

Relationship Between Increased Vertical Coordination, Product Prices, and Quality

Current trends in food consumption include preferences for a wide variety of reliably high-quality, convenient food products available at reasonable prices. These trends have been influenced by the increasing value of households' time, reduction in household size, information linking diet and health, and greater ethnic diversity (Kinsey). Demand for convenience food products—such as take-out food, frozen entrees, and microwavable dishes—is influenced by the high value placed on time in our society. As the value of time increases, opportunity costs associated with illness and information gathering also increase. Hence, consumers increasingly prefer quality assurances, better protection from unsafe foods, and more accurate information about nutritional content. Health concerns also affect food preferences, such as the current trend toward reduced-cholesterol and reduced-fat products.

New methods of vertical coordination that improve financial opportunities, reduce the cost of managing price and production risk, and lower transaction costs can lead to increases in production efficiency, and more convenient, higher quality meat products. Changes in vertical coordination can facilitate the adoption of new cost-saving technology by reducing transaction costs and barriers to the inflow of capital. Reductions in transaction costs associated with specific investments in breeding stock, and measuring and sorting of live animals, may lead to more uniform, higher quality animals. Processing costs may decline with higher quality animals and improved scheduling of animals for slaughter.

Figure 8 illustrates potential market effects of an increase in the level of coordination. Changes in vertical coordination can reduce farm production costs and costs of marketing services, or marketing costs, which include slaughtering, processing, cutting, and merchandising. By facilitating the adoption of technological advances in farm production, the farm supply curve shifts to the right (panel a). An increase in packing plant efficiency would lower marketing costs from $m=(Pr-Pf)$ to $m'=(Pr'-Pf')$, where m is marketing

costs, Pr is the retail price, and Pf is the farm price (panel b). In each case, the retail supply function for meat products shifts to the right. Improvements in the quality and uniformity of live animals would increase the availability of high-quality meat products, which would shift the demand curve for meat (panel c). The change in the retail price resulting from simultaneous shifts in retail supply and demand depends on the size of the horizontal shifts and the elasticities of supply and demand. On the other hand, the equilibrium quantity is unambiguously larger. In panel d, the shift in supply from S_r to S_r' exceeds the shift in demand, from D_r to D_r' , so the retail meat price falls from Pr to Pr' .²³

Chicken Products

Changing methods of vertical coordination in the broiler industry have clearly benefited consumers of chicken products. Production contracts facilitated the adoption of new cost-reducing technology, while additional production and marketing efficiencies were obtained from vertical integration of the feed, hatchery, processing, and breeding stages. The industry has emphasized quality, variety, convenience, uniformity, and affordability in its product offerings. Consequently, retail chicken prices have fallen, while broiler supplies and per capita consumption have continued to increase. While achieving those results in the domestic market, the broiler industry has also become a net exporter of chicken meat.

Retail Prices and Supplies

The broiler industry has made remarkable gains in production and marketing efficiency. From 1975 to 1997, commercial broiler production (ready-to-cook basis) nearly quadrupled (fig. 9). After adjusting for inflation, consumers can now purchase whole broilers for

²³Additional details concerning the relationship between vertical coordination, transaction costs, food production costs and quality, and supply and demand shifts can be found in Martinez, Smith, and Zering.

