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Pork quality and the role of marketing contracts: a case study of the US pork industry

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Abstract

Purpose – This paper aims to provide an assessment of the growth in marketing contracts in the US pork industry as an efficient means to control pork quality and reduce transaction costs.

Design/methodology/approach – Information collected from pork quality and safety summits sponsored by the National Pork Producers Council in cooperation with the National Pork Board, published surveys of large packers related to contract use, and 15 contracts submitted by producers to the Iowa Attorney General's Office from 1996 to 2001 were examined. The theoretical framework used combines branches of the industrial organization literature.

Findings – The paper provides information documenting the growing importance of addressing pork quality problems in the 1990s and how marketing contracts between packers and producers can help address these problems. Recognizes their role in reducing transaction costs associated with carcass pricing programs, reducing pork quality measuring costs, providing quality control, and reducing costs of adapting to quality uncertainty.

Research limitations/implications – The list of contracts examined is a small collection of contracts voluntarily submitted by producers, and pertains to a specific geographic section of the USA. Thus, they may not be representative of the entire industry.

Practical implications – The paper provides background information on quality issues faced by the US pork industry and a framework for better understanding the potential role of marketing contracts in addressing these issues.

Originality/value – This paper provides rather unique institutional background information on important changes occurring in the US pork industry in the 1990s and the role of the growth in marketing contracts in addressing related pork quality issues over time. Given the proprietary nature of specific contract terms, a small sample of long-term marketing contracts is analyzed to better understand contract design.

Keywords Contracts, Transaction costs, Measuring costs, Pork, Quality, Carcass pricing, United States of America, Food industry, Animal products

Paper type Case study

Introduction

In the US pork industry, the pace of recent organizational changes has been especially dramatic. Contracting between pork packers and producers has increased considerably in the 1990s, which resulted in fewer hog sales on the spot market. Marketing contracts offered by pork processing companies typically specify the quantity of slaughter hogs to be purchased on specified dates and places. Marketing contracts provide hog producers a secure outlet for their hogs and specific pricing terms. Producers are

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explicitly compensated for hog carcass weight and leanness. These arrangements accounted for approximately 69 percent of hogs sold in 2004, compared to 11 percent in 1993, and less than 2 percent in 1980 (Grimes and Plain, 2009; Hayenga *et al.*, 1996; Marion, 1985).

The rapid increase in marketing contracts has been a concern of policymakers. As marketing contracts replace hog sales on the spot market, spot prices are based on fewer sales. Consequently, these markets may become highly volatile, subject to manipulation, and less representative of a competitive market equilibrium. This may lead to misallocated resources and lower social welfare because marketing contract prices are typically tied to a spot price. Moreover, smaller independent producers complain that packers prefer to contract only with larger producers and price premiums paid are not made publicly available. In response to producer concerns about price transparency, beginning in April 2001, the US Department of Agriculture (USDA) implemented the Livestock Mandatory Price Reporting Program to provide all segments of the livestock and meat industries with information on which to base market decisions.

On the other hand, survey evidence suggests that long-term marketing agreements play an important role in addressing pork quality problems. For example, Lawrence *et al.* (2001) surveyed 11 of the largest US pork packers, representing 77 percent of total hog slaughter, to determine the reasons for entering into formal marketing agreements. Primary reasons included: to obtain a consistent supply of high quality hogs, to obtain higher quality hogs, and to improve food safety. Market intervention policies that restrict changes in the organization of pork markets could reduce social welfare if these changes are efficient responses to the marketing environment. This case study explores how the shift to marketing contracts could facilitate pork quality improvements in the US pork industry using a small sample of hog marketing contracts from 1996 to 2001.

Marketing contracts and product quality

Marketing contracts can facilitate improvements in product quality in several ways. First, they can reduce measurement, or information, costs, which include costs of searching for information about buyers or sellers in the market, inspecting goods prior to purchase, and assigning a price (Hallwood, 1990; Hobbs, 1996). Measuring costs may be especially significant when transactions are heterogeneous (e.g., vary in premiums placed on quality characteristics across transactions and over time), or characterized by asymmetric information (Lafontaine and Masten, 2002; Williamson, 1985). Two types of asymmetric information can be distinguished. The seller may have more information than the buyer about a difficult-to-measure quality attribute, or an individual's contribution to the quality outcome cannot be determined by measuring the finished product. Marketing contracts may reduce costs that are associated with assuring a closer correspondence between product value and price, or actions and rewards (Barzel, 1982; Williamson, 1985).

