical literature in the area of contracting and organization. To date, we are not aware of any systematic analyses of grain production contracts. Indeed, no one has yet developed so much as a framework for thinking about grain/oilseed contract structure in an organized manner, much less its importance and impact on market behavior and performance.

The advance of the Internet in agriculture has opened up access to some forms of contract information. DuPont Specialty Grains (formerly Optimum Quality Grains, LLC), for example, maintains a web site of its contract opportunities for producers originally called the Optimum Sales Connection and Resource (OSCAR). OSCAR allows producers to search for DuPont Specialty Grains-sponsored contract opportunities within a chosen radius from their farms. The site lists the participating elevators and seed dealerships for each contract opportunity, as well as a sample contract. We accessed all available sample contracts for identity-preserved, GMO-free soybeans for the 1999 to 2002 crop years.[8] This resulted in a sample of 23 different contract programs (sample contracts) offered through hundreds of elevator locations throughout Nebraska, Iowa, Illinois, Indiana, Ohio, and Missouri. In each of these contracts, Protein Technologies International, Inc., (PTI) either is the contractor (buying party) or is the contract agent (i.e., the contract parties are the elevator and the producer, but PTI facilitates and monitors the contract). Across all the programs for 2002, a total of 100,000 acres were sought through OSCAR for contracted non-GMO soybean production, using over 90 elevator delivery locations.

Table 1 lists the different contract opportunities surveyed and some of the key terms in the contracts. Contracts labeled for 1999 were offered during the first months of 2000. The 1999 contracts were strictly for STS® soybeans, DuPont's herbicide-tolerant beans.[9] Of the nine contracts for 2000, six were for specifically for STS® beans. The STS® contracts require the producer to purchase STS® soybeans from a participating seed dealer and apply Synchrony® herbicide (also purchased from authorized sellers) at recommended rates. The other three contracts for 2000 and all but one of the later contracts are for any non-GMO variety, vesting more seed variety and management practice decision rights in the producer.

The contracts include a certification form that growers must complete and provide at delivery indicating their compliance with the various input, management, and segregation practices called for in the contract. The checklist specifies tasks associated with ensuring harvest, transportation, and storage equipment is appropriately cleaned and storage facilities are clearly marked for segregation from other crops. The contracts also call for minimum border row widths of 20 feet to reduce cross-pollination potential. This certification form is identical for all of the programs except the two ADM contracts. Although crop samples are tested for quality traits at delivery, the easily identifiable tasks associated with preserving the "identity" of the crop make the process highly *task programmable*.

Source Of Value

It is important to bear in mind the actual source of value (gains from trade) in these contracts. Although the contracts call for delivery of soybeans, the purpose of the contract is to compensate growers for producing non-GMO soybeans and undertaking the effort to keep those beans free of GMO contamination. The contracts are all priced as incremental premiums for GMO-free quality. In fact, the base price for the soybeans themselves is not specified in these contracts. Thus, these contracts do not reduce price uncertainty for producers. The contracts are very clearly not for soybeans per se, but for producers' management services to preserve the desired trait of selected types of soybeans, in this case GMO-free generally or STS® in particular.

This basic source of value underlies most specialty-crop production, including products such as high oil corn, high oil beans, or high oleic beans, where the producer is being compensated for delivering a particular type (or identity) of what might otherwise be a commodity crop. The degree of specificity in the required seed stock may be different among certain types of products (as the difference between STS® or non-STS®, non-GMO bean contracts), but the essential source of value is the same: the producers management services in preserving the unique trait associated with the product by avoiding co-mingling or contamination through harvest, storage, and shipping.[10] A non-GMO, high sucrose soybean contract program available through OSCAR used an essentially identical contract to the non-GMO contracts discussed here other than the specific references to the high-sucrose seed stock required and the combined GMO-lox thresholds required for to qualify for the premium.[11]

All basic pricing (and price-risk management) decisions for the beans are left to the producer. This may cause marketing problems for the producer when the contract requires storage of soybeans under a "buyers call" with a large delivery window, and the producer is unsure of which futures contract to hedge the soybeans. This issue will be discussed in more detail later. The only stipulation on pricing is that any product not priced prior to delivery can be priced under a Price Later contract with the elevator. The contracts essentially offer premiums for using a particular type of seed stock (and in the earlier contracts, herbicide) and for preserving the identity of that product through segregation.