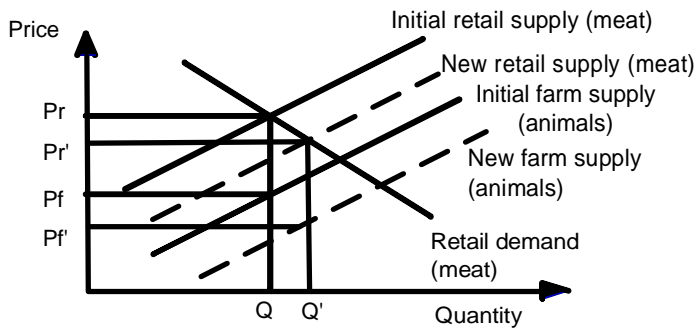
Figure 8

Potential effects of increased vertical coordination in a meat industry

Increased coordination can lower meat prices and increase meat consumption

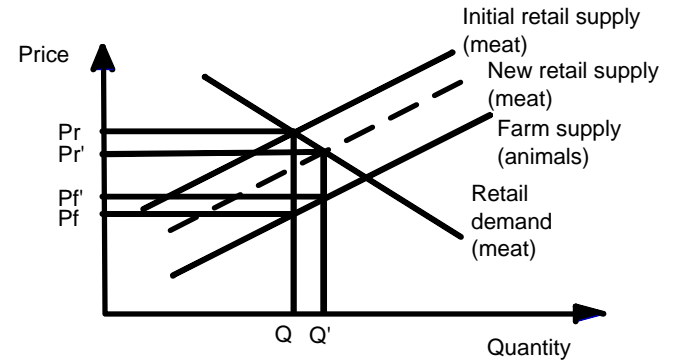
Panel a

Retail supply shift from lower farm costs



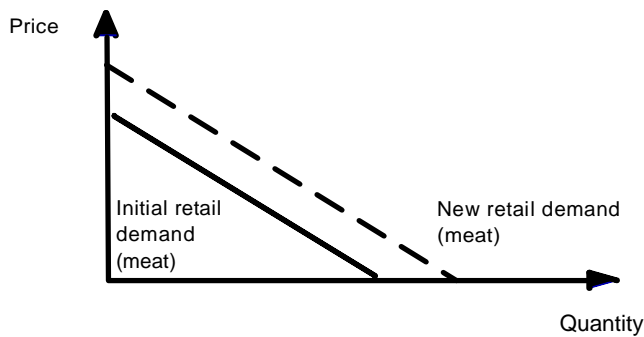
Panel b

Retail supply shift from lower marketing costs



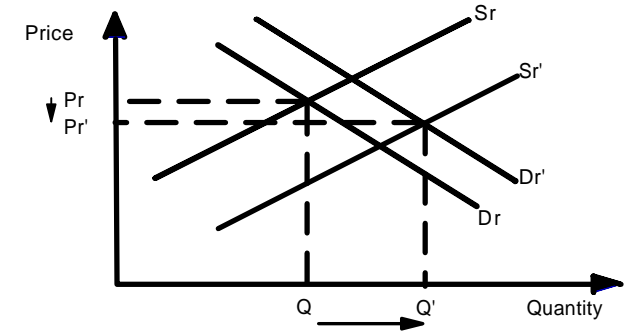
Panel c

Demand shift from quality improvement



Panel d

Net effect at the retail stage of increased vertical coordination

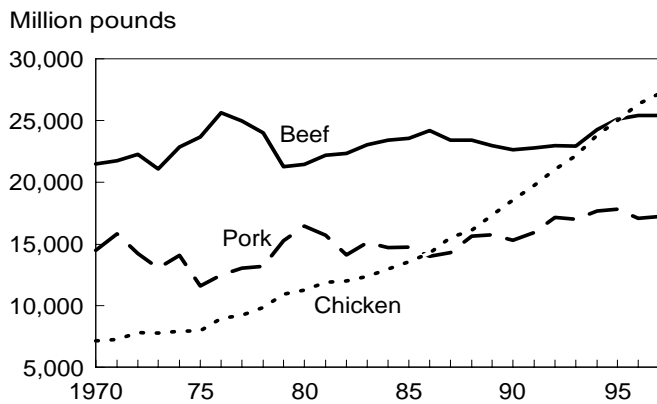


Source: ERS, USDA.

