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8. Evaluating New Food Technologies in Pork Production

Jacinto F. Fabiosa and Helen H. Jensen

Food Marketing Policy Center
Department of Agricultural and Resource Economics
University of Connecticut

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Jacinto F. Fabiosa

Helen H. Jensen (hhjensen@iastate.edu)

Department of Economics
Iowa State University, Ames, IA 50011-1070

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Evaluating New Food Technologies in Pork Production

Jacinto F. Fabiosa and Helen H. Jensen[1]

In the U.S. diet approximately 37 percent of food energy consumed is derived from total fat, which contains 13 percent saturated fatty acids, 14 percent monounsaturated fatty acids, and 7 percent polyunsaturated fatty acids (USDA 1985, 1986). Mounting scientific evidence establishing the link between consumption of fat and fat rich in saturated fatty acids (saturated fat) and adverse health consequences has prompted leading health organizations to recommend reducing the consumption of total saturated fat. In addition, the U.S. Congress has set explicit nutritional goals, the foremost of which is the goal to decrease total fat consumption to an average of 30 percent and saturated fat to 10 percent of total calories (U.S. Department of Health and Human Services, Public Health Service 1991). Approximately 56 percent of all dietary fat and 70 percent of saturated fat come from animal sources. The scientific evidence and increased public attention on dietary fat have encouraged the meat industry to plan marketing strategies and to invest in technological innovations to enhance the desired qualities in their products.

Some brand name manufacturers have stressed product differentiation to position products to capture returns from the increased willingness of consumers to pay a premium for leaner meat products. For pork, processors have removed more excess fat from the carcass and demanded less fat in the hogs that they purchase. And, hog producers have changed breeding and feeding practices to reduce the carcass fat. The proportion of excess fat removed from the carcass declined from a high of 20.6 percent of carcass weight in 1955 to the present level of around 5.5 percent because of the leaner carcasses. However, there is a limit to how much fat can be trimmed from the carcass, and fat trimming as a post production quality control remedy is a relatively high cost procedure today due to higher wages and lower prices for lard than were the case earlier.

The pork industry has significant potential to position its products to meet the taste and health preference of consumers due, in part, to possibilities to change final product through feeding practices. One technology to modify fat deposition is through diet intervention. This technology provides the opportunity to design a product to meet consumers' preferences for taste, quality, and healthfulness in food products.

This study is designed to evaluate the economic consequences and feasibility of using a nutritional innovation to redesign pork products. The economic analysis is based on a structural econometric model that includes both the technological parameters of the production process and estimated economic relationships. The next section describes a pork fat modification experiment conducted by animal scientists at Iowa State University (ISU). Following that are sections describing the structure of the econometric model used to evaluate the economic consequences of this technology, the calibration of the model to capture the changes brought about by the new technology, the simulation results, and finally the summary and conclusions.

Fat Modification

The objective of the pork fat modification experiment was to produce pork with modified fatty acid composition. Specifically, the experiment aimed to decrease the proportion of saturated fat in total fat, to decrease the proportion of palmitic acid (16:0), the suspected hypercholesterolemic fatty acid, relative to the proportion of stearic acid (18:0), which has neutral cholesterolemic effects in the pork fat. The instrument used to modify the fatty acid composition in pork was solely the pig's diet. The experiment was based on the hypothesis that providing supplemental feeding of fat depresses *de novo* fatty acid synthesis in pigs and thereby decreases the synthesis of hypercholesterolemic fatty acids for deposition.

A typical corn-soybean diet was used as the control, with 86 percent being corn and 12 percent being soymeal, as shown in Table 8.1. The supplemental fat was in the form of either soyoil or choice white grease (pork lard). The levels for both ingredients were set at 10, 20, 30, and 40 percent of total calories in the diet. Only the results from the choice white grease (CWG) at a level of 30 percent of the diet and from soyoil (SBO) at the level of 30 percent of the diet are summarized here. The CWG30 diet consisted of 60 percent corn, 22 percent soymeal, and 16 percent choice white grease by weight in the ration. The SBO30 diet consisted of 60 percent corn, 18 percent soymeal and 16 percent soyoil. Details on the experimental design are available from the Department of Animal Science, ISU (Beitz 1992).

TABLE 8.1 Diet Composition Ration Formulation and Growth Characteristics for 120-230 Lbs. Liveweight on Control and Choice White Grease Diets

	Control Diet	CWG30 Diet	SBO30 Diet
	% in Ration[a]	% in Ration[a]	% in Ration[a]
Ingredient			
Ground shelled corn	85.86	60.05	59.62
Soymeal (44%)	12.31	22.24	18.45
Choice white grease	0.00	15.85	0.00
Soyoil	0.00	0.00	16.42
Sodium chloride	0.92	0.28	0.27
Vitamin premix	0.42	0.22	0.23
Calcium carbonate	0.27	0.85	0.84
Dicalcium phosphate	0.22	0.52	0.54
Performance			
Feed Efficiency	3.54	2.73	2.77
Weight Gain	110.00	110.00	110.00
Feed Required	389.46	300.12	305.16

Source: Beitz and Penner 1994.
[a]As-fed basis.