Acreage Contracts

Although the premiums are paid on the number of bushels of GMO-free soybeans delivered, the contracts themselves are denominated in acres. The producer agrees to deliver, and the contractor to purchase, 100% of the yield from the number of acres designated in the contract. Unlike a bushel contract, in which the contractor is guaranteed a set number of bushels and the producer bears all of the yield risk, acreage contracts shift some of the production volume risk to the buyer. The grower is still exposed to the risk of low yields since the amount of revenue is still based on bushels delivered, but he does not bear the additional risk of having to make up for any shortage in yield by purchasing beans to fulfill his delivery obligations. The buyer, on the other hand, cannot be guaranteed a given volume prior to harvest, since yields may vary.[12]

In addition, because the buyer is obligated to take 100% delivery from the contracted acres, there is uncertainty about the total amount of premiums that will have to be paid. One means of reducing the buyer's risk of low yields would be to contract for surplus production, but the 100% purchase clause (as opposed to a pre-specified cap on volume) increases the cost to the buyer. This risk to the buyer can be mitigated to some extent by 1) pooling yields over a fairly broad area, or 2) only offering these contracts in areas that have relatively low production yield risk. This would suggest that these contract terms might be more prevalent in certain geographic areas. A third possibility is that inspection standards may be applied more rigorously in order to reject more of the volume being delivered, thus reducing the amount of premiums paid.

The minimum number of acres required varies across programs, from as little as one acre in the ADM and 1999 programs, to as many as 50 acres in the 2000 Crestland and PTI contracts. The minimum acreage has implication for the costs of administering the contract program. The smaller the minimums, the larger the potential number of contracts required to satisfy the program's total acreage demand. Assuming the large number of contracts also means a larger number of producers, the costs of tracking seed purchases, field inspections, segregation handling declarations, and related administrative functions would likewise increase. A possible explanation for incurring this high transaction cost is to afford growers the opportunity to "test" the crop on only a small acreage, with the hope of larger plantings in future years.[13]

Interestingly, the variance in minimum acreage across programs reduces dramatically in the later years. Almost all of the 2001 and 2002 contracts call for 20-acre minimums.

None of the contracts requires explicit identification of the specific acres under contract, only a designated number of acres. This allows growers to substitute acreage through the growing season by planting more than the contracted acres with non-GMO beans (provided other requirements such as border row restrictions are met). There appears to be nothing to prevent growers from diversifying their risk of yield loss (or quality variance) across fields. Because the contract only calls for numbers of acres, the grower can choose which acres he will harvest for delivery at the contract premium. This would appear to be a win-win risk reduction—producers self-select their best yielding acres to get the segregation premium and buyers get more product.

However, this arrangement also creates the potential for padding the contract delivery quantity with beans harvested on more than the contracted number of acres. For instance, a producer could have 100 acres under contract but 120 acres in production. Since the producer is not limited on the number of bushels delivered, he could deliver all 120 acres worth of production and get the premium on the over-delivery by simply claiming to have gotten an exceptional yield on his contracted acres. Of all the contracts we surveyed, only the Consolidated Grain & Barge (CG&B) programs (both 1999 and 2000) protect against this form of opportunism. The contract states that yields higher than 20% above the county average must be verified, suggesting the potential for padding deliveries may have been recognized. However, the fact that more recent programs do not include this protection suggests that it may not be a significant hazard.

