CHANGES IN MEAT PURCHASES DURING 1952 AND 1953 RELATED TO FAMILY CHARACTERISTICS

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By

Raymond W. Gieseman

A THESIS

Submitted to the College of Agriculture
Michigan State University of Agriculture and
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Any errors that remain in the final manuscript are the sole responsibility of the author.

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AN ABSTRACT

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ABSTRACT

The purpose of this study was to determine whether consumer response to price changes for selected cuts of red meats were related to family characteristics such as levels of income, age and education of the homemaker, and size of family.

The two years, 1952 and 1953 were chosen as the time period for this study. This was a period of substantial change in prices for both beef and pork items. Substantial changes were made by consumers in their purchasing patterns for these cuts.

The basic data for this study were obtained from the purchase records of 131 families in the Michigan State University Consumer Panel. Three methods were used in analyzing the data. First, families were grouped according to each characteristic to determine whether families who were different with respect to any given characteristic were also different in their response to price changes. Secondly, families were grouped according to the degree of change in meat purchases to determine if these sub-groupings were also different with respect to family characteristics. Finally, multiple regression analysis was used to determine the net effects of family characteristics on consumer responsiveness to price changes.

When the various family characteristics were related to consumer response to price changes for meat items it was found that none of the characteristics were highly significant in determining consumer

behavior. However, the results obtained were consistent in all three methods of analysis in pointing out the directional relationship between family characteristics and consumer responsiveness to price changes.

It was generally found that age of the homemaker was positively related to consumer responses in meat purchases. Education of the homemaker and size of family were usually found to be negatively related to changes in meat purchases. The effects of income measures on response in meat purchases were not established as being important.

From the results obtained it was concluded that age of the homemaker may well be the most important factor determining group differences in responsiveness to meat price changes.

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CHAPTER I

INTRODUCTION

Purpose of Study

The purpose of this study is to determine whether consumer response to price changes for selected cuts of red meat is significantly related to family characteristics such as level of income, size of family, age and education of the homemaker. The results of the study will provide evidence as to whether price elasticity of demand for meats varies among economic sub-groupings of families.

The basic hypothesis is that families grouped according to family characteristics differ significantly in their response to price changes for beef and pork items. An alternative hypothesis would suggest that families grouped according to the degree of change in per capita consumption and expenditure, for each of the items, are significantly different with respect to the family characteristics studied. The second hypothesis is the reverse of the first.

Throughout the empirical testing of these hypotheses it is assumed that all families are subjected to the same price changes and that consumers have equal exposure to advertising and other merchandising practices.

Source of Data

The basic data for this study were obtained from the Michigan State University Consumer Panel, a diary-type panel in continuous operation

since early 1951.[1] This Panel consists of about 250 families, representative of the city of Lansing, Michigan. The Panel is unique in that it provides weekly information on consumer food purchases which are suited to both time series and cross-sectional analysis.[2]

Consumer panel data has been found to be quite useful in estimating the short run price elasticities of demand for meat items. However, for these estimates to be reliable as a means of predicting behavior in geographic areas other than that from which the basic data were obtained, it is felt that information is needed as to the responsiveness of different groups of consumers to price changes. The selection and analysis of consumer panel records for families who reported meat purchases during a period of time when substantial price changes occurred seems to be an appropriate way to handle this problem.

Nature of Previous Studies

Several studies have been made which attempt to measure the price elasticity of demand for various meat items. These studies are generally time series analysis based on annual data for the entire United States for a period beginning in the early 1920's and extending up to the early 1950's, the war years generally being excluded. Some of the more

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[1] The organization and operation of the MSU Consumer Panel is under the direction of Dr. G. G. Quackenbush and Dr. J. D. Shaffer.

[2] For further information on the objectives and usefulness of this Panel, see: G. G. Quackenbush, "Demand Analysis From the MSC Consumer Panel," Journal of Farm Economics, Vol. 36, No. 3, 1954, pp. 415-427.

widely known studies typifying this line of work include studies by Fox[3] and Working.[4]

Fox has fitted single equations by the least squares method in estimating price elasticities of demand for beef, pork, and all red meats. These results were obtained by expressing the average annual retail price as a function of the quantity of meat consumed per person and disposable income. The study is based on aggregate data for the period 1922-1941. In a somewhat similar manner, Working has derived estimates of both price and income elasticities of demand for beef and pork as well as all red meats. The actual technique for fitting single equations so as to obtain "unbiased" estimates of various demand parameters differs somewhat from those used by Fox. In addition to estimating demand elasticities, based on annual adjustments in consumption, Working also attempts to establish a longer run price elasticity of demand using a five-year lagged relationship between price and quantity.

A recent study by Shepherd et al. uses similar data as that used by Fox and Working to point out shifts in demand between beef and pork.[5]

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[3] Karl A. Fox, The Analysis of Demand for Farm Products, Tech. Bul. 1081, U. S. Department of Agriculture, Washington, D. C., September, 1953.

[4] Elmer J. Working, Demand for Meat, Institute of Meat Packing, University of Chicago, Chicago, Illinois, 1954.

[5] Geoffrey Shepherd, J. C. Purcell, and L. V. Manderscheid, Economic Analysis of Trends in Beef Cattle and Hog Prices, Res. Bul. 405, Iowa State College, Ames, Iowa, January, 1954.

In an earlier study, Shepherd made some estimates of price elasticities for all meat based on national average per capita consumption and United States average retail meat prices.[6]

The studies referred to above are useful insofar as they are able to estimate the slope of the demand curve for given commodities. However, as Foote has pointed out, several questions in regard to price elasticities of demand derived from conventional time series analysis have been raised. Among the more important problems are:[7] (1) Do demand functions differ among various economic groups? (2) How do demand functions change over time? (3) Do elasticity coefficients vary with the level of economic activity? Foote concludes that because conventional time series estimates are based on aggregate market data, little information for answering these questions is provided by such analyses.[8]

Studies such as have been cited earlier are of limited use in estimating shorter run demand parameters. Based on aggregate data over a period of twenty to thirty years they do not provide for the analysis of adjustments within a short period of time, particularly intra-year adjustments.

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[6] Geoffrey Shepherd, Changes in the Demand for Meat and Dairy Products in the United States Since 1910, Res. Bul. 368, Iowa State College, Ames, Iowa, November, 1949.

[7] Richard J. Foote, Price Elasticities of Demand For Non-durable Goods, With Emphasis on Food, A.S-96, U. S. Department of Agriculture, Washington, D. C., March, 1956, p. 8.

[8] Ibid.

The crucial problem of determining how demand functions differ for economic sub-groups as they are distinguished by various socio-economic characteristics has also remained untouched by conventional types of analysis. Do low income families respond more readily to price changes than comparable families with higher incomes? Is the size of family significantly related to responsiveness?

Certain limitations on the applicability of standard time series estimates of elasticity have created an interest in the use of consumer panel data for estimating price elasticities. Quackenbush has pointed out the applicability of consumer panel information in predicting price and cross elasticities for major food items.[9] Kuznets, who has done considerable work with consumer panel data, has made the following statement about its usefulness in demand analysis:[10]

> Of the four areas singled out in Mr. Foote's paper as those in which significant advances are being made, I would be inclined to rate the utilization of data from consumer panels as holding the greatest promise of obtaining valid estimates of short-run demand (purchase) parameters.

Kuznets seems to be in complete agreement with Foote as to the limitations of estimates based on annual data for the aggregate United States market. These and other statements seem to point toward greater use of consumer panel data to promote a more dynamic approach to the analysis of short run demand parameters in market analysis.

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[9] G. G. Quackenbush, op. cit., p. 415.

[10] George M. Kuznets, Discussion on paper presented by Richard J. Foote, "Demand and Prices," Journal of Farm Economics, Vol. 37, No. 2, 1955, p. 235.

An extensive study has been undertaken at Michigan State University to estimate price and cross-elasticities of demand for all major cuts of meat from consumer panel data.[11] A series of single equation models have been fitted by least squares in deriving demand elasticities for broad groups of meats as well as for a large number of retail cuts. However, these analyses are based on data for the entire panel and do not relate the elasticity estimates to family characteristics. Since the Michigan State University Consumer Panel is located in a single city, differences in responsiveness of different groups at the retail level become important when attempts are made to apply these estimates to other areas. If family characteristics are related to consumer behavior, then some consideration of this relationship must be made in estimating price responsiveness for other areas whose population makeup may be different from the sample population.

The only known attempt to determine if responsiveness to price changes is related to family characteristics was a study by Zwick.[12] Using a consumer purchasing panel as the source of information, an attempt was made to analyze the effects of variations in family characteristics on purchase behavior by means of covariance analysis. Seven characteristics, family size, income, education, age, ethnic background, religion and occupational status were used in the study. Age was the only factor found related to consumer responsiveness.

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[11] Harold M. Riley, "Some Measurements of Consumer Demand For Meats." Unpublished Ph. D. Thesis, Department of Agricultural Economics, Michigan State University, 1954.

[12] Charles Zwick, "A Quantitative Study of the Demand for Meat," Econometrica, Vol. 23, No. 3, (Abstract), pp. 327-328.

A review of the above mentioned studies indicated that there are several available estimates on responsiveness to meat price changes for large aggregate consuming groups. More recently, consumer panel data has been used to make estimates of short-run demand parameters. However, little empirical evidence is available to determine whether the degree of response to price changes is related to family characteristics such as level of income, size of family, age and education of the homemaker.

Method of Study

There are several approaches that might be used for measuring the extent to which consumer responsiveness to price changes is related to family characteristics. One approach would be to extend previous attempts to estimate price elasticities by sub-grouping families according to one or more characteristics. It would then be possible to compute a separate time series regression for each of the sub-groups. Such an equation would express quantity as a function of the price of the item considered, the price of competing products, and other appropriate variables. The regression lines thus obtained would show the responsiveness of different sub-groups of families to price changes. These regression lines could then be compared and differences in slope could be tested for significance. Such work is being carried out as part of the over-all project under which the meat purchase data from the Michigan State University Consumer Panel are being analyzed.

Thus far, however, the only sub-grouping that has been used is a classification of families into three groups based on per capita income.

Experience with this procedure indicates that it may be impractical to further subdivide the 250 families into groupings involving additional family characteristics. Since this analysis requires rather costly recombinations of data, an attempt should be made to more clearly identify the relevant family characteristics affecting responsiveness to price change before attempting to proceed further with this approach.

Another approach to the problem was, therefore, considered desirable. The first step was to select those families who were in the panel during both 1952 and 1953. These families were then sorted into sub-groups based on family characteristics considered to be important, and the mean changes in purchases of major cuts of meat between 1952 and 1953 compared. Using such a method it was possible to test these means to see if consumer responses differed between the sub-groups. This procedure was then followed by a series of regressions in which the change in level of purchases for each item of meat by each family was expressed as a function of the family characteristics. The regression coefficients indicate which characteristics, if any, are significantly related to change in purchases and the extent of this relationship.

This approach, while relatively simple, will explain differences in response between consumers in considerable detail. A more complete account of the methods used and their limitations will be given in later chapters.

Usefulness of Results

Some of the uses which might be made of the results of this study could be listed as follows:

1) The approach used in this study, while relatively simple, shows in considerable detail the relationship between family characteristics and responsiveness to meat price changes. This information will be useful in determining the extent to which price elasticities of demand derived from the Michigan State University Consumer Panel will accurately predict similar adjustments in other markets where families are systematically different from those in the panel. If responsiveness is related to one or more characteristics, the nature and extent of the relationship will be useful in formulating additional analysis of Michigan State University Consumer Panel data.

2) Various trade groups might well find the results helpful in carrying out pricing and promotional programs that will lead to maximization of profits.

3) Finally, the results attained will add to the fundamental knowledge about the structure of demand for meat products, and might well lead to a more meaningful approach in demand analysis.

CHAPTER II

METHODS OF ANALYSIS

Choice of Time Period Studied

During the two year period, 1952-1953, consumers collectively made one of the sharpest adjustments in meat purchasing that has occurred in recent history. During this period the average American family increased its beef purchases from 61.5 to 76.7 pounds per capita while pork consumption decreased from 71.6 to 62.9 pounds per capita. These sharp changes in levels of consumption reflect important cyclical adjustments in livestock production. Sizable price adjustments were realized at all levels of livestock and meat distribution as the supply and demand situations changed.

The pattern of beef and pork purchases described above for the national market are also revealed in the weekly food purchase diaries of the Michigan State University Consumer Panel.

Validity of the Data Used

Table I summarizes the panel data for beef consumption in the two years 1952-1953. It provides the reader with the comparison between the total United States market, the Michigan State University Consumer Panel, and the sub-sample of 131 families selected for this study.

The estimated United States average retail price for beef is based on choice grade retail cuts and is somewhat higher than the average retail price obtained from quantity and expenditure data reported by

TABLE I

COMPARISON BETWEEN THE UNITED STATES, THE MICHIGAN STATE UNIVERSITY CONSUMER PANEL AND THE SUB-SAMPLE OF PANEL FAMILIES FOR SELECTED MEASURES OF BEEF PURCHASES, 1952-1953[a]

	Retail Price			Per Capita Consumption			Per Capita Expenditure			Percent Weeks Bought		
	1952 (Cents)	1953 (Cents)	Percent Change	1952 (pounds)	1953 (Pounds)	Percent Change	1952 (dollars)	1953 (dollars)	Percent Change	1952 (%)	1953 (%)	Percent Change
United States												
Total Beef	86.6[b]	69.1[b]	-20.2	61.5[c]	76.7[c]	19.9						
M.S.U. Panel												
Total Beef	71.1	57.0	-19.8	37.6	48.2	28.2	26.73	27.48	2.8			
Hamburger	63.0	46.4	-26.4	15.8	17.6	11.4	9.95	8.16	-18.0	59.1	57.8	-2.2
Roasts	72.7	56.6	-22.1	11.8	15.5	31.4	8.58	8.78	2.3	23.3	28.7	23.2
Steaks	88.7	75.7	-14.7	8.2	12.7	54.9	7.27	9.62	32.3	30.8	40.9	32.8
Stewing and Boiling Beef	51.7	37.9	-26.7	1.8	2.4	33.3	.93	.91	- 2.2	6.8	7.8	14.7
Sub-Sample of Panel Data												
Total Beef (4 cuts)				41.5	55.0	32.5	29.82	32.14	7.8			
Hamburger				16.5	17.9	8.5	10.35	8.69	-16.0	58.5	58.2	- .5
Roasts				13.1	19.0	45.0	9.66	10.78	11.6	22.3	29.6	32.7
Steaks				9.6	15.0	56.3	8.61	11.47	33.2	31.0	41.1	32.6
Stewing and Boiling Beef				2.3	3.1	34.8	1.20	1.20		6.8	7.5	10.3

[a] It is assumed that families in the sub-sample were confronted with the same prices as for the panel.

[b] Composite retail price per pound of choice grade retail beef cuts. Beef Marketing Margins and Costs, Miscellaneous publication 719, U. S. Department of Agriculture, Washington, D. C., 1952, p. 19.

[c] Approximate carcass weight at the wholesale level. Consumption of Foods in the United States, 1909-52, Supplement for 1954. Agricultural Handbook No. 62, U. S. Department of Agriculture, Washington, D. C., 1955, p. 13.

panel members. This is to be expected since prices for the panel include all grades of beef.

The panel estimates of per capita quantities of beef are based on trimmed retail cuts versus wholesale carcass weights for United States average per capita consumption. Luncheon meats, also a part of the United States average consumption estimate, are included under a separate section in the panel records and are not a part of panel estimates for total beef consumption.

The general pattern of beef purchases for the nation, the consumer panel and the sub-sample indicated that all three groups made substantial increases in beef consumption. Some divergency in the percentage changes for the average per capita consumption of beef in the United States and the average per capita consumption of beef for panel families suggests that the latter may have been slightly more responsive to declining beef prices. Similar differences were noted between the panel and the sub-sample, the latter making the largest increases in beef purchases. Most of this variation was explained in purchases of roast beef, the sub-sample increasing their consumption by 45 percent while the average Michigan State University panel family increased their purchases by only 31.4 percent.

