Changing Emphasis on Pork Quality

Pork quality is the set of characteristics that make meat desirable. Those characteristics might be determined by: aesthetics (taste, smell, texture, and color); nutrition (vitamins, proteins, minerals, energy, type and proportion of fat); safety (absence of pathogens or toxins); intangible qualities (organic, or meat produced under high standards of animal welfare); and qualities 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).

Pork quality concerns were driven to the forefront by several developments in the 1990s, against the backdrop of fundamental trends driving consumer preferences for food products (Kinsey, 1994, 2000). These developments refocused packer initiatives for improving leanness, safety, and other meat quality attributes.

Renewed Emphasis on Lean and the Switch to Carcass Pricing Programs

Historically, lard was an important product derived from pigs. But after World War II, the demand for lard dropped sharply (Rhodes, 1978, p. 157). To provide incentives for leaner hogs, almost all slaughter hogs were graded and priced live at point of sale using the live hog grades and standards administered by USDA. The standards were based on the expected carcass grades that the live animal would bring (Rhodes, 1978). The highest carcass grade was expected to produce 53 percent or more of the four principal lean cuts (trimmed ham, loin, picnic shoulder, and Boston shoulder), as a percentage of total carcass weight. Live animal evaluation, grading, and pricing was a critical component of most animal science programs and a critical component of the U.S. pig production and marketing system (Boggs and Merkel, 1979).

Problems occurred with live hog grading. The grading remained an estimate of the actual carcass grade and prices were often set for pens of hogs rather than for each individual animal (Rhodes, 1978, p. 157). Resulting errors in attribute measurement implied that producers received only a small reward for producing higher quality hogs and, hence, had weak incentives for improving quality.

The Carcass Grade and Yield Program

The imprecision of the post-WWII live hog grading and pricing system created incentives for a new system of hog selling to emerge. New research-based carcass grades and standards, initially introduced in 1952 and modified slightly in 1968, were intended to reflect differences in value across carcasses and to provide incentives for farmers to "breed and produce the more valuable, leaner hogs." Rhodes (1978) describes the "carcass grade and yield" pricing system offered by packers. After slaughter, packers would measure the weight, length, and average backfat thickness of the hot carcass

(prior to reaching the chill room or cooler). These measurements would be compared to the carcass grades and standards table to establish a carcass grade. The base hog price per pound would be adjusted up or down to reflect the grade of the carcass.

The carcass grade-and-yield system had two major weak points. First, it relied on people to manually measure, record, and report the dimensions of each carcass. This procedure introduced a significant transaction cost and potential source of error. Second, the system separated the critical grading portion of pricing from the point of sale (e.g., the auction ring or the unloading dock). (This latter feature along with the potential for human error engendered distrust in some farmers, who nicknamed the system "grade and steal.")

Spurred by rapid advances in electronic computing, other microelectronic devices, and information management in the 1980s and 1990s, some packers shifted their basis for payment to carcass weight instead of live weight. Computerized scales and computer programs recorded weight, calculated payments, and printed reports. Payment based on carcass weight eliminated payment for gut-fill (feed consumed prior to delivery, but not digested by the animal, thus making the animal heavier prior to slaughter).

The carcass grade-and-yield program, however, presented a quality paradox. Almost all market hogs being sold in the late 1980s and early 1990s were in the top two USDA grades, so there was little or no incentive for farmers to produce leaner carcasses. Carcasses with more backfat weighed more (were a greater proportion of liveweight) than lean carcasses. As a result, given two animals of the same liveweight, the animal with more backfat produced a heavier carcass and might generate a greater payment, even though it was not as lean.

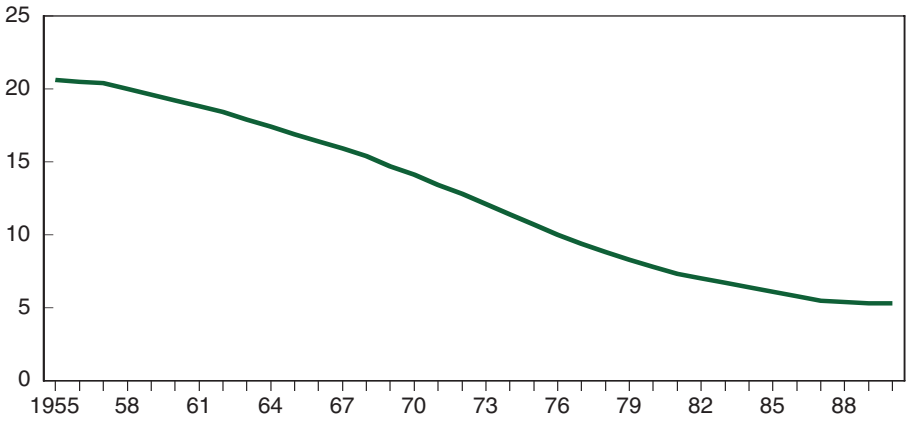
New Measurement Technology and the Emergence of Carcass Pricing Grids

