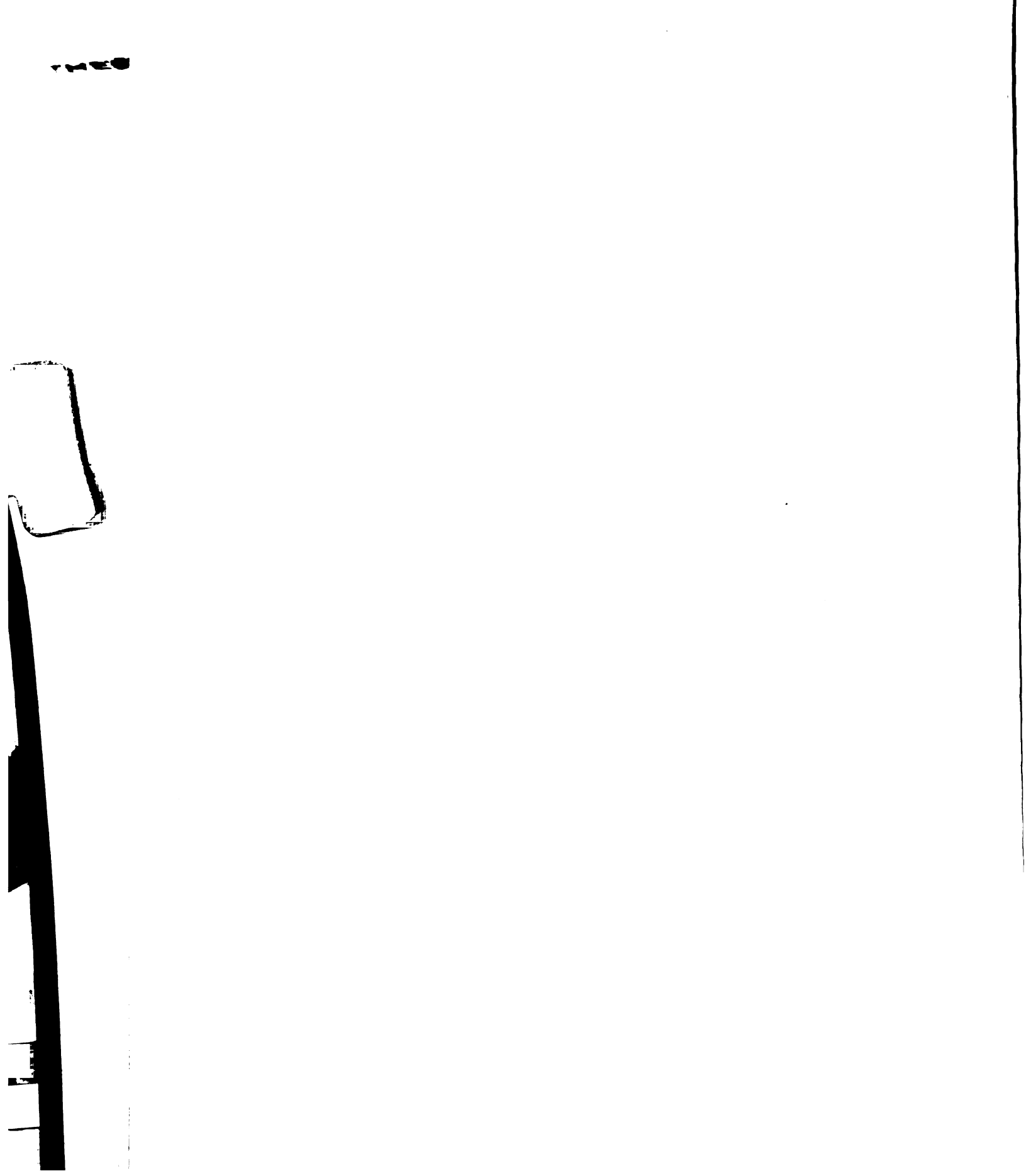


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**A COMPARISON OF STATIC AND DYNAMIC INCOME-EXPENDITURE
RELATIONSHIPS FOR SELECTED MEAT ITEMS**

By

Robert J. Bachleda

A THESIS

Submitted to the College of Agriculture
Michigan State University of Agriculture and
Applied Science in partial fulfillment of
the requirements for the degree of

MASTER OF SCIENCE

Department of Agricultural Economics

1959

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The author will accept the responsibility for any remaining errors in the manuscript.

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Dean H. H. H. H.

ABSTRACT

The primary purpose of this study was to examine the validity of the implicit assumption involved when the relationships derived from cross-sectional income-expenditure studies are used in making predictions. The assumption is that families experiencing an increase in income will adjust their meat expenditure patterns to be similar to the expenditures of families in the income group they are entering. A secondary objective was to determine the relationships between family size and adjustments in meat expenditures associated with increased income.

The data were provided by a ninety-nine family sub-sample of the Michigan State University Consumer Panel. During the time period 1953-57, annual family expenditures for eight meat items were "observed" before and after families received an income increase. Per capita income per family served as the criterion for placing families into two income groups. Income groups were then sub-classified by two family sizes.

Static cross-sectional income-expenditure elasticities were computed between income groups. The "expected" expenditure adjustments were computed by applying these cross-sectional relationships to actual income changes. The "observed" adjustments in family expenditures per capita associated with increased income served as the basis for computing dynamic income-expenditure elasticities for each income group.



A comparison of the "observed" and "expected" expenditure adjustments served as a basis for judging the validity of the assumption involved when cross-sectional relationships are used for making predictions. Student's "t" test was used to evaluate differences in expenditure levels between families grouped by income and family size. This test was also used to indicate if the "observed" expenditure adjustments were significantly different from zero.

The results of this study indicated that the validity of the assumption that families experiencing an increase in income will adjust their meat expenditure patterns to be similar to the expenditures of families in the income group they are entering can be seriously questioned. It was found that per capita meat expenditures were significantly related to family size among low income families. It was also found that high income families were smaller in size than low income families. Predictions of expenditure adjustments based upon cross-sectional relationships are therefore likely to be greater than actual dynamic adjustments associated with a rise in income. There was also some evidence that year to year expenditure adjustments are less than "expected" adjustments based upon cross-sectional relationships. It was further observed that dynamic income-expenditure adjustments are probably affected by inflationary income increases and shifts in demand associated with changes in tastes and preferences.



TABLE OF CONTENTS

CHAPTER	Page
I INTRODUCTION.....	1
Purpose of Study.....	1
Previous Studies.....	3
Time-Series Analyses.....	4
Cross-Sectional Analyses.....	8
Summary of Previous Studies.....	15
Usefulness of Results.....	16
II METHODS OF ANALYSIS.....	17
The General Approach.....	17
Source and Nature of Data.....	18
Selection of Families.....	19
Units of Measurement.....	20
Grouping of Families.....	21
Selection of Meat Cuts.....	22
Selection of Time Period.....	23
Preliminary Investigation.....	30
Methodology.....	30
Static Cross-Sectional Relationships.....	30
Dynamic Relationships.....	34
Comparison of the Static and Dynamic Income-Expenditure Relationships.....	36
Limitations of Analysis.....	39
III CHANGES IN BEEF CUT EXPENDITURES ASSOCIATED WITH INCREASED INCOME.....	41
Introduction.....	41
Results from a Static Cross-Sectional Analysis of Beef Roast and Steak Expenditures.....	41
Results from a Dynamic Analysis of Beef Roast and Steak Expenditures.....	45
Comparison of the Observed and Expected Changes in Beef Roast and Steak Expenditures.....	48

continued

TABLE OF CONTENTS - Continued

CHAPTER	Page
IV CHANGES IN SELECTED PORK CUT EXPENDITURES ASSOCIATED WITH INCREASED INCOME.....	51
Introduction.....	51
Results from a Static Cross-Sectional Analysis of Selected Pork Item Expenditures.....	52
Results from a Dynamic Analysis of Selected Pork Item Expenditures.....	55
Comparison of the Observed and Expected Changes in Pork Item Expenditures.....	59
V CHANGES IN BROILER AND COLD CUT EXPENDITURES ASSOCIATED WITH INCREASED INCOME.....	62
Introduction.....	62
Results from a Static Cross-Sectional Analysis of Broiler Expenditures.....	64
Results from a Dynamic Analysis of Broiler Expenditures..	66
Comparison of the Observed and Expected Changes in Broiler Expenditures.....	68
Results from a Static Cross-Sectional Analysis of Cold Cut Expenditures.....	69
Results from a Dynamic Analysis of Cold Cut Expenditures..	71
Comparison of the Observed and Expected Changes in Cold Cut Expenditures.....	73
VI SUMMARY AND CONCLUSIONS.....	75
BIBLIOGRAPHY.....	84
APPENDIX.....	86

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

LIST OF TABLES

TABLE	Page
1 Income-Quantity Elasticities for Selected Meat Cuts, Urban Families in the United States, Spring, 1948.....	10
2 Weekly Expenditures for Selected Cuts of Meat by Per Capita Income Groups, March and June, 1948.....	11
3 Income-Quantity Elasticities for Meat Items by Size of Family, Lansing, Spring, 1950.....	14
4 Family Characteristics by Per Capita Income Groups, Sub-Sample of Ninety-Nine Families, Michigan State University Consumer Panel, 1953-1957.....	22
5 Average Annual Prices for Selected Meat Cuts, Michigan State University Consumer Panel, 1951-1957.....	26
6 Per Capita Disposable Income of a Ninety-Nine Family Sub-Sample, Michigan State University Consumer Panel, 1953-1957.	29
7 Average Annual Per Capita Income, by Income Groups Subdivided by Family Size, Ninety-Nine Family Sub-Sample, Michigan State University Consumer Panel, 1953-1957.....	32
8 Per Capita Expenditures for Selected Beef Cuts, by Income Groups, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	34
8a Per Capita Expenditures for Selected Beef Cuts, by Income Groups, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	42
9 Average Level of Family Expenditures for Selected Beef Cuts, All Urban Families in the North Central Region, A Week in April-June, 1955.....	42
10 Per Capita Expenditures for Selected Beef Cuts, by Income Groups Subdivided by Family Size, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	44
11 Annual Average Per Capita Beef Cut Expenditures Associated With Increased Income, by Income Groups, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	45

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.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

LIST OF TABLES - Continued

TABLE	Page
12 Annual Average Per Capita Beef Cut Expenditures Associated with Increased Income, by Income Groups Subdivided by Family Size, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	47
13 Observed and Expected Beef Roast and Steak Adjustments Associated with Increased Income, Low Income Group, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	48
14 Per Capita Expenditures for Selected Pork Cuts, by Income Groups, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	52
15 Average Level of Family Expenditures for Selected Pork Cuts, All Urban Families in the North Central Region, A Week in April-June 1955.....	53
16 Per Capita Expenditures for Selected Pork Cuts, by Income Groups Subdivided by Family Size, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	54
17 Annual Average Per Capita Pork Cut Expenditures Associated with Increased Income, by Income Groups, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	55
18 Dynamic Income-Expenditure Elasticities for Selected Pork Cuts, by Income Groups, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	57
19 Annual Average Per Capita Pork Cut Expenditures Associated with Increased Income, by Income Groups Subdivided by Family Size, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	58
20 Observed and Expected Pork Cut Expenditures Associated with Increased Income, Low Income Group, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	59
21 Average Level of Family Expenditures for Broilers and Cold Cuts, All Urban Families in the North Central Region, A Week In April-June, 1955.....	63
22 Per Capita Broiler Expenditures, by Income Groups, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	64

LIST OF TABLES - Continued

TABLE	Page
23 Per Capita Broiler Expenditures, by Income Groups Subdivided by Family Size, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	65
24 Annual Average Per Capita Broiler Expenditures Associated With Increased Income, by Income Groups, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	66
25 Annual Average Per Capita Broiler Expenditures Associated with Increased Income, by Income Groups Subdivided by Family Size, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	67
26 Per Capita Cold Cut Expenditures, by Income Groups, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	70
27 Per Capita Cold Cut Expenditures, by Income Groups Subdivided by Family Size, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	71
28 Annual Average Per Capita Cold Cut Expenditures Associated with Increased Income, by Income Groups, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	72
29 Annual Average Per Capita Cold Cut Expenditures Associated With Increased Income, by Income Groups Subdivided by Family Size, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	73

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

LIST OF FIGURES

FIGURE	Page
I United States Consumer Price Index, for All Items, Total Food and Total Food Eaten at Home, Department of Labor, Bureau of Labor Statistics, 1953-57.....	28
II Changes in Per Capita Beef Steak Expenditures Associated with Income Increases, Michigan State University Consumer Panel Sub-Sample, 1953-57.....	31

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CHAPTER I

INTRODUCTION

Purpose of Study

There have been several cross-sectional studies which have investigated the relationship between meat expenditures and family income for specified time periods. In using these results for prediction purposes, there is usually an implicit assumption that families experiencing an increase in income adjust their meat purchases so they are similar to the purchases made by the income group the families are entering. The primary purpose of this study was to examine the validity of this implicit assumption.

The data utilized in this study were obtained from the Michigan State University Consumer Panel which was organized and operated under the direction of Quackenbush and Shaffer.¹ The Consumer Panel was in operation for approximately eight years, beginning in February 1951 and concluding its operations in December 1958. During this time approximately 250 family food purchase diaries were received weekly. The panel was one of the few conducted in the United States which provided weekly information on consumer food purchases.

¹J. D. Shaffer and G. G. Quackenbush, "Cooperation and Sampling in Four Years of M. S. U. Consumer Panel Operation," Quarterly Bulletin, Agricultural Experiment Station, Michigan State University, East Lansing, August, 1955, pp. 85-103.



Consumer panel purchase data were suited to both time-series and cross-sectional analyses.¹ Therefore, it was possible to examine consumer meat expenditures before and during an increase in income. Expenditure adjustments were then compared with the "expected" changes in expenditures obtained from a conventional cross-sectional analysis of the same data. This comparison was the basis for accepting or rejecting the validity of the implicit assumption used in making predictions from the income-expenditure relationships derived from cross-sectional studies.

The second objective was to determine the level of expenditures for eight meat cuts for different levels of family income. These relationships were then compared with the results obtained in other cross-sectional studies.

The third objective was to estimate the relationship between family size and per capita meat expenditures among families with similar levels of per capita income. If per capita meat expenditures differed among families of different sizes with similar levels of income, then, income-expenditure estimates would be subject to error where family size is not homogeneous in the group from which the relationships were derived and the group whose responses to an increase in income we are attempting to predict.

¹For 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.

74



Previous Studies

Engel was the first to make a statistical analysis of the relationship between consumption and income. As a result of this study, Engel concluded, "The poorer a family, the greater the proportion of total spending which goes for food purchases."¹ The generalization that incomes are first devoted to the necessities of staying alive and that luxury spending or saving occurs at higher income levels was developed from the above study. Therefore, it was expected that consumers in the lower income bracket would be more responsive in adjusting their food purchasing patterns after experiencing an increase in income than families at higher income levels experiencing similar increases in income.

"Income elasticity" is a quantitative measure of the responsiveness of consumers in adjusting their purchases after experiencing a change in income. Consumer responsiveness can be measured either as changes in quantities or expenditures. For purposes of empirical measurement, income elasticity is usually defined as the percentage change in either quantity or expenditure associated with a one per cent change in income, all other things remaining the same.² The variables which may influence income elasticity estimates are assumed constant in this study. These

¹George J. Stigler, "The Early History of Empirical Studies of Consumer Behavior," Journal of Political Economy, Vol. 62, No. 2, 1954, pp. 48-100.

