EXPENDITURES AND INCOME ELASTICITIES FOR CEREAL PRODUCTS, MARKET SERVICES, AND GRAIN

By

Kurt R. Anschel

A THESIS

Submitted to the School for Advanced Graduate Studies
of 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

1961

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ABSTRACT

This study was undertaken to develop income elasticity coefficients for cereal products at retail, for market services embodied in them, and for the grain used as raw materials. It was hypothesized that the income elasticity of demand for cereal products is approximately 0.5, the income elasticity of demand for grain is 0.0 and the income elasticity of demand for services in grain products is greater than 1.0.

The income and expenditure data were obtained from the Michigan State University Consumer Panel for the years 1955-58. Families of 2 or more persons were selected if they had an increase in income during the second of two consecutive years, reported expenditures and income each week, and maintained a constant family size during any two consecutive years.

Services are defined as all non-farm additions to the product sold at retail. The quantity of services bought by each family is derived by determining the quantity of raw material included in all cereals purchased and received as gifts and then subtracting the value of grain computed at a constant price from the total expenditures for products at retail.

Both time series and cross-sectional analyses of the

data were made. The income elasticity of cereal products at retail is 0.51 when computed by the time series method. The income elasticity of demand for grain is 0.21. The income elasticity of demand for services in grain products is 0.55. The same elasticities coefficients computed by the cross-sectional method are lower.

In addition, the income elasticities of seven product groups are derived. The elasticity coefficient for Mill Products (raw grain, flour, etc.) are the lowest of any product group. Those for bakery products (cakes, doughnuts, pies, etc.) are the highest.

Further analysis of the data shows that 88 percent of all retail expenditures are made for services and that bakery products include the highest ratio of services to grain in value terms.

The hypothesis that the income elasticity of demand for services is greater than 1.0 was not verified. Because the expenditures for services already are a high proportion of total expenditures, the extent to which the expenditures for services can increase relative to the expenditures for grain is limited. The elasticity coefficient for services cannot diverge widely from the coefficient for expenditures at retail. A mathematical statement and proof of the interrelationship between elasticity coefficients for the product at retail, for market services and for grain is developed.

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CHAPTER I

INTRODUCTION

Purposes of Study

Economists, today, are becoming increasingly concerned with the effects of the inclusion of services in retail products on demand. It is generally thought that as income increases, the demand for services increases. This thesis will analyze the effect of increases of income on the expenditures for market services embodied in cereal products. In addition, the change in retail expenditures for cereal products at retail and for the grain used as raw material as a result of increases of income will be studied.

This study will also give some insight into the future demand situation for cereal products. Recently the retail demand for cereal products has increased. The portion of the family food budget spent on grain products increased more than any other product group during the period 1953-1957.[1] The farmer's share of retail expenditures for cereal pro-

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[1]Agricultural Marketing Service, U.S. Department of Agriculture. Farm-Retail Spreads for Food Products. Miscellaneous Publication No. 741 (Washington: U.S. Government Printing Office, 1957) p. 73.

ducts decreased more than only one other product group.[2] An attempt will be made to determine what can be expected to happen to expenditures for cereal products as consumer income continues to increase. The three major hypotheses to be tested are (1) the income elasticity of demand for cereal products at retail is approximately 0.5, (2) the income elasticity of demand for the grain used as raw materials is approximately 0.0, and (3) the high income elasticity for cereal products is due to an income elasticity for market services embodied in them of greater than 1.0.

Using data from the Michigan State University Consumer Panel, nine basic income elasticities are derived; the income elasticities for all grain product at retail, for all market service embodied within them, and for all grain used as raw materials, the income elasticities for grain, market services, and retail expenditures of seven grain product catagories, and the income elasticities in the three major grains, for the products made from those grains, and the services added to those grains.

In addition to the above major objectives, there is one less important objective. There are two methods for determining elasticities, the cross-sectional method and the time series method. Very little is known about the differences in these methods. It has been observed that time

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[2]Agricultural Marketing Service, U.S. Department of Agriculture. The Marketing and Transportation Situation. January, 1961. p. 47.

series analyses usually results in lower elasticities than cross-sectional studies.[3] An explanation is that the time series method describes a short-run adjustment and the cross-sectional method analyzes the long-run adjustment of expenditures to income changes.

In this thesis, no attempt is made to explain the difference between the two methods, but only to illustrate them. Since the time series method gives results which are better adapted for predictive work in the short-run, most emphasis is placed on its results.

Results of this thesis are useful for gaining insight into changes of demand for grain, grain products, and services included in grain products as a result of income changes. For policy, income elasticities can be used for increasing insight into changes of consumption as a result of income subsidies, food stamp plans, and other demand expansion plans. The effects of monetary and fiscal policy can be better understood through the use of income elasticities.

The Theoretical Framework

This thesis is written within the framework of the received theory of consumer demand. Quantity demanded is

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[3]For example see: Robert J. Bachleda, "A Comparison of Static and Dynamic Income-Expenditure Relationships for Selected Meat Items." (Unpublished Master's Dissertation, Department of Agricultural Economics, Michigan State University) pp. 75-84.

determined by the interaction of (1) the price of the good, (2) prices of all other goods, (3) taste, habit, and custom, (4) the numbers and characteristics of the population, and (5) the purchasing power of the consumer. The purchasing power of the consumer is determined by his money income and the changing value of that income. This thesis is concerned with changes in purchasing power through changes in money income.

To measure the effect of changes in income on consumption, it is necessary to hold the influence of all the unmeasured independent variables constant. To do this, one must select historical periods in which the variables were known to have been constant, to select periods short enough so that their consequences are negligible, to adjust the data to account for their effects, or to modify the conclusions so as to allow for their influences.

A measure of the effect of changes in income on demand is income elasticity. Income elasticity may be defined as the ratio of percentage change in the consumer's demand for a commodity to the percentage change in his income that has brought about the change in demand.[4] The arc measure of elasticity is used in this study since no attempt was made to derive a formulation of the demand schedule for each

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[4] Tibor Scitovsky. Welfare and Competition (Chicago: Richard D. Irwin, Inc., 1951) p. 46n.

possible income. The arc formula is:

$$\frac{(E_2 - E_1)\ \ (Y_2 + Y_1)}{(E_2 + E_1)\ \ (Y_2 - Y_1)}$$

where

E_1 = expenditures during the first time period

E_2 = expenditures during the second time period

Y_1 = income during the first time period

Y_2 = income during the second time period

Elasticities can be measured in percent change of quantity or percent change of expenditure. The latter method is preferable for most studies because it can be used to compute the elasticity of several similar products.