Measuring difficulties associated with overcoming asymmetric quality information may also be viewed as an "exchange hazard" (Williamson, 2000; Poppo and Zenger, 2002). When hog quality attributes are difficult to measure the producer may engage in opportunistic behavior to exploit private information by failing to perform as agreed, such as shirking or cutting corners on quality, also referred to as moral hazard. This is

expected to lead to contracts with added security features to mitigate the hazard, such as provisions for third party monitoring of sellers, documents to justify activities performed, and other means of increasing information disclosure.

Second, marketing contracts can facilitate adaptations to uncertainties in the marketplace (Masten, 1996; Ryall and Sampson, 2003). Matching producers' hogs to the quality needs of packers may require continual revision in light of changing customer demands and quality standards. As market uncertainty increases, it becomes more costly to write enforceable, complete contracts that detail behavior contingent on future outcomes. This leaves opportunities for parties to engage in opportunistic behavior to avoid compliance or increases the likelihood that parties will fail to optimally adapt to changing conditions. Consequently, contracts are likely to become more "relational" in nature. That is, rather than laying out detailed terms of cooperation, contracts are likely to specify the process by which terms will be established. By making contract terms less explicit, transaction costs associated with renegotiating and revising contract terms are reduced in light of uncertain future demand and quality needs.

Third, in cases where the packer is unaware of actions by the producer, two options are available to limit moral hazard (Eisenhardt, 1989). Contracts may reward producers based, at least partially, on outcomes of their behavior (outcome-oriented contract), or the packer may invest in information about producer behavior (behavior-oriented contract). The optimal performance evaluation strategy (behavior-oriented versus outcome-oriented) will depend on the ability to measure quality outcomes and related inputs. When quality outcomes are difficult to measure or difficult to measure in a reasonable amount of time, behavior-oriented contracts will become more attractive. Behavior-based contracts are more likely if producer activities can be easily defined and evaluated, or the production process is highly task programmable, which makes it easier to specify appropriate producer behavior in advance (Eisenhardt, 1989).

When producers are involved in several valuable activities that affect multiple, important quality attributes, and the measurability of these attributes vary, explicit incentives for those that are easily measured will be reduced (Holmstrom and Milgrom, 1991). This is because compensation based solely on a measurable outcome, such as volume supplied, may lead to poor performance in an immeasurable outcome, such as some dimension of pork quality. Similarly, explicit incentives for an individual producer's contribution to an easily assessed activity would lead the producer to neglect other team production activities. The presence of incentive clauses for easily measured quality outcomes will be influenced by the ability to identify producer activities that affect the immeasurable attributes.

Increasing emphasis on pork quality

Pork quality is the characteristics that make meat desirable. For consumers, quality may be determined by aesthetics (taste, smell, texture, color); nutrition (vitamins, proteins, minerals, energy, type and proportion of fat); safety (absence of pathogens, toxins); intangible qualities (organic, meat produced under high standards of animal welfare); and characteristics such as convenience and reliability. Pork processors identify several other determinants of pork quality: low "drip loss," or fluid lost from fresh, uncooked pork; color and color consistency; limited external fat; and absence of defects (Morgan *et al.*, 1994).

In the 1990s, several developments moved pork quality concerns to the forefront in the USA. Renewed emphasis on leanness emerged in the decade of the 1980s with human health research reports linking fat and cholesterol to cardiovascular disease in people (Robenstein and Thurman, 1996). Although live hog grading proved to be effective in encouraging farmers to reduce the fat content of their hogs, progress slowed in the late 1980s, while health conscious consumers were apparently willing to pay for even less fat (Kenyon and Purcell, 1999; Hayenga *et al.*, 1985).

In 1992, several of the largest pork packing companies adopted a new carcass measurement technology, referred to as the Fat-O-Meater. The technology is an optical probe, used to distinguish backfat from lean tissue, combined with a scale and linked to a computer. Backfat thickness and loin muscle depth, combined with the carcass weight, are used to calculate the estimated percent carcass lean.