²Ibid., The Theory of Price, (rev. Ed., New York: Macmillan Company, 1952), pp. 49-53.

variables may be classified into four groups:¹ 1) conditions which affect the desires of consumers for commodities, such as, changing styles, advertising, and living customs; 2) changes in the quantities available, and prices of competing or substitute products; 3) changes in the composition and prices of all other items in the budget; and 4) availability of unused sources of purchasing power over and above current income.

Previous studies have been usually classified as one of two types, time-series or cross-sectional analyses. The type of data, methodology, results and limitations of each classification are discussed in the following section. In analyzing data, some researchers prefer to adjust income and expenditures for price level changes by means of an index and other researchers prefer to leave the data unadjusted. It is important to understand that these differences in handling and analyzing data result in income elasticities which differ and in some cases are not comparable.

Time-Series Analyses

Time-series analyses have been largely limited to broad food categories such as, all meat, beef, or pork due to the limiting nature of the data available. Several of these studies were based on annual data for the United States, with observations beginning in the late 1910's

¹F. L. Thomsen, "Measuring Changes in the Demand for Farm Products," Journal of Farm Economics, Vol. 21, No. 1, 1939, pp. 132-142; see also, Marguerite C. Burk, "Changes in Demand for Food From 1941 to 1950," Journal of Farm Economics, Vol. 33, No. 3, 1951, pp. 291-295.



and extending into the 1950's. The war years were generally excluded because the effects of price controls and other variables which influenced the economic system of the country. These data provide information on income, food consumption, and expenditures over a period of time with the resulting income quantity or expenditure elasticities representing an average responsiveness to an increased income for all families in the United States. These income elasticities are usually computed by regression techniques. However, the relationships between quantities or expenditures, and income are not derived directly from the equation and some manipulation of the coefficients is usually required to obtain the elasticity estimate.

One of the earliest time-series analyses was done by Schultz who used annual average observations for the years 1922-1933.¹ Quantity and income data were reduced to a per capita basis to eliminate the variability due to different family sizes. Quantity data represents carcass weight with veal being included with the beef data. Prices were deflated by the Bureau of Labor's Consumer Price Index. Schultz used a single equation multiple regression technique with the dependent variable being quantity, and the independent variables being the prices of all meat, beef, pork and income. The estimated income-quantity elasticities for all meat, beef and pork were .18, .48, and .54 respectively.

¹Henry Schultz, The Theory and Measurement of Demand, (Chicago: University of Chicago Press, 1938), p. 641.



Shepherd, using a multiple regression analysis estimated the income-quantity elasticity for all meat to be about .75.¹ United States per capita annual average observations for all meats for the period 1920-41 were used.

Fox estimated the income-consumption elasticity for all meat to be .56. Income elasticity estimates for beef and pork were about .7.² Annual per capita data were used for the period 1922-41 with income elasticities being computed by the single equation method. Linear relationships were assumed between per capita consumption and disposable income per person.

A single New England community was the source of two and one-half years of weekly data used in computing short and long-term income-expenditure elasticities.³ Aggregate data for the community were used rather than data for a sample of households because expenditure decisions of the household may be formed in such a manner that a budgetary study would not determine the impact of an income change on expenditures. Income payments to consumers were obtained from the major firms in the area. Bank balances were obtained directly from each bank to determine if net saving or dissaving occurred during the period. The sales

¹Geoffrey Shepherd, Changes in Demand for Meat and Dairy Products in the United States Since 1910, Res. Bul. 368, (Ames, Iowa: Iowa Agr. Exp. Sta., 1949), p. 381.

²Karl A. Fox, "Factors Affecting Farm Income, Farm Prices, and Food Consumption," Agr. Econ. Res., No. 3, 1951, pp. 65-111.

³George K. Brinegar, "Short-Run Effects of Income Change on Expenditures," Journal of Farm Economics, Vol. 35, No. 1, 1953, pp. 99-109.



records of 10 retail firms were used to estimate the purchases of goods by consumers. The analysis of income and expenditure data consisted of fitting linear regressions of data for: 1) six month periods within the two and one-half year period, and 2) the two and one-half year period. The income-expenditure elasticities were computed at the income means. Brinegar calculated confidence limits for the elasticities at the 95 per cent level. In adjusting for price changes, price elasticities were assumed which corresponded to the findings of price elasticity studies.

The short-term elasticities calculated for six month periods were characterized by relatively wide confidence limits which prohibited detailed generalizations about meat expenditures. However, the analysis of the two and one-half period yielded an income elasticity for fresh meats unadjusted for price changes and seasonality of .30 and .46 adjusted for seasonality. The income-expenditure elasticity adjusted for price changes and seasonality was .27 and .30 adjusted for seasonality. Since the short-term elasticities were computed at the mean income, it was possible that increases in meat expenditures for low income families were offset by decreases in expenditures by large income families, which resulted in the wide confidence limits for the six month periods.

Income elasticities based on time-series analyses have been computed by utilizing annual average data for a long period of time. These aggregate data may result in an income elasticity which excludes the evidence

of trends in consumption of meat groups or cuts of meat over a long period of time. Income elasticities based on data from an earlier time period for a product which was of minor importance in the consumer food budget will result in an inaccurate estimate of consumers responsiveness to an increased income if consumers increased the relative importance of this product in their food budget without the benefit of an increase in income.

Cross-Sectional Analyses

Cross-sectional or budgetary studies have utilized both survey and panel data for the United States, Western Europe, and specific geographical areas in computing income elasticities for all meat, beef, pork and selected cuts of beef and pork. Arc elasticity is usually used to determine the responsiveness of consumers in adjusting their meat expenditures to an increase in income. Data collected by the survey method usually represents a short period of time whereas panel data represent a long period of time, usually one year, or average yearly data if more than one year's data were utilized. These studies attempted to analyze the effects of an increased family income on consumer meat purchasing patterns.

For prediction purposes, it was assumed in some studies that families adjusted their purchasing patterns so they were similar to the economic class they were entering. Other studies did not make this assumption. Attempts to determine the relationships between socio-economic variables and levels of meat consumption were the objectives of other studies.

A survey of 2200 families was made in Minneapolis in 1934, a time of large unemployment and depressed incomes.¹ It was found that meat consumption was greater among the high income families. The study illustrated that size and composition of families had minor influence upon per capita meat consumption but more recent studies² have indicated that family size was an important variable influencing per capita meat consumption.

During both 1948 and 1955, the United States Department of Agriculture conducted surveys of families in order to determine the average weekly food expenditures. Classification data such as income and size of family were obtained so similar families could be grouped. Waite and Trelogan used these data to compute income-quantity elasticities for specific meat cuts.³ Table 1 summarizes these results.

The elasticities (shown in Table 1 on the following page) are simple arc elasticities using the second income group, with an average family income of \$1,555 and the sixth income group with an average income of \$5,861. The wide variation in meat purchases among the

¹W. C. Waite and R. W. Cox, A Study of the Consumption of Meats in Minneapolis, 1934, Minn. Agr. Exp. Sta., Bul. 321, 1935.

²For further details, see: J. D. Shaffer, G. G. Quackenbush and T. N. Moss, The Consumption of Meat and Related Products in Lansing, Michigan, Spring, 1950, M.S.C. Agr. Exp. Sta., Techn. Bul. 239, 1954, pp. 11-16; also, W. M. Simmons, Consumer Meat Purchases in Syracuse New York 1948 and Comparisons with 1942, Bul. 869, (Ithaca, New York: Cornell University Agr. Exp. Sta., 1951), pp. 6-7.

³W. C. Waite and H. C. Trelogan, Agricultural Market Prices, 2d. ed., (New York: John Wiley & Sons, 1951) p. 41.

TABLE 1
INCOME-QUANTITY ELASTICITIES FOR SELECTED MEAT CUTS,
URBAN FAMILIES IN THE UNITED STATES, SPRING 1948

Meat Cut	Income Elasticity
Beef steak other than round	1.037
Smoked ham (cooked)	.820
Poultry total	.636
Beef steak round	.553
Bacon	.102
Pork chops	-.212

Source: Computed from Food Consumption of Urban Families in the United States, 1948 Food Consumption Survey USDA, Report No. 5.

families with the same income indicates that the reliability of these estimates may be rather low.¹

Simmons conducted a cross-sectional study of 726 families living in Syracuse, New York with the following objectives:²

1. To determine the level of meat consumption in Syracuse, New York in March and June 1948; to determine variations in consumption and expenditures for meat among different groups of consumers; and to ascertain the factors associated with or affecting these variations.
2. To determine how changes in economic status for a given group of consumers affect the total quantity of and expenditures for various kinds and cuts of meat.

Results showed that there was a direct relationship between per capita income and expenditures for beef roasts, beef steaks, bacon, poultry, and cold cuts. Results for pork steaks and chops, pork roasts, and ham were inconclusive. See Table 2.

¹Bur. of Human Nutr. and Home Econ., U. S. Dept. of Agr., Meat: Variations in Consumption and Interrelationships with Other Foods, Commodity Summary No. 11, 1951, p. 3.

²Simmons, op. cit., p. 30.

TABLE 2

WEEKLY EXPENDITURES FOR SELECTED CUTS OF MEAT BY PER CAPITA
INCOME GROUPS, MARCH AND JUNE 1948^a

Meat Cut	Per Capita Income ^b			
	Low	Low-Medium	High-Medium	High
	(Weekly Expenditures per capita, dollars)			
Beef				
Steaks	.13	.18	.24	.30
Roasts	.16	.18	.30	.34
Pork				
Steaks and chops	.10	.11	.09	.09
Roast	.12	.10	.11	.10
Bacon	.04	.07	.10	.12
Ham	.16	.17	.21	.07
Poultry	.11	.18	.26	.36
Cold Cuts	.22	.21	.19	.14

^aSource: W. M. Simmons, Consumer Meat Purchases in Syracuse, New York in 1948 and Comparisons with 1942, Bul. 869 (Ithaca, New York: Cornell University Agr. Exp. Sta., 1951), pp. 14,20,23.

^b Income Group	Boundaries	Mean Income
Low	140-474	369
Low-Medium	475-674	562
High-Medium	675-954	794
High	955-3690	1311

Other variables which influenced per capita expenditures were size of family, nationality, religion, and the activity of the wage earner. Simmons concluded that a definite association existed between rates of change in per capita income between 1942 and 1948 and changes in per capita expenditures for meat. In the group whose 1942 income was below the median, a third of the families with a low rate of increase in income purchased about 10 per cent less meat per capita in 1948 than in

1942 in contrast to the third of the families with the highest relative increase in income by 1948 who purchased about 65 per cent more meat per capita than in 1942. (Per capita income in 1948 was adjusted to 1942 dollars by dividing per capita income by the cost of living index for Buffalo, New York, with March and June 1942 = 100.) Those families which had income below the median in 1942 decreased their beef roast expenditure by 10.4 per cent after experiencing an increase in disposable income. Families which had income above the median in 1942 decreased their expenditures for beef steak and roasts, pork steaks, chops and roasts. The decrease in expenditures for these meat cuts was greater than 10 per cent with the exception of pork roasts which decreased by 8.8 per cent between 1942 and 1948.

Simmons concluded that in the short-run, consumers tended to spend about the same amount for meat. Consumers adjusted to changing marketing conditions and prices by increasing or decreasing the quantity of meat purchased or by shifting to other kinds of meat considered "superior" in nature.

In the spring of 1950, 1885 families in Lansing, Michigan were contacted and interviewed by individuals employed by the Department of Agricultural Economics, Michigan State University. The objective of this survey was to obtain the quantities and expenditures for food and socio-economic data by which families were classified. Analysis of the information obtained determined whether or not differences in family size, income, age of housewife, education of housewife, and occupation

of householder were related to significant variations in per capita expenditures.

Moss, using cross-sectional tables, illustrated that family income and size of family appeared to be the most important factors affecting per capita meat consumption.¹ Family income appeared to have little if any effect on poultry expenditures. However, by size of family, a downward trend in per capita poultry expenditures was evident as family size increased.

Riley, using data in Moss's thesis, computed a series of simple arc elasticities.² The results indicated that the income-quantity elasticities varied by size of family and that the low-medium income group had a higher income-quantity elasticity than did the medium-high income group. The results of this analysis are presented in Table 3.

West used Michigan State University Consumer Panel data for the period 1951-55 to compute arc income-expenditure elasticities for broad food groups, including all meats.³ Included in the all meats category were meat, poultry, fish and eggs. Families were classified into 3 per

¹Thomas Neil Moss, "Some Relationships of Selected Socio-Economic Factors to Food Consumption and Expenditures, Lansing, Spring 1950," (unpublished Ph.D. thesis, Department of Agricultural Economics, Michigan State University, 1952).

²Harold M. Riley, "Some Measurements of Consumer Demand for Meats," (unpublished Ph.D. thesis, Department of Agricultural Economics, Michigan State University, 1954).

³Jerry Glenn West, "Estimates of Income Elasticity From Consumer Panel Data," (unpublished Ph.D. thesis, Department of Agricultural Economics, Michigan State University, 1958).



TABLE 3
INCOME-QUANTITY ELASTICITIES FOR MEAT ITEMS BY
SIZE OF FAMILY, LANSING, SPRING 1950^a

Kind of Meat	Size of Family	Elasticity Between Income Groups	
		Low-Medium	Medium-High
Beef	1-2	.68	.20
	3-4	.41	.16
	5 or more	.28	.06
Pork	1-2	.48	-.06
	3-4	.08	.00
	5 or more	-.16	.15
Beef Steak	1-2	.81	.52
	3-4	.52	.30
	5 or more	.80	.45

^aSource: Harold M. Riley, "Some Measurements of Consumer Demand for Meats," (unpublished Ph.D. thesis, Department of Agricultural Economics, Michigan State University, 1954), p. 51.

capita income groups: less than \$1100, \$1100 to \$1900, and more than \$1900. Income elasticities obtained for all meats corresponding to the above income classification were .07, .21 and -.03. West attributes the negative elasticity of -.03 for the more than \$1900 group as the result of families having increased their expenditures for meals away from home rather than their expenditures for food served at home.

A priori reasoning indicated that the elasticities for all meat were lower than if the elasticities had been computed for red meats alone because the income elasticities for poultry, fish, and eggs are probably lower than the elasticities for red meats. West's study was different from earlier research in that expenditures by a particular group of

families were examined before and after increases in family income. When these income elasticities are used for prediction purposes, there is no need for the assumption used in conventional cross-sectional analysis.

West examined the differences in per meal expenditures for three income groups, when families were classified according to family income. Statistical analysis indicated that there were no significant differences in per meal per person expenditures between income groups even at the fifty per cent level. Similar results were obtained when computing the per meal expenditures per capita per family year for the three per capita income groups.

The analysis used by West to examine expenditures for food groups before and after changes in per capita income is essentially the same method used in this study to determine the validity of the assumption implicit in predicting the effects of increased income on consumer meat expenditures.

Summary of Previous Studies

Results from cross-sectional analyses have generally indicated that a direct relationship existed between family income and expenditures for most meat items. When family income increased, it was assumed for prediction purposes, that families receiving increases in income adjust their expenditures so that they are similar to the expenditures of the income group the families are entering. The primary purpose of this thesis was to test the validity of this assumption.

West observed family meat expenditures before and after increases in income. Estimates of income elasticity obtained reflected the actual changes consumer panel families made in their expenditure patterns when their income increased. These estimates of consumer response in adjusting their meat purchases after receiving an increased income were much lower than the estimates which have been derived from other cross-sectional studies. These results tended to indicate that families did not adjust their meat expenditures as much as was predicted by cross-sectional elasticities. The study being undertaken will determine if the above results are true for selected meat items.