The three elasticities dealt with in this thesis are highly interrelated. Total expenditures for cereal products by any income group is, by definition, the sum of the expenditures for grains and services. An equation expressing the interrelationship between the three elasticities is:

$$e_t = \frac{(g_2 + g_1)e_g + (s_2 + s_1)e_s}{(g_2 + g_1) + (s_2 + s_1)}$$

where

e_t = income elasticity of total expenditures at retail

e_s = income elasticity of services

e_g = income elasticity of grain

s_1 = expenditures for services during the first time period

s_2 = expenditures for services during the second time period

g_1 = expenditures for grain during the first time period

g_2 = expenditures for grain during the second time period

The same relationship can be expressed in terms of one of the component elasticities:

$$e_s = e_t + \frac{g_1 + g_2}{s_1 + s_2}(e_t - e_g)$$

$$= \frac{(t_2 + t_1)}{(s_2 + s_1)} e_t - \frac{(g_2 + g_1)}{(s_2 + s_1)} e_g$$

where

e_t = income elasticity of total expenditures at retail

e_s = income elasticity of services

e_g = income elasticity of grain

s_1 = expenditures for services during the first time period

s_2 = expenditures for services during the second time period

g_1 = expenditures for grain during the first time period

g_2 = expenditures for grain during the second time period

t_1 = total expenditures during the first time period

t_2 = total expenditures during the second time period

It is apparent from the above relationships that the elasticity of either component in the retail product is de-

pendent on the change of total retail expenditures and is inversely proportional to the ratio of the expenditure of the component to total expenditures in both time periods.

Previous Studies

Studies of income elasticities have utilized one of two methods, the time series method or the cross-sectional method. The time series method is usually used to compute the income elasticity of broad product categories using regression techniques to study the changes in expenditures over time as income changes. This thesis typifies another use of the time series method by studying the adjustment in expenditure as the income of a selected group of families changes.

Time Series Studies

The first time series study of the income elasticity of services was made by Bunkers and Cochrane using annual aggregate data from 1913-1954 for the United States. A least-squares method was used to estimate the consumption function for food. Services were estimated by subtracting the adjusted farm product value from the adjusted value of all food expenditures. Cochrane and Bunkers estimated the income elasticity of all food to be between 0.25 and 0.28, and the income elasticity of all food services to be between 0.96 and 1.32.[5]

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[5]Elmer W. Bunkers and Willard W. Cochrane, "On the In-

This writer knows of only one other attempt to estimate the income elasticity of services. Albert Fourt, using methods similar to those of Bunkers and Cochrane, estimated the income elasticity of all food services to be about 1.2. Fourt used aggregate U.S. data, and multiple regression methods.[6]

There have been numerous time series estimates of the income elasticity for grains and grain products. We will only mention a few of the more important studies here.

Wold and Jureen computed the "quantity" income elasticity for flour in Sweden during the years 1921-1939. A "quantity" income elasticity, is an elasticity expressed in terms of the percentage change in quantity per percent change in income. Wold and Jureen got their data from a consumer panel and used a least-squares method to estimate the regression equation. They found a quantity income elasticity of -0.60 for flour.[7]

Richard Stone estimated income elasticities in his rather complete volume, Measurement of Consumer's Expend-

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come Elasticity of Food Services." Review of Economics and Statistics. XXXIX (May, 1957) pp. 211-15.

[6]Louis Albert Fourt. "Empirical Income Elasticities of Demand for Food and Its Component Values Produced by Farmers, Manufacturers, and Other Marketing Agencies in the United States, 1929-1956." (Unpublished Ph.d. dissertation, Department of Economics, University of Chicago) p. 41.

[7]Herman Wold and Lars Jureen. Demand Analysis (New York: John Wiley & Sons, Inc., 1953) p. 291.

iture and Behavior in the United Kingdom. He estimated income elasticities of bread, cakes and biscuits, miscellaneous cereals, and flour by the time series method. Stone also used least-squares multiple regression methods from data obtained from household budgets. His income elasticities were:[8,9]

Flour	-0.15
Bread	-0.05
Cakes and biscuits	0.73
Other creals	0.49

Cross-Sectional Studies

Cross-sectional studies usually utilize panel or survey data. Studies using panel data usually are limited to relatively few families, utilizing expenditures for a year or more. Surveys usually include large numbers of families for short periods of time and use weekly or monthly data.

The cross-sectional method assumes that each income group's consumption level is at equilibrium for all families of that income. With a change in income, the consumption level of the group experiencing the change will be the same as the families already at the higher income level. Income elasticity is the percent difference in consumption levels of two income groups per percent difference in income.

In 1948 and 1955, the United States Department of Ag-

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[8]Richard Stone. Measurement of Consumer's Expenditure and Behavior in the United Kingdom. (Cambridge, England: Cambridge at the University Press, 1954) p. 318.

[9]Results shown rounded off.

riculture conducted household food consumption surveys. The 1955 survey of 6,060 families was used to compute the income elasticities of all major food products at three different income levels for farm and non-farm families. A multi-linear regression method was used to determine the elasticities. Income elasticities computed for grain and cereal products of non-farm families are found in Table I-1.

Table I-1

U.S.D.A. Household Food Consumption Survey of 1955: Income Elasticities of Demand for Grain Product Expenditures of Non-farm Families Based on Value of Consumption at Home, 1 Week, Spring 1955.

Products	Income Groups		
	0-$3399	$3400-$4999	$5000 +
Flour and other cereal products	-.13	-.08[1]	-.04
Flour	-.41	-.14[1]	-.14[1]
Mixes	.46	.26[1]	.01[1]
Cereals (breakfast)	.04[1]	.13[1]	-.02[1]
Other cereals	-.24	-.53	.09[1]
Bakery products	.32	.06[1]	.02[1]
Bread	.23	.12[1]	-.05
Baked goods	.45	-.02[1]	.15[1]

[1]Not significantly different from zero at 10 percent level.

Source: George E. Rockwell, Jr. Income and Household Size - Their Effects on Food Consumption. Marketing Research Report No. 340 (Washington: U.S. Department of Agriculture, Agricultural Marketing Service, 1959) p.8.

CHAPTER II

METHODOLOGY

The General Method

Members of the Michigan State Consumer Panel who experienced an increase in income in the second of two consecutive years during the period 1955-1958 are included in this study. These families are classified by two methods, three income groups and two income groups. Income elasticities are computed for each income group of both classifications using the cross-sectional and time series methods.

Income elasticities for cereal products at retail, for market services embodied in them, and for the grains used as raw materials are computed for each product group at each income level to investigate the relationship between income change and expenditure. The income elasticities are determined by both the time series and cross-sectional methods.

Sources and Nature of the Data

Expenditures

The expenditure data from which the results of this study are obtained was collected by the Michigan State University Consumer Panel. The Panel was drawn from a random sample of 1,885 Lansing, Michigan, families (here called

the master sample). The master sample was stratified according to family income, family size, homemaker's age, and homemaker's education, and a random sample was drawn from each strata. As members of the panel dropped out, new members were selected from the master sample who best fit the characteristics of the departing family. In addition, newly formed families were added each year to keep the panel representative over time.