The detailed measurements and computing capability allowed packers to introduce their own "pricing grids": a schedule of price adjustments to a base price that depend on carcass weight and percent lean. Carcass pricing grids, also referred to as carcass merit programs or carcass value pricing programs, which provide more precise measures of leanness suggest a higher expected price and stronger incentives for producing leaner hogs. Evidence collected from six large meat packers in the Southeast showed that carcass pricing grids were providing significant incentives for producers to raise larger, leaner, and more-muscled hogs (Kenyon *et al.*, 1995).

The pork industry experienced significant growth in carcass pricing programs in the 1990s. As reported by USDA, the percentage of hogs purchased by packers based on carcass evaluation increased from 11 percent in 1990, to 25 percent in 1993, and to 72 percent in 2001. By 2007, hogs purchased on a carcass basis reached 79 percent of total hog slaughter. As the popularity of carcass pricing programs grew, leaner and more muscular hogs became available at heavier, more desirable weights (Table I). According to Meisinger (2000), more progress was made in the 1990s to reduce carcass fat and increase muscling than in the previous four decades combined.

Pale, soft, exudative pork

As renewed emphasis was placed on producing lean, well muscled hogs in the 1990s, pork quality continued to change in other ways. In particular, a relatively high incidence of "pale, soft, exudative" (PSE) pork became more apparent. PSE is a fresh pork classification category defined by very light color, soft texture (or lack of firmness), and exudative or exhibiting a high degree of drip-loss after slaughter. These attributes were found to be associated with the Porcine Stress Syndrome (PSS) gene (or stress gene), which was carried by some of the leaner genetic lines (Smith, 1999). Hence, as hogs became leaner and more heavily muscled, they were also more susceptible to producing pork with the PSE condition.

Trait	1992	2002
Live weight (lb)	245.1	255.7
Backfat thickness (inches)	1.07	0.69
Carcass muscle (percentage)	49.5	55.5

Source: Miller (2004)

Table I.
Average US pork quality
characteristics, 1992 and
2002

PSE pork quickly became recognized for its undesirable qualities (Kaufman *et al.*, 1994). Economic losses associated with PSE included reduced yield during processing and cooking, drip loss in retail display trays, reduced shelf life, increased quality variation, and reduced consumer appeal. Panel scores suggest that pale-colored pork is less acceptable to consumers (McKeith *et al.*, 1996). PSE pork is also less tender because of increased cooking losses.

At the same time, as packers attempted to differentiate their products through branding programs, pork quality standards and consistency became increasingly important. In Lawrence *et al.*'s (2001) survey of 11 large US pork packers, the packers reported a need for increased quality control and consistency in response to greater demand from their pork customers and ultimate consumers. The survey also found that branded programs by packers have been rapidly increasing, accounting for 18 percent of 1999 sales volume, and were expected to represent an even larger share by 2004. In the eight-year period from 1996 to 2003, over three times as many branded fresh pork products were introduced compared to the previous eight years (Datamonitor, 2003).

Meat safety

Another development that raised quality awareness was a spate of meat safety recalls by food companies in the 1990s. These events heightened media attention and consumer awareness of the importance of containing microbial hazards (Shane, 1999). On the heels of the Jack-in-the-Box beef recall in 1993, new regulatory initiatives in the meat and poultry industries were designed to replace the "poke and sniff" inspection methods for detecting tainted meat. In 1996, the USDA, Food Safety and Inspection Service published the final pathogen reduction regulation for the meat and poultry industry (Unnevehr *et al.*, 1998). It set standards for reducing of microbial pathogens on meat and poultry products and required meat and poultry plants to implement Hazard Analysis Critical Control Point (HACCP) plans.

HACCP is a preventative approach to controlling biological, physical, and chemical food safety hazards. As part of the HACCP program, companies identify the types of hazards that could affect their products, institute controls to prevent or minimize the hazards, monitor results of these controls, and maintain records of monitoring efforts. In the event that problems are found, the packer is required to take corrective action by locating and eliminating the cause and establishing preventative measures. The government oversees the process and verifies its adequacy. In effect, HACCP shifted more responsibility for safety from the government to meat packers. Mandated use of HACCP reflected the growing importance of preventing and controlling safety problems before products reach the consumer (Unnevehr, 2003).