Delivery Options

Delivery options are perhaps one of the more understudied and undervalued dimensions of agricultural production contracts. There are two standard types of terms. *Harvest Delivery* (HD) denotes a field-to-elevator delivery during the harvest season, typically with the producer determining the timing of delivery. *Buyer's Call* (BC) typically refers to arrangements where the producer stores the product and the buyer determines the timing of delivery, generally after the harvest season. The BC contract may stipulate a specific delivery window (e.g., December through August), as well as the terms of the call (e.g., a 2-week warning). In a BC contract, the producer is responsible for storage and quality maintenance (drying, deterioration, and continued segregation) until delivery. Thus, the BC contract imposes additional costs on producers. Aside from the storage cost savings to the elevator, the BC contract also allows the elevator to coordinate deliveries in a manner that allows the elevator to most efficiently use its handling, storage and (un)loading facilities, since the elevator also must preserve the identity of the soybeans by preventing contamination with other product moving through the elevator.

The length of the contract period and the uncertainty of when delivery might be called within that window are further uncertainties producers face with a BC contract. Almost all of the BC contracts have delivery windows extending until August of the next year. Uncertainty about the actual storage duration may impact both the producer's ability to hedge the value of the crop and his costs of preparing the soybeans for storage and maintaining quality. What soybean futures contract does one use to most effectively hedge the price risk when the delivery month is unknown? Since the elevator is more likely to have some idea of when the soybeans will be called than is the producer, it should be better situated to manage that price risk. Producers also must deal with quality issues when storing grain/soybeans for an extended period of time. Soybean and corn storage days decline rapidly as the moisture level and temperature increase.

Thus, producers may incur additional drying and storage costs to condition the grain/oilseed for a potential 10-month storage period.

The contracts in our sample show a change in the usage of these two options over time. In 1999 and 2000, most contract programs offered both HD and BC options as separate contracts, with differing premiums. Only the ADM program offered just a BC contract. The HD contracts have harvest season delivery windows, typically from September 1 to November 30. The BC contracts differ in their delivery windows; some overlap with the harvest season, others do not begin until the harvest window is closed. As noted above, almost all of the early BC contracts extend through August of the next year and stipulate two-week warning period on calls.

Buyer's calls are the only types of contracts offered in 2001 and 2002. These newer contracts differentiate the timing of the call and use the term "Harvest Delivery" to denote a harvest season call window and the term "Buyer's Call Delivery" to denote post-harvest call windows, where the producer still has store the crop for a time before delivery. The premium is then determined by the timing of the call. There is only one contract form that simply lists two different premiums depending on when the call is made. Although delivery windows are not specified in the sample contracts, the language suggests that the total contracted acreage may be subject to different delivery windows (i.e., some may be contracted for a harvest season call while the rest is slated for post-harvest delivery). Without specific language stating when contracted acreage will be called, producers would be subject to even greater revenue uncertainties, since the amount of the premium is tied to the call window. The new contracts also omit any sort of warning period on the calls, leaving open the possibility that calls could be made with little or no advanced notice.

This shift in decision rights regarding delivery timing suggests a reallocation of value between growers and elevators. If the option to choose delivery timing is valuable to the elevator, as suggested by the fact that only BC contracts are now offered, then it must also be valuable to producers. One may well argue that the benefits to the elevator of being able to coordinate the inflow of identity preserved soybeans from multiple producers are greater than the benefits to producers of being able to decide their own delivery schedules. That would suggest that elevators should be able to compensate producers for the transfer of value associated with the change in delivery options.

Table 2 shows the premium schedule for each of the contract programs. Premiums are conditioned on satisfying the maximum GMO contamination threshold listed in the GMO column (we will discuss differences in these thresholds later). The premiums are on a flat, per bushel basis regardless of the number of months the soybeans are stored (in the case of BC deliveries), except as noted in the Late Season Call column. In every case where both HD and BC contracts are offered, the difference in premiums is not more than $0.05/bushel. In fact, with the exception of the Consolidated Grain & Barge contracts that offer no differential, $0.05/bushel appears to be the standard difference between HD and BC contracts. This implicitly suggests a flat storage premium of $0.05/bushel, regardless of how long the beans have to be stored before being called. This $0.05/bushel premium continues into the 2002 crop year, suggesting producers are accepting the premium in sufficient numbers to supply the contract programs despite that fact that storage costs are typically estimated at $0.03/bushel/month.