Figure 9

Total production of chicken, pork, and beef

Chicken production surpassed pork in 1986 and beef 10 years later

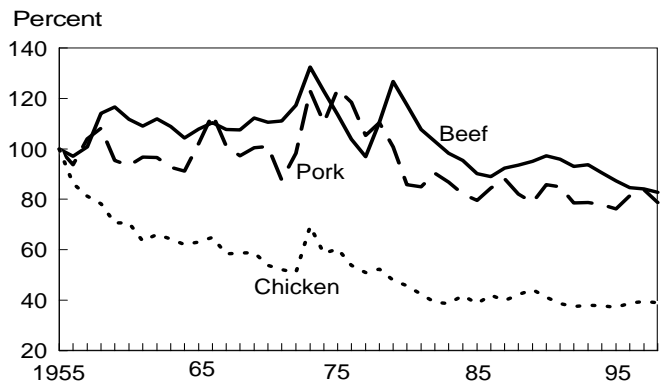


Source: ERS, USDA.

Figure 10

Deflated retail price of chicken, pork, and beef as a share of 1955 price

The real price of chicken is about 60 percent less than the price paid in 1955



Source: ERS, USDA.

less than 40 percent of what they paid in 1955 (fig. 10). After World War II, the ability to offer broilers to the emerging supermarket industry at declining *nominal* prices, while the price of many other food and meat items were increasing, played an important role in the continual growth of the broiler industry.

Additional evidence of the magnitude of production and marketing efficiency gains is illustrated by updating simulations conducted by Lasley. The retail price of whole broilers was simulated by holding technology and input-output relationships constant, and varying broiler production and marketing costs according to changes in input prices (see Appendix). The simulated retail price was then compared with the actual retail price to indicate productivity gains passed on to consumers (fig. 11). While the early to mid-seventies represented a period of rapidly increasing feed and energy prices, the retail price of broilers increased at a slower rate. If higher input prices had been passed on to consumers, average retail prices would have been \$1.58 per pound for broilers over the 1992-96 period, instead of the actual average of 91 cents per pound.

Quality and Product Form

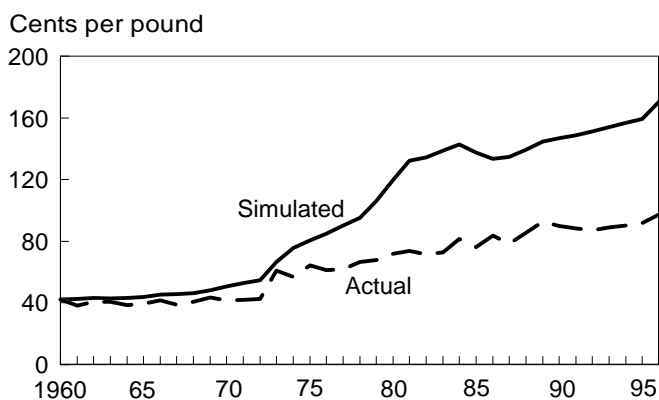
The U.S. broiler industry has also responded to consumer preferences for a variety of convenient, value-added products, with assurances of quality. In the mid-1960's, most broilers were sold as unbranded, homogeneous, ready-to-cook, whole birds. In response to large supplies and volatile broiler prices, integrators focused increasingly on product differentiation, through further processing and brand labeling (Bugos).²⁴ Fewer birds are now purchased whole; consumers prefer to purchase chicken based on selected parts or that are pre-cooked. In the 1980's, combined sales of cut-up and further processed chicken exceeded sales of whole birds (fig. 12). By 1995, 63 percent of broiler volume was cut up and sold as parts, and 11 percent was sold

²⁴Product differentiation gives firms the ability to compete on a nonprice basis, so that earnings are less dependent on the volatile nature of undifferentiated commodity markets. Purchase decisions regarding undifferentiated products are based on prices because consumers perceive products from competing sellers to be the same. Firms gain some discretion over the price of their products by differentiating their product selection, so that sales become less sensitive to price changes.

as further processed products, such as chicken franks, patties, nuggets, and marinated products.