TABLE 8.2 Fat Modification Experiment Data

	Mean Control	Mean CWG30	Mean SBO30
Feeding Data (lbs)			
Days in Feed (days)	74.78	60.00	69.21
Feed Intake	476.67	347.74	381.95
Initial Weight	116.61	128.63	117.84
Final Weight	250.56	257.16	254.11
Gain in Weight	133.94	128.53	136.26
Daily Feed Intake	6.65	5.94	5.68
Average Daily Gain	1.92	2.20	2.09
Feed Efficiency (#)	3.54	2.73	2.77
Backfat Data (inches)			
First Rib	1.88	1.85	1.76
Last Rib	1.18	1.23	1.13
Last Lumbar	1.28	1.51	1.33
Average	1.45	1.53	1.40
Tenth Rib	1.11	1.21	1.07
Outer Layer	0.45	0.49	0.48
Middle Layer	0.52	0.55	0.49
Inner Layer	0.14	0.18	0.11
Carcass Proportion (%)			
Lean	49.84	45.90	47.69
Fat	31.10	36.65	33.23
Bone	13.93	12.55	14.71
Skin	5.14	4.93	5.28
Measures			
Liveweight (lbs.)	237.89	249.84	245.79
Carcass Weight (lbs.)	177.51	187.48	181.35
Carcass Length (inches)	31.86	31.92	32.29
Dressing Percentage (%)	74.70	75.02	73.79
Muscles Produced/Day	0.65	0.73	0.69
Loin Eye Area (in^2)	5.90	5.87	5.58

Source: Fat Modification Experiment, ISU.

Table 8.2 shows the mean of some of the growth and body composition variables measured in the experiment. For example, on average, the pigs given the CWG30 diet were 12 pounds and for the SBO30 diet 1 pound heavier to start with compared with control pigs. The weight gain was standardized at 110 pounds (i.e., from 120 to 230 pounds) for comparison purposes. The respective feed efficiency of the different diets was used to estimate the required feed intake to produce 110.00 pounds of liveweight gain in the animals (389.46 pounds of feed in the control diet; 300.12 pounds in the CWG30 diet; and 305.16 pounds in the SBO30 diet shown in Table 8.1). The individual ingredients of the ration by weights were then derived based on the total required feed and the proportion of each ingredient in the ration. It took 3.54 pounds of control feed to produce one pound of gain, whereas it took only 2.73 pounds of CWG30 feed or 2.77 pounds of SBO30 feed to produce the same weight gain. The pigs on the CWG30 diet had the fastest rate of gain; and at the end of the experiment, pigs fed the CWG30 diet showed the highest proportion of fat in the carcass. This greater proportion of fat, however, is partly caused by feeding the CWG30 fed pigs to a heavier final weight than the control pigs. Pigs on the SBO30 diet had higher rates of gain compared with the control diet. Their carcasses showed the highest proportion of bone, and skin, with the proportion of fat only slightly higher than that of the control diet.

Fat Composition

At the end of the feeding period, the pigs were slaughtered and the composition of fat analyzed. Three measures were used to evaluate the impact of the supplemental feeding of fat on the composition of fat in pigs. The first was the ratio of palmitic acid to stearic acid; the second was the ratio of unsaturated fatty acids with saturated fatty acids; the third was the ratio of polyunsaturated fatty acids with saturated fatty acids. The ratios from the pigs fed the supplemental fatty acids were compared with ratios in the control pigs and the USDA Food Nutrient Composition Data (1983, 1992) which provides the measures applicable to foods (pork) in the U.S. food supply. The latter is used as a “proxy” for the industry standard.

Table 8.3 shows the proportion of unsaturated fatty acids, polyunsaturated fatty acids, and the ratio of palmitic to stearic acid in the loin, ham, and shoulder muscles of the pigs fed with the CWG30 and SBO30 diets compared to USDA food values and the control group. The experimental results were mixed: there was evidence of being able to manipulate characteristics of products through feeding and the experimental diet did increase the share of unsaturated fatty acids and of polyunsaturated fatty acids, for most cuts. However, the experimental CWG30 ration led to products with a higher proportion of palmitic acid to stearic acid. The SBO30 ration led to a product with a lower ratio of palmitic to stearic acid, compared with the control diet; these results were deemed especially desirable and the SBO30 diet was the focus of subsequent economic analysis. Other physical properties of the SBO30 product also favored this choice.

The Livestock Model Specification

Changes in the production of pork cannot be evaluated independently of the economic consequences to producers and the industry. The economic feasibility of a new technology depends on evaluating both changes to the costs of production and also consumers' willingness to pay for the new product.

A livestock model, developed at the Center for Agricultural and Rural Development (CARD) was used to evaluate the economic consequences of production when using the fat modification technology (see Buhr 1993 for the detailed model specification). This econometric model incorporates in its functional specification and accounting identities both biological and economic processes that govern pork production and consumption. These include binding biological limits (e.g., weight gain rates, length of gestation), lags of variables to capture the time periods required in production, and accounting identities to ensure consistency in the stock (e.g., animal inventory) and flow (e.g., number slaughtered, pig crop, and mortality) variables. The model has a simultaneous econometric framework where the market equilibrium price and quantity are jointly determined.