The CG&B contracts had a different payment structure for the buyer's call. The premium is the same under both the HD and BC contracts, at $0.20/bushel. The only premium for BC growers is if the soybeans are called later than March. For any beans not delivered before March 31, the grower receives an additional \$0.02/bushel/month for every month thereafter through the August closing date. Although this structure recognizes the idea of monthly storage costs, it is still below the typically figured \$0.03-\$0.05/bushel/month for commercial storage. CG&B also offered an additional incentive for producers under the BC contract. It is unique in providing a premium to producers if the elevator is unable to take delivery once a call has been made. If the elevator cannot accept delivery in the month of the call, the producer receives an additional \$0.00088333//bushel/day for every day of delay (comparable to a rate of about \$0.026/month).

Premiums and Quality

Thus far, we have only discussed the relative premium for BC versus HD contracts. As seen in Table 2, the level of the premiums differs across contract program as well, from as little as \$0.10/bushel to as high as \$0.25 or \$0.30/bushel for HD or BC programs, respectively. Moreover, the quality requirements also differ, making the quality-adjusted differences in premiums even greater.

There does not appear to be any correlation between quality characteristics (either by splits, heat damage, corn contamination, or GMO threshold) and the premium offered for the identity preserved soybeans. The Consolidated Grain & Barge and ADM contracts have among the lowest tolerance levels for percent of splits, percent heat damaged, and for GMO level, yet each of those contract programs pays a \$0.20/bushel premium, the average value for contracts in those crop years (1999-2000). The Crestland Cooperative contract programs reduced the allowable corn contamination threshold between 1999 and 2000 with no change in premium, then raised the allowable GMO threshold (from 0.10% to 0.50%) and dropped the STS® variety requirement between 2000 and 2001, again with no change in premium. In 2000, the

PTI/Bloomington contract program included allowable GMO thresholds of both 0.10% for the STS® contracts and 0.50% for any non-GMO, with the STS® contract paying $0.20/bushel (BC) to the non-GMO's $0.15 (BC). In 2001 and 2002, the PTI/Bloomington program dropped the STS® contracts and paid $0.25 and $0.30/bushel, respectively, for the non-GMO.

As shown in Table 3, premiums are higher on average in the later two years than in the first. The average premiums for HD contracts increased from $0.1917/bushel in 1999 and 2000 to $0.2286/bushel in 2001 and 2002, a 19.25% increase. This may reflect the fact that, in the later contracts, the harvest delivery is actually a buyer's call contract with a harvest delivery window. That is, the elevator has decision rights over when during the harvest season delivery will be made. However, the average premium for post-season delivery BC contracts increased from $0.2056/bushel to $0.2750/bushel, a 33.75% increase. The difference between HD and BC contract premiums is about $0.05 in the later period, consistent with the standard premium on individual contract programs. That difference is less than one cent in the early period, reflecting the fact that several programs either paid no premium (CG&B) or did not offer HD contracts (ADM) and paid average premiums. Whether this overall increase in premiums is driven by the market demand for identity preservation, a market supply response to segregation costs, or by the transfer of harvest delivery decision rights to the elevator (in return for a bump in the base premium) we cannot say. In either case, it shows producers are better compensated for their segregation services in the later years.

In addition to the higher average premiums, the later contract premiums are also more consistent across programs. Table 3 also presents the standard deviation of the premiums for the different time and delivery periods. The standard deviation drops from 0.0516 and 0.0565 for the HD and BC contracts, respectively, in 1999 and 200 to 0.0267 for both in 2001 and 2002.

This suggests the market may be converging on a particular market premium for identity preservation services given current quality thresholds and market conditions.