Usefulness of Results

Some of the uses which might be made of the results of this study are as follows: 1) Improve the estimates of consumer responsiveness to increases in real income and thus the accuracy of forecasts on the national level. These results will also be useful in analyzing the expected effects of Government food subsidy programs; 2) Provide information on the detailed consumption patterns for selected meat cuts by income groups which is of considerable value in planning, marketing, promotional, and merchandising programs, and 3) The results obtained will add to the fundamental knowledge concerning the validity of the implicit assumption used in conventional cross-sectional analyses for prediction purposes for specific cuts of meat.



CHAPTER II

METHODS OF ANALYSIS

The General Approach

Consumer panel families who experienced an increase in income between two consecutive years were included in the study. These families were aggregated into two per capita income groups. Cross-sectional analysis was used to determine the relationship between income and meat expenditures. Cross-sectional income-expenditure elasticities were then computed between these income groups. Families in each income group were regrouped according to size of family. This was done to determine if family size affected the level of meat expenditures.

Meat expenditures of the families in the two per capita income groups were "observed" before and during an increase in income. Dynamic income-expenditure elasticities were computed to determine the responsiveness of families in adjusting their meat expenditures to an increased income. Families in each income group were then grouped according to family size to determine if this variable affected expenditure adjustments associated with increased income.

Static cross-sectional and dynamic income-expenditure relationships were compared. This comparison was the basis for accepting, modifying

or rejecting the assumption underlying the use of conventional cross-sectional relationships for prediction purposes.

Source and Nature of Data

The Michigan State University Consumer Panel consisted of approximately 250 families who kept weekly food purchase diaries which showed the price, quantity and total expenditures for each food item purchased. During the panel's existence, there was a constant flow of families entering and leaving the panel. The primary reasons families left the panel were: moving out of town and not enough time to cooperate.¹

An attempt was made to obtain and maintain an unbiased probability sample. The original sample was obtained by conducting a sample survey of 1885 families in the Lansing area. From this group a sub-sample of 300 families was selected on the basis of; income of the household, number in the household, age of the housewife, and education of the housewife.² As panel families dropped out, new members were recruited from the list of families in the sample survey. The old family was replaced by a new family which had similar characteristics. Provisions were also made for selecting a proportionate number of newly formed families so as to maintain a representative sample over time.³

¹Shaffer and Quackenbush, op. cit., p. 91.

²J. D. Shaffer, "Methodological Bases for the Operation of a Consumer Purchase Panel," (unpublished Ph.D. thesis, Michigan State University, 1952).

³Ibid., "A Plan for Sampling a Changing Population Over Time," Journal of Farm Economics, Vol. 36, No. 1, 1954, p. 156.

The weekly food purchase diary listed approximately 1,000 food items. These food items were categorized into product groups. Meat items were categorized into six groups: beef, pork, lamb-mutton, veal, other meat and meat mixtures, and poultry.

Size of family and income were reported weekly as well as the number of meals eaten away from home. At the end of the year, a questionnaire was sent to each participating family asking several questions, one of which concerned the income received during the year. The summation of income reported in the weekly diaries were compared with the income estimate on the end-of-year questionnaire. If these two figures were comparable, it was assumed that the income figure represented a valid estimate for that family. If the two income estimates did not coincide with each other, an attempt was made to reconcile the differences by interviewing the family.

Selection of Families

Michigan State University Panel families who met the following criteria were included in the sub-sample utilized in this study.

1) Families who participated in the panel for two consecutive years and experienced an increase in income. 2) Families who maintained a constant size or decreasing size during the period 1953-57. This selection was done to eliminate fluctuations in family size due to birth of children which resulted in lower per capita meat expenditures for that family, even though members of this family consumed the same or greater quantities of meat than before the increase in family size. 3) Families of

two or more persons were included in the sub-sample. In previous studies, it was noticed that one-person families were primarily responsible for the extreme variability of expenditure data. These families were not included in the study in an attempt to reduce the variability of expenditures for different income groups. 4) Families who sent in at least 40 diaries per year. These diaries were not required to be sent in consecutively. For those families who participated less than 52 weeks, an adjustment of their expenditures was made to make these expenditures comparable with those families who participated for 52 weeks. This adjustment brought all expenditures to the same level. A family observation was considered to consist of a family who participated in the Michigan State University Consumer panel for two consecutive years and who met the above criteria.

Family meat expenditures included only meat consumed at home. Expenditures for meals eaten away from home were excluded as participants in the consumer panel only reported the price of the meals and not its contents.

Units of Measurement

The measurement of expenditures can be per family, per meal, or per capita. To be comparable per family or per meal expenditures must be reduced to a per capita basis in order to eliminate the consumption variability due to different family sizes.

In this study, income and expenditure data were reduced to a per capita basis even though the per capita method tends to place many of

the large families in the low income group while placing small families in the upper income groups. Large sized families purchase more meat than do small sized families, but reducing family expenditures to a per capita per family basis, the per capita expenditures of large families were smaller than those of small families. The optimum situation would be to determine the meat expenditures associated with increased income for different family sizes within income groups. When the sub-sample data were grouped according to family size by income groups, it was found that there were very few families in several of the family size categories. To have an adequate number of observations in each category, families were aggregated into two groups; 2-3 person and 4 or more persons per family.

Income can be measured as gross or disposable income. Disposable income was more significant than gross income because of the influence of size of family and other tax deductible items. In the remainder of this analysis the term income will refer to per capita disposable income unless specified differently.

Grouping of Families

There were ninety-nine families who met the criteria used in selecting families for the sub-sample used in this study. These families were divided into two per capita income groups: less than \$1700 and \$1700 and above. The less than \$1700 and the \$1700 and above income groups were referred to in this study as the low and high income groups.

The relationship between family characteristics and disposable income are important for correct interpretation in analyzing consumer responsiveness in adjusting their purchasing patterns after experiencing an increase in income. The higher income families are smaller in size and the homemaker was older and had lower levels of education than homemakers in low income families. See Table 4.

TABLE 4

FAMILY CHARACTERISTICS BY PER CAPITA INCOME GROUPS,
SUB-SAMPLE OF NINETY-NINE FAMILIES, MICHIGAN
STATE UNIVERSITY CONSUMER PANEL, 1953-57

Income Groups	Average Number of Persons	Average Income (dollars)	Average Age of Householder (years)	Average Education of Householder (years)
Less than \$1700	4.15	1218.93	40.6	11.9
\$1700 and above	2.64	2654.58	48.6	12.3

Selection of Meat Cuts

The meat cuts included in this study were primarily selected by their importance in the families meat purchasing patterns. The limited number of observations on other meat cuts and their small percentage of expenditures places severe limitations on their usefulness. A secondary criteria used in the selection of meat cuts was that low and high income families have different meat cut expenditures. If the income groups' meat expenditures were similar, the "expected" expenditure adjustments

computed from cross-sectional relationships would be close to zero. Since the primary purpose of this study was to determine the validity of the assumption underlying cross-sectional predictions, it was necessary for the "expected" adjustments to be significantly different from zero.

The eight meat cuts studied were: beef roasts and steaks, pork chops, roasts, bacon and ham, broilers, and cold cuts. Bacon included Canadian bacon while cold cuts excluded weiners and frankfurters.

Selection of Time Period

An attempt was made to use a maximum amount of data from the Michigan State University Consumer Panel, but to avoid major price fluctuations. Therefore, data were used only for those years where meat prices were relatively stable.

It was also deemed desirable to select a period during which the general price level was relatively stable. If we use money income as one variable and do not introduce the general price level separately, the income expenditure elasticity estimate will be accurate for prediction purposes only if we are dealing with a period when both the price level and real income are changing in about the same ratio or if the price level is stable. If, however, there is a large change in the price level and a shift in the relationship occurs between the price level and real income, we cannot expect the previously observed relationship between money income and expenditures to remain the same.¹

¹E. J. Working, "Agricultural Demand During Rearmament," Journal of Farm Economics, Vol. 34, No. 2, 1952, p. 210.

Price elasticity is defined as the percentage change in the quantity taken associated with a one percentage change in price.¹ Previous studies have indicated that many of the meat cuts have price elasticities centering around unity. Theoretically, when a meat item has a price elasticity of one, a one per cent increase or decrease in price results in a one per cent increase or decrease in the quantity demanded but expenditures remain constant. For those meat cuts which have a price elasticity around unity, expenditures will not change because of price variations. Those meat cuts which have a price elasticity greater or less than one, expenditures will increase or decrease, depending on the direction of the price change. However, if the price changes are small consumer expenditure adjustments due to price variations are likely to be negligible.

Purchasing patterns will not be adjusted unless the magnitude of the price change will insure a significant increase in satisfaction derived from a different bundle of goods. Thus, a families' purchases of a given item will vary according to the magnitude of the price change. Bilkey generalized that the smaller the price change, the smaller the probability of families adjusting their purchasing patterns and conversely, the larger the price change, the greater the probability of families adjusting their purchasing patterns.² Thus we would expect that

¹Stigler, op. cit., p. 32.

²Warren J. Bilkey, The Basic Relationships In Consumer Expenditure Behavior, Harvard Studies in Marketing Farm Products, Number 4-H, Cambridge, 1951, p. 39.

sub-sample families made few adjustments in their purchasing patterns due to price variations.

The Michigan State University Consumer Panel operated from February 1951 through December 1958 but significant price variations occurred during this period which limited the years to be used in this study. Data for 1958 was unavailable. Table 5 indicates that during the period 1951-52 beef roast and steak prices were higher than during the period 1953-57. Steak and roast prices decreased during the 1952-53 period by 14.5 and 23.0 per cent respectively. During this period the supply of slaughter cattle increased, depressing beef prices. The period 1953-57 exhibited relative price stability for these two beef cuts. As stated earlier, the prices of the meat cuts analyzed must be stable in order to minimize the effects of price on the purchasing patterns of consumer. For this reason, the period 1951-52 was dropped from the analysis.

Pork prices were more variable than beef prices during the period 1953-57. See Table 5. The variability of pork prices was primarily due to the differences in the production cycles of pork and beef. For cattle this cycle is 14-16 years, whereas the production cycle for hogs is 3-5 years. The production of hogs reached its peak in the last part of 1953 and the first part of 1954 and 1957 which depressed pork prices during these periods. Production of hogs decreased during the period 1955-56 which stimulated pork prices.

The price of cold cuts was relatively stable as shown in Table 5. During the years 1953-57, the average annual price of cold cuts varied

TABLE 5

**AVERAGE ANNUAL PRICES FOR SELECTED MEAT CUTS, MICHIGAN STATE
UNIVERSITY CONSUMER PANEL, 1951-1957**

Meat Cut, Price Per Pound						
Year	Beef Cuts				Pork Cuts	
	Roasts (cents)	Percentage Change	Steak (cents)	Percentage Change	Bacon (cents)	Percentage Change
1951	.77	-3.9	.95	-5.3	.56	-5.4
1952	.74	-23.0	.90	-14.5	.53	24.5
1953	.57	-5.3	.77	-3.9	.66	-3.0
1954	.54	-5.6	.74	-1.4	.68	-7.7
1955	.51	2.0	.73	0.0	.56	-8.9
1956	.52	7.7	.73	8.2	.51	27.5
1957	.56		.79		.65	

Meat Cut, Price Per Pound						
	Pork Cuts					
	Chops (cents)	Percentage Change	Ham (cents)	Percentage Change	Roasts (cents)	Percentage Change
1951	.71	0.0	.66	-3.0	.57	-5.3
1952	.71	8.5	.64	7.8	.54	5.6
1953	.77	0.0	.69	4.3	.57	-1.8
1954	.77	-10.4	.72	-8.3	.56	-17.9
1955	.69	0.0	.66	0.0	.46	-2.2
1956	.69	8.7	.66	-1.5	.45	13.3
1957	.75		.65		.51	

Meat Cut, Price Per Pound				
	Other Meats		Poultry	
	Cold Cuts (cents)	Percentage Change	Broilers (cents)	Percentage Change
1951	.66	1.5	.57	-1.8
1952	.67	-4.5	.56	-1.8
1953	.64	-1.6	.55	-18.2
1954	.63	-1.6	.45	13.3
1955	.62	-3.2	.51	-15.7
1956	.60	6.7	.43	-4.7
1957	.64		.41	

only by 7 cents with the largest percentage change in prices between years being 6.7 per cent.

The price of broilers and fryers exhibited considerable fluctuations, generally downward, during the period 1953-57. This decrease in price was primarily due to the influence of increasing size and efficiency of the broiler industry.

Even though there were fluctuations in the prices of the meat cuts discussed, the magnitude of the price change was such that they probably did not greatly influence consumers expenditure patterns for beef or cold cuts. The variation in pork prices may have influenced consumer pork expenditure patterns. Income-expenditure relationships were definitely affected by the decreasing price of broilers during the period 1953-57. Income expenditure elasticities computed for broilers represent the responses of consumers to both a price and income change.

The general price level was relatively stable during the period 1953-57. The Consumer Price Index, (United States 1947-49 = 100) increased only 5.77 per cent during the period, an average increase of 1.15 per cent per year. The Consumers Price Index was unusually stable from 1953-56 but during 1957 the index increased by 3.94 per cent. See Figure I. Inflationary pressures affected the prices of food eaten at home less than all items purchased by consumers. Food prices during this period remained relatively constant primarily because of the plentiful food supply. The inflation that occurred was experienced in the durable good segment of the economy.

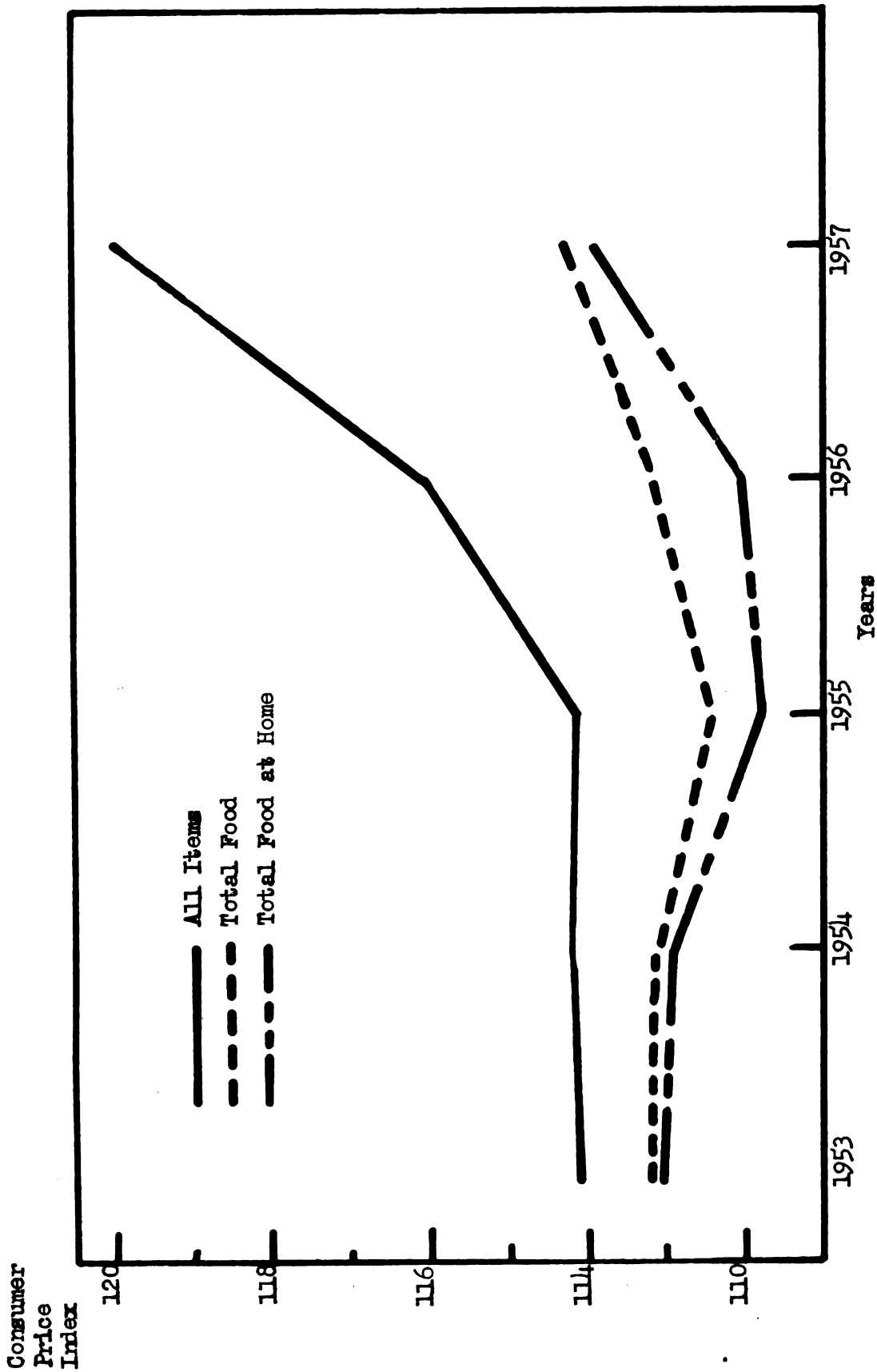


Figure I. United States Consumer Price Index, for All Items, Total Food, and Total Food Eaten at Home, Department of Labor, Bureau of Labor Statistics, 1953-57 (1947-49 = 100).