Table II indicates that the decreases in pork consumption by the average American consumer and the decreases in pork consumption for the Michigan State University panel families were quite similar. Since the pork consumption estimates for the Michigan State University panel are

TABLE II

COMPARISON BETWEEN THE UNITED STATES, THE MICHIGAN STATE UNIVERSITY CONSUMER PANEL AND THE SUB-SAMPLE OF PANEL FAMILIES FOR SELECTED MEASURES OF PORK PURCHASES, 1952-1953[a]

	Retail Price			Per Capita Consumption			Per Capita Expenditure			Percent Weeks Bought		
	1952 (Cents)	1953 (Cents)	Percent Change	1952 (pounds)	1953 (pounds)	Percent Change	1952 (dollars)	1953 (dollars)	Percent Change	1952 (%)	1953 (%)	Percent Change
United States												
Total Pork	57.2[b]	63.3[b]	10.7	71.6[c]	62.9[c]	-12.2						
M.S.U. Panel												
Total Pork	58.2	63.7	9.5	34.8	29.4	-15.5	20.27	18.73	-7.6			
Bacon	50.8	64.0	26.0	7.8	6.5	-16.7	3.96	4.16	5.1	38.0	33.2	-12.7
Chops and Steaks	68.6	72.6	5.8	7.4	6.1	-17.6	5.08	4.43	-12.8	33.8	28.6	-15.4
Ham	64.5	69.3	7.4	8.3	7.3	-12.0	5.35	5.06	- 5.4	18.7	17.5	- 6.4
Picnics	47.4	49.3	4.0	3.1	2.8	- 9.7	1.47	1.38	- 6.1	4.5	3.9	-13.3
Roasts	53.8	56.5	5.0	4.8	3.7	-22.9	2.58	2.09	-19.0	9.2	7.3	-20.7
Sausage	54.1	53.7	- .7	3.4	3.0	-11.8	1.84	1.61	-12.5	17.7	16.3	- 7.9
Sub-Sample of Panel Data												
Total Pork (6 Cuts)				40.9	33.4	-18.3	23.94	21.48	-10.3			
Bacon				8.1	7.0	-13.6	4.19	4.54	8.4	36.3	32.7	- 8.9
Chops and Steaks				10.4	6.8	-34.6	6.72	5.06	-24.7	36.6	29.3	-19.5
Ham				9.4	8.2	-12.8	6.35	5.68	-10.6	19.3	17.7	- 8.3
Picnics				3.7	3.5	- 5.4	1.75	1.80	2.9	4.5	4.1	- 8.9
Roasts				5.7	4.7	-17.5	2.98	2.65	-11.1	9.5	7.8	-17.9
Sausage				3.6	3.2	-11.1	1.96	1.75	-10.7	16.9	15.2	-10.1

[a]It is assumed that families in the sub-sample were confronted with the same prices as for the entra panel.
[b]Average retail value of pork, Pork Marketing Margins and Costs, Misc. Pub. 711, U. S. Dept. of Agriculture, Washington, D. C., 1956, p. 19. [c]Approximate carcass value of pork excluding lard at the wholesale level. Consumption of Food in the United States, 1909-52, op. cit., p. 13.

again based on trimmed retail cuts and do not include luncheon meats, the panel estimates for pork consumption are somewhat lower than the United States estimate. Slightly larger decreases in pork consumption were observed for the 131 families included in this study as compared to the over-all panel membership. Chops and steaks were individual cuts where most of this divergency in total pork consumption estimates occurred.

Some variation in the levels of consumption observed in the above comparisons for beef and pork may well have been attributed to differences in the socio-economic traits of the consumer groupings cited. While no attempts were made to compare family characteristics of the average United States consumer and panel members, the composition of families in the panel and families in the sub-sample was examined. The characteristics for which comparisons were made included age and education of homemaker size of family and per capita income. The results are summarized in Table III.

Some differences in the age distributions were noted for the two groups with older homemakers being slightly more predominant in the sub-sample than was true for the entire panel membership. Differences noted in the size of families indicated that the sub-sample favored smaller size families. The average per capita income for the sub-sample may have been somewhat higher than for the panel. These deviations in family characteristics are probably related to the problems of maintaining a representative panel sample over time, since the sub-sample was

TABLE III

COMPARISON OF FAMILY CHARACTERISTICS FOR THE MICHIGAN STATE UNIVERSITY CONSUMER PANEL AND A SUB-SAMPLE OF 131 FAMILIES REPORTING 40 WEEKS OR MORE DURING BOTH 1952 AND 1953

Family Characteristic	Percentage Distribution of Panel Families[a]	Percentage Distribution of 131 Families of the Sub-Sample
Age, 1952		
35 years and under	31.3	24.4
36-45 years	21.3	21.4
45-55 years	22.8	26.7
56 and over	24.6	27.5
	100.0	100.0
Education, 1952		
8 years and under	21.3	22.1
9-11 years	22.0	22.1
12 years	38.3	35.2
13 years and over	18.4	20.6
	100.0	100.0
Size of Family, 1952		
1 person	8.5	10.7
2 persons	31.5	38.2
3 or 4 persons	38.9	35.8
5 or more persons	21.1	15.3
	100.0	100.0
Per capita Income, 1953		
$1249 and under	33.0	29.8
$1250-$1890	35.9	29.8
$1891 and over	31.1	40.4
	100.0	100.0

[a] J. D. Shaffer and G. G. Quackenbush "Cooperation and Sampling in Four Years of Michigan State University Consumer Panel Operation," Quarterly Bulletin, Michigan Agricultural Experiment Station, Vol. 38, No. 1, Michigan State University, East Lansing, Michigan, 1955, pp. 95-97.

composed of only those families who were most persistent in reporting during 1952-1953.[1]

It would appear after comparing United States meat consumption trends with those of the Michigan State University panel and the sub-sample that the latter will provide suitable information to test the hypothesis that families grouped according to socio-economic traits differ significantly with respect to price responsiveness for meat items. While the sample used in the study does not deviate much from the over-all panel in patterns of responsiveness or in family characteristics, it is maintained that close agreement in these measures is not mandatory to establish group differences based on family characteristics.

Selection of Cuts

Ten major retail cuts of meat have been included in this study. The four cuts of beef represented over 90 percent of the total beef purchases of consumers in the Michigan State University Consumer Panel. The six pork items represented a similar percentage of the total pork consumption. The limited number of observations on other cuts and their small fraction of the total consumption of red meats places severe limitations on their usefulness. Since panel estimates of elasticities for these cuts have not been made, they were excluded from the study.

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[1] For a more detailed account on the representativeness of the Michigan State University Consumer Panel, see: J. D. Shaffer and G. G. Quackenbush, "Cooperation and Sampling in Four Years of Michigan State University Consumer Panel Operation," Quarterly Bulletin, Michigan Agricultural Experiment Station, Vol. 38, No. 1, Michigan State University, East Lansing, 1955, pp. 85-103.

Theoretical Considerations

Time series analysis of weekly purchase data have provided estimates of the price and cross elasticities of demand for beef and pork. These estimates indicate that average weekly purchases of both beef and pork are quite responsive to price changes. Furthermore, there appears to be a certain amount of substitution between beef and pork. These phenomenon are closely related to the theoretical concept of demand and the elasticity principles implicit within this framework.

The Marshallian concept of demand, suggests that a decrease in the price of a commodity usually results in an increase in the quantity that consumers are willing to buy. Similarly, consumers respond to an increase in price by decreasing the quantity taken. Evolving from this principle is the demand curve, fundamental to time series analysis, and showing the average relationship between price and quantity for given conditions.

In a dynamic economy there are many factors which may affect the position of the demand curve. These factors are constantly changing. Thus a group of consumers does not always move along a given demand curve, but instead may shift their pattern of purchases in response to a change in wants and preferences, level of income, or a change in the price of competing products. Some of these changes occurred in the time period during which data for this study were generated.

If we plot the average prices and total quantities for beef that characterized the entire panel in 1952-1953 and draw a hypothetical demand curve for each of these points, we might come up with a

relationship such as that shown in Figure 1. This illustration assumes that supply is fixed for any given year because it is doubtful if changes in the retail prices of meats have any substantial effect on total meat production for a time period for less than one year.[2]

A similar diagram showing the relationship for pork could also be drawn. In this instance the hypothetical demand curve for 1953 data would probably be slightly to the left of the original 1952 estimate since the price of beef decreased.

Figure 1 provides some insight into the problem that leads to the underlying purpose of this study. The demand curves D_1D_1 and D_2D_2 represent a plausible situation for a large group of consumers during two periods of time. The movement from point A to point B, for example, illustrates that consumers responded to beef price changes as well as to changes in pork prices and other socio-economic factors. The effects of the last two factors is revealed in a shift of the demand curve itself. It is interesting to note, for example, that United States per capita incomes rose 4% in 1953 over 1952 levels. Consumer panel families in the sub-sample experienced similar increases of 5.6%.

Preparation of Data

To facilitate the study of responsiveness of families to price changes it was necessary that all families in the study be in the panel during the two-year period examined. This was accomplished by imposing

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[2] This argument is similar to that used by Fox in determining the demand for farm products. Karl Fox, The Analysis of Demand for Farm Products, Tech. Bul. 1081, U. S. Department of Agriculture, Washington, D. C., 1953, pp. 22-23.

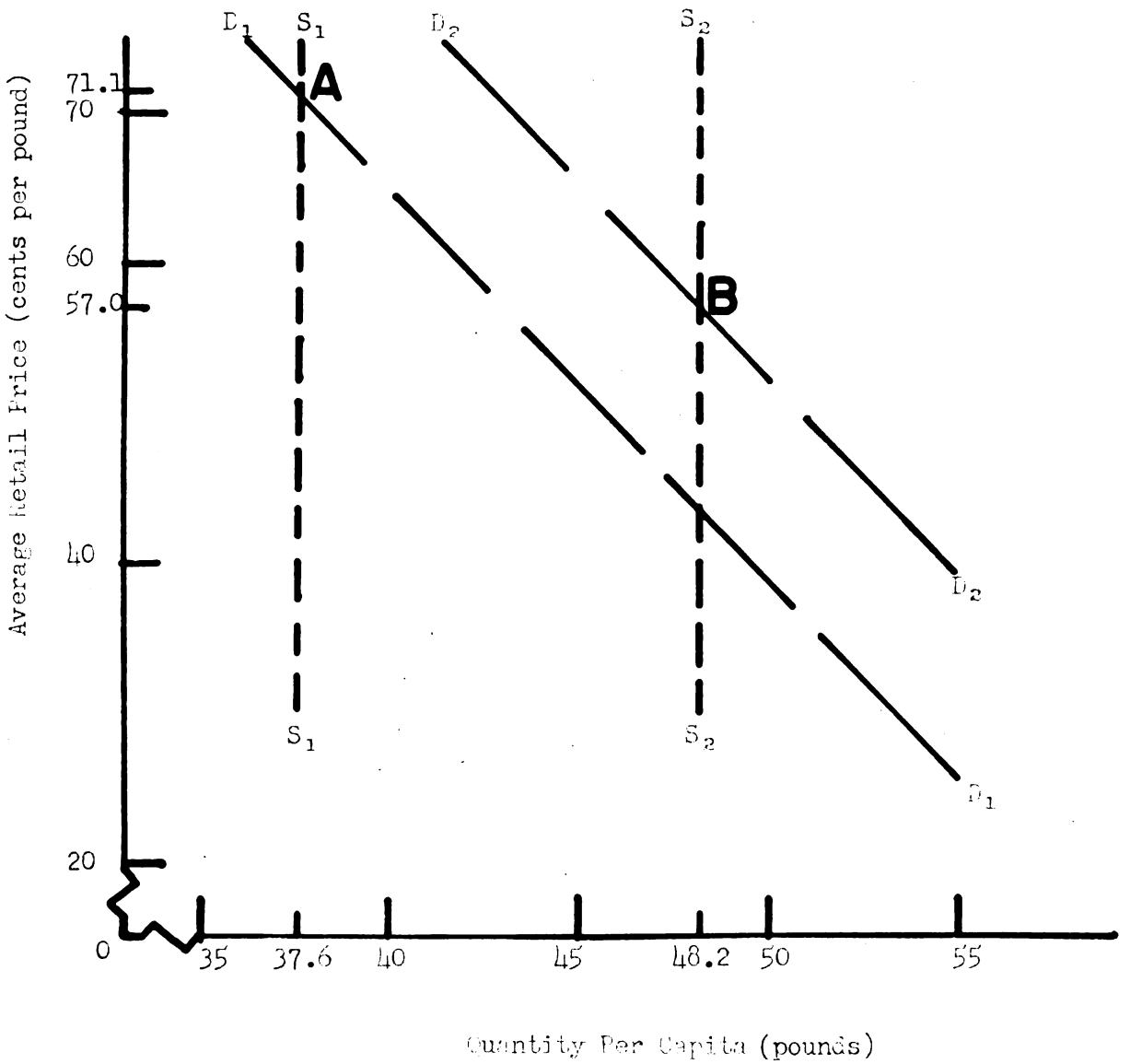

D1
S1
D2
S2
A
B
71.1
70
60
57.0
40
20
0
35
37.6
40
45
48.2
50
55
D2
D1
S1
S2
Average Retail Price (cents per pound)
Quantity Per Capita (pounds)

FIGURE 1.

the restriction that only those families be considered who were in the panel at least 40 weeks in both years. There were 138 families who met this requirement, but seven were eliminated due to a lack of information. The data for the remaining 131 families were then placed on summary cards especially designed for the study (See Appendix A).

The five family characteristics needed for the study, size of family, age and education of homemaker, per capita income and per family income were summarized for each family and placed at the top of the summary card. Information pertaining to the four cuts of beef and six of pork were obtained from panel records. Three measures of purchasing activity were considered, total quantity purchased, total expenditures, and the percent weeks bought. The quantity and expenditure figures were adjusted for all families who were in the panel less than 52 weeks in either year so that all purchase data was on an annual basis. Per capita quantity and expenditure figures for each family were then obtained by dividing the adjusted total figures by the number of persons in the family. In twelve instances the number of persons in the family was adjusted when a new child increased the family size during the period studied. Since children under two years of age have very little effect on the consumption of retail cuts of meat, it was felt that these adjustments were needed to insure reliable measures of per capita consumption.

The percent weeks bought figures were obtained by dividing the number of weeks any given item was purchased by the number of weeks the family participated in the panel. The remaining columns on the summary

card were used to indicate the changes that occurred in the three measures of activity between the two years. This data became the primary source of information for the analysis of consumer responsiveness to price changes.

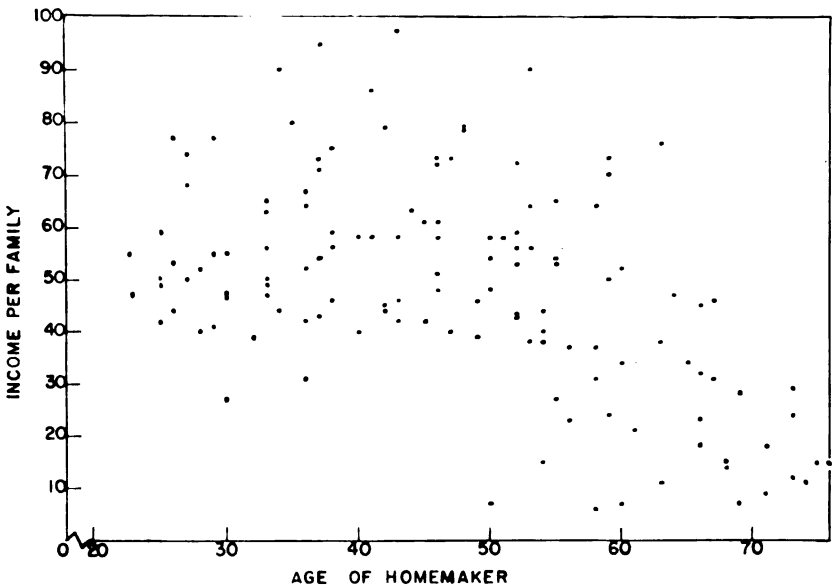
Interrelatedness of Family Characteristics

Interrelationships between family characteristics are an important consideration in studying the effects of these characteristics on responsiveness to price changes. They are important not only from the standpoint of correct interpretation of the results obtained from simple mean computations when families are grouped according to characteristics, but also in terms of formulating and evaluating the multiple regression results. The scatter diagrams in Figures 2 and 3 provide some indication as to the extent of interrelationships between characteristics.