From 1951 to 1958 each week approximately 250 families reported food expenditures, meals eaten out, food gifts, food grown at home, family size, and family income. At the end of each year every family was sent a questionnaire to check the annual income against the sum of the income reported each week. When the income reported in the annual questionnaire differed from the sum of the income reported each week, a personal interview was arranged to determine the cause of the discrepancy and to determine the correct income.

The weekly diary was broken down into 14 different product categories such as dairy products, fats and oils, fruits, vegetables, meats, and bakery and cereal products. These larger headings were further broken down into sub-product groups. Under bakery and cereal products there were 11 sub-product groups: bread; buns, rolls, and cakes; cookies; doughnuts and pies; mixes; flour and corn meal; crackers; spaghetti, etc.; breakfast cereals; appetizers, etc; and other grain products. Under the sub-product groups were

listed the actual products. There were 211 specific bakery and cereal products listed in the diary.

The diary did not achieve the form described above until 1954. Previously bakery and cereal products were in larger aggregates and as a result the data collected before 1954 was unusable. Data collected in 1954 was also unusable because the coding system was different. Therefore the study is limited to the years 1955-1958.

Equivalents

In order to estimate the expenditures for market services it is necessary to know the quantity of grain in each product. An equivalent of the quantity of grain in a product is expressed in pounds of grain per pound of product. The quantity of purchases and gifts multiplied by the equivalent gives the pounds of grain acquired. The grain, valued at its farm price is subtracted from total expenditures, the difference being the value of services.

The equivalents are derived from data published by the U.S.D.A. and data made available by the grain products industry in response to a questionnaire sent to a selected group of firms.[1] When the data supplied was in terms of fractions of bushels per pound of product, the following conversion factors were used to reduce bushels to pounds;

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[1] Production and Marketing Administration, U.S. Department of Agriculture. Conversion Factors and Weights and Measures for Agricultural Commodities and Their Products. (Washington, D.C., 1952) pp. 37-43.

wheat, 60 pounds per bushel; durum, 60 pounds per bushel; corn, 56 pounds per bushel; oats, 32 pounds per bushel; barley, 48 pounds per bushel; rye, 56 pounds per bushel; buckwheat, 48 pounds per bushel; and rice, 45 pounds per bushel.

When the data was received in terms of pounds of flour it was estimated that the following quantities of flour were processed from 100 pounds ofgrain: wheat, 71.53 pounds; durum, 72 pounds; corn, 58.9 pounds; oats, 43.7 pounds; barley, 45.38 pounds; rye, 80 pounds; buckwheat, 60 pounds; rice, 63.7 pounds (from rough rice).

The equivalents obtained from the various sources usually differed, and often by a considerable amount. The quantity of grain used for any product differs from firm to firm due to differences in regional tastes and quality. The data used by the U.S.D.A. to compute equivalents comes from a variety of sources including the military, congressional investigations, and surveys and the results are intended to be averages for the entire industry.

The equivalents used in this thesis are computed in a variety of ways. When more than one firm reported the quantity of grain used to produce a pound of product and the U.S.D.A. also published an equivalent for that product, the U.S.D.A. equivalent is used if it does not differ by more than 10 percent from the average of the industry figures. If the U.S.D.A. figure differs by more than 10 percent, then the average of all data available is used weighing the U.S.D.A.

equivalent twice the weight given any industry equivalent. If only one figure was received from the industry, the U.S.D.A. equivalent is used regardless of the difference between it and the industry figure. If no U.S.D.A. figure is available then the average of the industry equivalents is used. In a few cases no sources were available and it was necessary to assign an equivalent based upon the equivalents of similar products. Table II-1 presents the equivalents and the method of computation.

Grain Prices

The price used for evaluating the grain purchases is derived by averaging the annual prices between 1954 and 1958 as reported in The Grain Situation.[2] The prices of grain used are: wheat, $1.94; durum, $2.31; rye, $1.10; rice $4.84; buckwheat, $1.09; corn, $1.25; oats, $.634; and barley, $.947.

Selection of Families

Families fitting the following criteria are included in the sample utilized in the study: (1) families of two or more persons who experienced an increase in income in the second of two consecutive years, (2) families who maintained a constant size during the two year period of income

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[2]It will be noted that 1954 was used to compute the grain price average. That year was included because as originally planned the expenditure data for 1954 was to be included. Because the coding system in 1954 was different from the system used in the following years, 1954 could not be used but the grain prices were not changed accordingly.

Table II-1

The Method and Results of Computing the Pounds of Grain in a Pound of Product

Products	Grain	Equivalent #grain/#product	Source
I. Mill Products			
1. cake flour	wheat	2.125	U.S.D.A.[1]
2. graham flour	wheat	1.05	firms' average
3. white flour	wheat	1.398	U.S.D.A.
4. corn meal	corn	1.40	U.S.D.A.
5. corn starch	corn	1.65	U.S.D.A.
6. plain rice	rice	1.00	U.S.D.A.
7. prepared rice	rice	0.40	same proportion as canned spaghetti to white flour
8. whole wheat flour	wheat	1.02	U.S.D.A.
9. buckwheat flour	buck-wheat	1.67	U.S.D.A.
10. barley flour	barley	2.204	U.S.D.A.
11. rye flour	rye	1.265	firms and (2x) U.S.D.A. avg.
12. barley	barley	1.00	unprocessed grain
13. rice	rice	1.00	unprocessed grain
14. wheat	wheat	1.00	unprocessed grain
15. soya	corn	1.40	same as corn meal
16. oat flour	oats	2.286	U.S.D.A.
17. soya flour	corn	1.70	U.S.D.A.(corn flour)
18. mush	corn	1.932	same as hominy grits

[1]Production and Marketing Administration, U.S.Department of Agriculture. Conversion Factors and Weights and Measures for Agricultural Commodities and Their Products. Washington,D.C., 1952) pp. 37-43.

Table II-1 (con't)

The Method and Results of Computing the Pounds of Grain in a Pound of Product

Products	Grain	Equivalent #grain/#product	Source
II. Cereals			
1. wheat cereals	wheat	1.18	U.S.D.A.
2. corn cereals	corn	2.240	U.S.D.A.
3. oat cereals	oats	2.430	U.S.D.A.
4. rice cereals	rice	1.577	U.S.D.A.
5. miscellaneous	wheat	0.393	1/3 wheat cereal equiv.
	corn	0.746	1/3 corn cereal equiv.
	oats	0.810	1/3 oat cereal equiv.
III. Mixes			
1. cakes and muffins	wheat	0.511	firm and (2x) U.S.D.A. avg.
2. cookies	wheat	0.594	firm and (2x) U.S.D.A. avg.
3. roll and biscuit mix	wheat	1.153	firm and (2x) U.S.D.A. avg.
4. pie crust mix	wheat	0.839	firms average
5. pie mix	wheat	0.222	U.S.D.A.
6. pancakes and waffles	wheat	0.630	U.S.D.A.
	rye	0.062	
	buck-wheat	0.330	
	rice	0.1036	
	corn	0.170	
7. bread	wheat	1.074	firm and (2x) U.S.D.A. avg.
8. corn muffins and bread	corn	1.505	firms average

