CONSUMER ACCEPTABILITY OF FROZEN MEAT

Contributed by Farrell E. Jensen and Sykes E. Trieb
Assistant Professor of Agricultural Economics,
Rutgers University
and
Head of Extension Marketing,
University of Georgia

Authors investigate the probability of substituting frozen meat for fresh meat. Their findings indicate that the probability of success for frozen meat as a substitute for fresh meat has not changed significantly in the past twenty years.

The recent furor about high food cost is in a large measure due to the recent rise in meat prices. Contributing factors include: higher consumer incomes, improved diets for many Americans resulting from the Food Stamp and Food Distribution Programs, and greater demand from foreign sources as per capita incomes increase.

Inevitably, as meat prices increase, consumers question the performance of firms in the marketing system. Studies have indicated that the present distribution system does have stages of inefficiency. The result is a combination of lower profits for firms in the distribution system and higher prices for the consumer. One stage in the system where much attention has been directed is the processing of retail cuts at the supermarket level. (1, 3, 4, 11)

The adoption of new technology enables firms in the marketing system to operate more efficiently. Centralized frozen meat systems is a technological process that has promise as a method to increase efficiency. The integration of frozen systems with central processing eliminates the need to process at the supermarket which studies have shown to be an inefficient use of resources. Leach has estimated that a central processing operation could result in annual savings of $2,378,000 for a 40-store chain with store sales equal to the national average. (3) An earlier USDA study reported potential savings of $650,000 for a group of 40 stores with a $13,000,000 annual meat volume. (10)

The main reason for combining frozen systems with central processing is the problem of shelf life for fresh meat. Under normal conditions, fabricated retail cuts have an average shelf life of three days. Time expended in the distribution system reduces proportionately meat life in the display case. The Kearney study, a comprehensive analysis of the meat industry, concluded that longer shelf life was the key to increased efficiency. (1)

To capitalize on the advantages of frozen meat systems there must be consumer acceptance of frozen meat manifested by effective demand. Since the extensive Swift frozen meat market test in 1955, limited information has been published about consumer acceptance and market potentials.

Studies have confirmed that approximately 90% of meat purchasers freeze meat in their homes under less than optimum conditions. (9) A logical question is whether consumers will purchase frozen meat. To obtain an answer, it is necessary to gain some understanding of the demand for frozen meat and to examine factors affecting the utility functions which underlay the demand curve as they relate to preference.

The specific objectives of this study were to estimate the probability of purchasing identical fresh and frozen meat items in a controlled market test and to examine the factors affecting the demand for frozen meat.

Research Design

Two matched pairs of test and control stores from a New Jersey supermarket company were selected for the thirteen week test conducted in the fall of 1970. The weekly sales volume of the stores ranged from $75,000 to $125,000.

Since the analysis is a study of two supermarkets, the results cannot be applied to the industry in general without discretion. However, the results may provide an insight into possible reactions at other stores.

The test products consisted of 26 fresh and frozen items that were common to the stores. Store personnel supervised the cutting and trimming of the frozen meat to assure that it conformed to fresh meat specifications. All 26 frozen items were packaged in an experimental vacuum film which allowed for total product visibility with no ice formation on the meat. The film had complete adherence to the meat so there were no air pockets where ice could form. Product nomenclature and price labeling were identical to the fresh cuts to eliminate bias from the introduction of new cuts and names. Weekly sales audits were maintained to determine frozen meat sales. The meatcutters kept records of the number of fresh items processed each week.

A frozen meat display case was installed in the center of the fresh meat department by replacing one 12-foot section of the refrigerated meat display case with a low-temperature case designed to maintain product temperature at 0^{o} to -10^{o}F. Therefore, the test products were positioned to maintain maximum customer exposure.

A consumer panel consisting of 460 homemakers was randomly selected from the clientele of the test stores. Panelists maintained daily purchase diaries throughout the test. The diaries were designed so that panelists could record all of their food purchases. Each week panelists returned and received a new diary.