Pork exports

The US pork industry experienced unprecedented growth in exports in the 1990s, increasing from 1.6 percent of production in 1990 to 8.6 percent in 2003. The North American Free Trade Agreement (NAFTA) and the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) opened previously protected markets. Technological advances allowed US exporters to ship chilled pork products to Japan, which is the largest US export market. In March 1997, Taiwan was forced to close

down its pork industry due to an outbreak of foot-and-mouth disease, which opened the door for other exporters.

Pork product quality and customized service were major factors affecting global trade of pork products. Consequently, as US pork export markets fueled new business opportunities, addressing pork quality problems became more important. For example, in the 1990s, the USA made significant progress toward overtaking Denmark (a major US export competitor) as the leading exporter to Japan, where meat quality issues are especially important. A 1990 survey of Japanese consumers regarding factors that affect selection of pork products found that food safety, fat intake, taste, and freshness were among the quality characteristics that ranked high (Sapp and Knipe, 1990).

Marketing contracts and carcass pricing programs

As advances in measurement technology enabled more accurate and less expensive measures of carcass leanness, packers could offer grids with narrower groupings for leanness and carcass weight. In addition to added packer costs related to record-keeping and maintaining producer identity (McCoy and Sarhan, 1988), carcass grading programs with more narrow quality groupings likely increase costs of sorting and pricing hogs.

The move to carcass pricing programs also likely raised producer costs associated with comparing alternative packer pricing programs for several reasons. First, each meat packer has different premium and discount schedules, depending on the type of outlet and products sold. For example, packers such as Hormel, who process much of their pork, prefer a lighter carcass. Others, such as Excel, prefer a heavier carcass for boned or boxed products. Marbery (2000a) writes that restaurants prefer relatively small loins, which come from 215-230 pound hogs compared with the standard 270-pound hog. A packer that exports to Japan prefers leaner pork.

Second, instruments used to measure lean vary across packers. In 2000, among the nation's 32 largest plants owned by 13 packers, seven of these packers used the Fat-O-Meater, which employs light diffraction to measure fat and loin depth. Ultrafom and Animal Ultrasound Systems (AUS), which measure fat depth and loin depth by ultrasound rather than light diffraction, are used by three companies. Two packers used a low technology ruler measurement on midline backfat to estimate lean. A more sophisticated measuring device, AutoFom, also uses ultrasound but scans carcasses at 2,000 points and monitors intramuscular fat, and pH and color (PSE pork indicators) in the cooler. This device was used by Hatfield and became operational in one of Hormel's plants in 2000. These differences led to significant grading program disparities across packers.

A third factor complicating price comparisons across packers is that carcass merit matrices may be revised by the packer, which suggests the producers must continually reevaluate alternative packer buying programs. Buying programs have been continually adjusted to increase compensation for leaner hogs, and packers have been narrowing their ideal carcass weight ranges to provide more consistent products. Packer resistance toward making these programs public also complicated producers' ability to evaluate alternative programs[1].

Along with the growing importance of carcass pricing grids, marketing contracts between packers and producers quickly supplanted much of the spot market trade. The dominant pricing method in these contracts was a formula price adjusted by the

packer's carcass pricing grid, with a current live spot market price (e.g., Iowa-Southern Minnesota plant prices) serving as the base price (Lawrence *et al.*, 1997; Hayenga *et al.*, 1996).

Given changes in the pricing system, two features of marketing contracts could lower packer and producer measuring costs compared to spot markets. First, long-term agreements may reduce search costs associated with finding suitable trading partners. The duration of most hog marketing contracts is four to seven years (Kenyon and Purcell, 1999), which can reduce producers' costs associated with reevaluating packer grids at each sales interval. Similarly, packer costs associated with identifying suitable producers are incurred at long-term intervals.