Table II-1 (con't)

The Method and Results of Computing the Pounds of Grain in a Pound of Product

Products	Grain	Equivalent #grain/#product	Source
9. buckwheat waffles and pancakes	buck-wheat	0.862	firm and (2x) U.S.D.A. avg.
IV. Spaghetti, Macaroni, etc			
1. spaghetti, macaroni (plain)	durum	1.389	U.S.D.A.
2. spaghetti, macaroni (meat)	durum	0.125	U.S.D.A.
3. spaghetti, macaroni (other)	durum	0.556	U.S.D.A.
4. noodles(plain)	durum	1.313	U.S.D.A.
5. noodles(other)	durum	0.195	U.S.D.A.
6. minute rice	rice	1.041	U.S.D.A.
7. tapioca	rice	0.935	U.S.D.A.
V. Crackers			
1. soda crackers	wheat	1.398	U.S.D.A.
2. graham crackers	wheat	0.848	firm and (2x) U.S.D.A. avg.
3. other crackers	wheat	1.398	U.S.D.A.
4. cracker meal	wheat	1.399	U.S.D.A.
5. corn flake crumbs	corn	2.240	U.S.D.A.

Table II-1 (con't)

The Method and Results of Computing the Pounds of Grain in a Pound of Product

Products	Grain	Equivalent #grain/#product	Source
VI. Bread and Rolls			
1. white bread.....	wheat	0.895	U.S.D.A.
2. special white breads.....	wheat	0.895	similar to white bread
3. mixed breads.....	wheat rye	0.657 0.250	U.S.D.A.(rye bread)
4. wheat breads.....	wheat	0.642	U.S.D.A.(whole wheat)
5. fruit breads.....	wheat	0.600	based on U.S.D.A.
6. buns.....	wheat	0.881	U.S.D.A.
7. biscuits.....	wheat	0.699	U.S.D.A.
8. rolls.....	wheat	0.881	U.S.D.A.
VII. Baked Goods			
1. cakes and muffins..	wheat	0.455	firm and (2x) U.S.D.A. avg.
2. cookies.....	wheat	0.616	firm and (2x) U.S.D.A. avg.
3. pies.....	wheat	0.224	U.S.D.A.
4. doughnuts.....	wheat	0.689	firm and (2x) U.S.D.A. avg.
5. breakfast rolls....	wheat	0.688	firm average

change, (3) families who reported every week during the two year period, and (4) families whose year end reported income equaled the sum of the income of each week.

Single person families are eliminated because the large number of meals they eat out and their high per capita income cause extreme variability in the elasticities. The inclusion of only families maintaining a constant size avoids problems of changing per capita income and changing per capita expenditure rates during the year. Families who report most weeks but not every week are not included because the number of family years[3] gained would have been too small to make the necessary adjustments worthwhile. A family is not included in the sample if the income reported at the end of the year and the sum of income reported each week were not equal and the interview arranged to reconcile the difference was unsatisfactory.

Time Period

The time period problem is one of trying to successfully eliminate the effects of cycles and seasonal variation of the unmeasured independent variables. The unmeasured independent variables may be classified in six major groups: (1) taste, custom, and habit, (2) the state of the arts, (3) the prices of grain and cereal products, (4) the prices of all other substitute goods, (5) the purchasing power of the dollar, and (6) the numbers and characteristics of the

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[3]A family year is the data resulting from the inclusion of a family for one year.

population. Over a long time period all these variables fluctuate but in shorter periods are more stable.

Taste, custom, and habit, numbers and characteristics of the population are usually regarded as fixed during a four year period. It takes much longer for mores, social customs, institutions, and age distribution and population of a nation to change significantly. The only exception is a period of tremendous upheaval such as depression or war, but the period 1955-58 was not one of these periods.

Technological change in a particular industry does not conform to any periodic movement. An industry's technology may not change for several generations and then may change rapidly. Technological change may be one of two types, the invention of a new process for the production of a commodity already on the market, or the invention of a new product. The invention of a new process will result in a reduction in the cost of production and, if entry into the market is free, the price of the product will fall. This in turn may cause a change in expenditure for the product. The change in aggregate expenditures will depend on the price elasticity of the product. If the price elasticity is less than minus one, total expenditures will increase. If it is greater than minus one, expenditures will decrease.

If an innovation results in a new product on the market, the product will slowly gain consumer acceptance and expenditures for substitute goods may decrease. In some cases the sole area of loss will be to the firms producing a pro-

duct used for the same purpose. If the price of the new product is much lower than the price of the products it replaces, expenditures may be drawn from other goods as well, or if the new good replaces an inferior good, expenditures for other goods will increase due to an income effect.

The economic effects of innovations which result in the introduction of new products are difficult to determine. New products often require long period of time before receiving full consumer acceptance. During the period of increasing acceptance no equilibrium of expenditures for the new product or competing products is established. For the purposes of this study, sales and expenditure figures are used to determine whether any equilibrium has been established for new products. Until an equilibrium is reached, consumption of new products will increase at a rate higher than older products.

Innovations can take place at three market levels: within cereal products; among those products which are close substitutes, other foods; and among the not so close substitutes, all other consumer goods.

The recent major innovation resulting in the introduction of a new cereal product was the invention of packaged mixes. The introduction of these products occurred after the Second World War, and by 1955 they had achieved full consumer acceptance.[4]

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[4]Based on confidential sales figures from an independent market research firm.

Among the close substitutes, the major innovation is frozen foods. During the period, 1955-1958, there was a very rapid growth of sales of frozen fruits and vegetables.[5] The introduction of frozen products makes most fruits and vegetables available the year around. The result is a rapid increase in the expenditure for fruits and vegetables, and the decrease in the demand for other products including bakery and cereal products. The effect is to lower the estimates of the income elasticity of demand for cereal products since the changes in consumption will be diminished as income rises.

Innovation in the non-food consumer goods industry continues at a constant rate if all non-food industries are grouped together. It is possible to regard the influence of innovations in these industries as continuing at a constant rate, which means there will be no effects on the results of this study. The only exception may arise out of some unusual situation such as war or depression when for economic or military reasons, the innovations were not available to the public creating a large unsatisfied demand.

A variable that may cause some change in the consumption of grain products is the prices of grain products relative to the prices of other foods and all other goods. The prices of cereal products decreased from 1955 to 1956

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[5]"1958 Almanac of the Frozen Foods Industry—A Collection of Facts and Statistics." Quick Frozen Foods. XX (March, 1958) pp. 165-196.

and thereafter increased. The price of all food increased during the same period. The Consumers Price Index of grain and cereal products decreased 4.3 percent from 1955 to 1956. In 1957 the index rose 4.9 percent and in 1958 rose 2.6 percent. During the same period the Consumers Price Index for all food increased 0.8 percent, 3.7 percent, and 4.9 percent. Assuming negative price elasticities, in 1956 expenditures for grain products should have increased relative to expenditures for other food products. In 1957, expenditures should have fallen relative to the expenditures for other food products, and in 1958 they should have risen again. The net effect is probably negligible since the three movements tend to cancel each other and the price elasticity of demand for grain products is elastic.