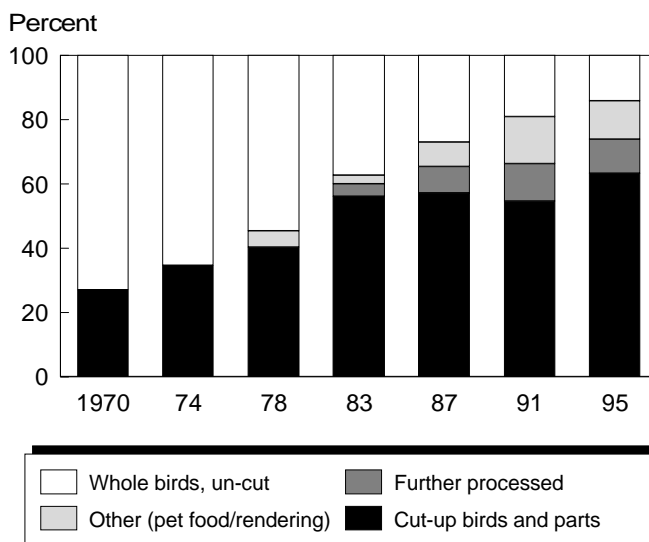
Contracting and vertical integration have given the integrator greater control over the volume and quality of broilers to meet the needs of large-scale specification buying by food-away-from-home establishments and supermarket chains. In the 10-year period follow-

Figure 11
Comparison of simulated and actual U.S. retail chicken prices
Without the adoption of new technology, consumers would be paying 75 percent more for chicken



Source: ERS, USDA.

Figure 12
U.S. processor marketing of broilers by product form
The broiler industry has responded to consumer preferences for convenient foods



Source: Compiled by ERS, USDA from National Broiler Council [a,b].

ing 1977, approximately 25,000 fast-food outlets added chicken items to their menus (Lasley and others). Fried chicken operators preferred small and uniform broilers to control portions and costs (Marion and Arthur). The wide range of value-added chicken forms appeals to food service operators because they can spend more time individualizing their entrees and less on labor-intensive preparation and assembly (*Institutional Distribution*). The poultry industry leads the other U.S. meat industries in new product development (fig. 13). Among prepackaged, consumer-ready meat products listed by a major supermarket chain in 1996, poultry products led all other meat categories.

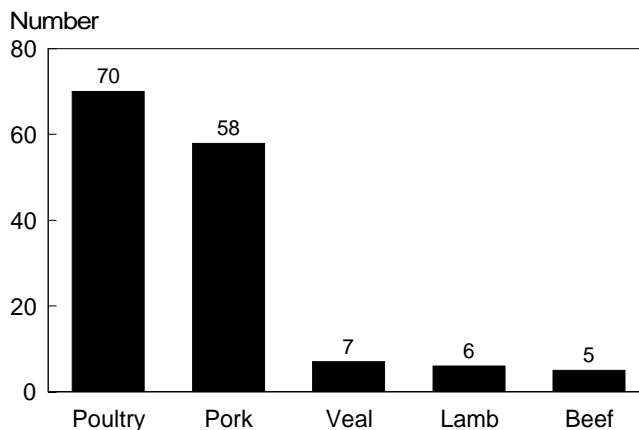
Through an integrated marketing system, broiler integrators also gain control over quality and uniformity that is necessary for branded products. Branding lowers consumer costs of measuring products (Barzel). If the consumer is to purchase a product without measuring every item, the seller may attempt to convince the consumer that the purchase is representative. That is, the product is uniform and will not vary from sample to sample. Broiler integrators have standardized production inputs and have gained a large degree of control over the production process. Hence, they are willing to associate their name or brand with more uniform, high-quality products (Easterling and Stucker). In 1988, brand names accounted for half of all supermarket sales of chicken across the Nation, and shoppers were willing to pay a 14-percent premium for brand-name broilers over supermarket brands (Bugos).