Panels provide a method of analyzing purchases of a specific consumer group over time and represent the most desirable alternative available to determine purchase and repeat-purchase probabilities. (6, 7, 8) Pure recall methodology is generally inaccurate since consumers tend to over estimate purchases of highly advertised brands.

One purpose of the consumer panel in this test was to monitor the purchase behavior of a control group over the test period and to estimate purchase probabilities. The consumer panel data was also helpful as a control description of the store sales data Market share alone is difficult to interpret due to lack of knowledge as to whether consumers are buying each week Either case could maintain the market share over a short test, but the long run results may differ.

Newspaper ads or handbills were not used because circulation areas overlapped with other supermarkets in the chain which were not included in the test. Point-of-purchase materials, case signs, wall signs, brochures, public address (in-store) announcements, and product sampling were used for in-store promotion of the product. During some weeks the identical fresh cuts were advertised in the newspapers which would have an impact on fresh sales However, there was no way to control this factor.

Test Results

Market Shares and Probability Estimates

After completion of the test, P_a, $1-P_a$ and market shares were determined.[1/] Probability estimates from the diary data and market share from the stores were approximately equal as shown in Table 1. The estimates were determined by regression techniques using market share or probabilities as the dependent variable and time in weeks as the independent variable. At each store the

Table 1 - Comparison of Probability Estimates and Market Share Trends for Diary and Store Sales

	Intercept	Coefficient	Standard Error	T-Value
		Weekly Purchases		
Store I				
Store data	14.0 %	- .42%	.183	- 2.30
Diary data	.153	- .0063	.0045	- 1.40
Store 2				
Store data	19.2 %	- .45%	.495	- .91
Diary data	.199	.0082	.0186	.44
		Repeat Purchases		
Store I	.22	- .0193	.0104	- 1.85
Store 2	.38	- .0416	.0172	- 2.42

package market share and probabilities were approximately equal after converting the percentages to decimal notation. Only one of the slope coefficients was significant.

Panelists were provided with coupons which could be redeemed on frozen meat. Coupons were used only to encourage panelists to buy the meat and 62.2 percent of the panelists made at least one purchase. The week that the coupons were redeemable was excluded from the statistical analysis. The inclusion of these weeks would have overstated the average market share of frozen meat as no coupons were distributed for fresh purchases.

In market research the initial purchase, although important, is not as significant as repeat purchases which are more accurate indicators of sustained demand. Repeat purchases for each product were calculated after the first frozen item was purchased to determine purchase activity after each panelist had tried frozen meat. Repeat purchase probabilities of P_a=.22 and P_a=.38 are shown in the bottom section of Table 1. The regressions of probability on weeks to determine the time trend are of more significance. At both stores the trend lines had negative slopes indicating that the probability of purchasing frozen meat decreased through time. The negative slopes of -.0193 and -.0416 were significant at the 10 percent level. The test was not of sufficient length to determine the level at which the probabilities would stabilize.

Part of the explanation for the declining probabilities is contained in Table 2. Even with a coupon, 48.2 percent of the panelists did not purchase frozen meat compared to 9.2 percent for the same fresh meat cuts. A total of 22.4 percent of the panelists purchased frozen meat on one

Table 2 - Number of Purchase Occasions by Panelists

Number of Purchase Occasions	Number of Panelists		Percent of Panelists		Cumulative Percentage Distribution	
	Fresh	Frozen	Fresh	Frozen	Fresh	Frozen
0	28	146	9.2	48.2	9.2	48.2
1	29	68	9.6	22.4	18.8	70.6
2	33	41	10.9	13.5	29.7	84.1
3-5	81	33	26.7	10.9	56.4	95.0
6-10	67	12	22.1	4.0	78.5	99.0
11-15	32	2	10.6	.7	89.1	99.7
Over 15	33	1	10.9	.3	100.0	100.0

occasion, compared to 9.6 percent for fresh meat. Ninety-five percent purchased no frozen meat, or purchased it on five or less occasions.

Panelists were classified according to their purchases over the test period. The classes were 1-2, 3-4, ..., 11-12, and over 12 purchases. In each case the difference in the number of fresh and frozen purchasers was tested by the Chi Square test. The number of panelists making a purchase in the fresh category was significantly greater at the ten percent level for each item. The low depth of trial and declining repeat purchase probabilities do not suggest a favorable market position for frozen meat in these markets.