Changes of the prices of all other goods have an influence on the expenditures for grain products. The Consumer Price Index for all items excluding food shows an increase of 1.8 percent in 1956, 3.4 percent in 1957, and 2.9 percent in 1958. The increases of the prices of all non-food consumer goods are greater than the increases of the prices of cereal products. As a result, expenditures for cereal products, and therefore the elasticities, are increased relative to other products. Since the difference between the increase of prices of non-food items and the increase in cereal product prices is small, the increase of the elasticities is probably small.

Changes in the purchasing power of the dollar and

changes in prices had opposite effects on the income elasticities. From 1955 to 1958 the purchasing power of the consumer's dollar fell gradually. The result was that the real income change was not so great as the change in money income of a consumer receiving an increase in income. As a result, the consumer probably did not increase his expenditures as much as was indicated by the increase in income. Therefore, the three income elasticities are slightly underestimated.

It is very difficult to accurately estimate the degree to which the income elasticities are underestimated as a result of changes in the unmeasured independent variables. In all probability the effects are small.

Selection of Grain Products and Product Groups

All those products listed in the Consumer Panel Diary under the Cereal and Grain Product category except appetizers are included in this study. Products which contain very small quantities of grain such as soups, appetizers, and baby foods are not included because they embody such a small part of total grain consumption.

Alcoholic beverages are not included owing to the nature of their consumption. Much of the expenditures and consumption of alcoholic beverages takes place outside the home, and therefore, would not be included in the Diary. It is also believed that the data for home consumption might have a strong downward bias.

Table II-2

Consumer Price Indexes for Cereal and Grain Products, Food, All Items Excluding Food, and All Goods, 1955-58

Index	1955	1956	1957	1958
Prices				
Cereal and grain products				
Wholesale	116.2	115.2	116.9	117.9
Retail	129.9	123.6	130.5	133.1
Food	110.9	111.7	115.4	120.3
All items excluding food.	116.7	118.8	122.8	125.5
All goods	114.5	116.2	120.2	123.5

Source: Bureau of the Census, U.S. Department of Commerce. Statistical Abstracts of the United States 1959. (Washington: U.S. Government Printing Office, 1959) pp. 330-338.

Table II-3

The Purchasing Power of the Dollar, 1955-1958

Market level	1955	1956	1957	1958
Wholesale	90.3	87.5	85.0	83.9
Retail	90.2	89.5	86.7	83.1

Source: Bureau of the Census, U.S. Department of Commerce. Statistical Abstracts of the United States 1959 (Washington: U.S. Government Printing Office, 1959) p. 338.

The products are aggregated into seven product groups. The aggregation is made on the basis of product type and quantity of services in the product. The primary criteria is product type although Table II-4 shows that the quantity of services varies with product group.

Table II-4

The Average Expenditure and Range of Expenditure Services in a Dollar's Purchase of Each Product Group

Product Groups	Average Value of Services Per Dollar Expenditure[1]	Range
Mill products	$.7443	$.5097-$.9371
Cereals	.8510	.7603- .9036
Mixes	.8794	.7505- .9821
Macaroni-spaghetti	.8983	.7618- .9895
Crackers	.8890	.8491- .9421
Bread and rolls	.8993	.8408- .9257
Bakery products	.9634	.9494- .9808

[1]Each product in the group weighed equally.

The product groups fall into four distinct classes. Mill products contain the greatest heterogeneity of products including some with just over 50 percent services and others with over 90 percent services. The most important products of the group are at the lower end of the scale. Only four products of the 18 products in the group include 80 percent or more services.

Cereals, mixes, and macaroni-spaghetti can also be grouped together as being similar in grain-service mix. The

individual products in each of these product groups vary from 75 percent to almost 100 percent services. The products in each product groups are fairly evenly distributed throughout the range.

Crackers and bread and rolls fall in the same class because their range of percent services lies between 85 and 95 percent. The individual products are closely grouped between 88 percent and 92 percent.

Bakery products have the highest proportion of services. They vary between 94 percent and 98 percent services with a fairly even distribution in the range.

Grouping of Families

The families selected are those who reported two or more years and had an increase in income in each succeeding year. For the time series calculations, each family year is classified as either primary or secondary. The primary years are the years before an income increase and the secondary years are the years in which there is an increase in income over the previous year. A family's data for a year may be primary and secondary if the family experienced an increase in income in more than one year and the family fit the other criteria during those years. If the family reported three years in succession and during the last two years experienced an increase in income over the previous year, the second year's data would be both in the primary group and the secondary group.

All the primary years are placed into one of four per capita income groups, below $1,349, $1,350 to $1,599, $1,600 to $1,999, and above $2,000. Regardless of the size of the increase in income, the secondary years are classified according to the income in the primary year. For instance, if in 1955, a family had an income of $1,000 and in 1956 an income of $1,450, the 1955 income and expenditures would be placed in the below $1,349 primary year group. The 1956 data would be placed in the below $1,349 secondary group. If in 1957, the same family had an income of $1,650, then the data for 1956 would also be grouped with the $1,350 to $1,599 primary year income group, and the 1957 data would be placed in the $1,350 to $1,599 secondary year income group regardless of the fact that in 1957 the income was above $1,599.

The income groups were chosen so as to make it possible to have both two and three income groups with approximately equal numbers in each income group. The three income group classification is obtained by combining the data of the $1,350 to $1,599 income group with the data of the $1,600 to $1,999 income group. The two income group method results from the combination of the two highest income groups and the combination of the two lowest income groups.

Measurement of Services

The term "services" has never been precisely defined in economic terminology and has been used to define a num-

ber of concepts. The primary use of the term has been to distinguish non-tangible additions to a product such as transportation, installation, personal attention, and repair. The use of services for intangibles is difficult to apply to empirical work. Most intangible additions to a product also involve tangible additions. From an economic standpoint the distinction is unimportant. The economist is interested in the ability of the additions to add value to the product regardless of the nature of the addition.

In this thesis, all non-farm additions to the grain are called services. It is argued that the consumer can buy the grain directly from the farmer and finish it himself if he so desires. Since the manufacturer is finishing the grain for the consumer, the additions of the manufacturer are services.

The concept of services as all non-farm additions to the product is a compromise. Technically all farm additions to the grain after harvesting (e.g. storage) should be included as services, but this is difficult as there is no convenient measure of some of these services.

The value of services is computed by subtracting the value of grain from the total value of the product. The value of grain is determined by first computing the quantity of grain purchased and received by gifts, and then multiplying by a constant price of the grain.