Second, minimum quantity requirements help to assure packers that hogs are of uniform quality, which allows packers to engage in much less testing at the time of exchange. A 1994 survey of the largest US pork packers revealed that almost half of the 13 packers involved in formal, written contracts had minimum volume requirements, and either minimum quality requirements or breeding/genetic stipulations (Hayenga *et al.*, 1996). Large numbers of hogs produced under similar breeding, nutrition, health, and other production conditions would give the packer useful information on the other hogs by measuring a few. Also, because much of the difference in the typical versus ideal hog is related to genetics (Kenyon *et al.*, 1995), stipulations regarding genetics provide further assurances of uniform quality. Genetic traits that directly effect meat quality include intra-muscular fat (that is, marbling), meat color, pH, and tenderness.

Contract design to control quality and limit measuring costs

While carcass pricing grids provided strong incentives for leanness, the growing prevalence of PSE-related characteristics and safety concerns were expected to lead to efforts to control these attributes as well. However, measuring costs associated with these attributes provided obstacles to compensating producers. Packers could not readily grade hogs using PSE indicators (for example pH, color, and water holding capacity) because they are difficult to apply in high-speed slaughter lines that kill 1000 hogs per hour (3 seconds per carcass) (Marbery, 2000b). In 2000, Forrest *et al.* (2000) noted that predicting color and water holding capacity of pork is one of the most difficult and important challenges facing meat scientists.

Biological (bacteria, viruses, etc.) and chemical (antibiotics, hormones, etc.) contaminants also presented measurement difficulties. Testing for pathogen content at different stages of the supply chain is often difficult because rapid tests are not available (Unnevehr and Jensen, 2001). Microbiological and chemical residue testing is of limited value because the time required to obtain results does not permit action to be taken while the meat is being processed.

While PSE and safety attributes presented measuring difficulties, relationships between these attributes and production activities became better known. Research improved knowledge about the link between PSE problems and hog production inputs (Smith, 1999). Producers are responsible for 50 percent of PSE problems, mostly through their choice of genetics. As hogs were bred to be lean and well-muscled, such breeding led to more stress-prone hogs. Producers can reduce hog stress in several ways, including minimizing the use of electric prods, designing finishing facilities to optimize environmental conditions, and using feed additives.

While less is known about the application of specific on-farm HACCP principles to control pathogen contaminants, such as salmonella, producers directly affect pork safety through health management and handling practices. The most significant way that producers implement HACCP principles is through the PORK QUALITY ASSURANCE™ (PQA) certification program (Lautner, 1999), which is a voluntary education program introduced in 1989 to prevent antimicrobial residues and enhance herd health practices. To blend with packer HACCP plans, the National Pork Producers Council released a new version of the PQA program in 1997, which was designed to more clearly define producers' responsibilities. At the time, PQA Level III was the highest level of the PQA program, and could only be completed after discussions with a third-party verifier (veterinarians, agricultural education instructors, USDA extension personnel).

Contract sample

Given the strong link between production inputs and PSE pork, and certain safety attributes, contracts are expected to specify input requirements and monitoring of production activities[2]. A survey of 13 large US packers provides a glimpse of specific non-price terms of long-term hog marketing contracts in 1993 (Hayenga *et al.*, 1996). In addition to minimum quality requirements or breeding/genetic specifications required by nearly half of the packers, feeding programs or approval of facilities were specified by three packers. However, herd health or drug withdrawal programs were included by only one packer.

A more recent snapshot of marketing contracts is provided by a sample of 15 marketing contracts submitted by producers to the Iowa Attorney General's Office. These contracts were offered from 1996 to 2001 by six leading packers at the time (Farmland, Hormel, IBP, John Morrell, Swift, Excel) (Table II). Frequency of contract clauses related to monitoring and input specifications are summarized in Table III.

Company	Contract year ^a	Number of different contracts
Farmland	1998	1
	1996	2
	1997	3
	1999	1
	2000	1
IBP	1997	2
	1997	2
John Morrell	2000	1
	ND ^b	2
	1998	1
Swift	2000	1
	2001	1
	2000	1
Excel	2000	1

Notes: ^aContract year is our best assessment of the year that the contract was initially available based on dates contained in the contract. listed for that year is contained in parentheses; ^bND = year not disclosed

Source: Iowa Attorney General's Office (www.iowaattorneygeneral.org/working_for_farmers/contracts/index.html)