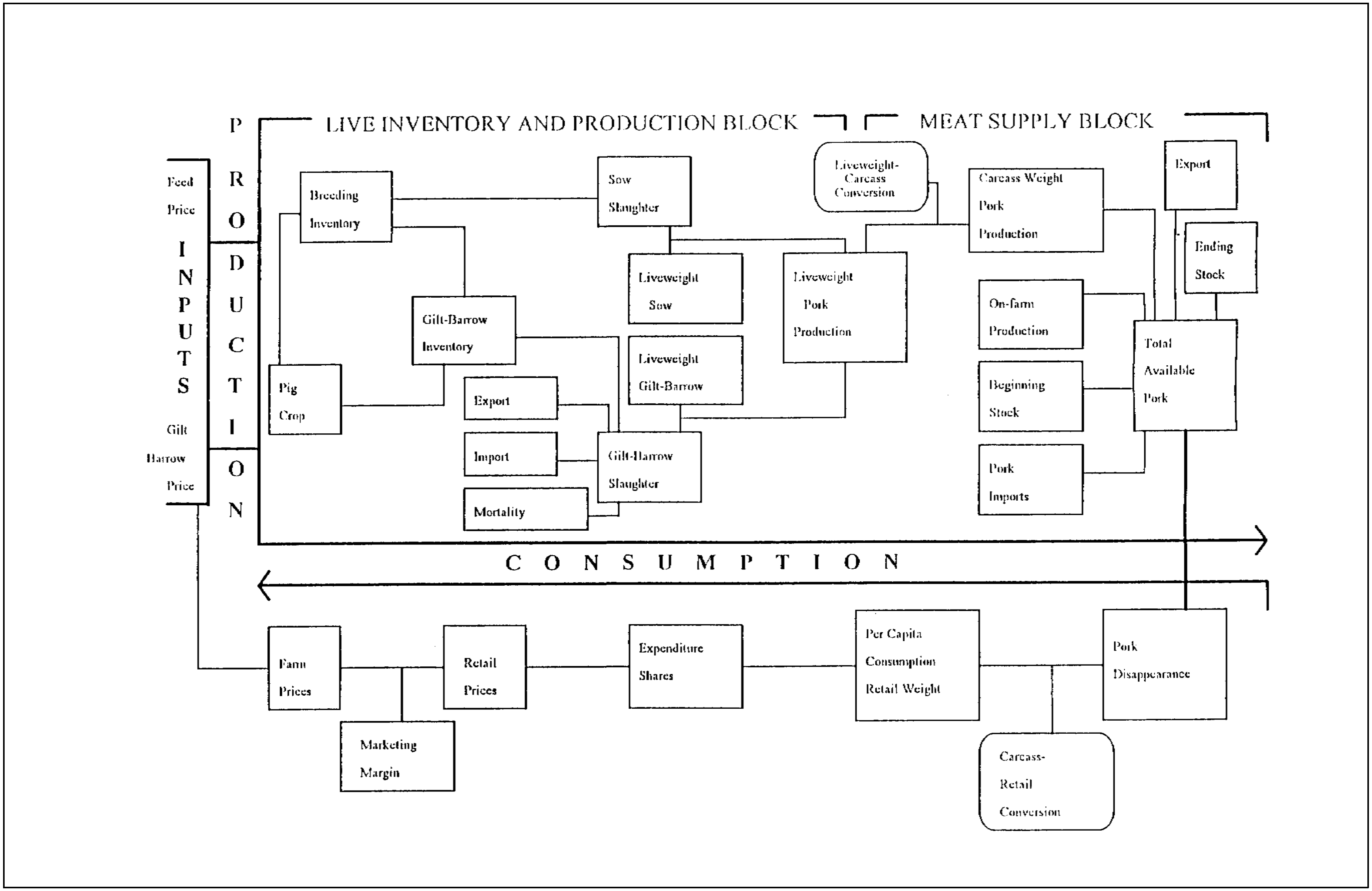
TABLE 8.3 Relative Fat Content in Pork, Raw, Separable Lean

	USDA Food Nutrient Composition[a]		Fat Modification Experiment		
	1983	1992	Control	CWG30[b]	SBO30
RETAIL CUTS					
HAM					
Saturated	38.36	38.24	36.14	35.60	51.37
Monounsaturated	50.00	49.89	53.89	50.60	41.25
Polyunsaturated	11.63	11.86	9.98	13.90	7.38
Ratios					
Un : Sat	1.60	1.73	1.77	1.80	0.95
Poly : Sat	0.30	0.31	0.28	0.39	0.14
16:0 : 18:0			2.27	2.62	2.03
LOIN					
Saturated	38.33	38.08	37.84	35.90	44.27
Monounsaturated	50.00	50.00	51.70	52.80	41.31
Polyunsaturated	11.59	11.91	10.46	11.30	14.41
Ratios					
	1.60	1.62	1.64	1.80	1.26
Un : Sat	0.30	0.31	0.28	0.32	0.33
Poly : Sat			2.33	2.40	2.08
16:0 : 18:0					
SHOULDER					
Saturated	38.25	38.17	38.33	36.40	41.07
Monounsaturated	50.21	49.92	52.10	53.30	41.93
Polyunsturated	11.53	11.90	9.56	10.30	17.00
Ratios					
Un : Sat	1.61	1.61	1.61	1.70	1.43
Poly : Sat	0.30	0.31	0.25	0.28	0.41
16:0 : 18:0			2.50	2.61	2.25

Source: [a]USDA Food Composition Handbook 1983, 1992.
[b]Fat Modification Experiment.