It would have been possible to use any constant price of grain without affecting the income elasticities for mar-

ket services and grain used as a raw material. For instance, if five pounds of a certain product had been bought in the primary years and ten pounds in the secondary years at $.25 per pound and the products equivalent is 1.5, then the percentage change in expenditures for grain would be the same whether the grain was worth $.01 a pound or $.07 a pound.

Primary years	Secondary years
5 x $.25 = $1.25	10 x $.25 = $2.50
1.5 x 5 = 7.5 lbs. grain	1.5 x 10 = 15 lbs. grain
7.5 lbs. at $.01 = $.075	15 lbs. at $.01 = $.15

$$\frac{.075}{.15} = \frac{1}{2}$$

7.5 lbs. at $.07 = $.525	15 lbs. at $.07 = $1.05

$$\frac{.525}{1.05} = \frac{1}{2}$$

To have a measure of service and grain expenditures which is at least partially realistic, constant prices are used which approximate the prices of grains during 1954-1958. The five year average of annual prices as reported by the U.S. Department of Agriculture are used. If the expenditure figures of services and grains are to be used and not the elasticities, it must be understood that they are not exact.

Methodology

Each family year is grouped into one of four per capita income groups, $0 to $1,349, $1,350 to $1,599, $1,600 to

$1,999 or $2,000 and above.

In order to compute the cross-sectional income elasticities, it is necessary to know each income group's average per capita expenditure for each product and the average per capita income. These are computed for the three income group and the two income group classifications aggregating the families from all four years.

The expenditures are first computed for each product and these are then summed for product groups, and then the product group totals are summed for total expenditures for given products. The expenditures are divided by the number of persons to determine per capita expenditures. This method makes it possible to compute cross-sectional elasticities for product groups as well as for aggregate expenditure. The formula for cross-sectional income elasticities used is:

$$\frac{(E_2 - E_1)(Y_2 + Y_1)}{(E_2 + E_1)(Y_2 - Y_1)}$$

where

E_1 = expenditures of the lower income group

E_2 = expenditures of the higher income group

Y_1 = income of the lower income group

Y_2 = income of the higher income group

In order to compute the elasticities by the time series method, the per capita expenditure and income levels are computed for each income group before and after an in-

come increase. After grouping the families into income groups according to income in the primary year, the average annual per capita expenditure for each product is computed for each income group for both the primary and secondary years. Also computed is the average per capita income of each income group in the primary and secondary years. The sum of expenditures are computed for each product group and then summed to derive total expenditures for cereal products of each income group during the primary and secondary years. Then the quantity of services is computed by multiplying the quantity of each product by the product's equivalent. This is then multiplied by the average price of the grains, and subtracted from total expenditures to obtain the expenditure for services for each product. From this data elasticities are computed for all product groups, and for total expenditure. The formula used is:

$$\frac{(E_2 - E_1)\ (Y_2 + Y_1)}{(E_2 + E_1)\ (Y_2 - Y_1)}$$

where

E_1 = expenditures during the primary years

E_2 = expenditures during the secondary years

Y_1 = income during the primary years

Y_2 = income during the secondary years

Chapter III

The Income Elasticities of Demand For Cereal Products At Retail, Market Services Embodied in Them, and the Grains Used as Raw Materials

This chapter will present the results of the elasticity computations as a means of studying the consumer's cereal expenditure response to an increase in income. The following chapter will be concerned with the data from which the elasticities are derived.

Income Elasticities of Demand for Cereal Products

The income elasticity for all cereal products at retail varies between 0.13 and 0.25 when computed by the cross-sectional method. The income elasticity for market services is slightly higher, ranging from 0.14 to 0.27. As one would expect, the income elasticity computed by the cross-sectional method for all grains used as raw materials is lower than the other two elasticities. The elasticities for grains are arrayed between -0.07 to 0.07.

The income elasticities computed by the time series method are higher than the elasticities computed by the cross-sectional method. The income elasticities computed by the time series method for all cereal products at retail are between 0.22 and 0.94. The income elasticity of all income groups for cereal products is 0.51. The income elasticity

for market services ranges between 0.24 and 1.0, slightly higher than the income elasticity for all grain products at retail. For all groups, the income elasticity for services computed by the time series method is 0.55. Again the income elasticity for grains used as raw materials is lower than the other elasticities. The income elasticities for grains are arrayed between 0.10 and 0.40, and the income elasticity of all groups for grain is 0.21.

The income group which had an initial income of $1,350 to $1,999 has the highest elasticities when the elasticities are computed by the time series method. In each case this group's income elasticity is the upper limit of the range. On the other hand, the elasticities of the income group with an initial income of $2,000 and more are always the lower limit of the range.

The high income elasticities of the $1,350 to $1,999 income group are due to the increased expenditures for bakery products and bread and roll products. Table III-1 shows that in the first five product groups, the middle income group does not have the highest average percentage change of expenditures. The inclusion of the bread and roll product group makes the percentage change of the middle income group slightly higher than the other two groups, and after adding the bakery goods category the difference becomes very large, greater than 4 percent.

Table III-1

Weighted Average Increase of Expenditures of Families Experiencing an Increase in Income[1]

Income	Product Groups[2]		
	I - V	I - VI	I - VII
$0,000 - $1,349	1.0458	1.0280	1.0611
$1,350 - $1,999	1.0092	1.0386	1.1045
$2,000 -	0.9951	0.9828	1.0238

[1]Weighted by expenditures in the first year.

[2]Product groups are:

I Mill products

II Breakfast cereals

III Mixes

IV Macaroni-spaghetti

V Crackers

VI Bread and rolls

VII Bakery products

Income Elasticities of Demand for the Product Groups

Mill Products

The income elasticity computed by the cross-sectional method for mill products at retail ranges between 0.10 and 0.19. The income elasticity for services is slightly higher, varying from 0.15 to 0.21. The income elasticity for grains

is only slightly lower than the income elasticity for services, ranging from 0.03 to 0.17.

Income elasticity of demand for mill products computed by the time series method varies between -1.44 and -0.02. The range of the income elasticity for market services is even wider and generally lower, being -1.82 to -0.25. The income elasticity of demand for grains used in mill products ranges from -1.0 to 0.2. The higher income elasticity for grains is due to a shift of expenditures from mill products containing more services to those containing less.

The change of expenditures for three products, whole wheat flour, cake flour, and prepared rice products make up 83% of the change of expenditures for mill products of the $2,000 and more income group. The change in expenditure for any of the three products is not more than $6.00 per person. Because these products are consumed by very few families in the income group, it is felt the sample is too small to justify the use of the three income group method when studying the product groups. Therefore, in the following discussion, the range of income elasticities will only include those elasticities derived using two income groups.

Breakfast Cereals

The second product group, breakfast cereals, has the following income elasticities of demand when computed cross-sectionally: -0.15 for breakfast cereals at retail, -0.15 for market services embodied in breakfast cereals, and -0.15

for grains used as raw materials in breakfast cereals. Computed by the time series method, the income elasticities for breakfast cereals are positive. The income elasticities for breakfast cereals are 0.50 and 0.62, for services embodied in them 0.69 and 0.58, and for the grains used as raw materials in breakfast cereals are 0.19 and 0.02. The elasticities computed by the cross-sectional method are negative because the higher income groups have fewer children, and, therefore, consume less breakfast cereal per person.