Table II.
Inventory of long-term
contracts

BFJ
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310

Table III.Frequency of contract
clause related to
production inputs

Clause	Number of packers with clause (<i>n</i> = 6)	Number of contracts with clause (<i>n</i> = 15)
Level III PQA or higher	5	13
Packer can observe production operations	5	10
Company-approved or company-specific feeding program	5	9
Company-approved genetics or feeder pig source	4	6
Handling of hogs	3	5
Veterinary supervision	3	8
Producer review of payment records	3	7
Producer can observe packing plant	3	6
Minimum requirements for PSE-related attributes	3	5
Specific genetics or feeder pig source	3	4
HACCP program compliance	3	5
Company-approved facilities	2	5
Packer audits of production management records	2	3
Company-approved management programs	1	1

Note: *n* = sample size**Source:** Compiled from contracts submitted by producers to the Iowa Attorney General's Office (www.iowaattorneygeneral.org/working_for_farmers/contracts/index.html)

Several clauses relate to food safety. In stark contrast to the earlier 1993 survey, nearly all packers had provisions that required producers to be certified at Level III PQA or higher. Over half of the contracts required producers to be supervised by a licensed veterinarian. Five contracts offered by three packers had provisions that require producers to comply with any company HACCP programs in place.

While five contracts have specific clauses with minimum PSE standards, they are not likely to involve regular measurements with consistent feedback to producers. For example, in Swift's 1998 contract, there is no indication of how the PSE condition would be measured or procedures for verifying compliance. Aside from lean composition and trim losses, there are no other pork quality data provided by any packer back to the producer on a consistent basis (Meisinger, 2000). Instead, PSE requirements may serve as a communication device to express PSE concerns to the producer, and perhaps signal to customers packer efforts to improve quality.

Given difficulties in measuring PSE pork, strong incentives for leanness provided by carcass pricing grids might be expected to divert producer effort away from controlling PSE pork. Clearly, the packer's ability to control PSE pork is enhanced by its relationship to genetics and other hog production inputs. Input specifications, together with packer monitoring, can give packers some control over PSE-related attributes.

Nearly all of the 15 contracts contain terms related to inputs that affect PSE. Six contracts had clauses requiring company approval (or joint agreement) of genetics or feeder-pig source. Four other contracts required a specific type of genetics or source of feeder pigs. In five contracts, producers were required to handle hogs in a humane manner or in a way that optimizes meat quality. Most contracts also required producers to use company-approved or company-specific feeding programs, and five contracts have clauses requiring company-approved facilities.

Are strong incentives for leanness efficient?

As discussed earlier, increasingly leaner, heavily muscled hogs were often carriers of the stress gene, which was linked to PSE pork. Strong incentives for leanness provided by carcass pricing grids are expected when the packer can use marketing contracts to specify and monitor producer behavior related to other important, but difficult to measure attributes. Given the ability to control the PSE attribute through genetics and production management practices, this is clearly the case.

Strong incentives for leaner hogs are also efficient when marginal benefits to the packer are relatively large compared to marginal benefits from reductions in PSE pork (Holmstrom and Milgrom, 1991). Marginal benefits from producer efforts to control PSE attributes may have been limited by industry wide efforts to breed out the stress syndrome from commercial herds (Casau, 2003; Marbery, 2000b).

As marginal benefits from increasing leanness become relatively smaller compared with controlling PSE attributes, weaker incentives, or perhaps disincentives, for leaner hogs are expected (Holmstrom and Milgrom, 1991). There is a positive relationship between increasingly lean hogs and PSE pork (which is disliked by packers/processors, distributors, and consumers). In addition, some researchers believe that fresh pork may have become too lean for consumers (Marbery, 2000c). Excessive leanness was one weakness identified in a 2002 pork quality audit of US packers accounting for 64 percent of hogs slaughtered (Messenger, 2004a)[3]. Disincentives for lean hogs was reflected in at least one carcass pricing grid recently submitted by a packer to the USDA's swine contract library[4]. The grid demonstrated a slight cutoff in lean premiums for hogs exceeding 58.9 lean percent in the industry's most common weight range, 232 to 292 pounds.