A diagram of the structure of the model is presented in Figure 8.1. The other components of the model (cattle and chicken) have almost the same structure as the pork model. The model can be described by "block": live inventory and production; meat supply; meat demand; and price transmission. For this analysis, input markets were assumed to be exogenous.

FIGURE 8.1 Livestock Model



Live Inventory Block

The live inventory block includes three important and interrelated stock variables: breeding inventory, gilt-barrow inventory, and pig crop. This block captures two major decisions of producers: the number of gilts to add to the breeding herd, and the number of gilts or barrow and sows or boars to slaughter. These decisions are conditioned on the given production technology, feed price, gilt and barrow price, interest rates, and other relevant economic variables. The available number of gilts or barrows for slaughter is determined by the gilt-barrow inventory, export, import, and mortality. The slaughter decision links the live inventory block of the model to the next block, which is the meat supply block.

Meat Supply Block

The meat supply block involves technical conversions of variables. First, by combining the number of pigs slaughtered with the average liveweight corresponding to the animal type, one can calculate the pork production measured as liveweight. With additional information on dressing percentage, the production in liveweight is converted into pork production in carcass weight. The total available pork in carcass weight is derived by using an accounting equation where pork from other sources (e.g., on-farm production and beginning stock) is added to the domestic commercial production. The intermediate output of this block is the total pork available. The technical conversions may be altered by the introduction of new technologies.

Meat Consumption Block

Because there is no aggregate actual pork consumption data available, the amount of consumption is inferred from the residual disappearance; that is, what remains from the total pork available after removing all the other known uses of pork (e.g., export and ending stock). The total pork consumption can be converted into per capita consumption in retail weight by using the appropriate population data and conversion factors, technical parameters that may change with the new technology.

Meat Demand Block

The consumption decision of consumers is modeled in a two-stage budgeting framework. Total income is apportioned first into major expenditure categories including meat. Then, the amount allocated to meat is further allocated to specific meat types, including pork. Both steps can be modeled in a utility maximizing framework, but only the second step is directly specified in the model used here. The total meat expenditure determined in the first step is determined outside the model estimation. The demand specification used to obtain the meat demand parameters in the second step is a linear approximation of an inverse version of the Almost Ideal Demand System (LA/IAIDS). The estimated demand relationships yield the estimated retail prices for pork and the two substitute meats: beef and chicken.

Price Transmission Block

A marketing margin equation is specified as a price transmission mechanism in the model to directly link the retail and farm markets and to simultaneously determine the equilibrium price and quantity. That is, by using the marketing margin equation, either a derived retail supply is matched with the retail demand, or a derived farm demand is matched with farm supply.

Changes in the swine industry induced by technological progress may have ramifications in input markets, particularly for feed grains. However, for the analysis reported in this chapter, the price of feed grains is assumed to be purely exogenous.

Model Calibration and Simulation

The livestock model estimated with baseline values and assumptions provided the basis for the analytical comparison of the impacts of the introduction of new feeding technologies. Technological changes were introduced by re-specifying some of the biological and technical parameters of the model to reflect changes in the new production technology. Then a new simulation was conducted by using the revised technical parameters in the model to evaluate the impact of the new technology on the cost of production, farm profitability, supply, retail and farm price, consumption, and market share. The new pork production technology can influence the model in different ways.

Model Baseline Diet vs. Experimental Diets

The analysis of costs compares results from the *baseline* diet with the experimental CWG30 and SBO30 diets. The baseline diet was one chosen to best represent standard industry practices and allowed comparison to costs and technologies representative of U.S. industry production. Thus, for the purpose of analyzing industry impacts, a diet based on current industry practices was used, and this diet is given in Table 8.4.

TABLE 8.4 Ration Formulation and Growth Characteristics for Model Baseline Diet

	40 to 120 Lbs.		120 to 230 Lbs.	
	% in Ration	Lbs. in Ration	% in Ration	Lbs. in Ration
Ingredient				
Ground shelled corn	76.22	163.42	77.50	215.29
Soymeal (44%)	23.78	50.98	20.00	55.56
Calcium carbonate	0.75	1.61	0.75	2.08
Dicalcium phosphate	1.05	2.25	1.05	2.92
Sodium chloride	0.25	0.54	0.25	0.69
Vitamin premix	0.25	0.54	0.25	0.69
Minerals	0.20	0.43	0.20	0.56
Performance				
Feed efficiency	2.68		2.53	
Weight gain	80.00		110.00	
Feed intake	214.40		278.30	

Source: Buhr 1993.