By 1992, live hog grading remained the dominant procurement method, accounting for 83 percent of slaughter hog purchases (USDA/GIPSA, 1998). However, an emphasis on leanness had emerged in 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 (fig. 1), further reductions were beginning to slow, while health-conscious consumers were apparently willing to pay for even less fat (Schroeder, 1993; Hayenga et al., 1985; Kenyon and Purcell, 1999).

In 1992, several of the largest pork packing companies adopted a new carcass measurement technology and a new pricing method. The technology was previously adopted and proven by Hatfield Quality Meats in the late 1980s (Marbery[b], 2000). It consists of an optical probe, used to distinguish backfat from lean tissue, combined with a scale and linked to a computer. The optical probe, called the Fat-O-Meater, is inserted through the backfat and loin muscle at a specified point on the carcass. Based on prior research, the backfat thickness and loin muscle depth, combined with the carcass weight, are used to calculate the estimated percent carcass lean.

Figure 1

Fat removed from a typical pork carcass, 1955-90



Note: 1990 is forecast. Series was discontinued after June 1989.
Source: Duewer, Bost, and Futrell, 1991.

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 estimated percent carcass lean (see appendix C). Carcass measurements are reported on a kill sheet and sent to the producer along with payment. Carcass pricing grids (also referred to as carcass merit programs or carcass value pricing programs) and more precise measures of leanness suggest a higher expected price for producing leaner hogs and therefore stronger incentives to do so. 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 muscular hogs (Kenyon et al., 1995).

As the popularity of carcass pricing programs grew, leaner hogs became available at more desirable weights. Producers introduced new genetics, improved nutrition, and enhanced management that increased growth rates, feed efficiency, and lean meat composition. A new surge in leanness followed as producers adopted leaner genetic strains from England, Denmark, and elsewhere in Europe. Measurement technology continued to evolve with the introduction of ultrasound devices that make hundreds of measurements of muscle thickness throughout each carcass. Two surveys of large U.S. pork packers, one in 1992 and the other in 2002, found that average hog backfat thickness fell by 36 percent, percent lean muscle increased from 49.5 percent to 55.5 percent, and live weight increased by 10 pounds (Morgan et al., 1994; Miller, 2004). According to Meisinger (2000), more progress was made in the 1990s to reduce carcass fat and increase muscling than in the previous 4 decades combined.

Pale, Soft, Exudative Pork Proves Undesirable

Beginning in the 1950s, when U.S. pork producers attempted to change pork's image of being a fatty meat by instituting breeding programs to reduce fat content, a decline in quality became apparent (Kauffman et al., 1994). This decline was later linked to Porcine Stress Syndrome, a gene carried by some of

the leaner genetic lines of hogs (K.E. Smith, 1999). "Pale, soft, exudative" (PSE) pork, which is fresh pork that has very light color, soft texture, and a high degree of drip loss ("exudative"), quickly became known for its undesirable qualities (Boggs and Merkel, 1979). PSE pork performs poorly in processing (e.g., makes poor precooked hams), is unattractive in the meat case, and has poor eating quality after cooking. Soft, floppy, and watery pork is of little value to processors and wholesalers because it is susceptible to shrinkage—as much as 15 percent—during handling, processing, and storage. Fresh PSE pork turns a very light pinkish gray at retail, which is unattractive to consumers. PSE pork may be directed to low-value uses such as an ingredient for sausage. Economic losses associated with PSE include reduced yield during processing and cooking, drip loss in retail display trays, reduced shelf life, increased quality variation, and reduced consumer appeal.

In the 1990s, as renewed emphasis was placed on producing lean, well-muscled hogs, other pork quality attributes became of greater concern than in earlier decades (see "Pork Quality Audits Document Importance of the PSE Attribute"). PSE-related attributes, associated with the Porcine Stress Syndrome gene (or stress gene), meant that as some hogs became leaner and more heavily muscled, they were also more susceptible to producing pork with the PSE condition.