The ninety-nine family sub-sample from the Consumer Panel experienced an average increase in disposable income of approximately 13 per cent. Of this 13 per cent increase in income, approximately 6 per cent was due to inflationary pressures and the remaining 7 per cent represented the actual amount of increased purchasing power in the hands of consumers. The upward trend in per capita income over time exhibited in Table 6 was partly the result of selecting only those families who experienced an increase in income.

TABLE 6

PER CAPITA DISPOSABLE INCOME OF NINETY-NINE FAMILY SUB-SAMPLE,
MICHIGAN STATE UNIVERSITY CONSUMER PANEL
1953-57

Year	Per Capita Income (dollars)
1953	1802.07
1954	1826.67
1955	1962.32
1956	1945.81
1957	2203.08

The large increase in per capita income in 1957 as compared to 1956 was primarily due to the large proportion of high income families in the sub-sample. There were very few low income families in 1957 who received an increase in income.

Preliminary Investigation

Adjustments in family beef steak expenditures associated with increases in income during the period 1953-57 are shown in Figure II. The apparent variability shown in the scatter diagram indicated that any attempts to forecast individual family responses to an increased income would result in a large error of estimate. Plotting changes in beef roast expenditures against income changes produced similar results.

It was hypothesized that there would be a greater stability of expenditure-income relationships when dealing with averages for groups rather than with individual families. Consequently, a decision was made to compute arc elasticity estimates to measure the responses of consumer groups to increased income. An arc elasticity computed between two income groups represent an average responsiveness of consumers to increased income. This responsiveness is assumed to be similar over the entire range for which the elasticity is computed. This assumption should be valid in this study since the elasticities were computed over a relatively short segment of the income range.

Methodology

Static Cross-sectional Relationships

Arc elasticities were computed to determine the income-expenditure relationship between the two income groups. The income data used in cross-sectional computations are shown in Table 7.



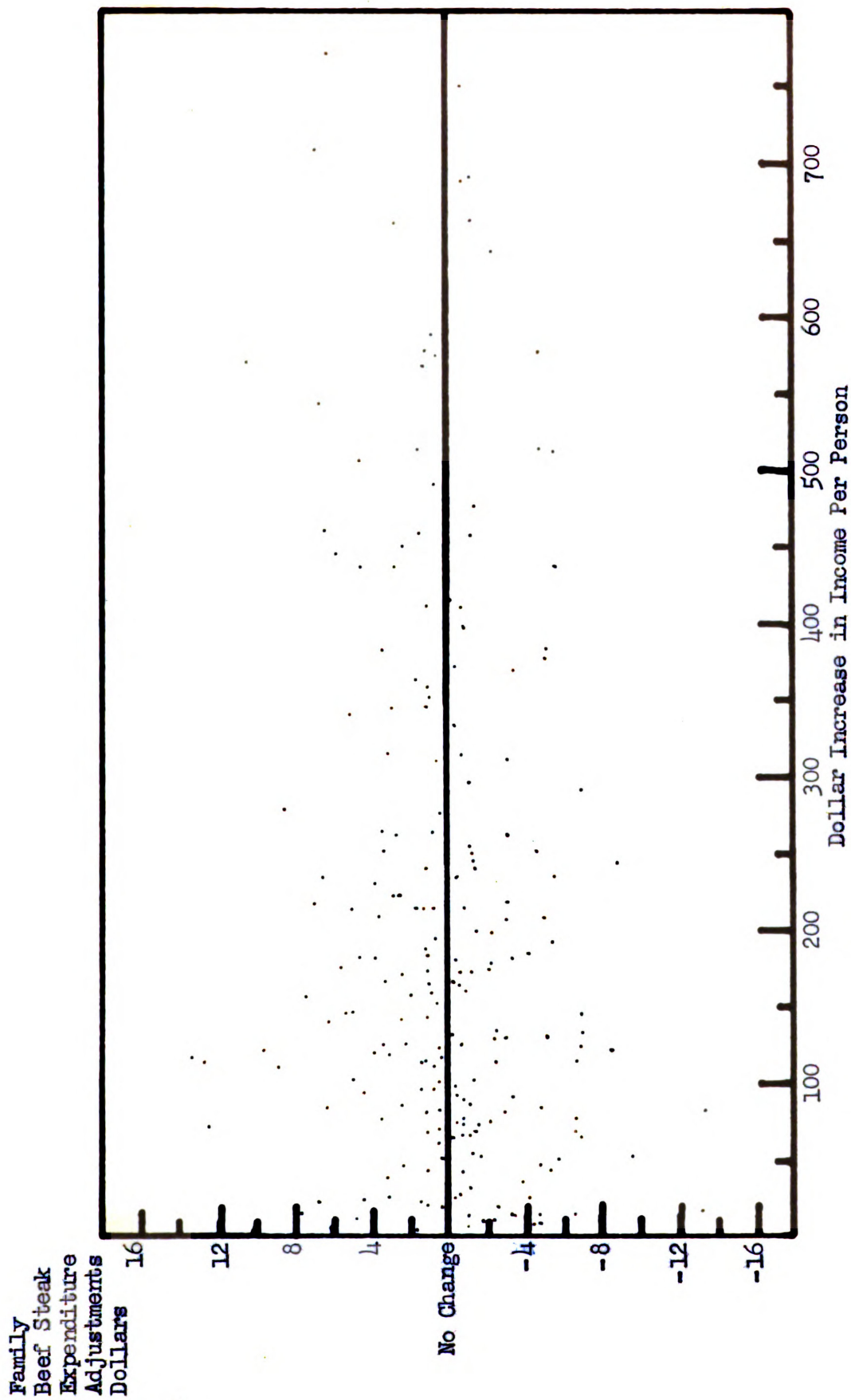


Figure II. Change in Per Capita Beef Steak Expenditures Associated with Income Increases, Michigan State University Consumer Panel Sub-Sample, 1953-57.

TABLE 7

AVERAGE ANNUAL PER CAPITA INCOME, BY INCOME GROUPS SUBDIVIDED
BY FAMILY SIZE, NINETY-NINE FAMILY SUB-SAMPLE, MICHIGAN
STATE UNIVERSITY CONSUMER PANEL, 1953-57

Income Groups	Number of Family Years	Per Capita Income (dollars)
Less than \$1700	119	1314.25
2-3 person	33	1344.53
4 or more	86	1302.62
\$1700 and above	95	2814.90
2-3 person	83	2902.48
4 or more	12	2209.57

These income data were obtained by adding and averaging family income before and after the family received an increase in income. The results in Table 7 showed that an inverse relationship existed between per capita income and family size.

Cross-sectional income-expenditure elasticities were computed by this formula:

$$\frac{E_B - E_A}{E_B + E_A} \cdot \frac{I_B + I_A}{I_B - I_A}$$

where

E_A = Average expenditures for income group A

E_B = Average expenditures for income group B

I_A = Average income for income group A

I_B = Average income for income group B

The estimates derived from these computations will be referred to in the course of this study as static income-expenditure elasticities.

Income groups were divided into two family size categories: 2-3 person and 4 or more person families. This breakdown of families within income groups indicated if there was any relationship between families who differed in size but who had similar per capita incomes. The income data for different family sizes are seen in Table 7. A research study of the consumer panel relating consumption of meat to various factors concluded that meat consumption per person was more closely associated with size of family than any other characteristic considered, but the effect was due partly to the accompanying inverse relationship between size of family and per capita income.¹ If there was a significant relationship between family size and meat expenditures, this would suggest that cross-sectional elasticities used to predict the responses of consumers to increased income would yield inaccurate estimates if the two populations were not homogeneous with respect to size.

Student's "t" test was used to determine if the level of expenditures were significantly different between families differing in size within income groups. The level of expenditures between two income groups were also tested for significance. The formula used was:²

$$t = \frac{\bar{E}_B - \bar{E}_A}{S_{AB} \sqrt{1/N_A + 1/N_B}}$$

¹Shaffer, Quackenbush, and Moss, op. cit., p. 12.

²Wilfred J. Dixon and Frank J. Massey, Jr., Introduction to Statistical Analysis, (2d. ed., New York: McGraw-Hill Book Company, Inc., 1957), p. 117.

where

$\bar{E}_A$ = Mean expenditure for income group or family size A.

$\bar{E}_B$ = Mean expenditure for income group or family size B.

S_{AB} = Pooled variance for the two income groups or family sizes.

Dynamic Relationships

Family meat expenditures were "observed" before and after families received an increase in income. Table 8 summarizes the income data for income groups and family sizes within income groups.

TABLE 8

AVERAGE PER CAPITA INCOME BEFORE AND AFTER AN INCOME INCREASE,
BY INCOME GROUPS SUBDIVIDED BY FAMILY SIZE, MICHIGAN
STATE UNIVERSITY CONSUMER PANEL SUB-SAMPLE, 1953-57

Income Groups by Family Sizes	Number of Family Years	T_1^* (dollars)	T_2^{**} (dollars)	Average Increase in Income (percent)
Less than \$1700	119	1227.34	1401.15	14.2
2-3 person	33	1238.70	1450.36	17.1
4 or more	86	1222.98	1382.26	13.0
\$1700 and above	95	2677.46	2952.34	10.3
2-3 person	83	2772.31	3032.64	9.4
4 or more	12	2021.42	2396.92	18.6

* T_1 = Per capita income before the income increase.

** T_2 = Per capita income after the income increase.

Although there were only ninety-nine families in the sub-sample, many families participated at least four years, supplying three observations per family. The number of observations per family for

the ninety-nine family sub-sample account for the 214 family-years included in the above table. Let us assume that a family experiences an increase in income each year during the period 1953-57. Thus, there would be four family-years for this family. The family year included T_1 which represent the families' 1953 income, and T_2 representing the 1954 income. Since we assumed an increase in income, the next family-year included T_1 the 1954 income and T_2 the 1955 income, etc.

The per cent change in income was relatively small for each income group and family size within income groups. The assumption of average elasticity throughout the income change was a realistic assumption to make in this analysis.

Meat expenditure adjustments associated with increased income were observed for the two income groups. Income expenditure elasticities were then computed for each income group by the following formula:

$$\frac{E_{A2} - E_{A1}}{E_{A2} + E_{A1}} \cdot \frac{I_{A2} + I_{A1}}{I_{A2} - I_{A1}}$$

where

E_1 = Expenditures for income group A in time period 1.

E_2 = Expenditures for income group A in time period 2.

I_1 = Income for income group A in time period 1.

I_2 = Income for income group A in time period 2.

These income elasticities will be known in this study as the dynamic income expenditure elasticities.

Sub-sample data were then classified into family sizes within income groups. This was done to determine if family size affected the

families meat expenditure adjustments after receiving an increase in income. If there was a significant relationship between family size and expenditure adjustments this would suggest that elasticity estimates used in predicting responses of consumers to increased income will result in an inaccurate estimate if the two populations were not homogeneous in respect to family size.

The changes in expenditures associated with an increased income were tested by the Student "t" test to determine if expenditure changes were significantly different from zero for income groups and for both family sizes. The formula used was:¹

$$t = \frac{\bar{d} - 0}{S/\sqrt{N}}$$

where $\bar{d}$ is the difference between the mean expenditures before and after an income change; S is the variance of the differences in mean expenditures between families.

Comparison of the Static and Dynamic Income-Expenditure Relationships

The validity of the assumption that families experiencing an increase in income will adjust their purchasing patterns to be similar to the purchasing patterns of the economic group the families are entering was tested by comparing the "observed" and "expected" meat expenditure adjustments.

¹Ibid., p. 121.

"Observed" expenditure adjustments were derived by:

$$E_t - E_{t-1}$$

"Expected" expenditure adjustments were derived by:

$$\left(\frac{I_t - I_{t-1}}{I_{t-1}} \right) (E_{t-1})$$

where

E_t = Expenditures for item in time period 1.

E_{t-1} = Expenditure for item in time period t-1.

= Static income-expenditure elasticity for item.

I_t = Per capita income in time period 1.

I_{t-1} = Per capita income in time period 2.

The difference in $E_t - E_{t-1}$ was the "observed" expenditure adjustments made by consumer after experiencing an increase in disposable income.

multiplied by $\frac{I_t - I_{t-1}}{I_{t-1}}$ yields the percentage change in expenditures "expected" from an increase in income of $\frac{I_t - I_{t-1}}{I_{t-1}}$. The "expected" percentage change in expenditures multiplied by E_t gives the "expected" changes in expenditures associated with $\frac{I_t - I_{t-1}}{I_{t-1}}$ increase in income.

In this way it was possible to determine if the "observed" expenditure changes were in the direction and magnitude of the "expected" expenditure adjustments. The validity of the assumption when the usual cross-sectional analyses are used for prediction purposes was accepted if the "expected" and "observed" expenditure adjustments were alike. However, if consumers either under or overadjusted their meat item expenditures, the validity of the assumption as stated would be critically questioned or rejected.

If the increased income was primarily due to inflationary pressures, the income-expenditure elasticities computed from consumer responses to increased income would be approximately one. Therefore, using income-expenditure data for the period 1953-57, where approximately half of the income increase experienced by consumers was "inflationary," dynamic income expenditure elasticities were affected. If the dynamic elasticities computed from expenditure changes resulting from both real and inflationary increases in income was greater than one, the effects of the inflationary increase would tend to reduce the dynamic elasticity. However, most of the real income dynamic elasticities for meats are probably less than one. Thus, when inflationary income is averaged with real income in computing dynamic income-expenditure elasticities, the result is to increase the "observed" dynamic elasticity.

Simmons pointed out that there was a definite association between the rate of change in per capita income and the change in per capita expenditures.¹ The results indicated that families receiving small increases in income did not adjust their expenditures as much as those families who received large increases in disposable income.