Mixes

The income elasticity of demand computed by the cross-sectional method for mixes is 0.08, for services is 0.09, and for the grains is 0.01. The income elasticity for mixes computed by the time series method varies from -0.22 to 0.17, for services are -0.20 and 0.16, and for the grains varies between -0.41 and 0.28.

Macaroni-Spaghetti

The income elasticities of demand for the macaroni-spaghetti product group computed by the cross-sectional method are 0.02 for the total product group at retail, 0.05 for market services in the product group, and-0.13 for grains used as raw materials. The time series method results in an income elasticities for the product group at retail of 0.01 and 0.04. The income elasticities for services are -0.12 and 0.07 and the income elasticities for the grains are 0.70 and -0.14.

Crackers

The fifth product group, crackers, has very different elasticities when computed by the two methods. The cross-sectional method gives results of 0.41 for crackers, 0.42 for the services in crackers, and 0.37 for the grains in crackers. Income elasticities computed by the time series method for crackers are 0.19 and -0.02, for services in crackers are 0.20 and 0.01, and for grains in crackers are 0.10 and -0.22.

Bread and Rolls

All per capita income groups spend more for bread and rolls than any other product group. Income elasticity, however, is relatively low. The income elasticities are 0.12 for bread and rolls at retail, 0.14 for services, and -0.02 for the grains. The time series method shows a great deal of consistency between the two income levels. The income elasticity of demand for bread and rolls at retail varies between 0.16 and 0.14, for services embodied in bread and rolls are 0.18 and 0.15, and for the grains used as raw materials in bread and rolls are 0.01 and 0.10.

Bakery Products

Expenditures for bakery products are almost as high as expenditures for bread and rolls. The income elasticities computed by the cross-sectional method are 0.62 for bakery products at retail, 0.63 for services embodied in bakery products, and 0.61 for grains used as raw materials. Bakery

products is the only product group with elasticities greater than one. The income elasticity for bakery products at retail computed by the time series method are 1.62 and 1.01. The income elasticity for services varies between 1.59 and 1.01. The income elasticity for the grains are 2.44 and 1.12. An analysis of the raw data reveals that the elasticity for grain is higher than the elasticity for services because of the large increases in expenditures for doughnuts and cookies after an increase in income. Both doughnuts and cookies contain more grain than the other products in the group.

Income Elasticities of Demand for the Grains

In addition to classifying each product in a product group, each product was classified according to from which grain it was made. As a result, it is possible to compute the income elasticity of demand for each grain, the income elasticity of demand at retail for the products made from each grain, and the income elasticity for the services embodied in the products made from each grain.

A few products are derived from more than one grain and a portion of their expenditures are added to the various grains from which they were made. Retail expenditures for the product were divided equally among the grains in the product.

Only three grains, wheat, corn, and durum, have expenditures high enough to justify computation of elasticities. Because wheat product expenditures make up about

90 percent of all grain product expenditures, the sample is large enough to permit study of the three income group classification. The expenditures per person for durum and corn are very low, and, therefore, the three group classification is unreliable for these grains.

Wheat

The three group cross-sectional classification shows an income elasticity for wheat used as a raw material of approximately 0.0. The income elasticity for all products made from wheat is approximately 0.2, and the income elasticity for services added to products made from wheat is about 0.2. The two group cross-sectional classification gives slightly higher results. The income elasticity for wheat is 0.12, for wheat products is 0.30, and for services is 0.32.

The income elasticities computed by the time series method are more variable. The range of income elasticities for wheat is 0.15 to 0.39, for wheat products is 0.25 to 1.0, and for services is 0.26 to 1.07. The two group time series method gives results which fall in the above ranges.

Corn

Cross-sectional analysis results in an income elasticity for all corn used as a raw material of -0.20. The income elasticity of demand for all products made from corn is -0.23, and the income elasticity of demand for services embodied in products made from corn is also -0.23. The income elasticities derived by the time series method are -0.31 and

-0.28 for corn, 0.14 and 0.12 for corn products, and 0.21 and 0.18 for services added to corn products. Most of the expenditures for corn and corn products are for breakfast cereals made from corn, and as a result the income elasticities for corn are primarily determined by the corn breakfast foods.

Durum

Although durum is a type of wheat, because it receives a price differential it is dealt with separately in this study. The income elasticity for durum computed by the cross-sectional method is -0.15, for durum products is 0.02, and for services embodied in durum products is 0.05. The income elasticities computed by the time series method for durum vary between 0.56 and -0.16, for durum products vary between 0.09 and -0.11, and for services are arrayed between 0.01 and -0.10. Most durum is sold as macaroni and spaghetti, and therefore the corresponding elasticities are almost the same.

CHAPTER IV

THE EXPENDITURE PATTERN FOR CEREAL PRODUCTS AT RETAIL, MARKET SERVICES EMBODIED IN THEM, AND THE GRAINS USED AS RAW MATERIAL

Introduction

This chapter presents an analysis of the data which underlies the previously presented income elasticities. The data analyzed includes: (1) expenditures for all grain products, (2) expenditures for the product groups, and (3) expenditures for the three most important grains. Special attention is given to the relationship between expenditures for the product groups and all grain products, and the proportion of expenditures for market services in total expenditures.

Expenditures For All Cereal Products

Cross-Sectional Data

The $2,000 and higher income group spends $37.62 per person for grain products of which $33.41 is for market services embodied in them. Thus, 88.8 percent of total expenditures (retail) is for services. The group with a per capita income between $1,350 and $1,999 spends an average of $34.94 per capita for grain products, $2,68 less than the

upper income group. Of the $34.94,[1] 88.2 percent is for services. The $0 to $1,349 income group spends $2.79 less per person than the middle income group and $5.57 less than the upper income group. Of the $32.15 spent by the lower income group, 86.8 percent or $27.89 is for services. In each case expenditures decrease as income decreases. In addition, the quantity of services purchased decreases both in value and as a percent of expenditures as income decreases. The upper income group spends 7.69 percent more than the middle group and the middle income group spends 8.67 percent more than the lower income group. The middle income group spends 10.5 percent more than the lower income group for services and the upper income group spends 8.5 percent more than the middle group for services. The expenditures for services changes more than the expenditures for grain products at retail.

The average per capita income of the $2,000 and more income group is $2,941.70. This group contains 140 family years with a total of 346.84 persons. The average family contains 2.48 persons.

The middle income group has an average per capita income of $1,623.91. One hundred and twenty family years are in this income group containing a total of 404 persons. The average family contains 3.37 persons.

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[1]All income and expenditure figures in this chapter are per capita figures unless otherwise stated.