Marketing contracts and adjustments to uncertainty

Many contract clauses related to production input requirements tend to be less detailed regarding the degree to which required inputs and expected outputs are fully specified. Rather than specifically defining input standards, many clauses require packer-approval of feeding programs, facilities, or genetics. In Excel's contract, for example, specifications regarding diet, management, facilities, and handling of hogs require that these inputs be company approved, meet industry standards, or minimize carcass damage. Other provisions describe packer expectations or plans for working together. As stated in one of Hormel's contracts:

Both parties will work together to assure the genetics are meeting both the production and carcass meat quality requirements.

The less detailed nature of these terms may reflect uncertainty in pork markets that make it difficult for packers to accurately predict future input requirements. Adapting to changing input requirements may be facilitated by recognizing potential areas of conflict in advance, and defining partner expectations and a plan for collaboration, rather than defining specific terms of cooperation. By leaving contract terms less explicit, transaction costs associated with renegotiating and revising contract terms are reduced in light of uncertain future needs.

Changing industry standards for pork products is one source of uncertainty in the transaction. In addition to the growing importance of domestic fresh pork branding

programs, international markets are increasingly targeted as avenues for growth. Quality standards are dictated by preferences of the importing country.

Changes in quality measuring tools are another source of uncertainty. More accurate measures of pork quality can lead to corresponding adjustments in input requirements and pricing programs. Examples from the late 1990s include IBP's (now Tyson Fresh Meat) adoption of the ultrasound system for measuring lean, and Hormel's Autofom carcass testing system, which also monitors PSE-related indicators.

Uncertainty related to output and input requirements is reflected in "adjustment mechanisms" to alter the contract over time. For example, almost all contracts specify that the packer can change the carcass pricing grid, some requiring advanced notice to the producer. In its 2000 contract, John Morrell reserves the right to change or add additional requirements, upon reasonable notice, consistent with evolving industry standards for quality. Two of Swift's contracts, require producers to modify nutrition plans if requested (citing the use of non-genetically modified feed as an example). In addition, if requested by the company, producers must implement programs that improve quality or the company's ability to sell products (citing HACCP as an example). These terms help to resolve coordination problems and conflicts that might otherwise develop.

Variation in sample contract provisions

Although there are many similarities in input requirements and monitoring clauses across the sample, there are also significant differences, even between contracts offered by the same packer. This may reflect differences in the type of outlet targeted. For example, leanness, consistent color, and water holding capacity are more important for pork destined for grocery store shelves and international markets compared to further processing and food service outlets (Huskey, 2000).

Differences in contract terms may also reflect changes in information and packer goals over time. Ten of the contracts offered by Hormel, Swift, and John Morrell allow us to observe contract terms over time. Splitting the sample into two time periods, 1996-1998 and 1999-2001, provides five contracts for each period (Table IV). Comparing frequency counts across periods, all three packers added clauses that required producers to comply with any company HACCP program, perhaps in anticipation of a farm-level HACCP program.

Clauses related to handling of hogs were introduced for the first time in the latter period. This may reflect growing knowledge about the causes of PSE-related attributes, and greater concerns over PSE pork in response to increasingly leaner and stress-prone hogs. While progress had apparently been made in breeding out the stress gene in the hog population, the 2002 pork quality audit revealed an increase in the incidence of PSE pork compared to 1992. This suggests handling problems may have been an important contributor to PSE-related problems[5].

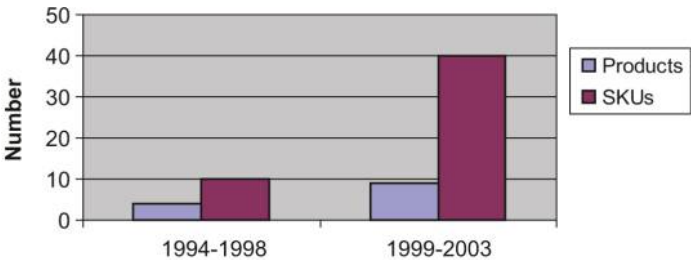
Changes in contract terms over time also coincide with attempts by these packers to expand their offerings of branded pork products. Using two five-year time periods, corresponding to the break in our contract analysis, we compare the number of new fresh pork products introduced by Hormel, John Morrell, and Swift. From 1999 to 2003, the number of new products tracked by Datamonitor increased markedly compared to the earlier period (Figure 1).