Property Rights, Measurement and Enforcement

In addition to the price, quantity (acreage), and delivery terms, the contracts also differ in some cases in the ways in which they handle measurement of oilseed quality and enforcement of the contracts in the case of a dispute. Basic weight and grading is done by the elevators in all cases, with the growers having the option to pay for an independent testing of their commodity by the Federal Grain Inspection Service (FGIS). However, there is no provision in any of the contracts for growers to get an independent testing of GMO contamination levels if desired. Most contracts specify possible testing procedures. For example, the 2002 PTI/21st Century contract reads, "Non-GM GRAIN shall be determined by an immunoassay test from Strategic Diagnostics Inc. (or another test approved by PTI / QCS) on a composite sample drawn from each load of Non-GM GRAIN." Because testing procedures are not uniform, and because producers are not specifically entitled to retesting, such clauses shift some risk to producers. This may be a more important issue in years with good yields. As noted above, the buyer's only protection against paying premiums for extra-normal yields is to more stringently test and reject deliveries. The choice of testing procedures may provide a strategic opportunity to buyers facing larger than expected yields.

Finally, there is the matter of law. The contracts all specifically state the State's law under which the contract would be disputed. ADM, not surprisingly, designates Illinois law as the controlling authority. All of the PTI contracts declared Iowa law as controlling—even the Bloomington, IL, program. This is significant because, if a dispute should arise, Illinois producers would have to hire Iowa attorneys to represent them in Iowa courts, a relatively expensive and inconvenient proposition for the producer. CG&B is interesting in that the 1999 contract declares Iowa law to be controlling, but that was changed to Missouri law in the 2000 program. This likely reflects the proactive, and somewhat antagonistic, position of the Iowa attorney general's office toward agricultural contracting. Here again, however, producers in one state may find themselves facing legal proceedings in another.

Need for Future Research

Despite the limited number of unique contract forms, the empirical evidence described above suggests the importance of more detailed, large-scale analyses of grain production contract structure, the factors affecting contract structure, and its impact on economic performance both for growers and elevators. Although there are many potential hypotheses to be tested, we outline a few here that we believe are particularly important.

First, acreage contracts provide producers reduced risks associated with poor yields. Growers are not "on the hook" for a fixed number of bushels that must be delivered regardless of farm yields. However, that puts more risk on buyers of the grain who may have specific volume requirements for efficient operations. An alternative is that biotechnology, broadly defined, has reduced the variance in production yields to a point that the pooled risk for the buyer is not a significant factor except in the case of a natural hazard. By specifying specific genetics with relatively tight production variances, the buyer may achieve an acceptable level of volume certainty even on acreage contracts. Consequently, we hypothesize that, for a given seed stock, premiums paid for bushel contracts should be higher than those paid for acreage contracts; and that acreage contracts will be more prevalent when either the contracted seed variety or the specific geographic location is known to have more consistent yields. A related hypothesis results from the observation that, during periods of exceptionally high yields, the buyer may have an incentive to more rigorously test for the value trait (in this case GMO-content) in order to reduce its premium payouts. One might hypothesize that rejection rates for acreage contract programs would be positively correlated with overall yields, while rejection rates under bushel contracts would not be correlated with yields.

Second, delivery options represent a major transfer of value between growers and elevators. Understanding the factors that determine whether or not elevators are willing to participate in HD contracts will help shed light on the nature and magnitude of the value associated with buyer's call options. Some factors may include the availability of on-farm storage in the local market, the size and segregation of bins in the elevator facility itself, the transportation logistics of the elevator and end user of the grain, and the number of potential contract producers in the area (reflecting coordination costs).

A related issue is the size of premiums for BC versus HD contracts. If in fact the premiums are to cover the additional segregation costs of IP, then perhaps there is no need for an additional premium for the delivery option. Commodity markets already offer market-based returns to storage. Since pricing and delivery are separable in these contracts, growers should be able to cover their additional cost of storage through appropriate pricing strategies and marketing tools. However, to the extent that the uncertainty regarding the timing of delivery affects the ability of producers to effectively hedge or manage their drying and storage costs as discussed above, there would still seem to be a value transfer associated with the different delivery options that should be accounted for in the relative premiums.