Families do not adjust their meat cut purchasing patterns immediately after receiving an increase in income. This analysis only covered a period of one year in which family expenditures were "observed." Therefore it is possible that family expenditure adjustments occurring

¹Simmons, op. cit., p. 34.

at a later date were not included in the "observed" expenditure adjustment.

Inflationary increases in income, lags in expenditure adjustments and the magnitude of increased income may influence the ultimate decision in accepting, modifying, or rejecting the validity of the assumption used for prediction purposes in conventional cross-sectional analyses.

Limitations of Analysis

The method used in checking family income assures that families are placed in the appropriate income group. If families reported an income which was erroneous, their expenditure data was placed in a "wrong" income group which affected the final results. However, it was assumed that all families were placed in the appropriate income group.

Other variables which probably influenced changes in expenditures associated with increased income and not examined in this study are: age, occupation, religious beliefs, credit, savings, temporary or permanent increases in income, education of the housewife, and meals eaten away from home.

The Consumer Panel sub-sample data was first divided into four income groups. The results obtained from this grouping did not conform to the results of the 1955 United States Department of Agriculture Household Food Survey. This was especially evident for pork chops, roasts and bacon expenditures where these expenditures for the medium income group were lower than expenditures for the low income group.

The results of the food survey indicated that the medium income families had larger meat item expenditures than the low income families. The findings of the consumer sub-sample data grouped into four income groups can be seen in Appendix A.

The static cross-sectional income-expenditure elasticities computed from these data were unreasonable. When static elasticities computed between the low and medium income groups were used for prediction purposes, the low income families experiencing increases in income were expected to decrease their expenditures for pork chops, roasts, and bacon. Previous studies have shown that low income families increased their pork item expenditures after experiencing an increase in income. Meat item expenditures for different family sizes within income groups showed no consistent relationships. For many of the meat items, large families evidenced larger per capita expenditures than small families. Both Shaffer and Simmons found that small families had higher per capita expenditure levels for selected meat items than did large families.

In an attempt to produce results which were internally consistent, the low and the medium income groups and the medium-high and high income groups were aggregated into two income groups. This was done to increase the number of observations in the remaining income group and family size categories.

CHAPTER III

CHANGES IN BEEF CUT EXPENDITURES ASSOCIATED WITH INCREASED INCOME

Introduction

The purpose of this chapter was to provide information on consumer responses in adjusting their per capita expenditures for beef roasts and steaks after experiencing an increase in income. Static and dynamic income elasticities were compared to determine the validity of the assumption that families experiencing increases in income will adjust their purchasing patterns so that they are similar to the purchasing patterns of the income group the families are entering.

The results of the analyses will be presented in the following order: 1) Static cross-sectional relationships, 2) Dynamic income-expenditure relationships, and 3) Comparison of the "observed" and "expected" changes in beef roast and steak expenditures.

Results From a Static Cross-Sectional Analysis of Beef Roast and Steak Expenditures

The high income group had larger per person expenditures for beef roasts and steaks than did the low income group. See Table 8. The level of expenditures for both roasts and steak for the two income groups were significantly different at the 5 per cent level. Both income groups spent more for beef steaks than roasts.

TABLE 8a

PER CAPITA EXPENDITURES FOR SELECTED BEEF CUTS, BY INCOME GROUPS,
MICHIGAN STATE UNIVERSITY CONSUMER PANEL SUB-SAMPLE,
1953-57

Income Group	Number of Families	Average Annual Per Capita Expenditure	
		Roast (dollars)	Steak (dollars)
Less than \$1700	119	6.29	7.18
\$1700 and above	95	10.14	12.30

The static income-expenditure elasticities computed for beef roasts and steaks were .66 and .74.

The results of the 1955 Food Consumption Survey indicated that families in the \$5,000 and above income bracket had higher expenditure levels for beef roasts and steaks than families in the less than \$4,999 income group. See Table 9.

TABLE 9

AVERAGE LEVEL OF FAMILY EXPENDITURES FOR SELECTED BEEF CUTS,
ALL URBAN FAMILIES IN THE NORTH CENTRAL REGION,
A WEEK IN APRIL-JUNE, 1955^a

Disposable Income Per Household ^b	Roast Expenditures (dollars)	Steak Expenditures (dollars)
Less than \$4,999	.72	.90
\$5,000 and above	1.21	1.77

^aSource: "Food Consumption of Households in the North Central Region,"
Report No. 3, Washington, D. C.: U. S. D. A., 1955, pp. 66-67.

^bOne person families were excluded.

Families in both income groups had larger beef steak expenditures than roast expenditures. Static cross-sectional income-expenditure elasticities computed between the means of the two income groups indicated that low income families receiving increases in income were "expected" to make larger steak than roast expenditure adjustments.

Thus far the results of a cross-sectional analysis for beef roasts and steak expenditures were similar to the findings of the 1955 Household Food Consumption Survey. These similarities were good indicators that an adequate number of observations were obtained in each income group. When the Consumer Panel sub-sample was divided into 4 income groups, beef cut expenditures were not similar to the results of the 1955 Household Food Consumption Study. See Appendix A.

When income groups were subdivided by family size, it was found that small families in both income groups purchased more roasts and steaks per person than did the large families, with one exception. The high income group large-sized families had greater per capita purchases of roasts than did the small families in the same income group. See Table 10. However, the level of expenditures for the family sizes within the high income group were not significantly different from each other at the 5 per cent level.

It is interesting to note that the level of per capita expenditures for roasts and steaks by size of family in the low income group tested to be significantly different at the one per cent level, whereas in the high income group, the level of per capita beef cut expenditures for the two family sizes were not significantly different at the 5 per cent level.

TABLE 10

PER CAPITA EXPENDITURES FOR SELECTED BEEF CUTS, BY INCOME GROUPS
 SUBDIVIDED BY FAMILY SIZE, MICHIGAN STATE UNIVERSITY
 CONSUMER PANEL SUB-SAMPLE, 1953-57

Income Groups by Family Size	Number of Families	<u>Average Annual Per Capita Expenditure</u>	
		<u>Roast</u> (dollars)	<u>Steak</u> (dollars)
Less than \$1700			
2-3 person	33	7.91	8.83
4 or more person	86	5.68	6.55
\$1700 and above			
2-3 person	83	10.04	12.63
4 or more person	12	10.37	9.57

Earlier studies indicated that the small-sized families per person expenditures for these meat items were greater than the per person expenditures of large families. The above analysis indicated that family size was an important factor influencing the level of expenditures for families in the low income group, but family size as a factor influencing the level of expenditures was statistically non-significant in the high income group. These results have important implications in deriving and comparing static income elasticities from different studies. As a result, income elasticities used to predict consumer responses to an increased income will result in an inaccurate estimate if the populations were not homogeneous with respect to family size.

Results from a Dynamic Analysis of Beef Roast
and Steak Expenditures

Table 11 shows that families in the low income group increased their roast expenditures by 30 cents after experiencing an increase in per capita disposable income. Families in the high income group decreased their roast expenditures by 64 cents. This expenditure decrease was significantly different from zero at the 10 per cent level.

Both income groups increased their per capita steak expenditures after experiencing an increase in disposable income. However, these expenditure changes were significantly different from zero only at the 40 per cent level. Consumers in the two income groups adjusted their steak expenditures similarly after receiving increases in income. See Table 11.

TABLE 11

ANNUAL AVERAGE PER CAPITA BEEF CUT EXPENDITURES ASSOCIATED
WITH INCREASED INCOME, BY INCOME GROUPS, MICHIGAN
STATE UNIVERSITY CONSUMER PANEL SUB-SAMPLE,
1953-57

Income Groups	Number of Families	a E ₁	b E ₂	Change in E ^c	Level of Significance ^d
Roast					
Less than \$1700	119	6.14	6.44	.30	.20
\$1700 and above		10.46	9.82	-.64	.10
Steak					
Less than \$1700	95	7.11	7.24	.13	.40
\$1700 and above		12.20	12.39	.19	.40

^aE₁ = Expenditures before an income increase.

^bE₂ = Expenditures after an income increase.

^cChange in E = E₂ - E₁

^dThe critical level of significance was at the 10 per cent level.

The estimated dynamic income-expenditure elasticities for beef roast for the low and high income group were .36 and -.61 respectively.

The dynamic elasticity for beef steaks for the low and high income groups were .14 and .16 respectively. The static income-expenditure elasticity for steaks and roasts indicated that low income families adjusted their steak expenditures more than roasts expenditures after receiving increases in per capita income. However, the dynamic income elasticity for the low income families showed that these families responded to an increased income by adjusting their roast expenditures more than their steak expenditures. In the next section, dynamic and static elasticities were converted to an expenditure basis and subjected to further analysis.

The high income small-sized families decreased their roast expenditures by .91 cents after experiencing an increase in disposable income. This group was the only group which decreased their expenditures for either roasts or steaks. The expenditure decrease of 91 cents for roasts was significantly different from zero at the 5 per cent level. See Table 12.

The large families in both income groups increased their roast and steak expenditures. However, these changes were not significantly different from zero.

Static income expenditure elasticities derived from previous studies indicated that low-income small-sized families were expected to be more responsive in adjusting their meat expenditures after receiving an

TABLE 12

ANNUAL AVERAGE PER CAPITA BEEF CUT EXPENDITURES ASSOCIATED WITH
INCREASED INCOME, BY INCOME GROUPS SUBDIVIDED BY FAMILY SIZE,
MICHIGAN STATE UNIVERSITY CONSUMER PANEL SUB-SAMPLE,
1953-57

Income Groups by Family Size	Number of Families	^a E ₁	^b E ₂	Change in E ^c	Level of Significance ^d
<u>Roast</u>					
Less than \$1700					
2-3 person	33	7.45	8.37	.92	.20
4 or more person	86	5.64	5.71	.07	> .40
More than \$1700					
2-3 person	83	10.49	9.58	-.91	.05
4 or more person	12	10.09	10.65	.56	.40
<u>Steak</u>					
Less than \$1700					
2-3 person	33	8.71	8.95	.24	.40
4 or more person	86	6.52	6.58	.06	> .40
More than \$1700					
2-3 person	83	12.62	12.64	.02	> .40
4 or more person	12	9.24	9.79	.55	.40

^aE₁ = Beef cut expenditures before an income change.

^bE₂ = Beef cut expenditures after an income change.

^cChange in E = E₂ - E₁.

^dThe critical level of significance was at the 10 per cent level.

increase in income than were the large size families. Low income small families made larger roast and steak purchases than did the low income large families. See Table 12. Thus the results from a static cross-sectional and dynamic analyses were similar.

Comparison of the Observed and Expected Changes in
Beef Roast and Steak Expenditures

Table 13 shows that the "observed" expenditure adjustments for the sub-sample of families in the low income group were in the direction of the "expected" adjustments computed by the static income-expenditure relationships for beef roasts and steaks.

TABLE 13

OBSERVED AND EXPECTED BEEF ROAST AND STEAK ADJUSTMENTS ASSOCIATED
WITH INCREASED INCOME, LOW INCOME GROUP, MICHIGAN STATE
UNIVERSITY CONSUMER PANEL SUB-SAMPLE, 1953-57

Beef Cut	Changes in Per Capita Expenditures	
	Expected (dollars)	Observed (dollars)
Roast	.57	.30
Steak	.74	.13

The low income families did not adjust their beef cut expenditures by as much as was "expected."

In Chapter II, it was pointed out that the low income group was composed of young families. These families were larger than families in the higher income group. In essence, when a static income elasticity is computed between the low and high income groups, the resulting elasticity indicates that the larger younger families in the low income group receiving increases in income will assume purchasing patterns of the higher income group whose families are older and smaller.

Thus, the static elasticities are computed between two different populations with respect to size and age of the homemaker. The high income families spent approximately 1.75 times as much for beef steaks and roasts than did the low income families. Therefore the "expected" adjustments computed from cross-sectional relationships tended to overestimate consumer low income families "observed" expenditure adjustments.

Families experiencing an increase in income do not immediately assume new patterns of consumption. Estimates from dynamic analysis include not only immediate reactions of consumer to an increase in income but also a past period lag reaction. This lag reaction was probably due to changes in income which occurred in earlier years, different family characteristics, increased experience of the homemaker, retirement of the house holder, or purchasing power over and above current income.

Low income families experienced a 14 per cent increase in income during the period 1953-57. Six per cent of this increase was attributed to inflationary pressures. These inflationary increases in income tend to make the "observed" expenditure adjustments larger than if the increase in income consisted of an all real income increase.

The evidence presented suggests that low income families receiving increases in income do adjust their beef item expenditures in the direction of the higher income group, but lag reactions, and the family characteristics between the two income groups result in low income families underadjusting their beef cut expenditures.

Therefore, the assumption that consumers experiencing increases in income will adjust their beef cut purchasing patterns similar to the income group the families are entering does not appear to be valid.

CHAPTER IV

CHANGES IN SELECTED PORK CUT EXPENDITURES ASSOCIATED WITH INCREASED INCOME

Introduction

The objective of this chapter was to derive static cross-sectional and dynamic income-expenditure relationships for four pork items; bacon, chops, ham and roasts. A further analysis will determine the effects of size of family on changes in expenditures for these pork cuts and the resulting income-expenditure elasticities.

Waite and Trelogan derived a number of cross-sectional income-quantity elasticities for selected meat items using data obtained in the 1948 Food Consumption Survey.¹ In comparing the income-quantity elasticities for beef and pork items, it was generally found that consumers experiencing an increase in income increased their quantity of purchases of beef items more than pork items. This evidence tends to indicate that the observed expenditure adjustments for bacon, chops, ham, and roasts associated with increased income would probably be smaller than the expenditure adjustments for beef roasts and steaks.

The results of the analysis, as in the last chapter, will be presented in the following order: 1) Static cross-sectional relationships,

¹Waite and Trelogan, op. cit., p. 41.

2) Dynamic income-expenditure relationships, and 3) Comparison of the "observed" and "expected" expenditure adjustments for selected pork cuts.

Results from a Static Cross-Sectional Analysis
of Selected Pork Item Expenditures

Families in the high income group had larger per capita expenditures for the four pork items than did the low income families. See Table 14. The level of pork cut expenditures for the two income groups were all significantly different at the 5 per cent level.

TABLE 14

PER CAPITA EXPENDITURES FOR SELECTED PORK CUTS, BY INCOME GROUPS,
MICHIGAN STATE UNIVERSITY CONSUMER PANEL SUB-SAMPLE, 1953-57

Income Group	Number of Families	<u>Average Annual Per Capita Expenditures</u>			
		Bacon (dollars)	Chops (dollars)	Ham (dollars)	Roasts (dollars)
Less than \$1700	119	4.59	3.12	4.72	2.11
\$1700 and above	95	5.46	5.25	8.11	3.01

The static income-expenditure elasticities for bacon, chops, ham, and roasts were .242, .715, .742, and .494 respectively.

Table 15 shows the expenditure levels for three pork cuts by income groups obtained by the 1955 United States Department of Agriculture Food Consumption Study. Pork roasts were not reported as a separate category.

TABLE 15

AVERAGE LEVEL OF FAMILY EXPENDITURES FOR SELECTED PORK CUTS,
ALL URBAN FAMILIES IN THE NORTH CENTRAL REGION,
A WEEK IN APRIL-JUNE 1955^a

Disposable Income per Household ^b	Bacon Expenditures (dollars)	Chop Expenditures (dollars)	Ham Expenditures (dollars)
Less than \$4,999	.41	.51	.68
\$5,000 and above	.57	.58	.76

^aFood Consumption of Households in the North Central Region, Rept. No. 3, Washington, D. C., U.S.D.A., 1955, pp. 68-69.