For the analysis, the diet for the 40-120 pounds range was used for all pigs, even those on the experimental diets, because there was no feeding data on this weight range in the experiment (i.e., initial weights were over 120 pounds). In the 120-230 pounds category, the baseline diet was 77 percent corn and 20 percent soymeal. The total required feed intake and weights of individual ingredients were estimated using the rations in Tables 8.1 and 8.4.

Adoption Rates

Adoption rates measure the number of producers using the new technology. Technical, social, and economic feasibility largely determine the rate at which hog producers will adopt new production technologies. Without the benefit of available information on producers' attitudes to the fat modification technology, the adoption rate was assumed to follow a rate of 5 percent initial adoption response starting in year 1995; then, an adoption rate of 50 percent after eight quarters, and the maximum adoption rate of 73 percent reached in 16 quarters. The economic consequences are conditioned on the assumed adoption rate.

Feed Cost Differential

By the very nature of the fat modification technology, its major effect enters the model through the feed cost equation. The substitution of corn by soymeal and the addition of choice white grease or soyoil is accounted for through their different relative proportions in the feed ration and the different prices of these ingredients. Moreover, the production efficiency impact (e.g., feed efficiency or pounds of feed per pound of gain in the pigs) enters the model via the amount of each ingredient used in estimating the total feed cost. For example, in the baseline ration, 2.53 pounds of feed produce a one pound gain in pigs, in contrast with the SBO30 diet which requires 2.77 pounds to produce a one pound gain. With 110 pounds of growth (from 120 to 230 pounds) needed to reach marketable weight, the feed efficiency translates to 278.30 pounds of feed required when using the baseline ration, 305.16 pounds of feed required when using the SBO30 ration, 300.12 pounds of feed required on the CWG30 ration, and 389.46 pounds of feed required when using the control ration.

The equivalent amounts of the major feed ingredients (i.e., corn, soymeal, and choice white grease or soyoil) in the respective feed rations for the 40 to 230 pounds bodyweight category are given in Table 8.5. The information in Table 8.5 was used to generate the feed costs for each of the diets. Additional information on baseline prices for corn, soymeal, choice white grease, and soyoil was used to obtain the feed costs.

TABLE 8.5 Total Feed Requirement for Major Feed Ingredients 40-230 Lbs.

	Model Baseline Diet	Fat Modification Experiment		
		Control Diet	CWG30	SBO30
Corn	379	498	344	345
Soymeal	107	99	118	107
CWG30	0	0	48	0
SBO30	0	0	0	50

Source: Buhr 1993 and Fat Modification Experiment, ISU.

Other changes caused by the new technology could include the marketed liveweight, conversion of liveweight to carcass weight, conversion of carcass weight to retail weight, and consumer willingness to pay (WTP) for the new product produced by the technology. With enough information on marbling score, firmness of fat, color, and yield, the grade of the animals could be compared with the industry average to determine whether a premium in the farm price would be warranted under current grading practices. However, only specified changes in WTP were included in the simulation analysis. The results here are for an 8 percent increase in WTP, compared to no change in WTP.

Simulation Results

The results of the model simulations are evaluated relative to the impacts of the experimental products on feed cost, profit, supply, retail price, farm price, consumption, and market share. The illustrations are for the SBO30 diet, but results are similar for the CWG30 diet.

A simple model of the market supply and demand relation illustrates the simulation results from the econometric model. The increase in the feed cost associated with the new technology causes the supply function of the hog producers that adopt the new technology to shift to the left, indicating a decrease in supply; that is, less will be supplied at a given price. The increased feed cost also translates to a shift in the *market* supply (S) in the same direction. With no change in demand, equilibrium quantity produced (and consumed, too) drops. This result corresponds to the case where consumers show no willingness to pay more (0 percent WTP): The pork supply shows a 4 percent decline without any increase in consumers' WTP. An 8 percent increase in WTP indicates an increase in demand, with an upward shift in demand. This change translates into the market demand shifting upwards: At a given price more pork is demanded. However, such an increase in demand is not sufficient to compensate for the full loss of production because of higher costs. Pork supply shows a decline despite an 8 percent increase in WTP.

The significant influence of the technology is in the change in the feed ration and its effect on the cost of production. The impact on *feed cost* is determined by the relative proportions of specific ingredients in the feed ration, relative price of major feed ingredients with corn price as the numeraric, and production efficiency associated with the feed ration. The relative prices fluctuate over time, but some upward trend is noticeable in later periods, and suggests that these major ingredients are becoming more expensive relative to corn.

The change in feed rations in the experimental diets results in higher feed cost per unit of feed because the relative prices of soymeal, choice white grease, and soyoil increase in later periods. The compounding factor in increasing feed cost is the lower feed efficiency of the SBO30 (and also CWG30) diet compared to the baseline diet.

The feed cost per pig in the 120-230 lbs. bodyweight category has almost the same pattern over time for the SBO390 and baseline diets. The SBO30 diet is higher in cost. The feed cost differential exerts a relatively large influence on the comparative results.