Beyond the delivery option, what factors account for the quality-adjusted differences in premiums and how do these differences affect producers' choice of contracting opportunities?

Presumably, this is dependent in part on the elevator's consumer market for the soybeans. However, one would expect that producers, given a choice, would opt for contracts that offer higher premiums with lower quality thresholds. When competing contract opportunities offer limited numbers of acres, this creates a gaming situation for producers to sign onto contracts earlier, thereby locking in the more favorable contract terms before the targeted acreage is achieved. How do growers react to competing contract offers and how does this affect both the structure of contract terms and the elevator's (or contractor's) strategic offering of contract opportunities, both in terms of when and where to make the offering?

What effect does contract specification have on the net returns to producers and to the elevators making the contract offerings? Given the differences in the allocations of value, risk, and decision controls inherent to the different contract terms, what is the net effect on producer welfare? Do producers self-select in ways that balance risk-return trade offs consistent with other marketing and risk management behavior? What factors affect the rate at which producers buy into contract programs in a given crop year? It is impossible to assess the impact of contracting on production agriculture without fully considering these different implications, and any policy action regarding contracting practices would be more likely to harm than help independent producers.

Finally, how will contract forms evolve as more specialty-traits are introduced into traditional commodity crops? The evidence from the non-GMO soybeans suggests a market convergence on premiums for segregation services as well as delivery or handling clauses. To the extent that individual traits simply create additional value on a per-bushel basis, one might expect the same standard forms to be used with premium value adjusted accordingly, as appears to be the case with the high sucrose beans discussed above (see footnote 10).

Notes

[1] For example, during the past 5 years there has been approximately a 42% increase in acres planted to white corn and a 300% increase in acres planted to high oil corn (U.S. Grains Council). Also, over the past 5 years, there has been rapid adoption of transgenic soybean seed use. Approximately 68% of domestic soybean acres were planted to transgenic soybean seed in 2001 (USDA 2002).

[2] Agricultural contracts are frequently characterized as "production" or "marketing" contracts. Typically, production contracts are thought of as being resource-providing contracts while marketing contracts provide a market outlet and pricing terms for the product. The sample contracts neither establish the base price of the beans nor provide resources, but instead specify inputs types and production practices and pay an incremental premium for keeping the product segregated. Since they fit neither of the typical definitions, we will refer to the contracts as "production" contracts with a broader definition in mind.

[3] The economics literature frequently uses the terms *risk* and *uncertainty* interchangeably. We consider them as distinct concepts, risk being the possibility (and perhaps magnitude) of negative payoffs associated with uncertain future outcomes.

[4] For simplicity of illustration at this point, this example assumes pricing is done within the context of the contract itself and is tied to delivery. The contracts surveyed here separate the commodity handling decisions from the pricing decisions, however the essence of the argument applies and will be made more to the point later in the paper.

[5] See Amram and Kulatilaka for a good introduction to the concept and application of real options theory.

[6] Cooter and Ulen (Chapter 6) provide a good background and on the legal and economic theories of contract, including a discussion of the necessary conditions for promises to be legally enforceable.

[7] The Contracting and Organizations Research Institute at the University of Missouri-Columbia is in the process of developing such a repository, but as yet has few contracts related to agricultural production.

[8] The 2002 crop year contracts and data reflect all programs posted through May 20, 2002.

[9] STS® (Synchrony®-Treated Soybeans) are resistant to DuPont's Synchrony® herbicide and are intended to compete with Monsanto's RoundUpReady® soybeans.

[10] The same type of argument can be made regarding poultry and certain types of hog contracts, where the producer is essentially paid not for the product being produced, but for his managerial expertise and services in raising the animals. Understanding the different nature of the value source in these contracts is important for a proper understanding of the decision rights and compensation structures of those contracts.

[11] The premium on the non-GMO high sucrose contract is a flat $0.90/bushel for a buyer's call, suggesting a sucrose premium of $0.625/bushel over the average non-GMO contract in the same crop year.