One criteria used by supermarket management to determine the feasibility of stocking items is sales per linear foot of display space. Fresh sales per linear foot, per week, averaged $186.03 compared to $44.74 for the frozen meat at equal prices. With comparatively low sales per foot, the sales incentive for stocking frozen meat is marginal.

Factors Affecting Demand

The in-depth interviews conducted at the end of the market test were designed to determine the factors which relate to the utility functions of fresh and frozen meat. Utility can be expressed as a function of the amount of a good and the summation of the attributes which give rise to this utility. Over 100 factors which were hypothesized to affect the utility functions were considered but the final selection was narrowed to 38 factors. These were incorporated into a questionnaire which was given to a sample of 220 panelists. Fresh and frozen meats were rated on a 1 to 10 scale on each statement.

Factor analysis, a statistical technique, that groups intercorrelated statements into a smaller number of underlying factors, was used to analyze the data. (2) The 38 statements were condensed into six factors.

The sample of panelists was separated into purchasers and nonpurchasers of the frozen meat to isolate the differences in perceived utility associated with the two products. A total of four analytical combinations, purchaser, nonpurchaser and the two product breakdown, are reported as factor loadings in Table 3.

The most important factor affecting the utility functions for both fresh and frozen meat by frozen meat purchasers was identified as "eating Characteristics." This factor explained 32 percent of the

Table 3 - Factors Influencing Utility of Fresh or Frozen Meat by Frozen Meat Purchasers

Variables	Factor Loading
Fresh	
EATING CHARACTERISTICS (32.08% of total variance)	
Tenderness while cutting cooked meat	.81
Tenderness while chewing cooked meat	.78
Amount of juice loss during cooking	.72
Juiciness of cooked meat	.70
Amount of juice loss during home storage	.68
Appearance of meat after cooking	.62
Flavor of cooked meat	.59
Meat shrinkage during cooking	.52
Frozen	
EATING CHARACTERISTICS (32.18% of total variance)	
Tenderness while chewing cooked meat	.86
Tenderness while cutting cooked meat	.82
Juiciness of cooked meat	.81
Flavor of cooked meat	.66
Meat shrinkage during cooking	.61
Appearance of meat after cooking	.57
Amount of juice loss during cooking	.56
For cooking on day of purchase	.50

total variance in each case. All six factors explained 52 percent (fresh) and 53 percent (frozen) of the total variance.

The same factor was identified as explaining most of the variance for fresh meat by those that did not purchase the frozen meat (Table 4). It explained 25.62 percent and the six factors explained 46 percent of total variance. However, the most important factor for the frozen rating was identified as "quality" which explained 37.21 percent of the total variance, compared to 55 percent for the six factors.

The most significant factors underlaying the utility functions are thus the same for three of the four combinations. However, nonpurchasers are concerned with the quality of frozen meats. Knowledge about this difference can assist in developing advertising programs to concentrate on the major negative reactions to frozen meats. Similar results were obtained in a study conducted one year after introduction of the Swift frozen meat in the 1950's. (5)

Purchasers were asked to rate the fresh and frozen meat for overall acceptability. Twenty-four percent indicated that the frozen meat was better, 33 percent indicated that fresh meat was better, and 43 percent indicated that both were the same The high percentage of favorably disposed people would suggest a higher level of purchase and repurchase response This paradox is partially explained by the fact that the frozen meat was a new unfamilar product. Education would be necessary to teach consumers handling, storing, cooking and quality evaluation techniques

Summary and Conclusions

The results of this study indicate that the market share and probability of purchasing frozen meat was less than fresh meat under similar marketing conditions at equal prices. If these stores can serve as an indicator, the probability of success for frozen meat as a substitute for fresh meat has not changed appreciably in the past twenty years. The degree of acceptance for the test stores was not sufficient to justify the introduction of entire frozen meat operations that would compete with fresh meat in other stores.