^bOne-person families were excluded.

Families in the \$5,000 and above income bracket had greater expenditures for bacon, chops, and ham than did the families in the less than \$4,999 income group. Both of these income groups had larger ham expenditures than bacon and chop expenditures. Although the results of the Food Consumption study and the present analysis are similar, it must be remembered that the former is based on a family income basis while the latter is classified on a per capita basis.

The low income small families had larger per capita expenditures for bacon, chops and roasts than did the low income large families. See Table 16. However, large families in the low income group had larger per capita ham expenditures than small families. The level of ham expenditures for the two family sizes within the low income group were significantly different from each other only at the 20 per cent level.

TABLE 16

PER CAPITA EXPENDITURES FOR SELECTED PORK CUTS, BY INCOME GROUPS
 SUBDIVIDED BY FAMILY SIZE, MICHIGAN STATE UNIVERSITY
 CONSUMER PANEL SUB-SAMPLE, 1953-57

Income Groups by Family Size	Number of Families	Average Annual Per Capita Expenditures			
		Bacon (dollars)	Chops (dollars)	Ham (dollars)	Roasts (dollars)
Less than \$1700					
2-3 person	33	5.13	3.54	4.19	3.12
4 or more	86	4.34	3.02	4.97	1.66
\$1700 and above					
2-3 person	83	5.67	5.61	8.23	2.85
4 or more	12	4.97	7.10	7.43	4.15

The high income small families had larger per capita expenditures for bacon and ham than did the high income larger families. For chops and roasts, the reverse situation occurred; i.e., the high income large families had the largest per person expenditures. Among the various expenditure comparisons between the two family size classifications in the high income group, only the roast expenditures were significantly different at the five per cent level.

Shaffer reported that family size was found to be the most important factor in explaining variations in family pork consumption.¹ In the present study, low income large families tended to have lower per capita pork item expenditures than the small families in the same income group. There was no such tendency in the high income group.

¹Shaffer, op. cit., p. 16.

Results from a Dynamic Analysis of Selected
Pork Item Expenditures

Table 17 shows the "observed" per capita pork item expenditure adjustments made by families in the two income groups who experienced an increase in per capita income.

TABLE 17

ANNUAL AVERAGE PER CAPITA PORK CUT EXPENDITURES ASSOCIATED
WITH INCREASED INCOME, BY INCOME GROUPS, MICHIGAN STATE
UNIVERSITY CONSUMER PANEL SUB-SAMPLE, 1953-57

Income Groups	Number of Families	E_1^a	E_2^b	Change in E^c	Level of Significance ^d
Bacon					
Less than \$1700	119	4.65	4.53	-.12	.30
\$1700 and above	95	5.37	5.55	.18	.30
Chops					
Less than \$1700	119	3.14	3.09	-.05	> .40
\$1700 and above	95	5.25	5.25	.00	> .40
Ham					
Less than \$1700	119	4.59	4.85	.26	.20
\$1700 and above	95	8.29	7.94	-.35	.30
Roast					
Less than \$1700	119	1.97	2.24	.27	.05
\$1700 and above	95	2.86	3.15	.29	.20

^a E_1 = Pork item expenditures before increase in income.

^b E_2 = Pork item expenditures after increase in income.

^cChange in $E = E_2 - E_1$.

^dThe critical level of significance was at the 10 per cent level.

The expenditure adjustments by income groups were not significantly different from zero in 7 of 8 possible observations. The roast expenditure adjustment by the less than \$1700 income group was significantly

different from zero at the 5 per cent level. Large per capita variations in both income groups were primarily responsible for most of the pork item expenditure adjustments being non-significant.

The low and high income groups adjusted their per capita roast expenditures approximately the same amount after receiving an increase in income. However, these income groups did not adjust their per person chop expenditures after receiving an increased income. The per capita bacon and ham adjustments indicated that low income families decreased their bacon expenditures and increased their ham expenditures after receiving an increase in income. High income families increased their per capita bacon expenditures and decreased their ham expenditures.

Later in this analysis, an examination of expenditure adjustments for the two income groups subdivided by family size will determine if any consistent relationship existed between family size and expenditure changes within income groups.

Both income groups' dynamic income-expenditure elasticities indicated that families increased their pork roast expenditures more than for the other three pork items. See Table 18.

The static income-expenditure elasticities between the low and high income groups were positive for the 4 pork items. Families in the low income group were expected to increase their expenditures for these 4 pork cuts after experiencing an increase in disposable income. The dynamic income-expenditure elasticities computed from the "observed" pork expenditure adjustments associated with increased income showed

TABLE 18

DYNAMIC INCOME-EXPENDITURE ELASTICITIES FOR SELECTED PORK CUTS,
BY INCOME GROUPS, MICHIGAN STATE UNIVERSITY CONSUMER PANEL.
SUB-SAMPLE, 1953-57

Pork Cuts	Per Capita Income	
	Less than \$1700	\$1700 and Above
Bacon	-.917	.319
Chops	-.012	.000
Ham	.416	-.419
Roast	.969	.938

that low income families increased their ham and roast per capita expenditures, did not adjust their chops expenditure and decreased their bacon expenditures.

Low income large families increased their ham and roast expenditures and left their bacon and chop expenditures unchanged after receiving increases in income. Small families in this income group tended to decrease their pork cut expenditures as illustrated by negative expenditure changes for bacon, chops and ham. See Table 19.

High income large families increased their per capita bacon and chop expenditures and left their ham and roasts expenditures unchanged after receiving an increased income. High income small families increased their per capita bacon and roast expenditures while decreasing their chop and ham expenditures after receiving an increase in disposable income.

Family size was an important factor influencing per capita expenditure adjustments for pork cuts associated with increased income.

TABLE 19

**ANNUAL AVERAGE PER CAPITA PORK CUT EXPENDITURES ASSOCIATED WITH
INCREASED INCOME, BY INCOME GROUPS SUBDIVIDED BY FAMILY
SIZE, MICHIGAN STATE UNIVERSITY CONSUMER PANEL
SUB-SAMPLE, 1953-57**

Income Groups by Family Size	Number of Families	E_1^a	E_2^b	Change in E^c	Level of Significance ^d
Bacon					
Less than \$1700					
2-3 person	33	5.48	4.98	-.12	.30
4 or more	86	4.34	4.34	.00	> .40
\$1700 and above					
2-3 person	83	5.61	5.77	.18	.30
4 or more	12	4.60	5.34	.74	.10
Chops					
Less than \$1700					
2-3 person	33	3.63	3.46	-.17	.40
4 or more	86	3.02	3.01	-.01	> .40
\$1700 and above					
2-3 person	83	5.07	4.92	-.15	.40
4 or more	12	6.41	7.79	1.38	.20
Ham					
Less than \$1700					
2-3 person	33	4.42	3.96	-.46	.20
4 or more	86	4.71	5.22	.51	.05
\$1700 and above					
2-3 person	83	8.40	8.06	-.34	.30
4 or more	12	7.44	7.42	-.02	> .40
Roasts					
Less than \$1700					
2-3 person	33	3.04	3.20	.16	.40
4 or more	86	1.61	1.72	.09	.30
\$1700 and above					
2-3 person	83	2.67	3.03	.36	.10
4 or more	12	4.14	4.15	.01	> .40

^a E_1 = Pork item expenditures before increase in income.

^b E_2 = Pork item expenditures after increase in income.

^cChange in $E = E_2 - E_1$.

^dThe critical level of significance was at the 10 per cent level.

Large families in both income groups tended to increase their pork item expenditures. Small families on the other hand were primarily responsible for the negative dynamic income expenditure relationships exhibited by bacon, chops and ham.

Comparison of the Observed and Expected Changes
in Pork Item Expenditures

The low income families' "observed" per capita ham and roast expenditures were in the direction "expected." Low income small families were primarily responsible for the "observed" per capita chops and bacon expenditure adjustments being opposite of what was "expected." See Table 20.

TABLE 20

OBSERVED AND EXPECTED PORK CUT EXPENDITURES ASSOCIATED WITH INCREASED
PER CAPITA DISPOSABLE INCOME, LOW INCOME GROUP, MICHIGAN STATE
UNIVERSITY CONSUMER PANEL SUB-SAMPLE, 1953-57

Pork Cut	<u>Changes in Per Capita Expenditures</u>	
	Observed	Expected
Bacon	-.12	.16
Chops	-.05	.32
Ham	.26	.48
Roast	.27	.14

Low income families overadjusted their roast expenditures, whereas these families underadjusted their bacon, chop, and ham expenditures.

Ham expenditure underadjustments were probably due to the age-size composition of families in the two income groups. These income groups



represented two different populations with the low income group being composed of younger and larger families than families in the high income group. Static cross-sectional relationships indicated that high income families spent almost twice as much per capita for ham than did low income families. It was reasonable to expect that low income families would not make the "expected" adjustments within one year.

Family size was found to be an important factor influencing pork cut expenditure adjustments. Low income small families decreased their bacon, chops, and ham expenditures after receiving an increase in income. These responses were primarily responsible for the "observed" bacon and chop expenditures adjustments not being in the "expected" direction.

Low income families experienced a 14 per cent increase in income, of which 6 per cent was inflationary. These inflationary increases in income tend to make the "observed" expenditure adjustments larger than if the increase in income consisted of an all real income increase.

In recent years, consumers have been shifting their tastes and preferences by purchasing more beef and decreasing their pork consumption. These changes might also have been responsible for consumers underadjusting their pork cut expenditures of what was "expected" based on cross-sectional relationships.

The evidence presented suggests that low income families receiving increases in income did adjust their pork roast and ham expenditures in the direction expected. However, these families tend to underadjust their "observed" expenditures of what was "expected." Inflationary

increases in income, shifting tastes and preferences and differences in family characteristics between the two income groups.

Therefore, the assumption that families experiencing increases in income will adjust their pork item expenditure patterns so as to be similar to the expenditures of the income group the families are entering does not appear to be entirely valid.

CHAPTER V

CHANGES IN BROILER AND COLD CUT EXPENDITURES ASSOCIATED WITH INCREASED INCOME

Introduction

The purpose of this chapter was to derive static cross-sectional and dynamic income-expenditure relationships for broilers and cold cuts. A secondary objective was to indicate the relationship that existed between family size within income groups and broiler and cold cut expenditures.

Broiler prices fluctuated the greatest of any of the meat cuts analyzed in this study. There was at least a five cent fluctuation in price between any two consecutive years during the period 1953-57 with the exception of 1956-57 when the average broiler prices differed by only two cents. Dynamic income-expenditure elasticities derived for broiler are probably affected to some extent by these price changes.

Cold cut prices were the most stable of any of the meat cuts studies. The average variation in prices occurring between any two consecutive years during the period 1953-57 was less than two cents. The effects of changes in price influencing the purchases of cold cuts were negligible.

Table 21 shows the results obtained in the 1955 United States Department of Agriculture Food Consumption Study. These data differ

from the sub-sample data in that chicken expenditures included not only broilers, but all types of poultry products such as eggs, duck, turkey, etc. Luncheon meats included fresh and canned varieties, but excluded frankfurters.

TABLE 21

AVERAGE LEVEL OF FAMILY EXPENDITURES FOR BROILERS AND COLD CUTS,
ALL URBAN FAMILIES IN THE NORTH CENTRAL REGION,
A WEEK IN APRIL-JUNE, 1955^a

Disposable Income per Household ^b	Chicken Expenditures (dollars)	Luncheon Meat Expenditures (dollars)
Less than \$4,999	.91	.52
\$5,000 and above	1.23	.59

^aSource: "Food Consumption of Households in the North Central Region,"
Rept. No. 3, Washington, D. C., U.S.D.A., 1955, pp. 70-71.

^bOne person families were excluded.

Families in the \$5,000 and above income group spent 32 cents more per week for chicken than did the less than \$4,999 income group. These income groups spent similar amounts for luncheon meats.

Static income-expenditure elasticities computed from these data showed that families in the less than \$4,999 income group receiving increases in income were "expected" to make substantial increases in their broiler expenditures and to only slightly increase their cold cut expenditures. Cold cut expenditures were expected to increase slightly

because of the small difference in the level of expenditures between the less than \$4,999 and \$5,000 and above income groups.

Presentation of analyses was similar to Chapters III and IV with the exception that the broiler and cold cut analyses are not discussed concurrently. This was done because broilers and cold cuts are two different types of meat and no direct comparison can be made between them. The first section deals with a static analysis of the family sub-sample. The second section discusses the dynamic aspects associated with increased income. The third and final section was a comparison of the dynamic and static income-expenditure elasticities.

Results from a Static Cross-Sectional Analysis of Broiler Expenditures

The high income group had larger broiler expenditures than did the low income group. The level of broiler expenditures for these income groups were significantly different from each other at the 5 per cent level. See Table 22.

TABLE 22

PER CAPITA BROILER EXPENDITURES, BY INCOME GROUPS, MICHIGAN STATE UNIVERSITY CONSUMER PANEL SUB-SAMPLE, 1953-57

Income Groups	Number of Families	Average Annual Per Capita Broiler Expenditures (dollars)
Less than \$1700	119	3.21
\$1700 and above	95	6.50

A static income-expenditure elasticity computed between the low and high income groups showed that families in the low income group were "expected" to increase their broiler expenditures by .949 per cent after receiving a one per cent increase in income.

Small families in the high and low income groups had larger per capita broiler expenditures than did the large families in these income groups. See Table 23.

TABLE 23

PER CAPITA BROILER EXPENDITURES, BY INCOME GROUPS SUBDIVIDED
BY FAMILY SIZE, MICHIGAN STATE UNIVERSITY CONSUMER.
PANEL SUB-SAMPLE, 1953-57

Income Groups by Family Size	Number of Families	Annual Per Capita Broiler Expenditures (dollars)
Less than \$1700		
2-3 person	33	4.16
4 or more	86	2.81
\$1700 and above		
2-3 person	83	6.89
4 or more	12	5.29

The differences in the level of expenditures for two family sizes in the low income group were significantly different from zero at the 5 per cent level, whereas the difference in the level of broiler expenditures for the high income group family sizes was non-significant. As it was found for beef and pork items, family size was an important factor influencing the level of expenditures for those families in the

low income group. Static cross-sectional elasticities used to predict the responses of low income families to increased income would result in an inaccurate estimate if the two populations are not homogeneous with respect to family size.

Results from a Dynamic Analysis of
Broiler Expenditures

Families average yearly broiler expenditures were "observed" before and after a family received an increase in income. Table 24 shows that families in the two income groups substantially increased their broiler expenditures. These expenditure adjustments for both income groups were significantly different from zero at the 10 per cent level.

TABLE 24

ANNUAL AVERAGE PER CAPITA BROILER EXPENDITURES ASSOCIATED WITH
INCREASED INCOME, BY INCOME GROUPS, MICHIGAN STATE
UNIVERSITY CONSUMER PANEL SUB-SAMPLE, 1953-57.

Income Groups	E_1^a	E_2^b	Change in E^c	Level of Significance ^d
Less than \$1700	2.98	3.44	.46	.01
\$1700 and above	6.16	6.83	.66	.10

^a E_1 = Expenditures before an income increase.

^b E_2 = Expenditures after an income increase.

^cChange in $E = E_2 - E_1$.

^dThe critical level of significance was at the 10 per cent level.

The dynamic income-expenditure elasticity estimates for broilers for the low and high income group were 1.08 and 1.00. Families in

both income groups increased their per capita broiler expenditures approximately one per cent after experiencing a one per cent increase in income.

The large families in both income groups increased their per capita broiler expenditures more than small families. See Table 25. The large families expenditure adjustments were also more significant than the adjustments made by small families.