In Lawrence, Schroeder, and Hayenga's survey of 11 large U.S. pork packers in 1999, packers reported a need for increased quality control and product consistency in response to greater demand from their pork customers and the ultimate consumer. The survey found that branded programs by packers had been rapidly increasing, accounting for 18 percent of 1999 sales volume, and were expected to represent an even larger share by 2004. According to new product introductions tracked by Marketing Intelligence Service, Ltd. (2003), over 3 times as many branded fresh pork products were introduced in the 8-year period from 1996 to 2003 compared with the previous 8 years. As packers attempt to differentiate their products through branding programs, pork quality standards and consistency become increasingly important.

Meat Safety

A spate of meat safety recalls in the 1990s included Jack-in-the-Box in 1993 for *E. coli* O157:H7 contamination of beef, Hudson Foods in 1997 for *E. coli* O157:H7 in frozen hamburger patties, and Thorn Apple Valley in 1999 for *Listeria* in ready-to-eat deli meat. The recalls heightened media and consumer attention, and raised awareness of the importance of containing microbial hazards (Shane, 1999; Winter, 2002). Product safety problems can have devastating consequences for a company, especially for branded products that place the firm's reputation at greater risk (Unnevehr and Jensen, 1999). For example, Hudson Foods lost its biggest customer, Burger King, and then was taken over by Tyson Foods. Thorn Apple Valley filed for bankruptcy protection and was later acquired by IBP, which was the Nation's largest meat packer.[3]

On the heels of the Jack-in-the-Box recall, 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, USDA's Food

[3] Food safety concerns and concerns over liabilities were apparently important driving forces in the growing retail demand for case-ready meat, which arrives at the store cut and prepackaged (Messenger[b], 2004; Summerour, 2002).

Pork Quality Audits Document Importance of the PSE Attribute

The 1992 Pork Chain Quality Audit, funded by the National Pork Producers Council (NPPC), was the U.S. pork industry's first attempt to gauge the extent of pork quality problems along the supply chain, from consumers to producers. The objective was to provide information to guide industry research programs designed to limit pork quality problems.

Large pork packers were audited to provide the industry with initial benchmarks of the quality status of U.S. pork. Packers, accounting for 68 percent of barrows and gilts slaughtered, completed questionnaires on items affecting pork quality and its value. Results from the packer survey found PSE pork in over 9 million hogs, accounting for 10.2 percent of U.S. commercial slaughter of barrows and gilts.

In 1994, a workshop was held by the NPPC to discuss results from the Pork Chain Quality Audit among representatives from each segment of the pork chain. The most important quality problems were then categorized and listed. Top packer concerns included "reducing fat and PSE," while retailers and food service operators found product inconsistency or lack of uniformity to be major concerns. Important consumer concerns included "inconsistent products, including color."

Subsequent studies, along with several more pork quality and safety summits sponsored by the NPPC, reaffirmed the prevalence and importance of pork muscle quality problems. An updated version of the 1992 Pork Quality Audit (*Benchmarking Value in the Pork Supply Chain*), commissioned by the American Meat Science Association, showed that the incidence of PSE pork had increased to 15.5 percent of slaughter hogs in 2002. Corresponding industry losses amounted to 90 cents/hog ($90 million) in 2002 compared to 78 cents/hog ($69 million) in 1992. PSE was also identified as the third leading concern of packers, behind inconsistent weights and thin bellies.

Sources: Morgan, et al.; Miller, 2001; *Pork*, July 2003, p. 17; Kelley, August 2003; and R. Smith, 2003.

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 microbial pathogens on meat and poultry products and mandated that meat and poultry plants implement Hazard Analysis and Critical Control Points (HACCP) plans. As part of the HACCP program, companies identify the types of hazards (biological, physical, and chemical) 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. Mandated use of HACCP reflected the growing importance of

preventing and controlling safety problems before products reach the consumer (Unnevehr, 2003).