There is a possibility that the market for frozen meat may be expanded by its introduction into market segments that cannot be served profitably by fresh meat operations. These possibilities include outlets like convenience stores, service stations or other high customer exposure locations. Additional research could determine the feasibility.

Even though consumer acceptance is lacking, there are several economic factors which may cause the industry to alter its distribution practices; particularly if it can be established that frozen meat systems can result in more efficient use of resources in the distribution system.

The factors are:

1. Meat department productivity levels have decreased while labor costs have increased.

2. The meat industry is long overdue for a breakthrough in technology. The majority of meat is still distributed to retail stores in wholesale cuts.

3 Central processing near meat production areas could reduce the ecological problems of fat and bone waste disposal in population centers.

Priorities for future research on frozen meat should include studies to determine purchase probabilities of identical fresh and frozen cuts at lower prices. Additional research could prove valuable in assessing the feasibility of alternative markets for frozen meat.

FOOTNOTE

1/ P_a is equal to the probability of purchasing frozen meat and $1-P_a$ is the probability of purchasing fresh meat.

Table 4 - Factors Influencing Utility of Fresh or Frozen Meat by Nonpurchasers of Frozen Meat

Variables	Factor Loading
Fresh	
EATING CHARACTERISTICS (25.62% of total variance)	
Tenderness while cutting cooked meat	.86
Tenderness while chewing cooked meat	.82
Juiciness of cooked meat	.79
Appearance of meat after cooking	.72
Ability of meat to maintain quality in home storage	.67
Flavor of cooked meat	.66
Meat shrinkage during cooking	.50
Frozen	
QUALITY (37.21% of total variance)	
Attractiveness of meat color in display case	.71
Ease of seeing amount of fat in meat	.69
Ease of determining amount of bone in meat	.67
Amount of fat in meat	.67
Ease of judging quality of meat in package	.66
Amount of bone in meat	.55
Appearance of meat in package in store meat case	.55
Ability to see packaged meat	.52
Ease of determining freshness at time of purchase	.50

REFERENCES

1. A. T. Kearney and Company, Inc., "A Study of the Feasibility of a Physical Distribution System for Use in Evaluating Improvements in the Cattle and Fresh Beef Industry."

2. Fruchter, Benjamin, Introduction to Factor Analysis, D. Von Nostrand Co., Inc., 1954.

3. Leach, Hugh V., "Factors Affecting Costs for Alternative Meat Distribution Systems," University of Missouri Agricultural Experiment Station, Bulletin 866, January 1968.

4. McKinsey & Company, Inc., "A Top Management Approach to Meat Merchandising." A report prepared for the National Association of Food Chains. (1968)

5. Maxon, Richard, "An Analysis of Prepackaged Frozen meats as a Marketing Innovation of Meat Distribution." Unpublished PhD Thesis, Department of Agricultural Economics, University of Missouri, 1963.

6. Morrison, Donald G., Ronald E. Frank and William F. Massey, "A Note on Panel Bias," Journal of Marketing Research, 3, February 1966, pp. 85-88.

7. Sudman, Seymour, "On the Accuracy of Recording of Consumer Panels II," Journal of Marketing Research, 1, August 1964, pp. 69-83.

8. Telser, Lester G., "The Demand for Branded Goods as Estimated from Consumer Panel Data," The Review of Economics and Statistics, 44, August 1963, pp. 300-324.

9. U. S. Department of Agriculture, Statistical Reporting Service, "Homemakers' Opinions About Selected Meats, A National Survey," Marketing Research Report, No. 854, July 1969.

10. Volz, M. D., and J. A. Marsden, "Centralized Processing of Fresh Meat for Retail Stores," Marketing Research Report, No. 628, Agricultural Marketing Service, Transportation and Facilities Division, U.S.D.A., October 1963.

11. Weatherly, Emory, Wendall Earle and Earl Brown, "Alternative Methods of Meat Distribution," Cornell University Agricultural Experiment Station, Department of Agricultural Economics, E.E. Research Report 232, December 1967.

12. The authors acknowledge the assistance of Harold Tuma, Associate Professor at Kansas State University and Paul Kahn of American Can Company.