While downward shifts in retail supply appear to be the dominant effect associated with increased vertical coordination in the broiler industry, demand shifts are also evident. A plot of per capita consumption of broilers and the deflated retail price provides a rough proxy of a demand curve (fig. 14). From 1955 to 1979, a strong negative relationship is indicated between the price of broilers and quantity consumed. However, the curve appears to have flattened since the 1980's. In 1982, 47 pounds of chicken per person was consumed at a price of 74 cents per pound. In 1989, per capita consumption rose to 57 pounds per person, while the price increased slightly to 75 cents per pound. Increasing per capita consumption and little or no change in price suggests the possibility of a shift

Figure 13

Prepackaged, consumer-ready meat products of a leading supermarket chain in 1996

The poultry industry has led the way in new product development



Source: Compiled by ERS, USDA from Brester, Schroeder, and Mintert.

out in demand.²⁵ Likely causes include higher relative prices of substitute meats, changing consumer tastes and preferences (for example, health concerns), and an income effect as more affluent consumers purchased premium parts and value-added products (Rogers, 1992).

Lower prices and response to consumer preferences for convenient, nutritious, high-quality chicken products have led to continual increases in per capita broiler consumption (fig. 15). Since 1955, per capita consumption of broilers has increased more than five-fold. From 1976 to 1997, per capita broiler consumption nearly doubled, compared with a 5-percent increase for pork and a 30-percent *reduction* for beef (beef consumption peaked in 1976). In 1986, per capita consumption of broilers exceeded pork for the first time and recently surpassed beef, the leader in red meat consumption.

Pork Products

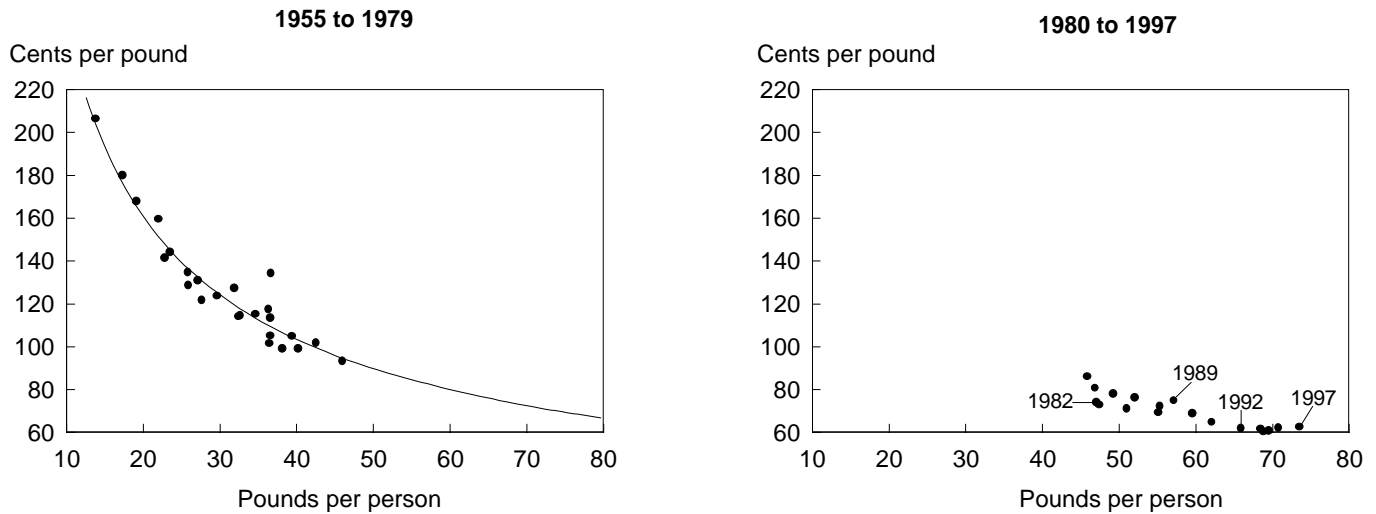
Industrialization in the pork industry has contributed to productivity gains in hog production, which have increased pork supplies and lowered pork prices. Pork quality has also become more closely associated with

²⁵A log-linear, constant elasticity relationship between price and per capita consumption is also possible, assuming that important factors other than price had no effect on demand.