TABLE 25

ANNUAL AVERAGE PER CAPITA BROILER EXPENDITURES ASSOCIATED WITH
INCREASED INCOME, BY INCOME GROUPS SUBDIVIDED BY FAMILY
SIZE, MICHIGAN STATE UNIVERSITY CONSUMER PANEL
SUB-SAMPLE, 1953-57

Income Group by Family Size	Number of Families	E_1^a	E_2^b	Change in E^c	Level of Significance ^d
Less than \$1700					
2-3 person	33	4.20	4.13	-.07	> .40
4 or more	86	2.47	3.14	.67	.005
\$1700 and above					
2-3 person	83	6.56	7.22	.66	.20
4 or more	12	4.85	5.73	.88	.10

^a E_1 = Broiler expenditures before an income change.

^b E_2 = Broiler expenditures after an income change.

^cChange in $E = E_2 - E_1$.

^dThe critical level of significance was at the 10 per cent level.

Family size was an important factor influencing broiler expenditure adjustments associated with increased income, especially in the low income group. These results indicated that dynamic income elasticities used to predict the responses of consumers to increased income would

result in inaccurate estimates if the size composition of families in the population from which the elasticities were derived differed from the population whose responses we are attempting to predict.

Comparison of the Observed and Expected Charges
in Broiler Expenditures

Low income families were "observed" increasing their broiler expenditures by 46 cents after receiving a 34 per cent increase in income. Static cross-sectional relationships indicated that low income families were "expected" to increase their broiler expenditures by 40 cents. Thus low income families over-adjusted their broiler expenditures by six cents after receiving an increase in income.

The differences in the "observed" and "expected" expenditure adjustments was the least of any of the meat cuts analyzed. However, during the time period in which data for this study were obtained, broiler prices decreased substantially.

Consumers have increased their demand for broilers due to this price change by significantly increasing their broiler expenditures and decreasing their pork consumption. There has also been an increase in per capita demand (demand curve shifting to the right) due to changing tastes and preferences, greater availability, and product improvement. These price effects intermingled with the income effects resulted in the low income families over-adjusting their "observed" broiler expenditures.

Inflationary increases in income also resulted in the low income families' "observed" expenditure adjustments being larger than if the increase in income consisted of an all "real" income increase.

The evidence presented suggested that low income families receiving increases in income do adjust their broiler expenditures in the direction expected. Low income families' "observed" expenditure adjustments would probably have under-adjusted the "expected" adjustments if price and inflationary income increases were eliminated from the data.

Therefore, the validity of the assumption that consumer experiencing increases in income will adjust their broiler expenditure patterns similar to the expenditures of the income group the consumers are entering can be critically questioned.

Results From a Static Cross-Sectional Analysis of Cold Cut Expenditures

Families in the high income group had larger per capita cold cut expenditures than did the families in the low income group. See Table 26.

The difference in the level of cold cut expenditures for these income groups was 83 cents, which is a relatively small difference when compared to other meat items. The levels of expenditures for these two income groups were significantly different from each other at the 10 per cent level. Similar results were obtained in the 1955 Food Consumption Survey.

TABLE 26

PER CAPITA COLD CUT EXPENDITURES, BY INCOME GROUPS, MICHIGAN
STATE UNIVERSITY CONSUMER PANEL SUB-SAMPLE, 1953-57

Income Groups	Number of Families	Annual Average Per Capita Cold Cuts Expenditures (dollars)
Less than \$1700	119	5.11
\$1700 and above	95	5.94

A static income-expenditure elasticity computed from these cold cut data indicated that families in the low income group receiving a one per cent increase in income were expected to increase their cold cut expenditures by .21 per cent. "Expected" responses for low income families in adjusting their cold cut expenditures to an increased income were the smallest of any of the meat cuts studied.

Results of the Food Consumption Survey showed that low income families were expected to make only a slight increase in cold cut expenditures after receiving an increase in income, the smallest adjustment of the seven meat cuts analyzed.

Family size did not influence the level of cold cut expenditures in the low income group and was of minor significance in the high income group. The level of cold cut expenditures for family sizes within the high income group were significantly different from each other only at the 20 per cent level. See Table 27. Therefore, the static income-expenditure elasticity computed for cold cuts was unaffected by family size.

TABLE 27

PER CAPITA COLD CUT EXPENDITURES, BY INCOME GROUPS SUBDIVIDED
BY FAMILY SIZE, MICHIGAN STATE UNIVERSITY CONSUMER
PANEL SUB-SAMPLE, 1953-57

Income Groups by Family Size	Number of Families	Annual Average Per Capita Cold Cut Expenditures (dollars)
Less than \$1700		
2-3 person	33	5.10
4 or more	86	5.10
\$1700 and above		
2-3 person	83	6.22
4 or more	12	4.74

Results from a Dynamic Analysis
of Cold Cut Expenditures

Table 28 shows that both income groups enlarged their cold cut expenditures after experiencing an increase in income. However, only the low income families expenditure adjustment of 34 cents tested to be significantly different from zero.

The dynamic income-expenditure elasticities for cold cuts for the low and high income groups were .50 and .31 respectively. These results are similar to those of previous cross-sectional studies which indicated that low income families increased their meat expenditures more than did the high income families.

Although family size did not influence the level of cold cut expenditures, it was an important factor affecting cold cut expenditure

TABLE 28

ANNUAL AVERAGE PER CAPITA COLD CUT EXPENDITURES ASSOCIATED
WITH INCREASED INCOME, BY INCOME GROUPS, MICHIGAN
STATE UNIVERSITY CONSUMER PANEL SUB-SAMPLE,
1953-57

Income Groups	Number of Families	E_1^a	E_2^b	Change in E^c	Level of Significance ^d
<u>Cold Cuts</u>					
Less than \$1700	119	4.94	5.28	.34	.025
\$1700 and above	95	5.85	6.03	.18	.30

^a E_1 = Cold cut expenditures before an income increase.

^b E_2 = Cold cut expenditures after an income increase

^cChange in $E = E_2 - E_1$.

^dThe critical level of significance was at the 10 per cent level.

adjustments associated with increased income. This was especially true for the low income small families whose per capita expenditure adjustments were significantly different from zero at the one per cent level. See Table 29.

The magnitude of the dynamic elasticities were affected by family size. These elasticities therefore could only be used to predict consumer responses to an increased income for populations which are homogeneous with respect to family size. If an attempt is made to predict consumers' responses in areas where family size composition differed from the sub-sample, an inaccurate estimate of families responses will result, especially in the low income group.

TABLE 29

ANNUAL AVERAGE PER CAPITA COLD CUT EXPENDITURES ASSOCIATED WITH
INCREASED INCOME, BY INCOME GROUPS SUBDIVIDED BY FAMILY
SIZE, MICHIGAN STATE UNIVERSITY CONSUMER PANEL
SUB-SAMPLE, 1953-57

Income Groups by Family Size	Number of Families	E_1^a	E_2^b	Change in E^c	Level of Significance ^d
<u>Cold Cuts</u>					
Less than \$1700					
2-3 person	33	4.67	5.53	.83	.01
4 or more	86	5.02	5.18	.16	.20
\$1700 and above					
2-3 person	83	5.17	6.26	.09	.40
4 or more	12	4.52	4.96	.44	.30

^a E_1 = Cold cut expenditures before an income change.

^b E_2 = Cold cut expenditures after an income change.

^cChange in $E = E_2 - E_1$.

^dThe critical level of significance was at the 10 per cent level.

Comparison of the Observed and Expected
Changes in Cold Cut Expenditures

Low income families were "observed" increasing their cold cut expenditures by 34 cents after receiving a 14 per cent increase in income. Static cross-sectional relationships indicated that low income families were "expected" to increase their cold cut expenditures by 16 cents. Thus, these families over-adjusted their cold cut expenditures by 18 cents. A factor which might have influenced low income families to over-adjust was changing tastes and preferences.

If the low income families' "observed" expenditure adjustments were corrected for inflationary income increases, the corrected "observed" expenditure adjustments would probably be greater than what was "expected." Therefore, the assumption used when cross-sectional analyses are used for prediction purposes does not appear to be valid. These over-adjustments might be due to low income families substituting expensive cold cuts such as pressed ham for low cost items such as bologna.

CHAPTER VI

SUMMARY AND CONCLUSIONS

In the past, income expenditure relationships for selected meat items have been computed by either time-series or a cross-sectional analyses. When the results of cross-sectional analyses were used for prediction purposes, it was assumed that families receiving an increase in income would adjust their expenditures to be similar to the expenditure pattern of the income group the families are entering. This study was constructed to test the validity of this assumption.

A secondary objective was to determine the relationship that existed between family sizes within income groups and meat cut expenditures.

The Michigan State University Consumer Panel was the source of data for the present study. Only those families who received increases in per capita disposable income and who participated in the panel at least 40 weeks out of a year for two consecutive years were included. One-person families were excluded because of the extreme variability in expenditure data for these families.

Some of the wide price changes in beef were avoided by omitting 1951 and 1952 Consumer Panel Data, but we still have pork and broiler price fluctuations. Pork prices were relatively unstable during the period 1953-57, however, the net price change was relatively small and probably exerted a minor influence on family purchasing patterns. Broiler prices were the most unstable of any of the meat cuts analyzed,

with the price movements being generally downward. This downward movement was associated with structural changes within the broiler industry. Per capita income for the Consumer Panel sub-sample exhibited an upward trend during the period 1953-57. The sub-samples' mean per capita income increased approximately 20 per cent during the period 1953-57.

The meat cuts studied were beef roasts and steaks; pork chops, roasts, bacon and ham; cold cuts, and broilers. These meat cuts were selected on the basis of the following criteria: 1) Importance of the meat cut in the family food budget, and 2) The existence of different levels of expenditures among families grouped by level of income.

Ninety-nine families were first separated into four per capita income groups; less than \$1200, \$1200-1700, \$1700-2400 and \$2400 and above. Cross-sectional income-expenditure elasticities computed for these income groups were unstable and did not bear consistent relationships when compared to previous studies. The results obtained for the eight meat cuts may be seen in Appendix A. These inconsistencies were probably due to the limited number of observations in each income group. The sub-sample was regrouped into two per capita income groups: less than \$1700 and \$1700 and above. Static cross-sectional income elasticities computed between these income groups were in the direction and approximate magnitude of some of the previous cross-sectional analyses. Thus by increasing the number of observations in each income group, stable and consistent relationships were obtained.

Families within each income group were separated into two family size categories; 2-3 person and 4 or more person families. The results of this second classification of families indicated the relationship between meat cut expenditures and family size within income groups.

Utilizing the Michigan State University Consumer Panel, changes in meat item expenditures associated with increased income were "observed" for each income group. Dynamic income-expenditure elasticities were computed for both income groups. Per capita income and expenditures before and after an increase in income were averaged for each income group. The average per capita meat expenditures and income for the two income groups was the basis for computing a static cross-sectional income-expenditure elasticity between these two income groups. When this type of elasticity is used for prediction purposes, it is usually assumed that families receiving increases in income will adjust their meat expenditures to the purchase patterns of the income group the families are entering.

Meat expenditures were "observed" before and after the family experienced an increase in income. The "expected" meat expenditures for the low income families were derived by the following procedure. The static income-expenditure elasticity times the low income group's percentage change in income times the low income families per capita meat expenditures before the increase in income yielded the "expected" expenditure adjustment. The "observed" and "expected" expenditure adjustments were compared to determine if low income families adjusted

their "observed" expenditures in the direction and magnitude of the static cross-sectional estimate. This comparison was the basis for accepting, modifying, or rejecting the validity of the assumption used in making prediction based on conventional cross-sectional analyses.

On the average, the high income families per capita beef roast and steak expenditures were significantly larger than the expenditures made by low income families. Per capita expenditures for roasts and steaks were significantly higher for the small families in these income groups than larger families. These results indicated that family size was an important factor influencing these beef cut expenditures, especially in the low income group. Therefore, static cross-sectional elasticities should only be used to predict the responses of families to increased income which are homogeneous with respect to family size in the sample from which the static elasticities were computed.

Neither of the income groups made significant increases in their "observed" per capita beef roast and steak expenditures after receiving an increase in income. High income families actually decreased their roast expenditures by 64 cents. Similar results were obtained by West¹ in his study of all meats. West indicated that high income families may have increased their expenditures for meals away from home and thus reduced their meat expenditures for meals eaten at home.

There was a definite tendency for small families in both income groups to be more responsive to an income increase than were large

¹West, op. cit., p. 72.

families. Thus family size tended to affect the values of the dynamic income-expenditure elasticities, especially in the low income group.

Low income families under-adjusted their "observed" beef roast and steak expenditures when compared with the "expected" adjustments computed from cross-sectional relationships. The high income group consisted of smaller and older families which spent approximately twice as much for these beef cuts than did low income families. These family characteristics affected the static elasticities and the subsequent "expected" expenditure adjustments. The "expected" expenditure adjustments as well as inflationary increases in income tended to make the "observed" expenditure adjustments larger than what was "expected."

Based on this evidence, the assumption that families experiencing an increase in income will adjust their beef roast and steak expenditures patterns to be similar to the expenditures of the income group families they are entering does not appear to be valid.

The high income families had larger expenditures for pork chops, roasts, bacon, and ham than did the low income families. The low income small families tended to have higher per capita expenditures for these pork cuts than did large families in the same income group. However, in the high income group there was no tendency for family size to affect the pork cut expenditure levels.

An examination of the pork cut expenditure adjustments by income groups indicated that there was no consistent relationship between increased income and expenditure adjustments. In the low income group,

dynamic income-expenditure elasticities were negative for two of the four pork cuts. When the data were grouped according to family size, it was found that the small families in the low income group were primarily responsible for these negative elasticities. It was evident that family size was an important factor affecting consumer responses.

The "observed" chop and bacon expenditure adjustments were not in the direction of the "expected" expenditure adjustments computed from cross-sectional relationships. Low income families over-adjusted their per capita roast expenditures when compared with the "expected" expenditure adjustments. Whereas, these families "observed" ham expenditure changes were less than "expected."

It was found that inflationary increases in income, family characteristics between the two income groups and family sizes within the low income group were partially responsible for the under-adjustments of bacon, chops and ham with compared with the "expected" adjustments. Therefore, the assumption that consumers experiencing increases in income will adjust their pork item expenditure patterns to be similar to the expenditures of the income group the consumers are entering does not appear to be valid.

The high income groups' average per capita expenditures for broilers was approximately twice as large as the broiler expenditures made by the low income group. Family size was found to be a significant factor affecting per capita broiler expenditures in the low income group. Low income small families had larger broiler expenditures than did large

families in this income group. In the high income group, small families had the largest broiler expenditures, but the difference for the two family size categories was non-significant.

The high income groups "observed" expenditure adjustments for broilers was larger than the adjustment made by the low income group. When the data were regrouped by family size, it was found that large families in both income groups were more responsive than small families in adjusting their broiler expenditures after receiving an increase in income. These results indicated that the value of the dynamic income-expenditure elasticities will depend on the composition of family size in the sample.

Low income families over-adjusted their "observed" broiler expenditure adjustments when compared with the "expected" adjustments computed from cross-sectional relationships. The difference in the "observed" and "expected" broiler expenditure adjustments was the smallest of all the meat cuts analyzed. However, if the "observed" broiler expenditure adjustments were corrected for price changes and inflationary increases in income, the "observed" expenditure adjustments would probably be less than "expected." These results tend to indicate that the assumption used when conventional cross-sectional analyses are used prediction purposes is not valid.