In terms of *profit* the results of the comparative simulations show that with the greater cost of production, the technology may not be economically feasible without an increase in the price paid by consumers for the new pork products. As shown in Figures 8.2A and 8.2B, adopters of the new technology would incur losses (0% $WTP_A < 0$) while non-adopters earn positive profits (0% $WTP_N > 0$), thus providing no incentive for adoption. In fact, simulation results (not reported here) indicate that, even with a 5 percent increase in consumers' WTP, adopters' profits are positive but still dominated by non-adopters' profits. Only at the 8 percent level of increase in consumers' WTP is the pattern reversed, where adopters' profits are larger than non-adopters' profits (i.e., 8% $WTP_A >$ 8% WTP_N). At this level there would be economic incentive for hog producers to adopt the new fat modification technology.[2]

FIGURE 8.2A Profit for Adopters (A) and Non-Adopters (N) (0% WTP)

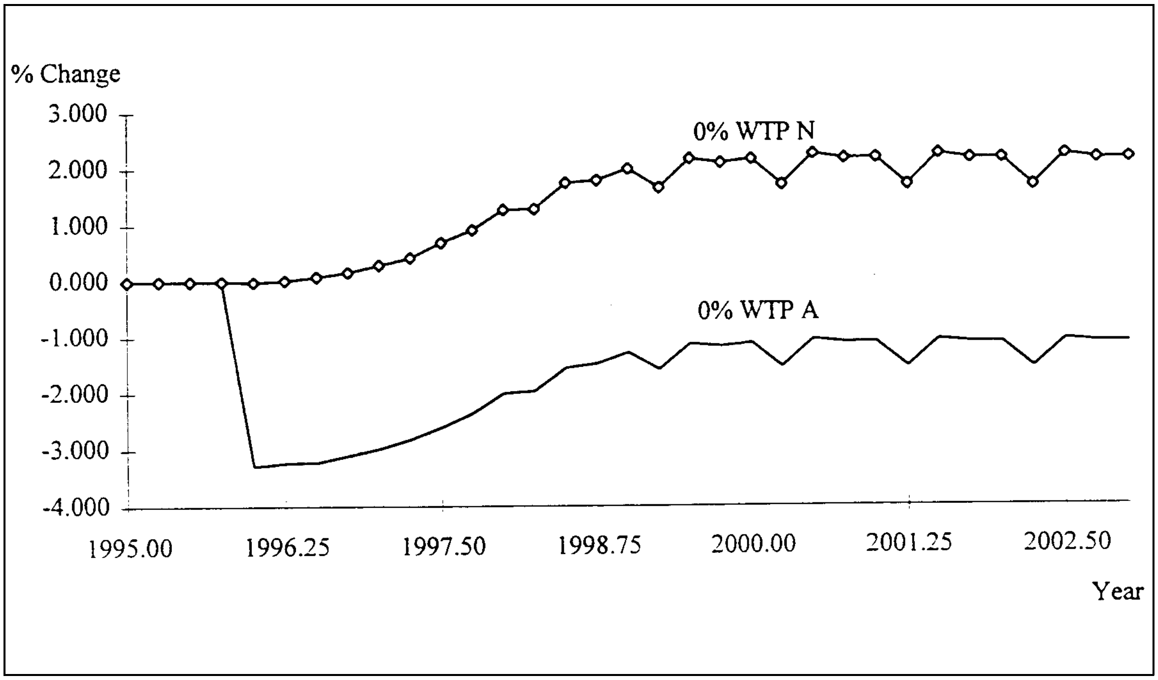


FIGURE 8.2B Profit for Adopters (A) and Non-Adopters (N) (8% WTP)