Figure 14

Relationship between deflated retail broiler price and quantity consumed

Additional broiler consumption at relatively stable prices after 1980 suggests a possible shift out in broiler demand

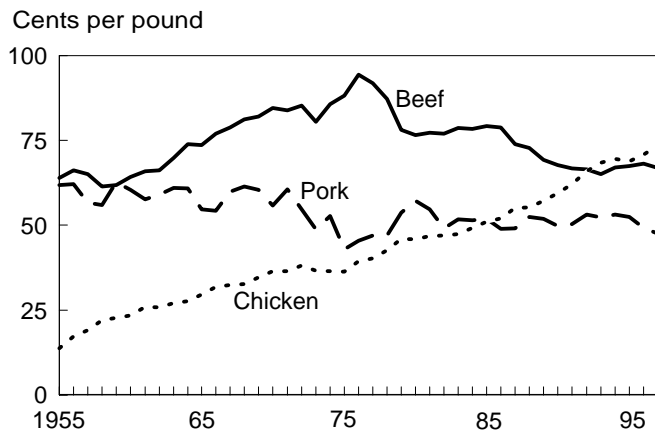


Source: ERS, USDA.

Figure 15

Per capita consumption of pork, beef, and chicken

Per capita chicken consumption has increased more than five-fold since 1955; chicken is now the leading meat consumed in the United States



Source: ERS, USDA.

consumer preferences. The industry may realize additional economic benefits from further increases in coordination between the production and packing stages. An assured large, stable flow of uniform, high-quality hogs to the packing plant can reduce pork production costs and satisfy consumer demand for high-quality pork products.

Current Situation

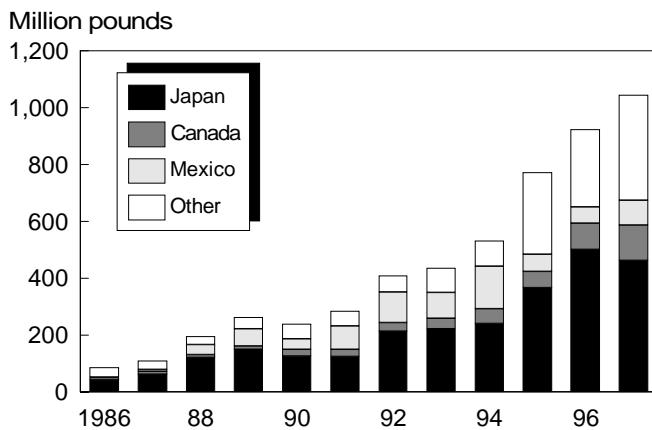
Since 1990, pork production has increased by approximately 2 percent per year, increasing both total domestic consumption (accounting for population growth) and net trade. In the 1990's, U.S. pork exports have increased five-fold, and the United States has become a net exporter of pork. To satisfy export customers, pork companies must deliver reliable supplies of reasonably priced products that are tailored to customer specifications. Quality characteristics important to Japan, for example, the leading importer of U.S. pork (fig. 16), include cutting method, meat color, and lack of PSE (Cravens).