[12] Production certainty increases as the crop year progresses; however, these contracts are only available to producers prior to planting.

[13] We thank one of the reviewers for pointing out this possible motivation.

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Table 1. Non-GMO Soybean Contract Programs Offered on OSCAR, 1999 – Spring 2002

Contract Program	*High Yield*	*Min Acres*	*Delivery*	*Delivery Window*[a]	*Call Warn*[a]	*Elev Delay*	*Late Season*	*Laws*
1999 Consolidated Grain & Barge STS-BC	>20%+	1	BC	Nov-Aug	2 weeks	$0.0008333/day	+$0.02/mo after Mar	IA
1999 Consolidated Grain & Barge STS-HD	>20%+	1	HD					IA
2000 Consolidated Grain & Barge STS-BC	>20%+	40	BC	Nov-Mar, Nov-Aug, Apr-Aug	2 weeks	$0.0008333/day	+$0.02/mo after Mar	MO
2000 Consolidated Grain & Barge STS-HD	>20%+	40	HD	Oct-Nov, 2000				MO
1999 PTI/Crestland STS-BC		1	BC	Jan-Aug	2 weeks			IA
1999 PTI/Crestland STS-HD		1	HD					IA
2000 PTI/Crestland STS-BC		50	BC	Jan-Aug, 2001	2 weeks			IA
2000 PTI/Crestland STS-HD		50	HD	Sep-Nov, 2000				IA
2000 PTI/Crestland-BC Non-GMO		50	BC	Feb-Aug, 2001	n.s.			IA
2001 PTI/Crestland-HDBC Non-GMO		20	BC	n.s.	n.s.			IA
2001 PTI Pioneer Variety 91B01-BC		1	BC	Nov-Jul 2002	n.s.			IA
2002 PTI/Iowa HDBC		20	BC	n.s.	n.s.			IA
2002 PTI/Creston Branch HDBC		20	BC	n.s.	n.s.			IA
2002 PTI/21st Century HDBC		20	BC	n.s.	n.s.			IA
2000 PTI/Bloomington STS-BC		20	BC	Sep-Aug, 2001	2 weeks			IA
2000 PTI/Bloomington STS-HD		20	HD	Sep-Nov, 2000				IA
2000 PTI/Bloomington-BC		20	BC	Sep-Aug, 2001	2 weeks			IA
2000 PTI/Bloomington-HD		20	HD	Sep-Nov, 2000				IA
2001 PTI/Bloomington-HDBC		20	BC	n.s.	n.s.			IA
2002 PTI/Bloomington-HDBC		20	BC	n.s.	n.s.			IA
2002 PTI/Illinois-BC		40	BC	n.s.	n.s.			IA
2000 ADM-Decatur STS-BC		1	BC	Sep-Aug, 2001	2 weeks			IL
2000 ADM-Export STS-BC		1	BC	Sep-Aug, 2001	2 weeks			IL

[a] – "n.s." signifies that the information was not specified in the sample contract forms. In the case of delivery windows, the sample forms suggest windows would be set for particular amounts of the acreage under contract (i.e., the total contracted acreage may be divided among different delivery windows).
All contracts are for identity preserved, non-GMO soybeans. Contracts are listed by crop year and by contract program. Programs labeled "STS" require use of DuPont's STS® soybeans and Synchrony™ herbicide; the others do not specify seed varieties unless explicitly noted. Contracts labeled "HD" are traditional Harvest Delivery contracts; those labeled BC or HDBC are Buyer's Call contracts, the latter including harvest delivery call windows (based on premium tables).