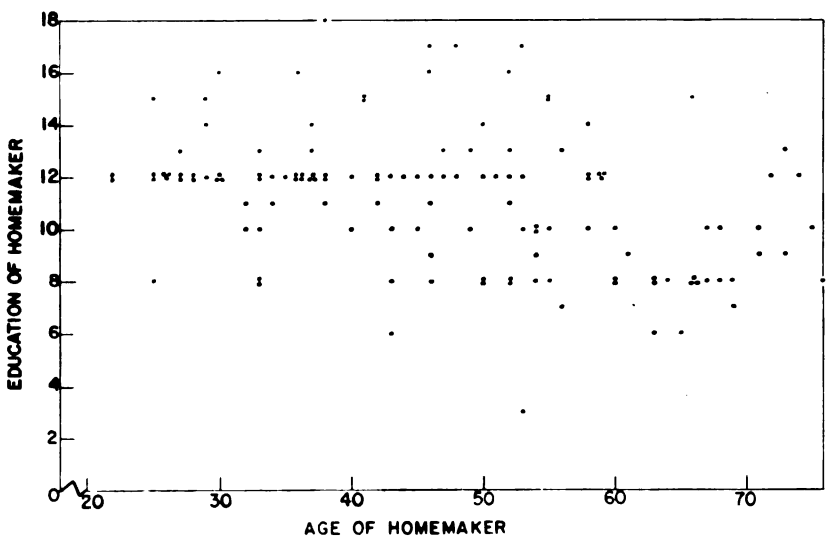
The scatter diagram for age of homemaker and family income shown in Figure 2, suggests that the level of income rises as age of homemaker increases from young to middle age, but in the older age range there is a definite tendency for incomes to decrease as age increases. Parts B and C of the same figure show that education of homemakers and size of family were negatively correlated with age. The size of families and age of homemakers were definitely correlated as a priori reasoning would have suggested.

When education and size of family were plotted against family incomes as in Figure 3, Parts A and B, there was general indication of a positive relationship. Education and size of family are shown in

A


INCOME PER FAMILY
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
AGE OF HOMEMAKER

B


EDUCATION OF HOMEMAKER
18
16
14
12
10
8
6
4
2
0
20
30
40
50
60
70
AGE OF HOMEMAKER

C

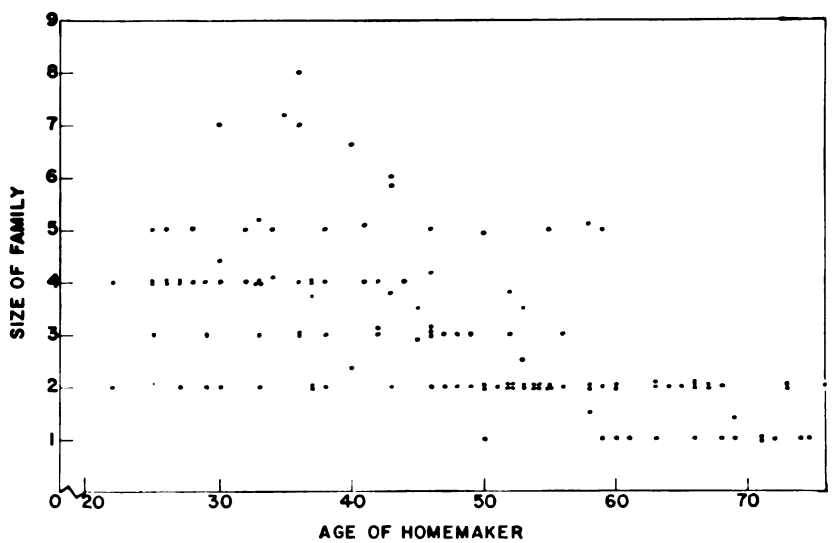
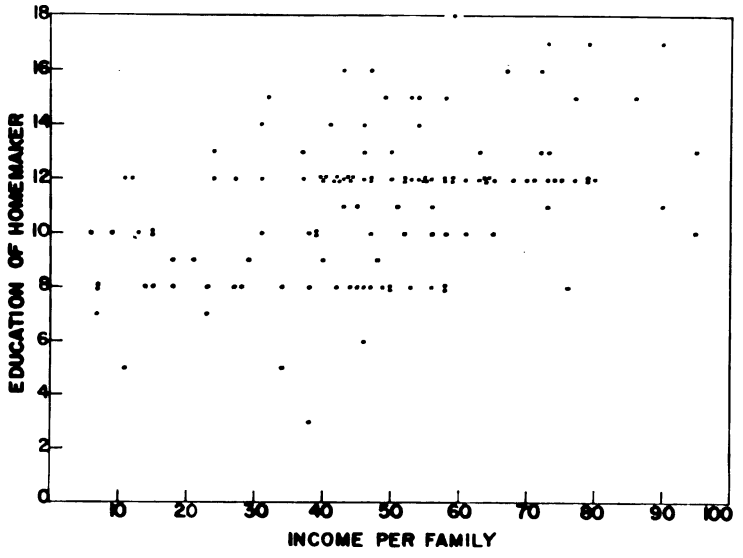

SIZE OF FAMILY
9
8
7
6
5
4
3
2
1
0
20
30
40
50
60
70
AGE OF HOMEMAKER

FIGURE 2.

A


EDUCATION OF HOMEMAKER
0
2
4
6
8
10
12
14
16
18
10
20
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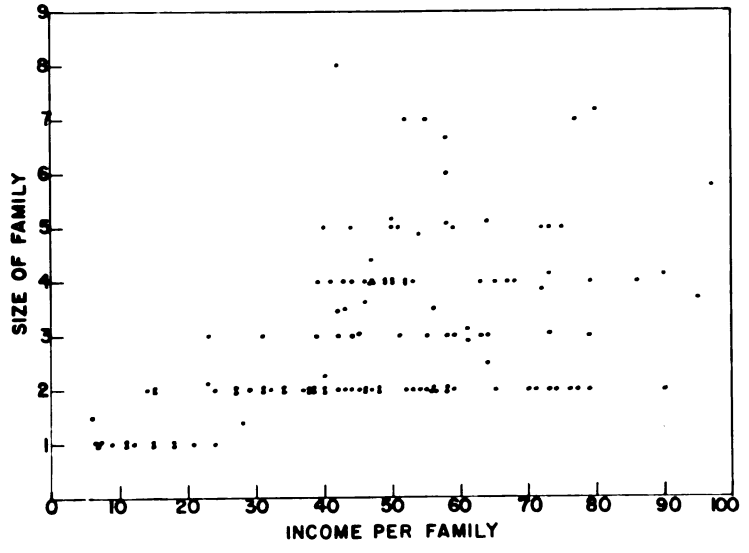
40
50
60
70
80
90
100
INCOME PER FAMILY

B


SIZE OF FAMILY
1
2
3
4
5
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9
0
10
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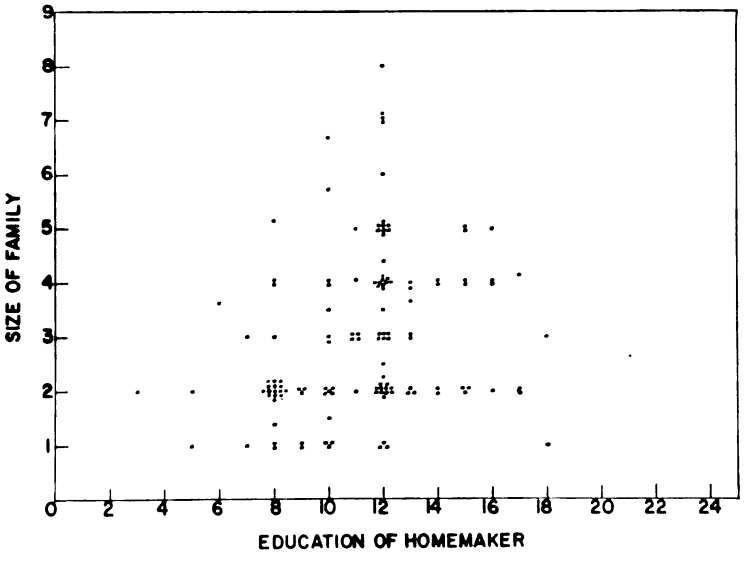
30
40
50
60
70
80
90
100
INCOME PER FAMILY

C


SIZE OF FAMILY
1
2
3
4
5
6
7
8
9
0
2
4
6
8
10
12
14
16
18
20
22
24
EDUCATION OF HOMEMAKER

Part C of Figure 2. This scatter gave little indication of relationships between these factors.

A more exact measure of the relationships between the family characteristics and the direction of this relationship were the coefficients of simple correlation. These comparisons are shown in Table IV. Marked interrelationships are particularly noted between family income when compared with size of family and age of homemaker.

TABLE IV

COEFFICIENTS OF SIMPLE CORRELATION BETWEEN FAMILY CHARACTERISTICS FOR 131 FAMILIES IN THE SUB-SAMPLE OF PANEL DATA, 1952-1953

Family Characteristics	Family Income	Age	Education
Family Income	--	-0.5016	0.4037
Age	-0.5016	--	-0.3602
Education	0.4037	-0.3602	--
Size	0.6398	-0.6133	0.3348

Methods of Analysis

The first procedure undertaken in the study was to sort the summary cards according to each family characteristic and compute the average changes in per capita quantity and expenditure for each group for each cut, as well as for total beef and total pork.[3] Changes in the percent of weeks bought were treated in a like manner for individual cuts to establish the effect of this measure on responsiveness.

[3] "Total beef and total pork" shall hereafter refer to the five beef cuts and six pork cuts used in the study unless otherwise noted.

The family characteristics included in this part of the analysis were per capita income, per family income, family size, age and education of the homemaker. The means computed were tested for significance by use of the Student "t" test.[4]

The 90 percent confidence limits were used throughout these tests as a basis for accepting or rejecting the various hypotheses. The principal reason for using this level of significance was an arbitrary decision that narrower confidence limits might reject hypotheses that were actually true.

A similar procedure as that described above was followed when families were grouped according to changes in per capita consumption or expenditure for beef and pork cuts. This method was designed to indicate the average level of each family characteristic associated with three groups of families sorted according to the degree of price responsiveness. In each case, the class limits determining the middle group of essentially no response was arbitrarily chosen by placing a similar number of families in all three groups. Both analyses used 1953 income figures when income was the characteristic examined. Since the distribution of income remained quite stable, choice of the income period would have little effect on the results of these analyses.

Multiple regression analysis makes it possible to determine the extent to which any given variable influences the predicted variable while other variables are being held constant at some known level.

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[4] Frederick E. Croxton and Dudley J. Cowden, Applied General Statistics, Prentice-Hall, Inc., New York, N. Y., 1949, Chapter 12.

In this study it was possible to estimate the expected response of groups of families when all of the family characteristics were considered in one equation. The intercorrelation between the family characteristics suggested that mean changes in purchases for families grouped according to one characteristic may lead to erroneous conclusions. The limited number of families prevented a more complete cross-classification of family characteristics to compare mean changes in consumption adjustments where several factors are considered. Therefore, regression analysis was used to provide useful indications of the net relationship between changes in consumption and each family characteristic. Since individual families were used as the unit of observation, the usual levels of significance were relaxed because primary concern here was predicted behavior of groups of families. A priori reasoning suggested that the relationships between the independent variables and price responsiveness were not linear in actual values. Therefore, a semi-logarithmic function was chosen for expressing these relationships. The slope of the regression line resulting from this function assumes that larger proportionate differences in responsiveness occur at lower levels for the factors considered.[5]

Four characteristics were used in the regression equation, per capita income being the factor omitted. The general form of the equation used was as follows:

$$X_1 = a + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5.$$

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[5] Mordecai Ezekiel, Methods of Correlation Analysis, John Wiley and Sons, Inc., New York, N. Y., Second Edition, 1947, pp. 75-83.

where X_1 = changes in level of consumption

X_2 = family income, 1953

X_3 = age of homemaker

X_4 = education of homemaker

X_5 = size of family

This equation assumes a linear relationship between the independent variables expressed in logarithms and the dependent variable in actual numbers.

It remains to be pointed out that the methods of analysis used in the study are not designed to give precise measurements of the structural relationships for individual family demand. The testing of means for family groups indicated that there was wide variability about the average level of responsiveness within each group. It was also found that the standard errors of the regression coefficients were quite large in equations where changes in individual family purchases were related to the measures of family characteristics. In spite of the lack of precision in estimating individual family behavior the analysis may provide estimates that are useful in predicting behavior for groups of families.

CHAPTER III

CHANGES IN BEEF PURCHASES BETWEEN 1952 AND 1953 RELATED TO FAMILY CHARACTERISTICS

Introduction

The intent of this chapter is to provide some measures of differences in consumer responsiveness to changes in beef prices. More specifically, it is an attempt to provide a more objective measure of the direct or indirect effects of family characteristics on consumer responsiveness to price changes.

The results of three types of analyses will be presented. The three types of analyses are: 1) sorting the families according to traits and computing simple averages of response measures; 2) sorting families according to the changes in consumption of the various meat items to obtain the average level of each family characteristic associated with different degrees of consumption change; and 3) multiple regression analysis showing the net relationship between responsiveness of families to price changes and family characteristics.

Due to the interrelationships that exist between family characteristics, it is doubtful that the results from the first two methods of analysis will yield true measures of the impact that any one characteristic may have upon the structure of demand by groups of families. Since further cross classifications of families where two or more characteristics are considered simultaneously is restricted by the limited number of families in the study, the net relationships between

variables were estimated by multiple regression analysis. However, the results obtained from the first two procedures are useful. They are helpful in understanding the nature of the data as well as in facilitating the interpretation of more complete methods of analysis.

Results From Sorting Families Into Groups According to Family Characteristics

General Comments

When this approach was used, families were sorted into three or more groups, once for each of the five characteristics, size of family, age of homemaker, education of homemaker, per capita income and per family income. The mean changes in three measures of consumer purchasing activity that occurred between the two years 1952 and 1953 were then computed. These measures included the change in percent weeks bought, change in per capita quantity purchased, and changes in per capita expenditures.

Age of Homemaker

Table V presents the mean changes in the three measures of purchasing activity considered when families were sorted according to age of the homemaker. This table is divided into three sections. Part A deals with the mean changes in percent weeks bought for each item and each group of families. Parts B and C deal in a like manner with changes in per capita quantity and per capita expenditure.

The change in percent weeks bought did not appear to be a factor closely related to the age of homemakers. None of the means tested for

TABLE V

AVERAGE CHANGES IN SELECTED MEASURES OF BEEF PURCHASES BETWEEN 1952 AND 1953 FOR FAMILIES GROUPED ACCORDING TO AGE OF HOMEMAKER[a]

Family Age Group[b]	Retail Cut				
	Hamburger	Roasts	Steaks	Stewing and Boiling Beef	Total Beef (4 Cuts)
	A. Change in Percent Weeks Bought[c]				
35 Years and under	-.79	6.40	6.19	1.10	
36-50 Years	-.28	7.80	11.90	- .38	
51 Years and over	.09	6.80	11.26	.98	
	B. Change in Per Capita Quantity (pounds per year)				
35 Years and under	2.08	3.43	2.56	.67	8.74
36-50 Years	.93	5.31	6.17	.24	12.64
51 Years and over	1.00	6.98	5.95	1.27	15.20
	C. Change in Per Capita Expenditure (dollars per year)				
35 Years and under	-1.40	.28	.98	-.06	-.20
36-50 Years	-1.53	1.35	3.42	-.03	3.21
51 Years and over	-1.83	1.27	3.64	.03	3.10

[a]The number of families in each age group are as follows: Age 35 and under, 32; 36-50, 45; 51 and over, 54.

[b]Tests of significance for comparisons between group means are shown in Appendix B, Part I.

[c]These figures indicate the actual change in percent weeks bought from 1952 to 1953 for the various cuts.

this classification were significant. It is interesting to note, however, that all three groups of families made sizeable increases in the percent weeks bought for roasts and steaks.

Significant differences between groups for changes in the quantities purchased and per capita expenditures for total beef indicated that older homemakers were definitely more responsive to price changes.[1] Most of the variation between groups for total beef purchases was attributable to roasts and steaks.