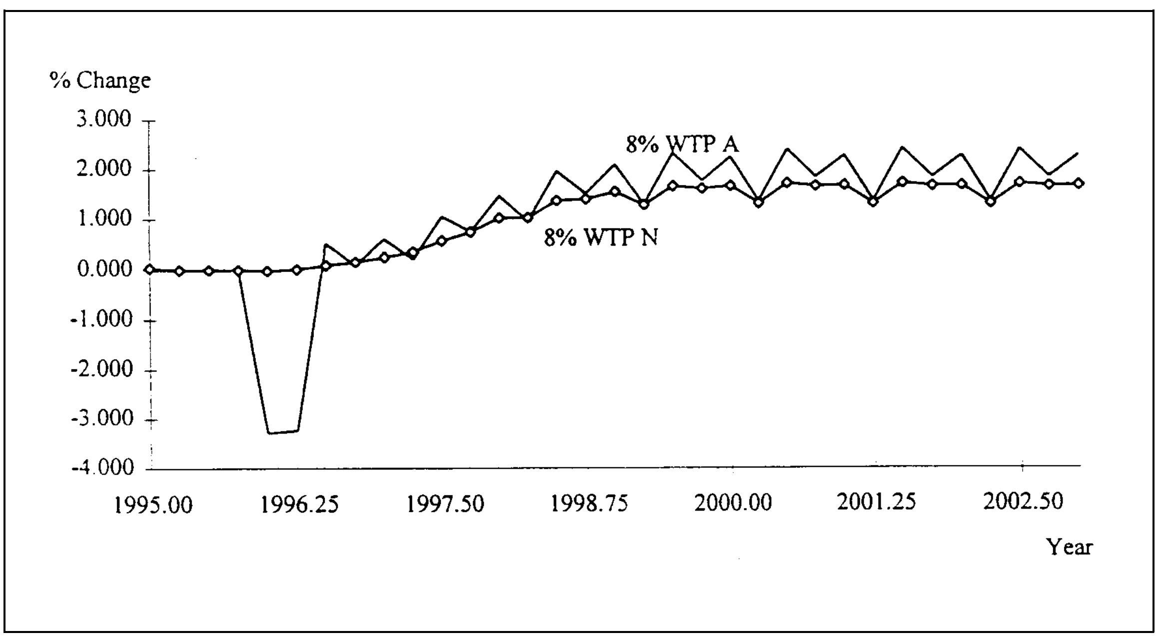
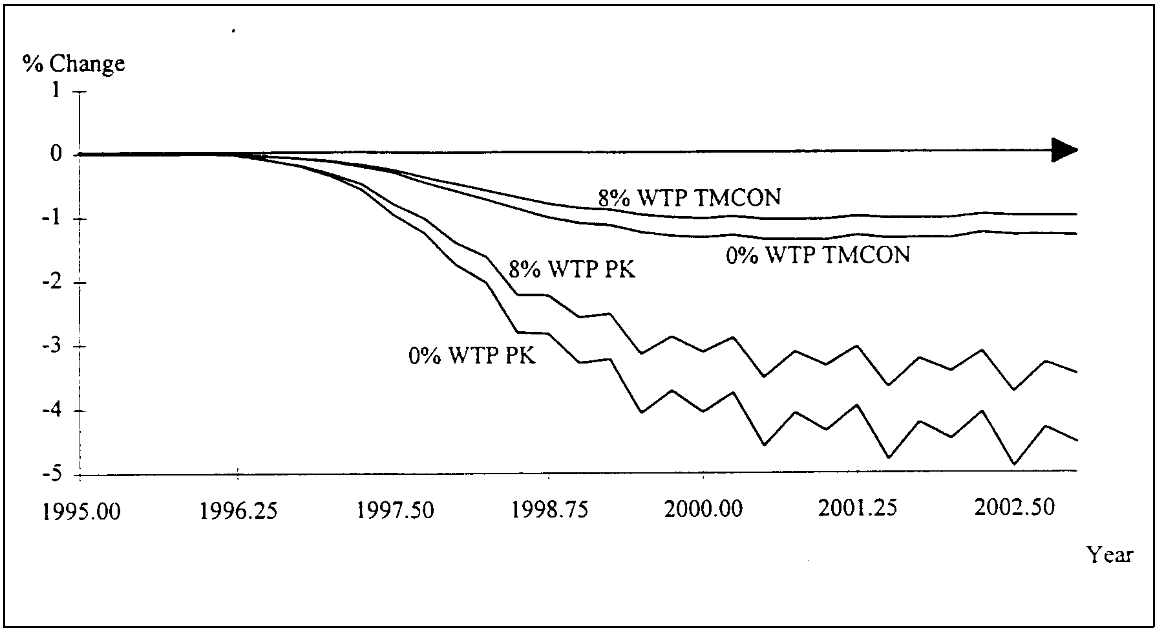


FIGURE 8.3 Change in Market Share of Pork (PK) and Total Meat Consumption (TMCON)



The effect on *consumption* is of the same pattern as for *production*. With the 8 percent increase in the WTP per capita, consumption of pork declines by 4 percent: The higher pork prices induce substitution from pork to other meats. Simulation results indicate that consumption of the substitute meats (beef and chicken) increased by 0.15 percent and 0.01 percent, respectively.

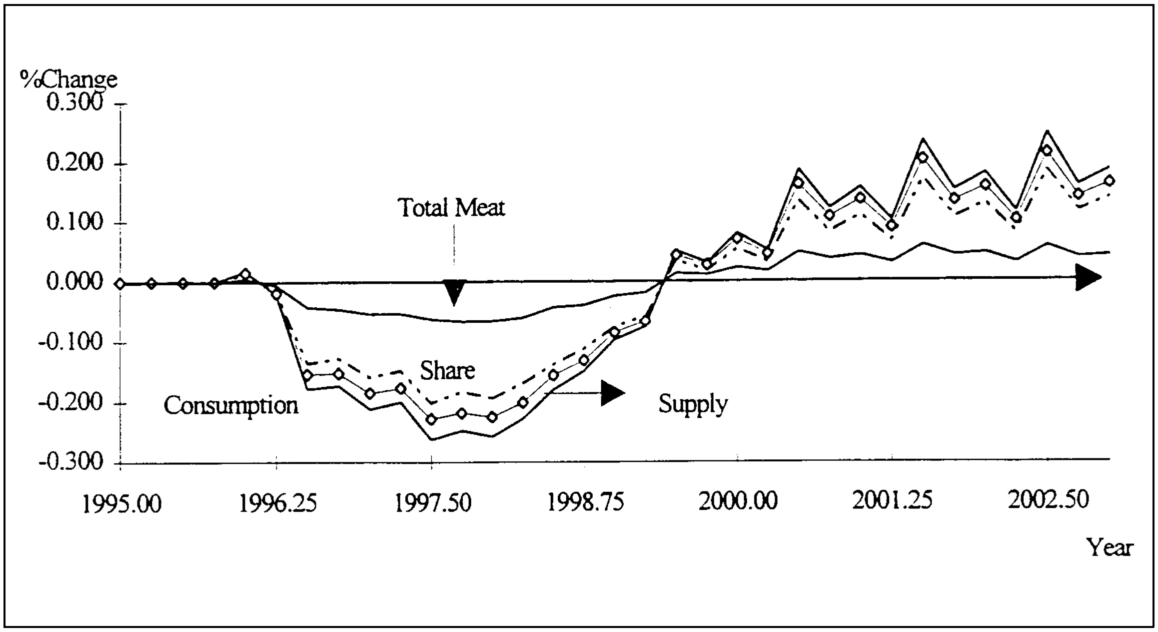
The *retail price of pork* shows an upward trend because of the dual pressure coming from the higher feed costs and demand (i.e., higher consumer WTP). A larger increase is registered for pork products with modified fat. This price increase is transmitted also to the farm.