International Markets

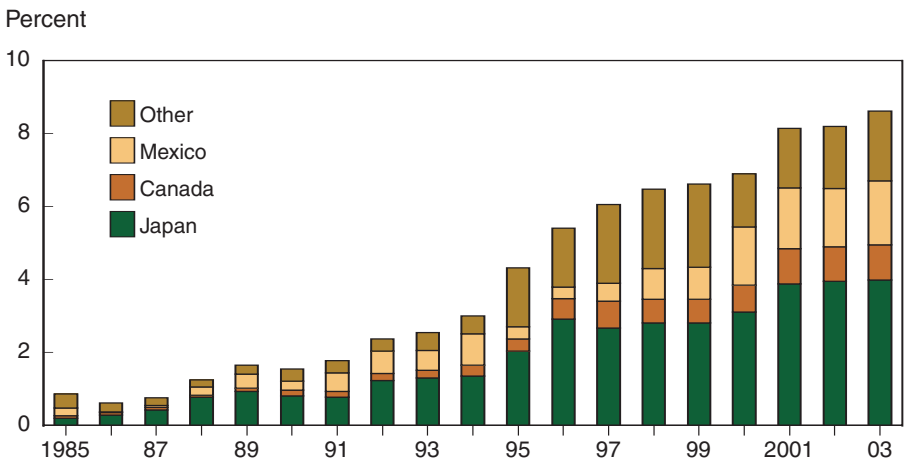
The U.S. pork industry experienced unprecedented growth in exports in the 1990s (fig. 2). The North American Free Trade Agreement (NAFTA) in 1994 and the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) in 1995 opened previously protected markets. Technological advances in 1995 allowed U.S. exporters to ship chilled pork products to Japan, which is the largest U.S. export market (fig. 2). In March 1997, Taiwan was forced to close down its pork industry due to an outbreak of foot-and-mouth disease (Pfaff, 1998). At the time, it supplied 41 percent of Japan's import market with products nearly identical to Japan's domestic product. This presented opportunities for other exporters to fill the void.

Pork product quality and customized service are major factors affecting global trade of pork products (Cravens, 1997). Hence, as U.S. pork export markets fueled new business opportunities, addressing pork quality problems became increasingly important (see "International Pork Quality Audit Addresses Quality Issues for Exports"). Some countries also have very strict regulations with regard to antimicrobial residues in animal products.

In the 1990s, the U.S. made significant progress toward overtaking Denmark (a major U.S. export competitor) as the leading exporter to Japan, where meat quality issues are especially important (fig. 3). Japanese consumers prefer darker colored meat and more marbling with little variation in lean color (Cravens, 2000). A 1990 survey of Japanese consumers regarding selection of pork products found that health concerns were the primary consideration, including food safety and fat intake (Sapp and Knipe). Other quality characteristics, including taste, freshness, and visible fat, also ranked high.

Figure 2

U.S. pork exports as a percent of total production, 1985-2003



Source: ERS, USDA [a,b].

International Pork Quality Audit Addresses Quality Issues for Exports

The 1994 International Pork Chain Quality Audit, funded by the National Pork Producers Council (NPPC) and the U.S. Meat Export Federation, provided insight into quality issues related to foreign markets. Interviews were conducted with 88 businesses in 16 countries to determine factors that affect demand for pork and how well the United States was conforming. The top three areas identified as needing improvement were:

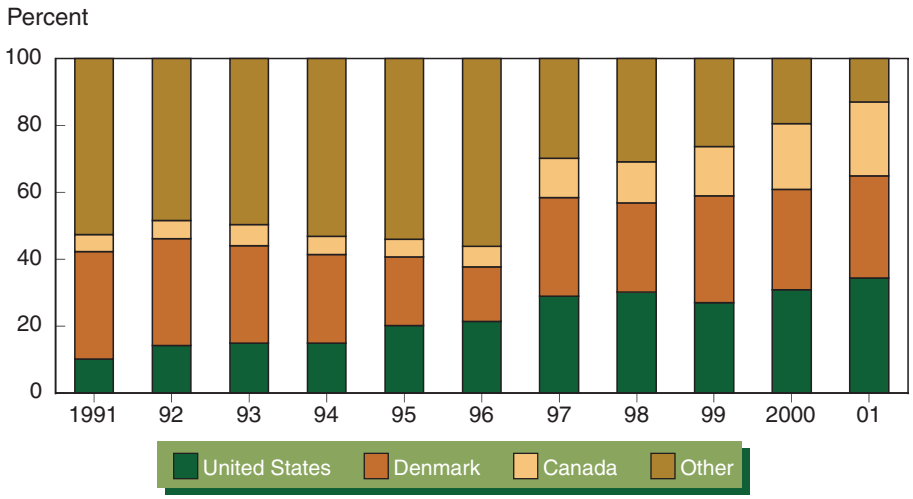
- Color, firmness, waterholding capacity, and PSE pork.
- Lack of customer service.
- Excessive abscesses/bruises/foreign material in pork.

Confidence in product safety was identified as the top reason for favoring U.S. pork. To maintain this perception and increase fresh pork sales abroad, it became more important to extend shelf-life by better controlling microbial growth.

Sources: Cravens, 1997; Smith and Belk, 1998.

Figure 3

Share of Japanese pork imports, 1991-2001



Source: Miller, February 2003.