For roasts, the older homemakers were more responsive to price changes than were those in the age group of 35 and under.

The middle aged group of homemakers was found to be the most responsive to changes in the price of beef steaks. However, older homemakers were found to be somewhat more responsive than were young homemakers.

The pattern of changes in total expenditures for beef indicated the same general tendency as for the quantity purchased, the older group of homemakers being most responsive. The same pattern of differences were especially noted in steak expenditures where younger housewives showed less responsiveness than either of the other two groups. A similar trend was noted for roasts but could not be established by statistical tests.

Since estimates of price elasticities for beef have indicated that the demand for roasts and steaks is fairly elastic, it seemed logical

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[1] "Significant differences" as used herein pertains to the 10 percent level unless otherwise noted.

to expect that consumer responsiveness to price changes should be largest for these cuts, which was the case. On the basis of differences in price reaction to these cuts it appears that there is a relationship between age of homemaker and the response to changes in beef prices. This analysis indicated that the older homemakers were most responsive to beef price changes.

Education of Homemaker

All three of the measures of consumer purchasing activity indicated that the educational level of homemakers is related to price responsiveness for beef. These relationships are shown in Table VI.

The average changes in percent weeks bought generally indicated that families with homemakers having from 9-11 years of formal education made the greatest change in frequency of beef purchases. For hamburger, this group did not test significantly different from any of the others, but it was established to have made a greater change in frequency of roast purchases than did homemakers with more than high school training.

Several groups were found to differ from each other in terms of the change in per capita quantity of total beef purchased. Families whose homemaker had from 9-11 years education were significantly more responsive to declining beef prices than were any of the other educational groupings. This was particularly true when they were compared with homemakers subjected to college training. The fact that homemakers with 8 years and less education did not test different from the 9-11 year classification probably further indicates that price responsiveness normally decreases as the level of education increases.

TABLE VI

AVERAGE CHANGES IN SELECTED MEASURES OF BEEF PURCHASES BETWEEN 1952-1953 FOR FAMILIES GROUPED ACCORDING TO EDUCATION OF HOMEMAKER[a]

Family Education Group[b]	Retail Cut: Hamburger	Roasts	Steaks	Stewing and Boiling Beef	Total Beef (4 Cuts)
	A. Change in Percent Weeks Bought				
8 years or less	- .59	5.81	8.21	1.08	
9-11 years	2.01	10.00	14.79	.86	
12 years	1.13	7.32	9.91	.28	
13 years or more	-4.14	4.35	7.33	.87	
	B. Change in Per Capita Quantity (pounds per year)				
8 years or less	.96	6.43	5.35	1.39	14.14
9-11 years	1.79	8.09	8.36	1.20	19.44
12 years	2.61	4.39	4.52	.03	11.54
13 years or more	- .94	3.79	3.55	.45	6.85
	C. Change in Per Capita Expenditure (dollars per year)				
8 years or less	-1.61	1.43	2.76	- .04	2.54
9-11 years	-1.07	3.12	4.69	.26	6.99
12 years	-1.16	.05	2.45	- .20	1.14
13 years or more	-2.79	- .05	1.68	.04	-1.12

[a]The number of families in each education group was as follows: Education of 8 years or less, 29; 9-11 years, 29; 12 years, 46; 13 years or more, 27.

[b]Tests of significance for comparisons between group means are shown in Appendix B, Part I.

The individual cuts most influential to the general trend in beef purchases again seemed to be roasts and steaks. While none of the means were significant for roasts, tests indicated the same pattern of variation between groups for hamburger and steaks as for total beef. The quantity responsiveness for stewing and boiling beef denoted significantly larger changes for homemakers with the least education when compared with homemakers completing high school.

The mean changes in per capita expenditures for all beef were generally in agreement with the results found for changes in total per capita quantity. Roasts and steaks were the only cuts showing significantly different levels of expenditures for education groups. The 9-11 year education group generally made greater changes than groups with higher levels of education.

There appear to be important differences in the price responsiveness of families when classified according to education of the homemaker. It was generally found that as education increased, responsiveness decreased. These differences seem to be most pronounced between the high school groups and those with higher levels of education.[2]

Size of Family

Size of family was found to have significant relationships with the changes made in percent weeks bought and per capita quantity. Some

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[2] Families with homemakers having 9-11 years of formal education were significantly different from homemakers with 13 or more years of education at the one percent level for both per capita quantity and expenditure changes in total beef.

significant differences between groups of families were also noted in the per capita expenditure patterns for beef.

The largest increases in percent weeks bought for roasts were made by families with two persons. This group increased their frequency of roast purchases more than single member households and somewhat more than families with five or more persons. The two person families were also significantly different from families with five persons or more in their frequency of purchases for stewing and boiling beef. Families with five or more persons actually decreased the frequency of purchase for this cut.

Per capita quantity changes for beef indicated that the most responsive groups were families with two persons and that this group differed significantly from families with five or more members. In general, two person families made greater per capita changes in roast purchases than did either of the other larger family size groups. A large increase in purchases of beef steaks, observed for single person families was not found to be significant when compared with other groups, but three and four person families were more responsive than were those having five or more persons in the family. The largest sized families reacted more to prices for hamburger than did small sized families. This situation was reversed for stewing and boiling beef, where smaller families were the most responsive.

Some heterogeneity was noted between groups of families in their per capita expenditure patterns for beef. Expenditure changes differed between the two large family size groups for steaks and total beef.

TABLE VII

AVERAGE CHANGES IN SELECTED MEASURES OF BEEF PURCHASES BETWEEN 1952 AND 1953 FOR FAMILIES GROUPED ACCORDING TO SIZE OF FAMILY[a]

Family Size Group	Retail Cut				
	Hamburger	Roasts	Steaks	Stewing and Boiling Beef	Total Beef (4 Cuts)
	A. Change in Percent Weeks Bought				
1 person	- .07	4.00	11.08	.24	
2 persons	-1.15	7.87	8.73	.61	
3 or 4 persons	-1.51	7.43	11.89	.51	
5 or more persons	-1.25	6.27	9.74	-1.37	
	B. Change in Per Capita Quantity (pounds per year)				
1 person	- .47	5.11	7.29	1.60	13.52
2 persons	1.39	8.01	4.89	1.11	15.40
3 or 4 persons	1.18	4.42	6.38	.52	12.50
5 or more persons	2.22	2.28	2.74	- .13	7.11
	C. Change in Per Capita Expenditure (dollars per year)				
1 person	-2.29	1.36	4.17	.08	3.32
2 persons	-1.85	1.80	2.45	.02	2.42
3 or 4 persons	-1.21	.51	3.59	.01	2.90
5 or more persons	-1.25	.25	1.28	- .23	.05

[a]The number of families in each family size group was as follows: family size 1, 14; 2 persons, 50; 3 or 4 persons, 47; 5 or more persons, 20.

[b]Tests of significance for comparisons between group means are shown in Appendix B, Part I.

Significant differences were also observed between the smallest and largest sized families for total beef.

Per Family Income

The sorting of families according to per family income and computation of mean changes in consumer responses to price changes indicated that this trait was not a good measure for indicating differences between consumer groups in their reaction to price changes. Stewing and boiling beef was the only item where the degree of response showed some relation to family income level. In this case the medium income families were slightly more responsive than the low income families.

Judging from any trends that might be shown in the data for other cuts, it would appear that there may have been some tendency for lower income families to make greater changes in their beef purchases than did the higher income groups. However, due to the wide variations about these means, this relationship was not statistically significant.

Per Capita Income

Per capita income proved to be better family trait to indicate differences in consumer responsiveness than did per family income. The quantity and expenditure changes for beef indicated that families with high and medium per capita incomes are generally more responsive to price changes for beef than the high income group. However, the medium and low income groups were the only group comparisons testing significantly different from each other.

TABLE VIII

AVERAGE CHANGES IN SELECTED MEASURES OF BEEF PURCHASES BETWEEN 1952 AND 1953 FOR FAMILIES GROUPED ACCORDING TO PER FAMILY INCOME, 1953[a]

Family Income Group[b]	Retail Cut				
	Hamburger	Roasts	Steaks	Stewing and Boiling Beef	Total Beef (4 Cuts)
		A. Change in Percent Weeks Bought			
$5,000 and over	- .27	6.82	8.54	- .26	
$4,001-$4,999	-2.19	8.36	11.09	1.92	
$4,000 and under	.58	6.28	11.71	.78	
		B. Change in Per Capita Quantity (pounds per year)			
$5,000 and over	1.74	4.78	4.58	.49	11.59
$4,001-$4,999	.25	7.78	4.07	1.18	13.28
$4,000 and under	1.12	5.22	7.39	.92	14.64
		C. Change in Per Capita Expenditure (dollars per year)			
$5,000 and over	-1.00	.70	2.20	- .08	1.83
$4,001-$4,999	-2.46	1.88	2.21	.12	1.75
$4,000 and under	1.88	1.05	4.29	- .01	3.46

[a]The number of families in each income group was as follows: per family income $5,000 and over, 63; $4,001-$4,999, 27; $4,000 and under, 41.

[b]Tests of significance for comparisons between group means are shown in Appendix B, Part I.

TABLE IX

AVERAGE CHANGES IN SELECTED MEASURES OF BEEF PURCHASES BETWEEN 1952 AND 1953 FOR FAMILIES GROUPED ACCORDING TO PER CAPITA INCOME, 1953[a]

Family Income Group[b]	Retail Cut				
	Hamburger	Roasts	Steaks	Stewing and Boiling Beef	Total Beef (4 Cuts)
	A. Change in Percent Weeks Bought				
$1,801 and over	- .11	6.73	8.07	.74	
$1,250-$1,800	- .32	8.61	12.69	- .22	
$1,249 and under	-1.44	6.95	9.99	1.03	
	B. Change in Per Capita Quantity (pounds per year)				
$1,801 and over	1.21	7.45	5.43	1.00	15.09
$1,250-$1,800	1.58	5.36	6.81	.57	14.32
$1,249 and under	.94	3.16	3.79	.63	8.52
	C. Change in Per Capita Expenditure (dollars per year)				
$1,800 and over	-1.72	1.60	2.58	.03	2.48
$1,250-$1,800	-1.31	1.53	3.96	- .06	4.12
$1,249 and under	-1.65	- .15	2.13	- .02	.30

[a]The number of families in each income group was as follows: per family income $1,249 and under, 53; $1,250-$1,800, 39; $1,801 and over, 39.

[b]Tests of significance for comparisons between group means are shown in Appendix B, Part I.

The mean changes in per capita quantity of roasts indicated that the higher per capita income class was most responsive to price changes for this cut. Other trends observed in per capita quantity and expenditure measures of group differences could not be established at the chosen level of significance.

Families Grouped by Degree of Change in Purchases

General Comments

To further delineate consumer responsiveness to price changes associated with family characteristics, an alternative to the original hypothesis was tested when families were grouped by the degree of change in purchases. This alternative hypothesis suggested that families be sorted into three levels of quantity or expenditure change for each cut and that averages be computed for the family characteristics at each of the three levels. This was done arbitrarily by arraying the 131 families by degree of change in purchases and then dividing them into three groups of approximately equal number. The families in Group 1 are those families who made the greatest response to price changes, while many of those in Group 3 made unexpected decreases in their consumption levels. The middle group tends to be concentrated around little or no response, but in some cases may include families who made sizeable increases in purchases, depending on the variability of changes made by all 131 families in the particular sort.

Within each response group the means were computed for each family characteristic. In computing these means the measures for average size

of family, and age and education of homemaker were based on class intervals (See Tables X, XI and XII). Means for income levels were based on actual income rather than a class interval measure.

Age of Homemaker

Table X shows the average age of homemaker for three family groupings based on their responsiveness to price changes. This table is quite similar with those of the previous section except that the group comparisons are shown horizontally rather than vertically. A total of ten different quantity and expenditure factors were used in comparing the groups of families.

Substantial differences were noted in the average age of homemakers among families grouped by the degree of change in total beef purchases. These differences were noted for both the quantity and the expenditure measure of change. These measures indicated that Group 1 families were significantly older than Group 2 families. This difference was highly significant for the per capita expenditure measure.[3] In both cases, Group 3 homemakers were slightly older than those in Group 2, but this difference was not significant.

The age patterns corresponding to the quantity and expenditure changes for individual cuts followed quite closely that for total beef. The one exception to this rule was noted in hamburger purchases. The per capita quantity changes for hamburger indicated that Group 1 homemakers were generally younger homemakers than those in the other groups.

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[3] Significant at the one percent level.

TABLE X

AVERAGE AGE OF HOMEMAKER FOR FAMILIES GROUPED ACCORDING TO THE DEGREE OF CHANGE IN SELECTED MEASURES OF BEEF PURCHASES FROM 1952 TO 1953[a]

Retail Cut and Measure of Change	Degree of Change in Consumption[b]			Class Limits for Group 2
	Group 1	Group 2	Group 3	
Hamburger				
Per capita quantity	3.27	3.63	4.07	+ 3.20 to - .75 lbs.
Per capita expenditure	3.30	3.98	3.71	-$0.25 to -$2.30
Roasts				
Per capita quantity	3.96	3.40	3.61	+ 6.25 to + .50 lbs.
Per capita expenditure	3.96	3.30	3.70	+$2.00 to -$0.75
Steaks				
Per capita quantity	3.89	3.54	3.55	+ 6.40 to + 1.10 lbs.
Per capita expenditure	3.80	3.56	3.61	+$3.40 to +$0.20
Stewing and Boiling Beef				
Per capita quantity	3.75	3.33	3.86	+ .75 to - .14 lbs.
Per capita expenditure	3.82	3.28	3.86	+$0.10 to -$0.86
Total Beef (4 Cuts)				
Per capita quantity	3.98	3.37	3.61	+16.70 to +4.80 lbs.
Per capita expenditure	4.05	3.12	3.80	+$4.70 to -$1.55

[a]The number of families in each age group was as follows: age 25 years and under, 6; 26-35 years, 27; 36-45 years, 27; 46-55 years, 35; 56-65 years, 18; 66 years and over, 18.

[b]Results for tests of significance between means are shown in Appendix B, Part I.

This group differed significantly in age from the Group 3 families who decreased hamburger consumption. The expenditure pattern for this cut indicated that the Group 2 families were the older homemakers, but these families did not test significantly different in age from the other groups.

For roasts and steaks, the average age of homemakers appeared to be highest in Group 1 families. This group tested significantly different from homemakers in Group 2 for roasts, but was not significantly different in age from other groups of families purchasing steaks. The per capita expenditure responses for stewing and boiling beef indicated that significant differences in age exists between family Groups 2 and 3. This difference suggested that older families are less responsive in the per capita quantity changes for stewing and boiling beef.

From the evidence shown above, it appears that age is associated with group responsiveness to beef price changes. It was generally found that older homemakers made the largest changes in their beef purchase patterns.

Education of Homemaker

Considerable differences were observed in the education levels of homemakers associated with different degrees of change in consumption (Table XI). It was found that the education level of homemakers was significantly higher for Group 2 families than for those families in Group 1 when compared on the basis of changes in quantity and expenditure for total beef.[4] The individual cuts contributing the most to

[4] Significant at the one percent level.

TABLE XI

AVERAGE EDUCATION OF HOMEMAKER FOR FAMILIES GROUPED ACCORDING TO THE DEGREE OF CHANGE IN SELECTED MEASURES OF BEEF PURCHASES FROM 1952 TO 1953[a]

Retail Cut and Measure of Change	Degree of Change in Consumption[b]			Class Limits for Group 2
	Group 1	Group 2	Group 3	
Hamburger				
Per capita quantity	2.50	2.51	2.61	+ 3.20 to - .75 lbs.
Per capita expenditure	2.64	2.33	2.66	-$0.25 to -$2.30
Roasts				
Per capita quantity	2.23	2.98	2.43	+6.25 to + .50 lbs.
Per capita expenditure	2.32	2.84	2.48	+$2.00 to -$0.75
Steaks				
Per capita quantity	2.39	2.70	2.55	+6.40 to + 1.10 lbs.
Per capita expenditure	2.39	2.77	2.48	+$3.40 to +$0.20
Stewing and Boiling Beef				
Per capita quantity	2.41	2.72	2.50	+ .75 to - .14 lbs.
Per capita expenditure	2.46	2.72	2.46	+$0.10 to -$0.86
Total Beef (4 Cuts)				
Per capita quantity	2.20	2.88	2.55	+16.70 to 4.80 lbs.
Per capita expenditure	2.23	2.88	2.52	+$4.70 to -$1.55

[a] The number of families in each education group was as follows: education of 8 years or less, 29; 9-11 years, 29; 12 years, 46; 13 years or more, 27.