The low and high income groups per capita cold cut expenditures were not significantly different from each other. The static income-expenditure elasticity for cold cuts of .21 was the smallest of any of the meat cuts analyzed. Family size was found not to have a

significant influence in determining the level of cold cut expenditures. Static elasticities computed for cold cuts in this study can probably be used to accurately predict consumer responses in areas where the composition of family size is different between the two populations.

The low income group was the most responsive in adjusting their "observed" cold cut expenditures to an increased income. Only the low income small families cold cut expenditure adjustments associated with increased income tested to be significantly different from zero. Thus, only the dynamic income-expenditure elasticities for the low income groups was affected by family size.

Low income families over-adjusted their "observed" per capita cold cut expenditures when compared with the "expected" adjustments. The assumption that low income families receiving increases in income adjust their cold cut expenditures similar to the expenditures of the income group the families are entering does not seem to be valid.

The evidence presented in this study indicated that the assumption used when cross-sectional analyses are used for prediction purposes will result in inaccurate estimates of family responses to increased income unless adjustments for family size variations, lag reactions and family characteristics between income groups are made.

The static cross-sectional and dynamic income-expenditure relationships indicated that family size was an important factor influencing the per capita expenditures for most of the meat items analyzed. Family size was of more significance in the low income group than in

the high income group. These results suggest that income elasticities used to predict the responses of low income families to increased income will result in an inaccurate estimate if the two populations are not homogeneous with respect to family size.

Further work in this area is needed to show the adjustments made by families experiencing similar increases in income, but differing in family characteristics such as age, education, occupation of householder, and other factors. The effects of these factors on adjustments made in the purchasing patterns of consumers will probably explain many of the differences in the "observed" and "expected" adjustments in expenditures examined in this thesis.

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APPENDIX A

This appendix is composed of the Michigan State University Consumer Panel sub-sample data divided into four per capita income groups. An attempt was made to have a similar number of family observations in each income group. However, when similar observations in each income group were attained, it was found that there were only 2-3 person families in the \$2400 and more income group. Thus the following tables do not list any family size distinction for this income group. Static cross-sectional and dynamic income-expenditure relationships were computed exactly as described in the methodology section of Chapter II.

TABLE A

PER CAPITA EXPENDITURES FOR SELECTED BEEF CUTS, BY INCOME GROUPS,
SUBDIVIDED BY FAMILY SIZE, MICHIGAN STATE UNIVERSITY
CONSUMER PANEL SUB-SAMPLE 1953-1957

Income Groups by Family Size	Number of Families	Average Annual Per Capita Expenditure	
		Roast (dollars)	Steak (dollars)
Less than \$1200	59	5.69	6.12
2-3 person	14	7.49	7.96
4 or more person	45	5.43	5.54
\$1200-\$1700	60	6.89	8.23
2-3 person	19	8.33	9.70
4 or more person	41	6.21	7.55
\$1700-\$2400	44	9.83	11.33
2-3 person	32	9.62	12.00
4 or more person	12	10.37	9.52
\$2400 and above	51	10.44	13.26

TABLE B

STATIC INCOME-EXPENDITURE ELASTICITIES FOR SELECTED BEEF CUTS,
MICHIGAN STATE UNIVERSITY CONSUMER PANEL SUB-SAMPLE
1953-1957^a

Income Groups ^b	Roast	Steak
Low to Medium	.528	.814
Medium to Medium-High	1.000	.912
Medium-High to High	.148	.369

^a Arc elasticities computed between two income groups.

^b Low income group includes families with per capita income of under \$1200.

Medium income group includes families with per capita income of \$1200-\$1700.

Medium-high income group includes families with per capita income of \$1700-\$2400.

High income group includes families with per capita income of \$2400 and above.

TABLE C

ANNUAL AVERAGE PER CAPITA BEEF CUT EXPENDITURES ASSOCIATED WITH
INCREASED INCOME, BY INCOME GROUPS SUBDIVIDED BY FAMILY SIZE,
MICHIGAN STATE UNIVERSITY CONSUMER PANEL SUB-SAMPLE, 1953-1957

Income Groups by Family Size	Number of Families	E_1^a	E_2^b	Change in E^c	Level of Significance
<u>Roast</u>					
Less than \$1200	59	5.71	5.67	-.04	> .40
2-3 person	14	7.11	7.86	.75	.30
4 or more person	45	5.28	4.99	-.29	.30
\$1200-\$1700	60	6.56	7.21	.65	.10
2-3 person	19	7.78	8.88	1.10	.20
4 or more person	41	5.99	6.43	.44	.20
\$1700-\$2400	44	10.27	9.39	-.88	.20
2-3 person	32	10.34	8.91	-1.43	.10
4 or more person	12	10.09	10.65	.56	.40
\$2400 and above	51	10.64	10.24	-.40	.30
<u>Steak</u>					
Less than \$1200	59	5.90	6.34	.44	.20
2-3 person	14	7.90	8.02	.12	> .40
4 or more person	45	5.27	5.81	.54	.20
\$1200-\$1700	60	8.32	8.14	-.14	.40
2-3 person	19	9.52	9.87	.35	.40
4 or more person	41	7.76	7.34	-.42	.20
\$1700-\$2400	44	11.53	11.12	-.41	.40
2-3 person	32	12.38	11.62	-.76	.30
4 or more person	12	9.24	9.79	.55	.40
\$2400 and above	51	12.86	13.65	.79	.20

^a E_1 = Expenditures before an income increase.

^b E_2 = Expenditures after an income increase.

^cChange in $E = E_2 - E_1$.

TABLE D

DYNAMIC INCOME-EXPENDITURE ELASTICITIES FOR SELECTED BEEF CUTS,
MICHIGAN STATE UNIVERSITY CONSUMER PANEL SUB-SAMPLE,
1953-1957

Income Groups	Roast	Steak
Less than \$1200	-.058	.526
\$1200-\$1700	.730	-.167
\$1700-\$2400	-.682	-.295
\$2400 and above	-.426	.665

TABLE E

PER CAPITA EXPENDITURES FOR SELECTED PORK CUTS, BY INCOME GROUPS
SUBDIVIDED BY FAMILY SIZE, MICHIGAN STATE UNIVERSITY CONSUMER
PANEL SUB-SAMPLE, 1953-1957

Income Groups by Family Size	Number of Families	Average Annual Per Capita Expenditures			
		Bacon (dollars)	Chop (dollars)	Ham (dollars)	Roast (dollars)
Less than \$1200	59	4.65	3.12	4.32	2.17
2-3 person	14	5.28	4.42	4.28	3.91
4 or more person	45	4.45	2.71	4.34	1.43
\$1200-\$1700	60	4.53	3.11	5.12	2.04
2-3 person	19	5.18	2.67	4.10	2.33
4 or more person	41	4.24	3.32	5.59	1.90
\$1700-\$2400	44	6.21	5.73	8.00	3.39
2-3 person	32	6.67	5.22	8.21	3.11
4 or more person	12	4.97	7.10	7.43	4.15
\$2400 and above	51	4.70	4.63	8.24	2.61

TABLE F

STATIC INCOME-EXPENDITURE ELASTICITIES FOR SELECTED PORK CUTS,
MICHIGAN STATE UNIVERSITY CONSUMER PANEL SUB-SAMPLE,
1953-1957

Income Groups	Bacon	Chop	Ham	Roast
Low to Medium	-.069	-.004	.470	-.186
Medium to Medium-High	.890	1.683	1.249	1.411
Medium-High to High	-.682	-.448	.072	-.638

TABLE G

ANNUAL AVERAGE PER CAPITA PORK CUT EXPENDITURES ASSOCIATED WITH
INCREASED INCOME, BY INCOME GROUPS SUBDIVIDED BY FAMILY
SIZE, MICHIGAN STATE UNIVERSITY CONSUMER PANEL
SUB-SAMPLE, 1953-1957

Income Groups by Family Size	Number of Families	E_1^a	E_2^b	Change in E^c	Level of Significance
<u>Bacon</u>					
Less than \$1200	59	4.83	4.46	-.37	.05
2-3 person	14	5.78	4.78	-1.00	.10
4 or more person	45	4.53	4.36	-.17	.30
\$1200-\$1700	60	4.47	4.59	.12	.40
2-3 person	19	5.18	5.17	-.01	> .40
4 or more person	41	4.15	4.32	.17	.30
\$1700-\$2400	44	5.90	6.52	.62	.025
2-3 person	32	6.38	6.96	.58	.10
4 or more person	12	4.60	5.34	.74	.10
\$2400 and above	51	4.83	4.57	-.26	.30

Continued

TABLE G - Continued

Income Groups by Family Size	Number of Families	E_1^a	E_2^b	Change in E^c	Level of Significance
<u>Chops</u>					
Less than \$1200	59	3.19	3.04	-.15	.30
2-3 person	14	4.70	4.14	.56	.30
4 or more person	45	2.72	2.70	-.02	> .40
\$1200-\$1700	60	3.08	3.14	.06	> .40
2-3 person	19	2.56	2.77	.21	.40
4 or more person	41	3.32	3.31	.01	> .40
\$1700-\$2400	44	5.44	6.01	.57	.30
2-3 person	32	5.08	5.35	.27	.40
4 or more person	12	6.41	7.79	1.38	.20
\$2400 and above	51	5.05	4.49	-.56	.05
<u>Ham</u>					
Less than \$1200	59	4.08	4.56	.48	.10
2-3 person	14	4.62	3.93	-.69	.20
4 or more person	45	3.92	4.76	.84	.025
\$1200-\$1700	60	5.10	5.14	.04	> .40
2-3 person	19	4.21	3.99	-.22	> .40
4 or more person	41	5.50	5.67	.17	.40
\$1700-\$2400	44	8.00	7.99	-.01	> .40
2-3 person	32	8.21	8.20	-.01	> .40
4 or more person	12	7.44	7.42	-.02	> .40
\$2400 and above	51	8.58	7.89	-.69	.20
<u>Roast</u>					
Less than \$1200	59	2.03	2.31	.28	.20
2-3 person	14	3.67	4.15	.48	.30
4 or more person	45	1.53	1.33	-.20	.20
\$1200-\$1700	60	1.91	2.16	.25	.10
2-3 person	19	2.40	2.25	-.15	.40
4 or more person	41	1.69	2.11	.42	.025
\$1700-\$2400	44	3.27	3.51	.24	.30
2-3 person	32	2.94	3.27	.33	.30
4 or more person	12	4.14	4.15	.01	> .40
\$2400 and above	51	2.44	2.78	.34	.20

^a E_1 = Expenditures before an income increase.

^b E_2 = Expenditures after an income increase.

^cChange in $E = E_2 - E_1$.

TABLE H

DYNAMIC-INCOME EXPENDITURE ELASTICITIES FOR SELECTED PORK CUTS,
MICHIGAN STATE UNIVERSITY CONSUMER PANEL SUB-SAMPLE,
1953-1957

Income Groups	Bacon	Chops	Ham	Roasts
Less than \$1200	-.662	-.400	.924	1.074
\$1200-\$1700	.204	.148	.060	.949
\$1700-\$2400	.761	.758	-.018	.539
\$2400 and above	-.616	-1.310	-.933	1.453

TABLE I

PER CAPITA EXPENDITURES FOR BROILERS, BY INCOME GROUPS SUBDIVIDED BY
FAMILY SIZE, MICHIGAN STATE UNIVERSITY CONSUMER PANEL SUB-SAMPLE,
1953-1957

Income Groups by Family Size	Number of Families	Average Annual Per Capita Expenditures
		Broilers (dollars)
Less than \$1200	59	2.87
2-3 person	14	3.24
4 or more person	45	2.75
\$1200-\$1700	60	3.56
2-3 person	19	5.08
4 or more person	41	2.85
\$1700-\$2400	44	7.40
2-3 person	32	8.18
4 or more person	12	5.29
\$2400 and above	51	5.59

TABLE J

STATIC-INCOME EXPENDITURE ELASTICITIES FOR BROILERS, MICHIGAN STATE
UNIVERSITY CONSUMER PANEL SUB-SAMPLE, 1953-1957

Income Groups	Broilers
Low to Medium	.595
Medium to Medium-High	1.949
Medium-High to High	-.685

TABLE K

ANNUAL AVERAGE PER CAPITA BROILER EXPENDITURES ASSOCIATED WITH
INCREASED INCOME, BY INCOME GROUPS SUBDIVIDED BY FAMILY
SIZE, MICHIGAN STATE UNIVERSITY CONSUMER PANEL
SUB-SAMPLE, 1953-1957

Income Groups by Family Size	Number of Families	E_1^a	E_2^b	Change in E^c	Level of Significance
<u>Broilers</u>					
Less than \$1200	59	2.63	3.10	.47	.10
2-3 person	14	3.27	3.21	-.06	> .40
4 or more person	45	2.43	3.07	.64	.025
\$1200-\$1700	60	3.33	3.78	.45	.05
2-3 person	19	5.12	5.04	-.08	> .40
4 or more person	41	2.50	3.20	.70	.05
\$1700-\$2400	44	6.96	7.83	.87	.20
2-3 person	32	7.75	8.61	.86	.20
4 or more person	12	4.85	5.73	.88	.10
\$2400 and above	51	5.36	5.82	.46	.30

^a E_1 = Expenditures before an increase in income.

^b E_2 = Expenditures after an increase in income.

^cChange in $E = E_2 - E_1$.

TABLE N

STATIC INCOME EXPENDITURE ELASTICITIES FOR COLD CUTS, MICHIGAN
STATE UNIVERSITY CONSUMER PANEL SUB-SAMPLE, 1953-1957

Income Groups	Cold Cuts
Low to Medium	.336
Medium to Medium-High	.391
Medium-High to High	-.234

TABLE O

ANNUAL AVERAGE PER CAPITA COLD CUT EXPENDITURES ASSOCIATED WITH
INCREASED INCOME, BY INCOME GROUPS SUBDIVIDED BY
FAMILY SIZE, MICHIGAN STATE UNIVERSITY
CONSUMER PANEL SUB-SAMPLE, 1953-1957

Income Groups by Family Size	Number of Families	E_1^a	E_2^b	Change in E^c	Level of Significance
<u>Cold Cuts</u>					
Less than \$1200	59	4.55	5.05	.50	.025
2-3 person	14	4.06	5.29	1.23	.05
4 or more person	45	4.70	4.97	.27	.20
\$1200-\$1700	60	5.32	5.51	.19	.20
2-3 person	19	5.27	5.77	.50	.10
4 or more person	41	5.34	5.39	.05	> .40
\$1700-\$2400	44	6.22	6.22	0.00	> .40
2-3 person	32	6.86	6.69	-.17	.40
4 or more person	12	4.52	4.96	.44	.30
\$2400 and above	51	5.48	5.83	.35	.20

^a E_1 = Expenditures before an increase in income.

^b E_2 = Expenditures after an increase in income.

^cChange in $E = E_2 - E_1$.

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TABLE P

DYNAMIC-INCOME EXPENDITURE ELASTICITIES FOR SELECTED COLD CUTS,
MICHIGAN STATE UNIVERSITY CONSUMER PANEL SUB-SAMPLE
1953-1957

Income Groups	Cold Cuts
Less than \$1200	.866
\$1200-\$1700	.271
\$1700-\$2400	0.000
\$2400 and above	.690

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1. The first part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

$$f(x) = \int_0^x \frac{1}{1+t^2} dt.$$

2. In the second part we shall study the properties of the function $f(x)$ defined by the equation

$$f(x) = \int_0^x \frac{1}{1+t^2} dt.$$

3. In the third part we shall study the properties of the function $f(x)$ defined by the equation

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