Table 2. Protein Technologies International (PTI) NonGMO Soybean Contract Program Quality and Premium Terms

Program	*Splits*	*Heat Dam*	*Corn*	***GMO***	***HD Premium***	***BC Premium***	*Late Season*
1999 Contitnental Grain & Barge STS-BC	10%	0.20%		**0.01%**		**$0.20**	+$0.02/mo after Mar
1999 Contitnental Grain & Barge STS-HD	10%	0.20%		**0.01%**	**$0.20**		
2000 Contitnental Grain & Barge STS-BC	10%	0.20%	0.10%	**0.10%**		**$0.20**	+$0.02/mo after Mar
2000 Contitnental Grain & Barge STS-HD	10%	0.20%	0.10%	**0.10%**	**$0.20**		
1999 PTI/Crestland STS-BC	20%	0.30%	0.50%	**0.10%**		**$0.30**	
1999 PTI/Crestland STS-HD	20%	0.30%	0.50%	**0.10%**	**$0.25**		
2000 PTI/Crestland STS-BC	20%	0.30%	0.30%	**0.10%**		**$0.30**	
2000 PTI/Crestland STS-HD	20%	0.30%	0.30%	**0.10%**	**$0.25**		
2000 PTI/Crestland-BC	20%	0.30%	0.30%	**0.50%**		**$0.10**	
2001 PTI/Crestland-HDBC	20%	0.30%	0.30%	**0.50%**	**$0.25**	**$0.30**	
2001 PTI Pioneer Variety 91B01-BC	20%	0.30%	0.30%	**0.50%**		**$0.25**	
2002 PTI/Iowa HDBC	20%	0.30%	0.30%	**0.50%**	**$0.20**	**$0.25**	
2002 PTI/Creston Branch HDBC	20%	0.30%	0.30%	**0.50%**	**$0.25**	**$0.30**	
2002 PTI/21st Century HDBC	20%	0.30%	0.30%	**0.50%**	**$0.25**	**$0.30**	
2000 PTI/Bloomington STS-BC	20%	0.30%	0.30%	**0.10%**		**$0.20**	
2000 PTI/Bloomington STS-HD	20%	0.30%	0.30%	**0.10%**	**$0.15**		
2000 PTI/Bloomington-BC	20%	0.30%	0.30%	**0.50%**		**$0.15**	
2000 PTI/Bloomington-HD	20%	0.30%	0.30%	**0.50%**	**$0.10**		
2001 PTI/Bloomington-HDBC	20%	0.30%	0.30%	**0.50%**	**$0.20**	**$0.25**	
2002 PTI/Bloomington-HDBC	20%	0.30%	0.30%	**0.50%**	**$0.25**	**$0.30**	
2002 PTI/Illinois-HDBC	20%	0.30%	0.30%	**0.50%**	**$0.20**	**$0.25**	
2000 ADM-Decatur-BC	10%	0.20%	0.50%	**0.10%**		**$0.20**	
2000 ADM-Export-BC	10%	0.20%	0.50%	**1.00%**		**$0.20**	

This table reflects the quality and grade specifications as well as the premium (in $/bu.) paid if the GMO purity level is attained. All of the contracts call for No. 1 grade soybeans with the additional damage and contamination thresholds noted above. The premium is strictly per bushel with no additional carrying premium except as noted for late season calls. HD Premiums reflect the premiums for harvest season deliveries (no on-farm storage required) even if the delivery set by a buyer's call—all the 2001 and 2002 contracts are technically structured as buyer's call.

Table 3. Differences in Premium Structures By Crop Years and Delivery Option

Contract Program Crop Years:	*1999-2000*	*2001-2002*
Average Harvest Delivery Premium: (n = 6 and 7 respectively)	$0.1917 (0.0585)	$0.2286 (0.0267)
Average Buyer's Call Premium: (n = 9 and 8 respectively)	$0.2056 (0.0635)	$0.2750 (0.0267)
Average Premium On All Programs: (n = 15 for both)	$0.2000 (0.0598)	$0.2533 (0.0352)

Average per bushel premiums offered for each delivery period in the 1999-2000 and 2001-2002 crop year groups. Note that the "Harvest Delivery" option in that later period is subject to a buyer's call, while in the earlier period it is not. Sample standard deviations in parentheses. Given the small sample, the difference between any two pairs is not statistically significant.