[b] Results for tests of significance between means are shown in Appendix B, Part I.

this general pattern in total beef purchases were roasts and steaks.

Lower levels of education were noted for the families most responsive to price changes for beef roasts, while higher educations generally predominated among Group 2 families who made little or no increase in the per capita quantity of roasts purchased. The Group 2 families had significantly higher educations than either of the other two groups.[5] The Group 2 families for per capita expenditure changes in roast purchases were also found to have better educated homemakers than Group 1 families.

The conclusions reached by this method seem to be in substantial agreement with the findings when families were sorted by education levels and the mean changes in consumption adjustment computed. Both procedures indicated high levels of significance between family groups, with less response being noted as education increased. This method was particularly good in pointing out the stability of purchase patterns for the more highly educated families.

Size of Family

In this method of analysis, size of family was somewhat more related to beef purchase changes than was found in the previous method where families were first grouped according to size. Highly significant differences were found between the larger sized families of Group 1 and the tendency observed for smaller sized families to be prevalent in Group 2 for both measures of change in total beef purchases.[6]

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[5] Significant at the one percent level.

[6] Idem.

TABLE XII

AVERAGE SIZE OF FAMILY FOR FAMILIES GROUPED ACCORDING TO THE DEGREE OF CHANGE IN SELECTED MEASURES OF CONSUMPTION FROM 1952 TO 1953[a]

Retail Cut and Measure of Change	Degree of Change in Consumption[b]			Class Limits for Group 2
	Group 1	Group 2	Group 3	
Hamburger				
Per capita quantity	2.59	2.74	2.30	+ 3.20 to - .75 lbs.
Per capita expenditure	2.52	2.70	2.48	-$0.25 to -$2.30
Roasts				
Per capita quantity	2.32	2.84	2.48	+ 6.25 to + .50 lbs.
Per capita expenditure	2.39	2.72	2.52	+$2.00 to -$0.75
Steaks				
Per capita quantity	2.48	2.70	2.46	+ 6.40 to + 1.10 lbs.
Per capita expenditure	2.46	2.70	2.48	+$3.40 to +$0.20
Stewing and Boiling Beef				
Per capita quantity	2.41	2.70	2.52	+ .75 to - .14 lbs.
Per capita expenditure	2.34	2.84	2.46	+$0.10 to -$0.86
Total Beef (4 Cuts)				
Per capita quantity	2.27	2.84	2.52	+16.70 to 4.80 lbs.
Per capita expenditure	2.36	2.84	2.43	+$4.70 to -$1.55

[a] The number of families in each size group were as follows: family size 1, 14; 2 persons, 50; 3 or 4 persons, 47; 5 or more persons, 20.

[b] Results for tests of significance between means are shown in Appendix B, Part I.

The differences in size of family observed in per capita quantity changes for individual cuts were most pronounced for hamburger and roasts. For roasts, Group 2 was definitely noted to have more large sized families than did Group 1.[7] For hamburger, the relationships between Group 2 families and Group 3 families were somewhat less pronounced. Roasts and stewing and boiling beef were the cuts where differences in family size associated with the per capita expenditure measures were most noticeable. Group 1 in the per capita expenditure measure of responsiveness for stewing and boiling beef indicated that Group 2 families were definitely larger families than were those in Group 1.[8] The general trend for the other cuts was for larger size families to be more stable.

The families in Group 2 who made little or no response in the quantity of hamburger purchased were larger than the Group 3 families. Larger size families again dominated Group 2 for quantity changes in roasts. The families in this group were significantly larger than families stepping up their roast purchases.[9] Tests also indicated that the Group 2 families, as a general rule, would be larger than Group 3 families who decreased the quantity of beef purchased between 1952 and 1953.

Changes in per capita expenditures for roasts showed the same general pattern for size of family as for quantity changes, but were

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[7] Significant at the one percent level.

[8] Idem.

[9] Idem.

less significant. Size of family was highly significant in explaining differences between families increasing expenditures for stewing and boiling beef and the families of Group 2 who made little or no changes expenditures for the cut. Some deviation was noted between the Group 2 and Group 3 families in the expenditure changes for the cut. These tendencies apparently indicate that larger families shifted away from this cut somewhat and probably paid less for these purchases than did other groups.

Per Family Income

Some differences were noted between the different consumption groups when per family income was used as a factor for comparison. The higher incomes for the non-responsive families were significant for the total quantity changes of beef when this group was compared with Group 1. Changes in expenditures for beef showed that Group 2 families had significantly higher incomes than either of the other two response groups.[10]

Differences in income between groups of families were noted for only one cut of beef. Group 1 families making increased expenditures for hamburger had somewhat larger incomes than did Group 2. The situation was quite different for per capita quantity measures of roast purchases. Here, the less responsive families tended to have higher incomes and were different from either of the other two groups, particularly the negative respondents.[11]

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[10] Significant at the one percent level.

[11] Idem.

TABLE XIII

AVERAGE PER FAMILY INCOME IN 1953 FOR FAMILIES GROUPED ACCORDING TO THE DEGREE OF CHANGE IN SELECTED MEASURES OF CONSUMPTION FROM 1952 TO 1953

Retail Cut and Measure of Change	Degree of Change in Consumption[a]			Class Limits for Group 2
	Group 1	Group 2	Group 3	
Hamburger				
Per capita quantity	$4977.30	$4967.40	$4531.80	+ 3.20 to - .75 lbs.
Per capita expenditure	5318.20	4495.30	4652.30	-$0.25 to -$2.30
Roasts				
Per capita quantity	4656.80	5597.70	4236.40	+ 6.25 to + .50 lbs.
Per capita expenditure	4661.40	5186.00	4634.10	+$2.00 to -$0.75
Steaks				
Per capita quantity	4829.50	5062.80	4586.40	+ 6.40 to + 1.10 lbs.
Per capita expenditure	4938.60	4834.90	4700.00	+$3.40 to +$0.20
Stewing and Boiling Beef				
Per capita quantity	4579.50	5181.40	4720.50	+ .75 to - .14 lbs.
Per capita expenditure	4629.50	5258.10	4595.50	+$0.10 to -$0.86
Total Beef (4 Cuts)				
Per capita quantity	4386.40	5362.70	4736.40	+16.70 to 4.80 lbs.
Per capita expenditure	4377.30	5662.80	4452.30	+$4.70 to -$1.55

[a] Results for tests of significance between means are shown in Appendix B, Part I.

TABLE XIV

AVERAGE PER CAPITA INCOME IN 1953 FOR FAMILIES GROUPED ACCORDING TO THE DEGREE OF CHANGE IN SELECTED MEASURES OF CONSUMPTION FROM 1952 TO 1953

Retail Cut and Measure of Change	Degree of Change in Consumption[a]			Class limits for Group 2
	Group 1	Group 2	Group 3	
Hamburger				
Per capita quantity	$1791.59	$1970.70	$1791.14	+ 3.20 to -.75 lbs.
Per capita expenditure	2017.50	1665.35	1863.64	-$0.25 to -$2.30
Roasts				
Per capita quantity	1917.95	2032.09	1604.77	+ 6.25 to +.50 lbs.
Per capita expenditure	1992.73	1752.79	1802.95	+$2.00 to -$0.75
Steaks				
Per capita quantity	1880.23	1853.02	1817.50	+ 6.40 to +1.10 lbs.
Per capita expenditure	1915.45	1778.14	1855.45	+$3.40 to +$0.20
Stewing and Boiling Beef				
Per capita quantity	1886.59	1930.70	1735.23	+ .75 to - .14 lbs.
Per capita expenditure	1862.95	1932.09	1757.50	+$0.10 to -$0.86
Total Beef (4 Cuts)				
Per capita quantity	1845.45	1930.47	1776.59	+16.70 to 4.80 lbs.
Per capita expenditure	1805.68	1930.23	1816.59	+$4.70 to -$1.55

[a] Results for tests of significance between means are shown in Appendix B, Part I.

Per Capita Income

When families were grouped according to family characteristics it was found that per capita income was a more important factor related to consumption changes than per family income. This was not found to be the case for the present method of sorting by changes in beef purchases. Changes in the quantity of roasts purchased was the only factor for which different groups exhibited any noteworthy variation in per capita incomes. The less-responsive group had larger incomes than Group 3 families.

Results from Regression Analysis

Four family characteristics were used in a series of multiple regression equations to determine the effects of these characteristics on consumer responsiveness to meat price changes. The information for all 131 families was fitted to measures of changes in per capita quantity and per capita expenditure for each of the individual cuts of beef and for total beef. The four independent variables for the equations were: per family income (X_1); age of homemaker (X_2); education of homemaker (X_3); and size of family (X_4). This equation was used to show the net relationship between family characteristics and the price responsiveness for the 131 individual family observations.

When the necessary computations were made, the equation representing the effect of family characteristics on the total quantity of beef was as follows:

$$\text{Change in Quantity } (Y_1) = 13.3817 + \underset{(6.8643)}{9.8748} \log X_1 + \underset{(12.0923)}{6.7077} \log X_2 - \underset{(12.2988)}{14.2686} \log X_3 - \underset{(8.3782)}{13.7574} \log X_4 \qquad (1)$$

$$R = .2312$$

The average change in per capita quantity that was predicted for total beef was close to 13 pounds. The average per family income associated with this response was $4,240, age of homemaker, 44.8 years, education 10.8 years, and size of family 2.7 persons.

These results give some evidence that perhaps two family traits, family incomes and size of family, affect consumer response to price changes for beef. The standard errors of the regression, indicated in parentheses below each regression coefficient, show that the level of significance for income and size of family approach 10 percent. The standard errors on the coefficients for age and education of the homemaker were quite large, indicating that the varied pattern of responsiveness for individual families would not give a good prediction of the effect of these characteristics on average responsiveness for a large group of families.

While the multiple correlation coefficients (R) are generally quite low throughout the study, it is maintained that these coefficients are an evaluation of the usefulness of the equations for predicting individual family behavior. Since the primary interest of this study was oriented toward predicting group action, this measure should not be evaluated by the usual criteria.

The equation for changes in expenditure for total beef was suggestive of similar patterns of response as that for total quantity measures. This equation was as follows:

$$\text{Change in Expenditure } (Y_2) = 6.7723 + \underset{(4.3381)}{2.4247} \log X_1 + \underset{(7.6409)}{4.5700} \log X_2 \qquad (2)$$

$$- \underset{(7.7713)}{5.9088} \log X_3 - \underset{(5.2942)}{2.6739} \log X_4$$

$$R = .1556$$

The results from this equation were in agreement with the results obtained in Equation 1 for per capita quantity changes in total beef. Family income and age of homemaker both tended to increase group expenditures for total beef. Education and size of family were variables that tended to decrease beef expenditures. However, the high standard errors of the regression coefficients in Equation (3) indicated that the relative importance of these family characteristics could not be substantiated.

The equations used in predicting the average responsiveness for all the families by individual cuts are shown below:

Hamburger:

$$\text{Change in Quantity } (Y_3) = 12.7113 + \underset{(2.6706)}{.7468 \log X_1} - \underset{(4.7039)}{7.1961 \log X_2} - \underset{(4.7842)}{1.7001 \log X_3} - \underset{(3.2592)}{1.3556 \log X_4} \qquad (3)$$

$$R = .1556$$

$$\text{Change in Expenditure } (Y_4) = .9273 + \underset{(1.5668)}{.4258 \log X_1} - \underset{(2.7596)}{1.5931 \log X_2} - \underset{(2.8067)}{1.6857 \log X_3} + \underset{(1.9121)}{.7586 \log X_4} \qquad (4)$$

$$R = .1169$$

Roasts:

$$\text{Change in Quantity } (Y_5) = -9.0652 + \underset{(4.6988)}{3.2799 \log X_1} + \underset{(8.2762)}{5.4169 \log X_2} - \underset{(8.4175)}{3.2716 \log X_3} - \underset{(5.7344)}{6.7039 \log X_4} \qquad (5)$$

$$R = .1758$$

Change in Expenditure (Y_6) = 4.9789 - .0707 log X_1 - .3426 log X_2
(2.5735) (4.5328)

(6)

- 1.9774 log X_3 - 2.4809 log X_4
(4.6102) (3.1407)

R = .1190

Steaks:

Change in Quantity (Y_7) = - 14.2526 + 5.2111 log X_1 + 9.8963 log X_2
(3.5993) (6.3397)

(7)

- 8.0399 log X_3 - 2.3594 log X_4
(6.4480) (4.3927)

R = .2308

Change in Expenditure (Y_8) = - 11.9017 + 2.0481 log X_1 + 6.7003 log X_2
(2.6938) (4.7447)

(8)

- 3.4924 log X_3 - .2873 log X_4
(4.8257) (3.2875)

R = .1713

Stewing and Boiling Beef:

Change in Quantity (Y_9) = 3.4191 + .4668 log X_1 - 1.0870 log X_2
(1.4452) (2.5456)

(9)

- 1.2891 log X_3 - 2.8504 log X_4
(2.5890) (1.7638)

R = .1770

Change in Expenditure (Y_{10}) = 1.3438 + .0488 log X_1 + .0482 log X_2
(.5504) (.9694)

(10)

+ 1.2844 log X_3 - .5980 log X_4
(.9859) (.6717)

R = .1397

The predicting equations for hamburger (Equations 3 and 4) indicated slightly conflicting results with what was obtained for total beef quantity and expenditure changes. Equation (3) indicated that family incomes had practically no relationship with hamburger purchases. The age of homemaker was found to be a factor decreasing per capita purchases for this cut. While this is contrary to the effects of age of homemaker observed for total beef, this deviation was also noted by other methods of analysis.

The regression equations fitted to roast purchases were not good indications of the importance of family characteristics on consumer purchase behavior. The standard errors for all but one of the family characteristics were larger than the regression coefficients themselves. In general, the directional relationship was the same for all factors in the per capita quantity equation for roasts as for total beef.

Family purchases of beef steaks were found to be positively correlated with family income and age of homemaker, but negatively related to education of the homemaker and size of the family. The lower relative standard errors of the regression coefficients for family income, age of homemaker, and education of the homemaker in Equation (7) indicated that these factors may be related to family responsiveness for steak purchases.

The effect of family characteristics on purchases of stewing and boiling beef was quite varied (Equations 9 and 10). Families generally made very little change in the purchases of stewing and boiling beef from 1952 to 1953.

It has generally been found in the regression analysis of beef purchases that family income and age of homemaker are positively related to changes in beef consumption. This was true for roasts and steaks, the two beef cuts accounting for most of the change in beef purchases between 1952 and 1953. Education and size of family were usually negatively related to changes in beef purchases.

CHAPTER IV

CHANGES IN PORK PURCHASES DURING 1952 AND 1953 RELATED TO FAMILY CHARACTERISTICS

Introduction

During the two-year period, 1952-1953, retail pork prices were rising while beef prices were making a substantial decline. Sizeable adjustments in pork purchasing patterns were made. The average retail pork price dropped nearly 10 percent in the Greater Lansing area and similarly for the United States. The average consumption of pork in the consumer panel decreased over 15 percent in 1953, while average expenditures for pork dropped nearly 8 percent.

These adjustments were also noted for the 131 families in this study that were taken from the consumer panel. Here it was found that the average decrease in the quantity of pork purchased was over 18 percent, while expenditures decreased slightly more than 10 percent. This pattern was not uniform for the families who reported their pork purchases during the two-year period. The range in the quantity of pork purchased by individual families was found to be from a decrease of nearly 55 pounds to an increase of over 20 pounds. These substantial changes that occurred in meat prices coupled with the varied patterns of adjustment in pork purchases that were made by individual families provide an excellent situation for analyzing the impact of these price changes on pork purchases.