Despite a 1-percent annual average reduction in the deflated retail pork price since 1990, per capita domestic consumption (not accounting for population growth) of pork has remained stable. Unlike demand for broilers, the domestic demand for pork may have shifted to the left since the 1970's. A plot of deflated pork prices against per capita consumption provides evidence of a decrease in demand for pork (fig. 17). During 1980-97, lower pork prices brought no general increase in per capita consumption like that seen in 1955-79. For example, from 1974 to 1995 the deflated retail pork price dropped from 219 cents per pound to 128 cents per pound, with no corresponding increase

Figure 16

U.S. pork exports by destination

U.S. pork exports have increased twelve-fold since 1986; Japan is the leading importer of U.S. pork



Source: ERS, USDA.

in per capita consumption. Thurman concluded that a significant portion of demand shifts for pork may be due to factors other than relative meat prices and income, such as consumers' perception that chicken contains less fat than red meats.²⁶ Apparent shifts in pork and broiler demand correspond to new information linking diet and health. In 1977, the Senate Select Committee on Nutrition and Human Needs defined a set of dietary goals for the United States that helped to stimulate a deluge of research reports. Organizations, such as the National Research Council and U.S. Department of Agriculture, recommend reduced cholesterol and fat in the diet (Kinsey). In the 1980's, the American Heart Association revised its dietary guidelines to include less red meat consumption (Thurman).

Future Growth of the Pork Industry

Growth of chain restaurants and the continued importance of grocery store outlets provide opportunities to cater to changing consumer preferences. Satisfying the needs of large chain restaurants requires large, uniform pork supplies. Introduction of bacon-topped sandwiches by hamburger chains, for example, created a new outlet for millions of pounds of bacon.

²⁶Thurman found no evidence to support the assumption that increased eating away from home decreases the own-price elasticity of pork.

Quality assurances are also required for branded products at retail chains, foodservice institutions, and international markets. While most red meat is unbranded, except for processed products like sausage, ham, and bacon, new products, like Smithfield Foods' *Lean Generation* brand of lean, fresh pork products, provide brand name quality assurances for consumers.

Smithfield Foods emphasizes the importance of long-term contracts and vertical integration in obtaining a consistent supply of high-quality hogs (Smithfield Foods, Inc.). Smithfield Foods has long-term contracts with affiliates of Carroll's Foods, a major North Carolina hog producer, to raise and purchase hogs. In 1991, this arrangement, referred to as Smithfield-Carroll's, acquired the exclusive franchise rights from the National Pig Development (NPD) Company, a British firm, to develop and market the NPD breed of hog in the United States. This breed is said to provide the leanest hog in U.S. commercial production and one of the leanest meats of any kind. Nutritional studies by the Sarah W. Stedman Center for Nutritional Studies at Duke University Medical Center in 1996 indicated that NPD pork was 34 percent to 61 percent leaner than non-NPD pork, depending on the cut. Products under the Smithfield *Lean Generation* label are the only pork products that have received the American Heart Association's seal of approval because of the products' superior health qualities. An NPD hog also produces about 15 pounds of additional salable meat per hog (Credit Suisse First Boston Corporation).