Clause	1996-1998 (<i>n</i> = 5)		1999-2001 (<i>n</i> = 5)	
	Number of contracts	Number of packers using the clause	Number of contracts	Number of packers using the clause
Level III PQA or higher	4	3	5	3
Veterinary supervision	3	2	3	2
Producer review of payment records	3	2	3	2
Packer can observe production operations	2	2	5	3
Company-approved or company-specific feeding program	2	2	5	3
Company-approved genetics or feeder pig source	2	2	2	1
Producer can observe packing plants	2	2	3	2
Company-approved facilities	2	2	3	2
Minimum requirements for PSE-related attributes	1	2	1	1
Handling of hogs	0	0	4	2
Specific genetics or feeder pig source	0	0	2	1
HACCP program compliance	0	0	5	3
Packer audits of production management records	0	0	0	0
Company-approved management programs	0	0	0	0

Note: *n* = sample size
Source: Compiled from contracts submitted by producers to the Iowa Attorney General's Office (www.iowaattorneygeneral.org/working_for_farmers/contracts/index.html)

Table IV.
Contract clause frequency
for contracts offered by
Swift, John Morrell, and
Hormel, 1996-1998 and
1999-2001 periods

Figure 1.
New branded fresh pork
product and associated
SKUs introduced by Swift,
John Morrell, and Hormell,
1994-1198 and 1999-2003



Notes: Stock Keeping Unit (SKU) is the lowest level that activity can be tracked on an item. For example, each unique size and form combination will be assigned a different SKU number

Source: Datamonitor

Conclusion

The US pork industry’s adoption of marketing contracts offer several advantages in light of changing emphasis on pork quality attributes. The long-term nature of marketing contracts limits the number of times that producers must evaluate alternative heterogeneous packer grading programs. Minimum volume requirements allow packers to obtain a larger number of uniform hogs from a single source, so that measuring a few provides more reliable information about quality of the rest. A sample of contracts collected in a specific region of the USA provides insight into the design of marketing contracts. By specifying production input requirements in contracts, packers could maintain strong incentives for the easily measured leanness attribute, while controlling for other quality attributes that are more difficult to measure. When quality specifications and production input requirements are subject to change, clauses in long-term marketing contracts that define packer expectations and plans for collaboration with producers facilitate adaptation to these changes. Coupled with production monitoring provisions, these contract terms appear to support effective coordination and timely responses to changing input requirements. While there may be other factors that contributed to the growing use of pork marketing contracts, changing emphasis on pork quality provided strong incentives for their increasing popularity. Sorting out the relative importance of alternative market forces driving changes in vertical coordination of the US pork industry provides rich ground for future research.

Notes

1. As part of the Livestock Mandatory Price Reporting Program, the USDA publishes mandatory data on contract arrangements, among other data, while protecting the identity of those reporting and the confidentiality of specific transactions.
2. Because packers do not typically own the hogs, provisions regarding production inputs are likely related to hog quality outcomes rather than efficiency gains that lower production costs. Furthermore, one may argue that input provisions have less to do with the leanness attribute because of strong explicit incentives for lean in the carcass pricing program (Smith, 1999).
3. The study found that bacon from thin bellies, while visually appealing to consumers because of less fat, is less palatable (Messenger, 2004b). It also causes processing problems related to yield losses from slicing and cook shrink. As bacon-topped sandwiches became more popular at restaurants, the belly became an increasingly valuable part of the hog.

4. This grid can be accessed at <http://scl.gipsa.usda.gov/content.aspx?page=227§ion=10> by clicking on Swine or Pork Market Formula under National, and then clicking on "Premiums and Discounts."
5. Recent concerns over handling issues are reflected in the establishment of a Trucker Quality Assurance (TQA) program by the National Pork Board in 2001. TQA is a certification program that educates truckers about proper handling, loading, and transporting of pigs, with emphasis on animal welfare and biosecurity topics (Miller, 2002). Recent research also suggests that there may be other genetic causes of PSE pork, besides the stress gene (Casau (2003); *Pork*, 2004). Hence, certain genotypes may be more prone to stress than previously thought, which increases the importance of proper hog handling.

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