The analyses presented in this chapter are essentially the same as those discussed in Chapter III for beef purchases. The first section summarizes mean differences in purchase adjustments when families are sorted into groups according to selected characteristics. The second section shows the mean differences in family characteristics when the 131 families are sorted into three groups based on the degree of shift in pork purchases. The third section gives the results of a series of regression analyses where the degree of change in pork purchases is expressed as a function of four family characteristics.

Results From Sorting Families into Groups According to Family Characteristics

Age of Homemaker

Table XV presents the mean changes in the three measures of purchasing activity when families were sorted according to age of homemaker.

Two cuts indicated that age of homemaker was significantly related to the change in frequency of percent weeks bought. These cuts were bacon and ham. Families with homemakers who were 35 years or under tended to buy bacon less frequently than those families with homemakers 51 years or over. However, for ham, the tendency was for older homemakers to purchase less frequently than the young age group. In both cases, the two extreme age groups were the only group comparisons established by test to be different.

All age groups made large decreases in per capita quantity and expenditure measures for pork. No important group differences were observed for either per capita quantity or expenditure measures of change

TABLE XV

AVERAGE CHANGES IN SELECTED MEASURES OF PORK PURCHASES BETWEEN 1952 AND 1953 FOR FAMILIES GROUPED ACCORDING TO AGE OF HOMEMAKER[a]

Family Age Group[b]	Retail Cut						
	Bacon	Chops and Steaks	Ham	Picnics	Roasts	Sausage	Total Pork (6 Cuts)
	A. Change in Percent Weeks Bought						
35 years and under	-6.87	-6.51	- .08	-.11	-1.99	-4.25	
36-50 years	-2.42	-6.84	-2.41	.63	-3.71	-1.01	
51 years and over	-1.80	-7.76	-4.05	-.43	- .03	-1.21	
	B. Change in Per Capita Quantity (Pounds)						
35 years and under	-1.44	-2.75	-1.43	-.44	- .85	- .85	-7.75
36-50 years	-1.33	-2.78	-1.01	.08	-1.66	.04	-6.66
51 years and over	- .74	-4.73	-1.49	-.19	- .67	- .65	-8.48
	C. Change in Per Capita Expenditure (Dollars)						
35 years and under	- .08	-1.38	- .71	-.06	- .33	- .53	-3.09
36-50 years	.46	-1.20	- .44	.17	- .71	- .00	-1.73
51 years and over	.49	-2.21	-1.02	.06	- .02	- .19	-2.91

[a]The number of families in each age group was as follows: age 35 years and under, 32; 36-50 years, 45; 51 years and over, 54.

[b]Tests of significance for comparisons between group means are shown in Appendix C, Part I.

in pork purchases. Similarly, the tendency to decrease the consumption of individual cuts of pork was not established as differing with age. Slightly larger decreases were observed in per capita quantity of bacon for younger age groups. This trend was reversed for chops and steaks where the older groups appeared to be somewhat more responsive.

Education of Homemaker

This method of analysis did not suggest that the education level of homemaker was important in explaining differences in the extent to which families shifted their pork purchases between 1952 and 1953. Some differences were apparent in the change in frequency of purchases but none of the mean changes in quantity or expenditure measures were significant. (See Table XVI)

The changes in frequency of percent weeks bought for chops and steaks suggested that families with better educated homemakers made less change in frequency of purchase. This observation was most pronounced between homemakers in the 9-11 year education group and families with homemakers having at least 13 years of education who made the largest decrease in purchases of chops and steaks. Roast purchases were made less frequently by homemakers with 9-11 and 12 years education, than by families having 8 years or less education. The homemaker with 8 years or less education actually increased the number of times this cut was purchased. The 8 years or less group of homemakers bought sausage less frequently than did the homemakers with 13 or more years of education.

TABLE XVI

AVERAGE CHANGES IN SELECTED MEASURES OF PORK PURCHASES BETWEEN 1952 AND 1953 FOR FAMILIES GROUPED ACCORDING TO EDUCATION OF HOMEMAKER[a]

Family Education Group[b]	Retail Cut						
	Bacon	Chops and Steaks	Ham	Picnics	Roasts	Sausage	Total Pork (6 Cuts)
	A. Change in Percent Weeks Bought						
8 years or less	-4.02	-5.11	.87	- .11	.79	-4.10	
9-11 years	-5.34	-3.21	-2.83	.48	-2.79	- .24	
12 years	-6.92	-8.47	-1.83	- .07	-2.75	-2.67	
13 years or more	-2.74	-11.19	-2.95	- .82	-1.77	.24	
	B. Change in Per Capita Quantity (Pounds)						
8 years or less	-2.53	-3.53	- .86	- .63	.72	-1.10	-7.77
9-11 years	- .78	-2.47	- .94	.35	-1.81	- .38	-6.02
12 years	- .80	-4.09	-2.22	- .38	-1.67	- .54	-9.70
13 years or more	- .41	-5.06	- .77	.18	-1.08	.25	-5.90
	C. Change in Per Capita Expenditure (Dollars)						
8 years or less	- .08	-1.55	- .40	.00	.57	- .65	-2.12
9-11 years	.29	- .82	- .71	.36	- .62	- .01	-1.52
12 years	.55	-2.05	-1.21	- .03	- .74	- .20	-3.67
13 years or more	.47	-2.01	- .38	- .03	- .29	.03	-2.21

[a]The number of families in each education group was as follows: education of 8 years or less, 29; 9-11 years, 29; 12 years, 46; 13 years or more, 27.

[b]Tests of significance for comparison between group means are shown in Appendix C, Part I.

Size of Family

Several size of family groups were found to differ in responsiveness to price changes when the average changes in measures of pork purchases for the various cuts were tested. However, there were no groups that differed significantly in size for either of the measures of change in total pork purchases. (See Table XVII)

The measure of change in percent weeks bought for three groups of retail cuts, chops and steaks, ham and pork roasts showed that larger sized families were more responsive to pork price changes. For bacon, these differences were highly significant between the two person family group and the 5 or more person families. The one person households were significantly less responsive than all other size groups for chops and steaks. The one person households also showed a similar difference from 5 or more person families in the change in frequency of roast purchases.

The per capita quantity measures for ham and picnic shoulders indicated group differences in purchases for these cuts. Households with only one person families were significantly more responsive in decreasing their purchases of ham than were the families with five or more members. One person families were also different from the two person families in the quantity of ham purchased. The one person families made increases in picnic shoulder purchases that were significantly different from the 3-4 person families who decreased purchases of this cut. Other patterns in the adjustment of pork purchases that may have occurred between family groups were not significant.

TABLE XVII

AVERAGE CHANGES IN SELECTED MEASURES OF PORK PURCHASES BETWEEN 1952 AND 1953 FOR FAMILIES[a] GROUPED ACCORDING TO SIZE OF FAMILY

Family Size Group[b]	Retail Cut						
	Bacon	Chops and Steaks	Ham	Picnics	Roasts	Sausage	Total Pork (6 Cuts)
	A. Change in Percent Weeks Bought						
1 person	- .38	.18	- .33	1.20	- .11	-1.34	
2 persons	1.18	-8.02	-1.28	- .01	- .73	- .54	
3 or 4 persons	-5.15	-7.33	-1.99	-1.09	-2.66	-3.45	
5 or more	-7.00	-9.43	-4.67	-1.18	-3.34	-1.19	
	B. Change in Per Capita Quantity (Pounds)						
1 person	-1.56	-2.02	-3.56	1.59	.07	- .80	-6.30
2 persons	-1.40	-5.11	- .80	- .55	- .81	- .43	-9.13
3 or 4 persons	- .67	-2.66	-1.64	- .52	-1.60	- .57	-7.68
5 or more	-1.05	-2.91	- .47	.56	-1.13	- .09	-5.12
	C. Change in Per Capita Expenditure (Dollars)						
1 person	- .03	- .53	-2.13	.90	.43	- .35	-1.73
2 persons	.47	-2.61	- .42	.01	- .19	- .10	-2.84
3 or 4 persons	.49	-1.09	- .76	- .28	- .61	- .35	-2.59
5 or more	- .10	-1.41	- .48	.28	- .53	- .06	-2.38

[a] The number of families in each family size group was as follows: family size 1, 14; 2 persons, 50; 3 or 4 persons, 47; 5 or more persons, 20.

[b] Tests of significance for comparisons between group means are shown in Appendix C, Part I.

Per Family Income

Bacon and pork roasts were the only cuts found to have significant differences between families when grouped by family incomes. (See Table XVIII)

The percent weeks bought for bacon was decreased significantly more by high income groups than for families with incomes of $4000 and under. However, the largest change in the frequency of percent weeks bacon was purchased was between the middle and low income groups, the former being significantly more responsive to price changes.[1] Families with incomes of $5000 and over bought roasts less frequently than did families in the $4000 and under group.[2] Middle income groups were somewhat more responsive than low income families in the percent weeks bought for roasts.

A trend in response to price changes for roasts observed in the percent weeks bought was also noted for the change in per capita quantity purchased. High income groups were significantly more responsive to price changes than were the low income families. No other group differences in purchase responsiveness were noted in the per family income sort.

Per Capita Income

Consumer responsiveness was significantly related to only one cut when per capita incomes were used to distinguish between family groupings. High per capita income families decreased the frequency of sausage

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[1] Significant at the one percent level.

[2] Idem.

TABLE XVIII

AVERAGE CHANGES IN SELECTED MEASURES OF PORK PURCHASES BETWEEN 1952 AND 1953 FOR FAMILIES GROUPED ACCORDING TO PER FAMILY INCOME, 1953[a]

Family Income Group[b]	Retail Cut						
	Bacon	Chops and Steaks	Ham	Picnics	Roasts	Sausage	Total Pork (6 Cuts)
A. Change in Percent Weeks Bought							
$5000 and over	-3.91	-8.02	-1.72	-.24	-3.42	-2.78	
$4001-$4999	-5.57	-6.59	-1.84	-.39	-2.99	- .96	
$4000 and under	-.59	-6.14	-1.41	-.41	.86	-1.28	
B. Change in Per Capita Quantity (Pounds)							
$5000 and over	-1.11	-3.67	-1.64	-.05	-1.62	- .53	-8.61
$4001-$4999	-2.30	-2.30	- .56	.13	-1.34	- .21	-6.38
$4000 and under	-.43	-4.24	-1.39	-.51	.02	- .54	-7.10
C. Change in Per Capita Expenditure (Dollars)							
$5000 and over	.17	-1.69	- .72	.05	- .65	- .25	-3.07
$4001-$4999	- .06	- .89	- .29	.10	- .48	- .17	-1.79
$4000 and under	.84	-2.13	-1.09	.07	.25	- .18	-2.24

[a] The number of families in each income group was as follows: per family income $5,000 and over, 63; $4,001 to $4,999, 27; $4,000 and under, 41.

[b] Tests of significance for comparisons between group means are shown in Appendix C, Part I.

TABLE XIX

AVERAGE CHANGES IN SELECTED MEASURES OF PORK PURCHASES BETWEEN 1952 AND 1953 FOR FAMILIES GROUPED ACCORDING TO PER CAPITA INCOME, 1953[a]

Family Income Group[b]	Retail Cut						
	Bacon	Chops and Steaks	Ham	Picnics	Roasts	Sausage	Total Pork (6 Cuts)
	A. Change in Percent Weeks Bought						
$1801 and over	-2.67	-6.90	-1.02	- .28	-1.84	-5.74	
$1250-$1800	-5.38	-6.80	- .21	-1.07	-1.24	-5.17	
$1249 and under	-1.79	-7.14	-2.79	- .39	-2.21	- .30	
	B. Change in Per Capita Quantity (Pounds)						
$1801 and over	-1.63	-4.07	-1.63	.55	-1.13	- .32	-8.23
$1250-$1800	-1.18	-3.00	- .71	- .65	- .68	-1.06	-7.26
$1249 and under	- .35	-3.44	-1.31	- .87	-1.32	- .07	-7.34
	C. Change in Per Capita Expenditure (Dollars)						
$1801 and over	.27	-1.91	- .99	.33	- .32	- .02	-2.64
$1250-$1800	.24	-1.22	- .49	.07	- .14	- .58	-2.12
$1249 and under	.51	-1.76	- .68	- .28	- .55	- .09	-2.85

[a] The number of families in each income group was as follows: per capita income $1,249 and under, 53; $1,250 to $1,800, 39; $1,801 and over, 39.

[b] Tests of significance for comparison between group means are shown in Appendix C, Part I.

purchases significantly more than the low per capita income group.[3] The middle per capita income group was also found to differ from the low per capita income families at a higher level of significance. No other relationships between per capita income groups and the level of response to beef price could be established from the data.

Families Grouped by Degree of Change in Purchases

General Comments

Most of the families in the Panel were observed to have made decreases in the consumption of pork. For this reason the middle group of families classified as group 2 families, which are referred to herein as being relatively stable in their pork purchasing patterns between 1952 and 1953, may include families who decreased consumption. (See Tables XX-XXIV) Those families who reacted to higher pork prices by making increases in pork purchases were the group 3 families. Substantial decreases in pork purchases were expected for the group 1 families. The results yielded by this method in the analysis of pork purchasing patterns are summarized below.

Age of Homemaker

The means for age of homemaker were based on results from sorting the families into six age groups. In general, the levels for the means fell between three and four indicating that older homemakers were somewhat more predominant in the study. (See Table XX)

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[3] Significant at the one percent level.

TABLE XX

AVERAGE AGE OF HOMEMAKER FOR FAMILIES GROUPED ACCORDING TO DEGREE OF CHANGE IN SELECTED MEASURES OF PORK PURCHASES FROM 1952 TO 1953[a]

Retail Cut	Degree of Change in Consumption[b]			Class Limits for Group 2
	Group 1	Group 2	Group 3	
Bacon				
Per capita quantity	3.57	3.58	3.91	- 1.50 to + .13 lbs.
Per capita expenditure	3.66	3.47	3.84	-$0.26 to + $0.77
Pork Chops and Steaks				
Per capita quantity	3.91	3.49	3.57	- 4.64 to .97 lbs.
Per capita expenditure	3.91	3.51	3.55	-$2.40 to -$0.19
Ham				
Per capita quantity	3.66	3.58	3.73	- 3.01 to + .58 lbs.
Per capita expenditure	3.64	3.56	3.77	-$1.85 to +$0.65
Picnics				
Per capita quantity	3.59	3.93	3.46	- 1.02 to + .03 lbs.
Per capita expenditure	3.57	3.93	3.48	-$0.38 to +$0.45
Pork Roasts				
Per capita quantity	3.79	3.30	3.89	- 1.80 to 0 lbs.
Per capita expenditure	3.77	3.21	3.98	-$0.90 to $0.00
Sausage				
Per capita quantity	3.57	3.84	3.57	- 1.17 to + .03 lbs.
Per capita expenditure	3.61	3.67	3.68	-$0.48 to +$0.12
Total Pork (6 Cuts)				
Per capita quantity	3.59	3.58	3.77	-11.01 to -1.70 lbs.
Per capita expenditure	3.52	3.69	3.77	-$6.49 to +$0.05

[a] The number of families in each age group was as follows: age 25 years and under, 6; 26-35 years, 27; 36-45 years, 27; 46-55 years, 35; 56-65 years, 18; 66 years and over, 18.

[b] Tests of significance for comparison between group means are shown in Appendix C, Part II.

Homemakers in group 3 who made unexpected increases in pork purchases were generally found to be older homemakers. This was especially true for pork roasts, where the group 3 homemakers were significantly older than the group 2 homemakers. The group 3 homemakers were significantly older for both the per capita quantity and expenditure measures of change in pork roasts purchases.

Education of Homemaker

The education levels of homemakers were found to be different between response groups for several cuts of pork in terms of per capita quantity changes, but was not found to be different among response groups for the measure of change in per capita expenditures. It was generally found that higher education levels of homemakers were slightly more predominant among families making slight to substantial decreases in pork purchases.

In the response groups for per capita quantity purchases of bacon, it was found that group 2 families had more education than the group 1 families who decreased bacon purchases. The reverse situation was noted for pork roasts where the more responsive group 3 families had better educated homemakers than the group 2 families who made little or no change in roast purchase. The group 3 homemakers, who made unexpected increases in sausage purchases, were at practically the same education level as for the group 2 families. The homemakers for both of these response groups spent significantly more years in school than the group 1 families.