Total meat consumption declines by nearly 1 percent with the introduction of the new technology for pork and the 8 percent increase in consumer WTP (illustrated by Figure 8.3). Moreover, as a result of decreases in the quantity of pork on the market, the market share of pork (measured as the proportion of pork consumption in total meat consumption) declined by an average of 1.50 percent, whereas the market share of beef increased by 0.53 percent, and the market share of chicken increased by 0.48 percent (see Figure 8.3).

At the 8 percent increase in consumer WTP, hog producers who adopt the new technology will earn positive profits that dominate non-adopters' profits. However, the pork industry as a whole experiences declining market share, production, and consumption. The greater price of pork at the farm and retail levels can be attributed to the increase in costs (higher feed cost) rather than increases in demand (higher consumer WTP) and result in lower production and consumption. Substitution from pork to beef and poultry increased the market share for beef and poultry.

For individual hog producers and the pork industry as a whole to benefit from the new technology, consumer WTP must increase by 37 percent. Figure 8.4 shows the percentage change in total meat consumption, total pork supply, per capita pork consumption, and market share of pork when consumer WTP increases by 37 percent. In 1995, it indicated that the pork industry would have increasing supply, consumption, and market share after the year 2000.

FIGURE 8.4 Change in Supply, Consumption, and Market Share of Pork at 37 Percent WTP



Summary and Conclusion

The fat modification experiment at ISU was designed to produce pork products with more desirable fatty acid composition. Supplemental feeding of fat in the form of soyoil and choice white grease was expected to depress the deposition of less desirable fatty acids. Experimental results indicate that feeding of supplemental choice white grease at concentrations of 30 percent of total feed calories increased the proportion of unsaturated fatty acids in the loin, ham, and shoulder muscles compared with the control diet and USDA data. The effects on palmitic acid relative to stearic acid were mixed, however the SBO30 diet resulted in the desired reduction of palmitic acid relative to stearic acid in all muscles when compared both with the control diet and USDA data. Additional experiments are underway to improve the product.

The fat supplemented diets associated with the new technology had a higher cost of feeds compared with the control diet and model baseline diet because they used higher proportions of feed ingredients that are relatively more expensive (soybean meal and soyoil). Moreover, the fat supplemented rations had lower feed efficiency (weight to weight basis) compared with the model baseline ration. To compensate for the higher cost of production, a minimum of an 8 percent increase in the consumer WTP for the new pork product was needed to provide individual hog producers incentive to adopt the new technology. For the individual hog producers and the pork industry as a whole to benefit from the new technology consumer WTP would have to increase at the higher rate of 37 percent.

The feasibility of generating a remunerative premium depends in large part on whether the new pork products can be clearly differentiated and whether consumers can be adequately informed and convinced (e.g., through advertising) of the health merits of the fat-modified pork product. Mandatory nutrition labeling, which specifies total and saturated fat percentages, has recently been introduced for fresh and processed meats. The new technology is likely to be most successful if consumers are convinced by significant improvements in attributes linked to the healthfulness of the product, and if taste and other qualities are not affected. However, without the additional feature of nutrition labeling and advertising, even a technically feasible production technology that can promote better health for consumers may not be economically feasible, despite its social usefulness.

Notes

[1]Jacinto F. Fabiosa was Postdoctoral Research Associate and Helen H. Jensen is Associate Professor of Economics at Iowa State University, Ames, Iowa. Financial support for this research came from the Center for Designing Foods to Improve Nutrition, Iowa State University. USDA/CSRS 91-34115-5903 and -0269. This paper is based on a report prepared in collaboration with Donald C. Beitz and Arley Penner.

[2] For comparison purposes, the model was re-estimated using the ration of the control diet. The new parameters were then used as a new baseline in the simulation experiment. This amounted to comparing the SBO30 diet with the experiment's control diet, not the original model baseline. The results are similar. The higher feed cost in the SBO30 diet dominates the outcome of the simulation.

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