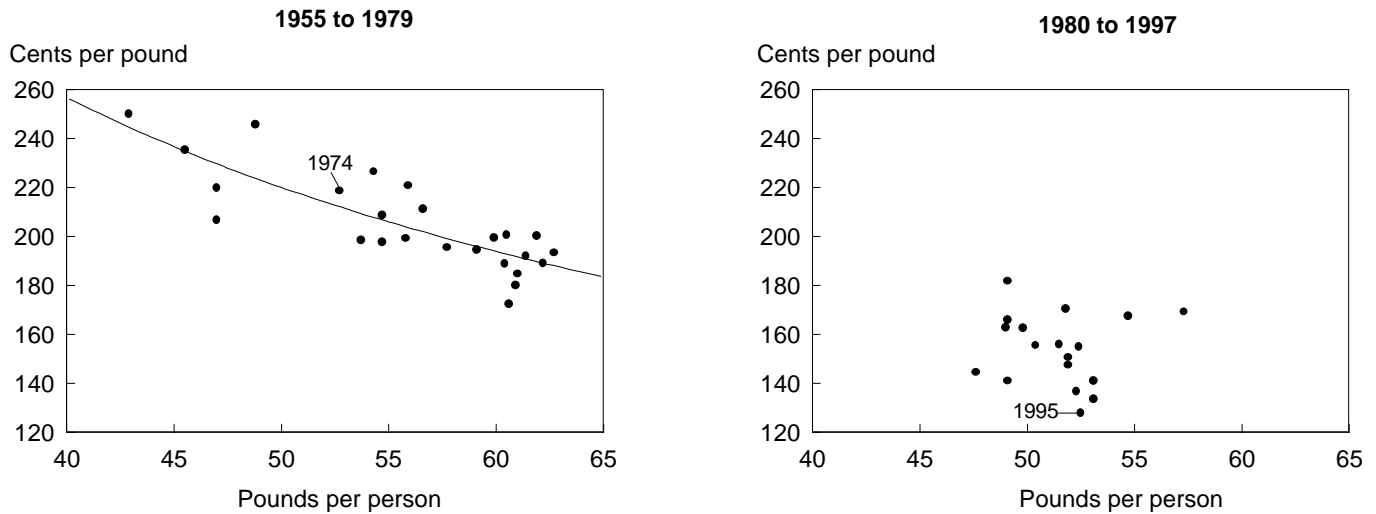
Smithfield's *Lean Generation* pork has been successful so far. The number of NPD hogs processed by Smithfield grew from 12,700 in 1993 (Smithfield Foods, Inc.) to 1.6 million in 1997 (Smithfield Foods, Form 10K, filed with Securities and Exchange Commission July 25, 1997). Through an agreement with Sumitomo Corporation, Smithfield also provides the Japanese market with a line of branded fresh pork products.

While some companies have made great strides in improving the quality of pork products, much still needs to be done to attain consistently high-quality pork. A 1992 survey of U.S. pork packing companies, representing 70 percent of total slaughter, found that quality problems cost packers \$10.08 per hog due to excess fat, PSE, and carcass defects, such as abscesses

Figure 17

Relationship between deflated retail pork price and quantity consumed

Pork prices fell by nearly 42 percent from 1974 to 1995 with no corresponding increase in consumption



Source: ERS, USDA.

and bruises (table 1). For example, carcass defects and excess fat must be removed, which results in less salable meat. PSE problems cause pork cuts best suited for fresh pork to be used in further processed pork.

Increasing coordination between packers and producers to improve pork quality may yield packer cost savings and larger quantities of consistent, high-quality pork products. Of the total packer costs related to quality problems, \$8.15 (80 percent of total problem cost) was controllable by actions at the farm level. By reducing improper injections of medication and rough handling of hogs, which cause abscesses and bruising, farmers can lower packer costs related to carcass defects. Leanness problems and PSE problems can be controlled by farmers through improved genetics. Availability of higher quality pork might also increase pork demand, by giving consumers a lean, yet palatable, pork product with a more attractive appearance.

Table 1—Packer costs associated with quality problems

Packer defect	Cost controlled by farmer		
	Cost \$/head	Percent	\$/head ¹
Leanness problems:			
Backfat thickness	2.80	100	2.80
Degree of ham and butt trimming	1.87	100	1.87
Excessive seam fat	.63	100	.63
Bellies too fat or too thin	.14	100	.14
Weight problems	.88	100	.88
Carcass problems:			
Carcass condemnations	1.00	75	.75
Abscesses	.47	100	.47
Bruises	.08	75	.06
Skin problems	.01	75	.0075
Arthritis	.08	100	.08
Other	1.29	0	0
PSE/color problems:			
Color	.27	75	.20
Pale, soft, watery	.34	75	.25
Dark, firm, dry	.01	75	.0075
Total packer costs	10.08		8.15

¹Calculated by multiplying cost per head and percent of cost controlled by farmer.

Source: National Pork Producers Council, 1994.