TABLE XXI

AVERAGE EDUCATION OF HOMEMAKER FOR FAMILIES GROUPED ACCORDING TO THE DEGREE OF CHANGE IN SELECTED MEASURES OF PORK PURCHASES FROM 1952 TO 1953[a]

Retail Cut	Degree of Change in Consumption[b]			Class Limits for Group 2
	Group 1	Group 2	Group 3	
Bacon				
Per capita quantity	2.36	2.80	2.55	- 1.50 to + .13 lbs.
Per capita expenditure	2.43	2.44	2.75	-$0.26 to + $0.77
Pork Chops and Steaks				
Per capita quantity	2.52	2.58	2.52	- 4.64 to .97 lbs.
Per capita expenditure	2.52	2.56	2.55	-$2.40 to -$0.19
Ham				
Per capita quantity	2.59	2.47	2.57	- 3.01 to + .58 lbs.
Per capita expenditure	2.64	2.47	2.52	-$1.85 to +$0.65
Picnics				
Per capita quantity	2.59	2.40	2.64	- 1.02 to + .03 lbs.
Per capita expenditure	2.66	2.47	2.50	-$0.38 to +$0.45
Pork Roasts				
Per capita quantity	2.77	2.41	2.46	- 1.80 to 0 lbs.
Per capita expenditure	2.68	2.58	2.36	-$0.90 to $0.00
Sausage				
Per capita quantity	2.27	2.67	2.68	- 1.17 to + .03 lbs.
Per capita expenditure	2.36	2.61	2.66	-$0.48 to +$0.12
Total Pork (6 Cuts)				
Per capita quantity	2.57	2.65	2.41	-11.01 to -1.70 lbs.
Per capita expenditure	2.66	2.58	2.39	-$6.49 to +$0.05

[a]The number of families in each education group was as follows: education of 8 years or less, 29; 9-11 years, 29; 12 years, 46; 13 years or more, 27.

[b]Tests of significance for comparison between group means are shown in Appendix C, Part II.

Size of Family

This sort was the only instance where differences in group responsiveness were associated with different levels of a family characteristic for total pork. Group 2 families who made little or no decrease in their expenditures for pork were found to be significantly larger than families in group 3 who increased pork expenditures.

Two individual cuts, bacon and pork roasts, were noted as having educational differences between levels of responsiveness. For bacon, the families making little or no change in per capita expenditures were significantly larger than were families increasing bacon expenditures. The quantity changes for pork roasts also indicated that group 2 families were larger than families in other categories. The larger sized families in group 2, for changes in quantity purchases of pork roasts, were established to differ in size from group 3 families who increased purchases of roasts.[4] The expenditure pattern for this cut also showed that the group 2 families were larger than Group 3 families who increased expenditures for roasts.

Per Family Income

The average levels of incomes for families grouped by degree of consumption change in total pork purchases was suggestive that group 3 families may have been higher income families than was true for the other response groups. However, this could not be established by statistical testing of group comparisons. Tests did indicate that for

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[4] Significant at the one percent level.

TABLE XXII

AVERAGE SIZE OF FAMILY FOR FAMILIES GROUPED ACCORDING TO THE DEGREE OF CHANGE IN SELECTED MEASURES OF CHANGE IN PORK PURCHASES FROM 1952 TO 1953[a]

Retail Cut	Degree of Change in Consumption[b]			Class Limits for Group 2
	Group 1	Group 2	Group 3	
Bacon				
Per capita quantity	2.50	2.67	2.46	- 1.50 to + .13 lbs.
Per capita expenditure	2.43	2.74	2.46	- $0.26 to + $0.77
Pork Chops and Steaks				
Per capita quantity	2.48	2.67	2.48	- 4.64 to .97 lbs.
Per capita expenditure	2.48	2.63	2.52	-$2.40 to -$0.19
Ham				
Per capita quantity	2.39	2.67	2.57	- 3.01 to + .58 lbs.
Per capita expenditure	2.41	2.61	2.61	-$1.85 to + $0.65
Picnics				
Per capita quantity	2.55	2.49	2.59	- 1.02 to + .03 lbs.
Per capita expenditure	2.64	2.51	2.48	-$0.38 to + $0.45
Pork Roasts				
Per capita quantity	2.54	2.80	2.25	- 1.80 to 0 lbs.
Per capita expenditure	2.59	2.70	2.34	-$0.90 to $0.00
Sausage				
Per capita quantity	2.41	2.61	2.61	- 1.17 to + .03 lbs.
Per capita expenditure	2.43	2.63	2.57	-$0.48 to + $0.12
Total Pork (6 Cuts)				
Per capita quantity	2.54	2.65	2.43	-11.01 to -1.70 lbs.
Per capita expenditure	2.48	2.79	2.36	-$6.49 to + $0.05

[a] The number of families in each family size group was as follows: family size 1, 14; 2 persons, 50; 3 or 4 persons, 47; 5 or more persons, 20.

[b] Tests of significance for comparison between group means are shown in Appendix C, Part II.

quantity purchases of bacon, group 2 families were higher income families than those families in group 3. The relatively higher income levels with group 3 families for quantity purchases of picnic shoulders seemed to be an exception to the general pattern of lower incomes associated with this group for other cuts.

Per Capita Income

The per capita quantity changes made in sausage purchases indicated that group 1 families had significantly higher per capita incomes than did other response groups. A general trend in the level of per capita incomes associated with various group responsiveness could not be established by testing the mean per capita incomes for response groups.

Results from Regression Analysis

The results from the regression analysis for pork were generally found to be similar to the results obtained for beef. The low multiple correlation coefficients obtained for these equations again suggested that the results would be of little use in predicting the price responsiveness of individual families. However, several of the regression coefficients in the equations for individual cuts were found to be significant at the 10 percent level or better. This indicated that some family characteristics may be important when predicting changes in group purchasing patterns for some cuts of pork.

An increase in the price of pork suggests that families who are most responsive to price changes would decrease their purchases of pork.

TABLE XXIII

AVERAGE PER FAMILY INCOME IN 1953 FOR FAMILIES GROUPED ACCORDING TO THE DEGREE OF CHANGE IN SELECTED MEASURES OF PORK PURCHASES FROM 1952 TO 1953[a]

Retail Cut	Degree of Change in Consumption[b]			Class Limits for Group 2
	Group 1	Group 2	Group 3	
Bacon				
Per capita quantity	$4813.60	$5162.80	$4504.50	- 1.50 to + .13 lbs.
Per capita expenditure	4650.00	5183.70	4647.70	-$0.26 to + $0.77
Pork Chops and Steaks				
Per capita quantity	4988.60	4830.20	4654.50	- 4.64 to .97 lbs.
Per capita expenditure	4918.20	4865.10	4690.90	-$2.40 to -$0.19
Ham				
Per capita quantity	4772.70	5058.10	4647.70	- 3.01 to + .58 lbs.
Per capita expenditure	4822.70	4869.80	4781.80	-$1.85 to +$0.65
Picnics				
Per capita quantity	4743.20	4674.40	5052.30	- 1.02 to + .03 lbs.
Per capita expenditure	5011.30	4734.90	4725.00	-$0.38 to + $0.45
Pork Roasts				
Per capita quantity	4804.70	5081.80	4586.40	- 1.80 to 0 lbs.
Per capita expenditure	4863.60	4841.90	4768.20	-$0.90 to $0.00
Sausage				
Per capita quantity	5095.50	4651.20	4722.70	- 1.17 to + .03 lbs.
Per capita expenditure	5054.50	4702.30	4713.60	-$0.48 to + $0.12
Total Pork (6 Cuts)				
Per capita quantity	5029.50	4797.70	4645.50	-11.01 to -1.70 lbs.
Per capita expenditure	5093.20	4739.40	4643.20	-$6.49 to +$0.05

[a]The number of families in each income group was as follows: per family income $5000 and over, 63; $4001 to $4999, 27; $4000 and under, 41.

[b]Tests of significance for comparison between group means are shown in Appendix C, Part II.

TABLE XXIV

AVERAGE PER CAPITA INCOME IN 1953 FOR FAMILIES GROUPED ACCORDING TO THE DEGREE OF CHANGE IN SELECTED MEASURES OF PORK PURCHASES FROM 1952 TO 1953[a]

Retail Cut	Degree of Change in Consumption[b]			Class Limits for Group 2
	Group 1	Group 2	Group 3	
Bacon				
Per capita quantity	$2038.86	$1761.40	$1748.41	- 1.50 to + .13 lbs.
Per capita expenditure	1935.68	1858.14	1757.05	- $0.26 to $ $0.77
Pork Chops and Steaks				
Per capita quantity	1932.73	1889.06	1729.77	- 4.64 to .97 lbs.
Per capita expenditure	1915.45	1869.30	1768.64	-$2.40 to -$0.19
Ham				
Per capita quantity	1891.59	1884.41	1775.45	- 3.01 to + .58 lbs.
Per capita expenditure	1858.18	1929.53	1762.95	-$1.85 to +$0.65
Picnics				
Per capita quantity	1746.59	1929.30	1876.59	- 1.02 to + .03 lbs.
Per capita expenditure	1796.36	1960.93	1795.91	-$0.38 to +$0.45
Pork Roasts				
Per capita quantity	1793.02	1889.31	1867.05	- 1.80 to 0 lbs.
Per capita expenditure	1774.55	1743.26	2030.45	- $0.90 to $0.00
Sausage				
Per capita quantity	2069.32	1826.74	1654.32	- 1.17 to + .03 lbs.
Per capita expenditure	2030.23	1804.19	1715.23	- $0.48 to + $0.12
Total Pork (6 Cuts)				
Per capita quantity	1880.23	1869.53	1801.36	-11.01 to -1.70 lbs.
Per capita expenditure	1956.82	1720.00	1870.91	-$6.49 to +$0.05

[a] The number of families in each income group was as follows: per capita income $1249 and under, 53; $1250 to $1800, 39; $1801 and over, 39.

[b] Tests of significance for comparison between group means are shown in Appendix C, Part II.

Thus, in studying the equations for pork it will be observed that family characteristics which tend to increase consumer responsiveness have a negative regression coefficient. Conversely, the regression coefficients for family characteristics that tend to decrease consumer responsiveness to price changes are associated with a positive value.

The predicting equation for quantity changes for total pork was as follows:

$$\text{Change in Quantity } (Y_1) = 16.9817 - \underset{(6.0855)}{6.3245 \log X_1} \qquad (1)$$

$$- \underset{(\text{Lo}.7186)}{1.8237 \log X_2} - \underset{(10.9017)}{1.0535 \log X_3} + \underset{(7.4267)}{5.6208 \log X_4}$$

$$R = .1005$$

The average change in total pork consumption that was predicted by this equation was a decrease of over seven and one-half pounds of pork. The average values of the family characteristics associated with this equation are the same throughout the study. To repeat, the average per family income (X_1) obtained for the equations was $4240, age of homemaker ($X_2$), 44.8 years; education of homemaker (X_3), 10.8 years; and size of family (X_4), 2.7 persons.

The effects of age of homemaker and size of family were to decrease consumer responsiveness to price changes. Family incomes and education of the homemaker tended to make families more responsive to price changes. However, all of the regression coefficients for this equation have very high standard errors, indicating that they probably give

little more than a directional indication of the relationship between family characteristics and consumer responsiveness to pork prices.

The equation for the prediction of changes in expenditures for total beef was as follows:

$$\text{Change in Expenditure } (Y_2) = 3{,}4400 - \underset{(3.2447)}{1.2907 \log X_1} + \underset{(5.7151)}{1.1791 \log X_2} \qquad (2)$$

$$- \underset{(5.8127)}{3.8608 \log X_3} + \underset{(3.9599)}{1.7319 \log X_4}$$

$$R = .0873$$

None of the characteristics were suggestive of substantial effects on consumer expenditures for pork when this equation was fitted. The large standard errors of the regression coefficients also indicate an unreliable relationship between any one of the given characteristics and consumer expenditures for all pork.

The equations used in predicting the average responsiveness in pork purchases for all families in the study are summarized by individual cuts.

The results for individual cuts of pork are indicated in the equations that follow.

Bacon:

$$\text{Change in Quantity } (Y_3) = -9.0524 - \underset{(1.6181)}{1.9628 \log X_1} + \underset{(2.8500)}{4.1941 \log X_2} \qquad (3)$$

$$+ \underset{(2.8987)}{6.6582 \log X_3} + \underset{(1.9747)}{3.0575 \log X_4}$$

$$R = .1138$$

Change in Expenditure (Y_4) = - 4.2372 - .4386 log X_1 + 2.0985 log X_2
(1.0791) (1.9008)

(4)

+ 2.3021 log X_3 + .7445 log X_4
(1.9333) (1.3170)

R = .1353

Pork chops and steaks:

Change in quantity (Y_5) = 25.9934 - 3.2159 log X_1 - 9.2577 log X_2
(2.7595) (4.8605)

(5)

- 2.7145 log X_3 + .5303 log X_4
(4.9434) (3.3677)

R = .1954

Change in Expenditure (Y_6) = - 1.0840 - .4917 log X_1 -.9141 log X_2
(1.8292) (3.2219)

(6)

- .8482 log X_3 + .0285 log X_4
(3.2769) (2.2324)

R = .0520

Ham:

Change in Quantity (Y_7) = - 6.680 + .0714 log X_1 + 4.2864 log X_2
(2.4630) (4.3383)

(7)

- 3.3800 log X_3 + 3.5185 log X_4
(4.4124) (3.0059)

R = .1373

Change in Expenditure (Y_8) = - 5.5516 + .4740 log X_1 + 2.7543 log X_2

(8)

- 2.3369 log X_3 + 2.2360 log X_4
(2.9728) (2.0252)

R = .1383

Picnic Shoulders:

$$\text{Change in Quantity } (X_9) = -4.9108 + \underset{(2.0295)}{1.7354} \log X_1 - \underset{(3.5747)}{.3195} \log X_2$$

(9)

$$- \underset{(3.6358)}{.1376} \log X_3 - \underset{(2.4769)}{2.0281} \log X_4$$

$$R = .0873$$

$$\text{Change in Expenditure } (Y_{10}) = .0977 + \underset{(.9859)}{.5626} \log X_1 - \underset{(1.7364)}{.3899} \log X_2$$

(10)

$$- \underset{(1.7661)}{.9962} \log X_3 - \underset{(1.2031)}{.9747} \log X_4$$

$$R = .0889$$

Pork Roasts:

$$\text{Change in Quantity } (Y_{11}) = 14.0555 - \underset{(2.0546}{1.1255} \log X_1 - \underset{(3.6189)}{2.2328} \log X_2$$

(11)

$$- \underset{(3.6807)}{6.7190} \log X_3 - \underset{(2.5075)}{.9163} \log X_4$$

$$R = .2094$$

$$\text{Change in Expenditure } (Y_{12}) = 5.3598 - \underset{(1.0876)}{.3638} \log X_1 - \underset{(1.9157)}{.3713} \log X_2$$

(12)

$$- \underset{(1.9484)}{3.3667} \log X_3 - \underset{(1.3273)}{.6554} \log X_4$$

$$R = .2108$$

Sausage:

$$\text{Change in Quantity } (Y_{13}) = -2.7167 - \underset{(1.2828)}{1.7087} \log X_1 + \underset{(2.2595)}{1.5677} \log X_2 + \underset{(2.2981)}{5.0664} \log X_3 + \underset{(1.5655)}{1.4616} \log X_4 \qquad (13)$$

$$R = .2108$$

$$\text{Change in Expenditure } (Y_{14}) = -2.9045 - .5260 \log X_1 + 1.090 \log X_2 + \underset{(1.3250)}{2.5749} \log X_3 + \underset{(.9027)}{.3298} \log X_4 \qquad (14)$$

$$R = .1791$$

The equation predicting changes in per capita quantity purchases of bacon indicated that all the family characteristics except family income tended to decrease consumer responsiveness for this cut. The standard error of the regression coefficient for education was quite low, indicating that this coefficient was significant at the 5 percent level. This would seem to give strong indications that education has a definite effect on bacon purchases, the higher the education of homemakers, the lower the response. The signs on the coefficients in equation 5 suggested the same directional relationships between the family characteristics and consumer expenditures for bacon as did equation 4.

Age of the homemaker was found to be significantly related to the changes in quantity of chops and steaks that consumers purchased. The direction of effect was for the change in purchases of chops and steaks to decrease as education increased. Size of family was the only

characteristic which tended to decrease consumer responses for these cuts.

The equations for ham indicate that education was the only family trait that decreased consumer responsiveness. Incomes were probably the only family characteristic that was discouraging to increased family responsiveness for picnic shoulders.

The level of education of the homemaker was found to be significantly related to consumer purchases of pork roasts. In general, it can be said that as education increased, roast purchases decreased. This tendency was borne out at the 10 percent level in both equations predicting changes in roast purchases.

The educational level of homemakers was also significantly related to changes in purchases of sausage. In this instance, it was found that as education increased, change in sausage purchases increased, indicating an unexpected response on the part of homemakers to price changes for this cut. This relationship was significant at the 5 percent level in the equation predicting changes in the quantity of sausage purchases, but was maintained at the 10 percent level in the equation predicting expenditure changes. The effects of other characteristics on the responsiveness of families for this cut remain uncertain.

CHAPTER V

SUMMARY AND CONCLUSIONS

In the past, price elasticities for meat items have been computed by conventional time series analysis using aggregate market data to indicate consumer behavior. Some recent attempts have been made to estimate price elasticities for meats at the retail level using consumer panel data.

The sample providing the source of data for demand studies based on consumer panel purchases is limited in nature and scope by the small number of families who provide the information for such studies as well as by the restricted geographical area represented by the population. These limitations have raised questions pertaining to the applicability of the price elasticity estimates thus obtained in predicting the behavior of more general groups of consumers and in different geographic areas.

To determine the applicability of price elasticity estimates based on consumer panel data it is necessary that price analysts have some indication of the relationships that exist between consumer response to price changes and family characteristics. The present study has been an attempt to relate four, and in some cases five, characteristics to consumer responsiveness to price changes for red meat items. These characteristics were; age and education of the homemaker, size of family, per family income, and per capita income. The two years,

1952 and 1953, were chosen as a suitable time period for carrying out the study.

During this two-year period, substantial price adjustments were observed as the supply and demand situations for beef and pork changed. These sizable changes in meat prices caused consumers collectively to make some of the sharpest adjustments in meat purchases that have occurred in recent history. The average annual per capita consumption of beef for families in the Michigan State University Consumer Panel increased nearly 10 pounds. Meanwhile, pork consumption was decreased by more than 5 pounds. These sharp adjustments in meat purchase patterns for the families in the panel were also observed for consumers at the national level. Although the average Michigan State University Consumer Panel family made rather logical adjustments to changing beef and pork prices, individual family adjustments were extremely diverse. In a sub-sample of 131 families, the change in per capita purchases of beef between 1952 and 1953 ranged from an increase of over 60 pounds to a decrease of more than 20 pounds of beef per capita. For pork purchases, the pattern of response varied from a decrease of nearly 55 pounds per capita to an increase of more than 20 pounds. Such a wide variability in the responsiveness of individual families provided an excellent opportunity to analyze differences in consumer response to meat price changes as related to family characteristics.

Only those families who were members of the Michigan State University Consumer Panel 40 weeks or more during both 1952 and 1953 were included in this study. The meat purchases of these families

were subjected to three methods of analysis. First, families were grouped according to each characteristic to determine whether families who were different with respect to a given characteristic were also different in their response to price changes. Secondly, families were grouped according to the degree of change in meat purchases to determine if these sub-groupings were also different with respect to family characteristics. Finally, multiple regression analysis was used to determine the net effects of family characteristics on consumer responsiveness to price changes for each cut as well as for total beef and total pork.

The results for beef indicated that age and education of the homemaker as well as size of family are probably related to the changes in beef purchases. The effects of per family income and per capita income were not consistently significant. However, in all cases it was possible to get little more than a directional indication of the effects that these characteristics had on beef purchases.

The results yielded by relating age of the homemaker to the level of response in beef purchases were fairly consistent throughout the study, both for the various methods of analysis and for individual cuts. The effect of age of homemaker was to increase responsiveness to beef price changes. As age increased, consumers were found to increase their beef purchases more relative to younger age homemakers.

It was generally found that education tended to decrease response to beef purchases. Similarly, it was found that as the size of family increased, consumer response to lower beef prices decreased.

Per family income and per capita income did not appear to have a marked effect on responsiveness. However, there was some indication that consumers with higher incomes may have made the largest increases in beef purchases.

The results obtained when family characteristics were related to changes in pork purchases were generally found to be consistent with the results obtained for beef. The effect of age of the homemaker was found to be somewhat less pronounced on pork purchases than it was on beef. However, the results from all three methods of analysis indicated that the directional relationship between age and degree of change in pork purchases was positive. This would indicate that older homemakers were more responsive to pork prices and therefore made the greatest decreases in pork purchases.

The effects of education of the homemaker were to increase pork purchases as education increased. This would indicate that the more educated the homemaker, the less the response in pork purchases. However, these results were somewhat inconsistent for individual pork cuts, where education was found to have varied effects on responsiveness to price changes.

The size of family was also found to be negatively related to changes in pork purchases. The effects of income measures on response in pork purchases were not established as being important.

The results obtained for age of the homemaker were somewhat contrary to those reported by Zwick in a similar study using the weekly food purchase diaries of a group of families in Medford, Massachusetts

(See page 6, Chapter I). Zwick found that as age increased, consumer response to price changes decreased.

Reasoning from a purely theoretical point of view, it would appear that the age of homemakers may well be positively related to consumer responsiveness to meat price changes. Since older homemakers formed their purchasing habits during less prosperious periods than did younger homemakers it may well be that these older homemakers tend to be more frugal in their shopping habits. If it can be maintained that purchasing habits, once established, do not change readily, there seems to be some reason for believing that the results pertaining to older homemakers being more responsive are valid.

Since older homemakers were generally found to have lower educations and smaller sized families than was true for younger homemakers, the negative relationship between meat purchases and these factors may well be influenced by the importance of age and its relationship to consumer behavior.

Empirical results of this study indicate that responsiveness to meat price changes does not bear a high degree of relationship to any of the family characteristics studied. However, when these empirical results are combined with theoretical considerations there appears to be substantial evidence to support a conclusion that age of homemaker is a significant factor affecting consumer responsiveness to meat price changes. The exact magnitude of this relationship should be pursued further in subsequent research.

BIBLIOGRAPHY

Croxton, F. E. and D. J. Cowden, Applied General Statistics. New York: Prentice-Hall, Inc., 1949.

Ezekiel, M., Methods of Correlation Analysis, New York: John Wiley & Sons, Inc., 1947.

Foote, R. J., Price Elasticities of Demand for Nondurable Goods, With Emphasis on Food, Agricultural Marketing Service, AMS-96, United States Department of Agriculture, March 1956.

Fox, K. A., The Analysis of Demand for Farm Products. Tech. Bull. 1081, Washington: United States Department of Agriculture, 1953.

Kuznets, G. M., "Discussion," (Paper presented by R. J. Foote, "Demand and Prices"), Journal of Farm Economics, Vol. 37, No. 2, May, 1955, pp. 235-236.

Quackenbush, G. G., "Demand Analysis from the M. S. C. Consumer Panel." Journal of Farm Economics, Vol. 36, No. 3, August, 1954, pp. 415-427.

Riley, H. M., "Some Measurements of Consumer Demand for Meats," unpublished Ph. D. Thesis, Department of Agricultural Economics, Michigan State College, 1954.

Shaffer, J. D. and G. G. Quackenbush, "Cooperation and Sampling in Four Years of Consumer Panel Operation," Quarterly Bulletin, Agricultural Experiment Station, Michigan State University, East Lansing, August, 1955, pp. 85-103.

Shepherd, G. S., Changes in the Demand for Meat and Dairy Products in the United States Since 1910. Res. Bull. 368, Iowa State College, Ames, Iowa, November, 1949.

_____, J. C. Purcell and L. V. Mandersheid, Economic Analysis of Trends in Beef Cattle and Hog Prices, Res. Bull. 405, Iowa State College, Ames, Iowa, January, 1954.

Working, E. J., Demand for Meat, Institute of Meat Packing, The University of Chicago, Chicago, Ill., 1954.

Zwick, C., "A Quantitative Study of the Demand for Meat," Econometrica, Vol. 23, No. 3, (Abstract), pp. 327-328.

APPENDICES

APPENDIX A

SUMMARY CARD

1._____ 2._____ 3a._____ b._____ _____

4._____ 5._____ 6a._____ b._____ _____

7a._____ b._____ 8a._____ b._____ _____

9a._____ b._____ 10a._____ b._____ _____

5100 -- Beef			5300 -- Pork		
30a	a	a	11a	a	a
b	b	b	b	b	b
c	c	c	c	c	c
d	d	d	d	d	d
e	e	e	e	e	e
60a	a	a	30a	a	a
b	b	b	b	b	b
c	c	c	c	c	c
d	d	d	d	d	d
e	e	e	e	e	e
70a	a	a	41a	a	a
b	b	b	b	b	b
c	c	c	c	c	c
d	d	d	d	d	d
e	e	e	e	e	e
80a	a	a	42a	a	a
b	b	b	b	b	b
c	c	c	c	c	c
d	d	d	d	d	d
e	e	e	e	e	e
	dq		70a	a	a
	de		b	b	b
			c	c	c
Total Change			d	d	d
	Q		e	e	e
	E		81a	a	a
			b	b	b
			c	c	c
			d	d	d
			e	e	e
				dq	
				de	

(See index to summary card on next page.)

INDEX TO SUMMARY CARD

Information pertaining to family:

1. Family number
2. Type of family
3a. Number of weeks in panel, 1952; b. 1953
4. Age of homemaker
5. Education of homemaker
6a. Average number of persons per week, 1952; b. 1953
7a. Per family income, 1952; b. 1953
8a. Average number of persons per meal per week, 1952; b. 1953
9a. Per capita income, 1952; b. 1953
10a. Supplementary information

Information pertaining to cuts:

30a. Average annual quantity, 1952; a. 1953; a. change
b. Average annual expenditures, 1952; b. 1953; b. change
c. Percent weeks bought, 1952; c. 1953; c. change
d. Average annual per capita quantity, 1952; d. 1953; d. change
e. Average annual per capita expenditures, 1952; d. 1953; d. change

Information pertaining to total beef or pork:

dq. Total change in per capita quantity, 1952-1953
de. Total change in per capita expenditures, 1952-1953

Information pertaining to changes in total meat consumption, (10 cuts):

Total change

Q. Total increase or decrease in per capita quantity of meat purchases, 1952-1953.
E. Total increase or decrease in per capita expenditures for meat purchases, 1952-1953.

APPENDIX B

PART I

RESULTS FOR TESTS OF SIGNIFICANT DIFFERENCES BETWEEN MEASURES OF CHANGE IN BEEF PURCHASES FOR FAMILIES GROUPED ACCORDING TO FAMILY CHARACTERISTICS

Classification of Families

Group	Age (Years)	Education (Years)	Size of Family (Persons)	Per Family Income (Dollars)	Per Capita Income (Dollars)
1	35 and under	8 or less	1	$5000 and over	$1801 and over
2	36-50	9-11	2	$4001-4999	$1250-1800
3	51 and over	12	3-4	$4000 and under	$1249 and under
4		13 or more	5 or more		

Group Comparisons Testing Significant[a]

	Age	Education	Size of Family	Per Family Income	Per Capita Income
Change in Percent weeks bought:					
Hamburger		(3&4)*			
Roasts		(2&4)**	(1&2)**		
			(1&3)*		
Stewing and Boiling Beef			(2&4)*	(1&2)*	
Change in Per Capita Quantity					
Hamburger		(2&4)**	(1&4)*		
		(3&4)***			
Roasts	(1&3)**		(2&4)**		(1&3)**
			(2&3)*		
Steaks	(1&2)**	(2&4)**	(3&4)**		
	(1&3)*	(2&3)**			
Stewing and Boiling Beef		(1&3)*	(1&4)*		(1&3)**
Total Beef	(1&3)*	(1&4)*	(2&4)**		(2&3)***
		(2&3)**	(3&4)*		
		(2&4)***			

PART I - Continued

	Age	Education	Size of Family	Per Family Income	Per Capita Income
Change in Per Capita Expenditure					
Roasts		(2&3)* (2&4)**			
Steaks	(1&2)** (1&3)**	(2&4)*	(3&4)*		
Total Beef	(1&2)* (1&3)**	(2&4)*** (2&3)*	(1&3)* (1&4)*		(2&3)**

[a] Levels of significance are indicated as follows: Ten percent level, *; five percent level, **; one percent level, ***.

PART II

RESULTS FOR TESTS OF SIGNIFICANT DIFFERENCES BETWEEN LEVELS OF FAMILY CHARACTERISTICS FOR FAMILIES GROUPED ACCORDING TO CHANGES IN BEEF PURCHASES BETWEEN 1952 AND 1953[a]

	Age	Education	Size of Family	Per Family Income	Per Capita Income
Change in Per Capita Quantity					
Hamburger	(1&3)**		(1&2)**		
Roasts	(2&3)*	(1&2)***	(1&2)*	(1&2)***	
		(2&3)***	(2&3)***	(2&3)**	(1&2)*
Stewing and Boiling Beef	(1&2)*				
Total Beef	(2&3)**	(2&3)***	(1&2)*	(2&3)**	
			(2&3)***		
Change in Per Capita Expenditure					
Hamburger				(2&3)*	
Roasts	(2&3)**	(2&3)**	(2&3)*		
Steaks		(2&3)*			
Stewing and Boiling Beef	(1&2)*		(1&2)*		
	(2&3)*		(2&3)***		
Total Beef	(1&2)**	(2&3)***	(1&2)**	(1&2)***	
	(2&3)***		(2&3)***	(2&3)***	

[a]Levels of significance are indicated as follows: ten percent level, *; five percent level, **; one percent level, ***.

APPENDIX C

PART I

RESULTS FOR TESTS OF SIGNIFICANT DIFFERENCES BETWEEN MEASURES OF CHANGE IN PORK PURCHASES FOR FAMILIES GROUPED ACCORDING TO FAMILY CHARACTERISTICS

Classification of Families

Group	Age (Years)	Education (Years)	Size of Family (Persons)	Per Family Income (Dollars)	Per Capita Income (Dollars)
1	35 and under	8 or less	1	$5000 and over	$1301 and over
2	36-50	9-11	2	$4001-4999	$1250-1800
3	51 and over	12	3-4	$4000 and under	$1249 and under
4		13 or more	5 or more		

Group Comparison Testing Significant[a]

	Age	Education	Size of Family	Per Family Income	Per Capita Income
Change in Percent weeks bought:					
Bacon	(1&3)*		(2&4)***	(1&3)** (2&3)***	
Chops and Steaks		(2&4)**	(1&2)* (1&3)* (1&4)*		
Ham	(1&3)*				
Roasts		(1&2)* (1&3)*	(1&4)**	(1&3)*** (2&3)**	
Sausage		(1&4)*			(1&3)*** (2&3)**
Change in Per Capita Quantity:					
Ham			(1&4)** (1&2)*		
Picnics			(1&3)**		
Roasts				(1&3)*	

[a]Levels of significance are indicated as follows: ten percent level, *; five percent level, **; one percent level, ***.

PART II

RESULTS FOR TESTS OF SIGNIFICANT DIFFERENCES BETWEEN LEVELS OF FAMILY CHARACTERISTICS FOR FAMILIES GROUPED ACCORDING TO CHANGES IN PORK PURCHASES BETWEEN 1952 AND 1953[a]

	Age	Education	Size of Family	Per Family Income	Per Capita Income
Change in Per Capita Quantity					
Bacon		(1&2)**		(2&3)*	
Pork Roasts	(2&3)*	(1&2)*	(1&3)*		
			(2&3)***		
Sausage	(1&3)*				(1&3)***
	(2&3)*				
Change in Per Capita Expenditure					
Bacon			(2&3)*		
Pork Roasts	(1&2)*				
	(2&3)**		(2&3)*		
Sausage	(1&3)*				
Total Pork			(2&3)**		

[a]Levels of significance are indicated as follows: ten percent level, *; five percent level, **; one percent level, ***.