The per capita income of the $2,000 and above group is 81.15 percent higher than the income of the $1,350 and $1,999 group. The average family size of the $1,350 to $1,999 is notably larger than the upper group.

The low income group has a per capita income of $1,022.57. A total of 304 persons are represented in 80 family years. The average family contains 3.80 persons.

The middle income group has a per capita income 58.8 percent higher than the lower group, and the upper group has an income 187.7 percent higher than the lower group. The average family size of the lower group is almost 0.5 persons larger than the middle group and is almost 1.4 persons larger than the upper group.

The wide difference in family size is due to the nature of the methods used. By grouping the family years according to income per person, the smaller families fall in the higher income groups. One family year in the upper income group contains eight persons, one family year contains five persons, 18 family years contain four persons, 21 family years contain three persons, 96 family years contain two persons, and three family years contain between two and three persons.

On the other hand, the lower income group has two family years containing eight persons, three containing seven persons, eight containing six persons, 11 containing five persons, 23 containing four persons, six containing three persons, and 27 containing two persons. It is apparent that

the families with the greater number of persons fall in the lower income groups.

Time Series Data

The time series data is derived from the expenditures of 521.4 persons falling into 171 primary and secondary years. The $2,000 and above income group contains 65 pairs of years. There are 150.4 persons represented in these 65 pairs of family years. The average per capita income in the primary years is $2,974.10 and in the secondary years is $3,302.93, an increase of 11.06 percent. The average family size is 2.31 persons.

The $1,350 to $1,999 income group represents 196 people in 58 primary and secondary family years. They have an average per capita income of $1,601.13 in the primary years and $1,780.26 in the secondary years. Income increases by an average of 11.19 percent per person in the secondary years. Each family contains 3.38 persons.

The lower income group, less than $1,349 per person, has 48 pairs of primary and secondary years. A total of 175 persons are in the group. Average family size is 3.65 persons. Average per capita income in the first year is $1,016.80. After an increase in income, average per capita income is $1,255.83, an increase of 23.51 percent per person.

The second classification utilizing only two income groups divides the families according to whether income per capita is below or above $1,600. When this method is

utilized 242.4 persons in 94 family years are in the group with an income of $1,600 or more. The average family size of the $1,600 and above income group is 2.57 persons. Income per person averages $2,509.75 before an income increase and $2,787.37 after the increase, an increase of 11.06 percent.

The low income group, each family having a per capita income of less than $1,600 in the primary years, contains 279 persons in 77 primary and secondary family years. The average family size is 3.62 persons. Per capita income increases from $1,188.57 in the primary years to $1,400.75 in the secondary years, an increase of 17.85 percent.

In the primary years, the $2,000 and above income group (of the three income group classifications) spends $38.45 per person on grain products of which 88.7 percent is for market services. In the secondary years, expenditures increase 2.38 percent to $39.37 per person of which 88.8 percent or $34.97 is for services. In the secondary years expenditures for services increase 2.54 percent. In total, 1.29 percent of income is spent on grain products in the primary years and 1.19 percent in the secondary years. The increased expenditures for grain products are small compared to the 11.06 percent increase in income. Expenditures for services increase slightly more than the expenditures for all cereal products.

The $1,350 to $1,999 per capita income group spends $35.73 per person for grain products in the primary years. During the primary years, the proportion of expenditures

spent for services is 88.5 percent, slightly less than the corresponding figure of the upper income group. In the secondary years, the middle income group spends $39.46 per person for grain products, even more than the amount spent by the $2,000 and above income group after an income increase. The proportion of cereal product expenditures spent for services increases to 89.12 percent. The change in retail expenditures is 10.44 percent and the change in expenditures for services is 11.24 percent compared to an income increase of 11.19 percent.

The middle income group initially spends less than the upper group for grain products. After an income increase the amount spent per person is almost the same ($.09 difference) although the income of the middle group does not increase as much in money terms as the income of the upper group.

The less than $1,350 income group spends $5.01 less than the middle group for grain products in the primary years. The lower group spends $30.72 per person for grain products of which 86.65 percent is for services. After an increase in income, expenditures for grain products increases 6.11 percent to $32.60 and expenditures for services increase to 87.13 percent of the expenditures for grain products. Although the expenditures for grain products increase in money terms, as a percent of income, they decrease from 3.02 percent to 2.60 percent.

It is significant that in only one case does the per-

cent of income spent on services increase (and then only by 0.01 percent). The middle income group spends 1.97 percent of their income on services in the primary years and 1.98 percent after an income increase.

Expenditures for the Product Groups

The data for expenditures made by three income groups for the product groups is unreliable. For some product groups, the middle income group spends less per capita than either of the other groups. In other cases the middle group spends more, and in still other cases it is just between the higher and lower income groups. When the middle income group is divided into two groups, $1,350 to $1,599 and $1,600 to $1,999, the expenditures by one part of the middle income group may be lower than the expenditures of the upper and lower income groups, and at the same time the other part of the middle group's expenditures are higher than all other groups. Because of the small size of the sample used in deriving the data for the middle income group, the expenditure pattern of one or two families might have an undue effect on the expenditure pattern of the entire group. Since the data from this group appears to be unreliable, it is necessary to limit the discussion to the two income group classification.

Mill Products

The expenditures made by the two income groups for mill products in the primary years differ by only $.20.

The high income group ($1,600 and more) spends $1.84 for mill products during the primary years and reduces its expenditures to $1.71 after an income increase. Retail expenditures decrease 7.41 percent. The low income group spends $1.64 before the income increase and after receiving an increase in income, expenditures for mill products decrease to $1.53 per person. In both cases, expenditures for services embodied in mill products decrease proportionately more than retail expenditures for mill products. The high income group spends $1.01 for services or 54.7 percent of retail expenditures for mill products before an income increase and spends $.90 or 52.6 percent of retail expenditures for mill products after the income increase. Expenditures for services decline 11.10 percent. The low income group's expenditures for services decline from $.90 to $.79, a decrease of 12.58 percent.

The proportion of the grain product budget spent on mill products is low for both income groups. The $1,600 and above income group spends 4.71 percent of its total grain product budget on mill products in the primary years and 4.08 percent in the secondary years. The $1,599 and below income group spends 5.29 percent in the primary years and 4.61 percent in the secondary years.

Although the difference in expenditures of the two income groups for mill products is very small as measured by either portion of income or measured by portion of retail expenditures for grain products, the low income group spends

more.

Breakfast Cereals

The group with a per capita income of $1,600 and above spends $3.36 for breakfast cereals before an income increase and $3.58 afterwards. The low group spends $3.53 before an income increase and $3.83 afterwards. The higher expenditure rate of the low income group is best explained by the larger number of children in the group.

The high income group increases expenditures for breakfast cereals 6.74 percent whereas the low income group increases expenditures for breakfast cereals 8.59 percent. The high income group spends $2.88 per capita on services embodied in breakfast cereals before an increase in income, and $3.10 after an increase in income. The proportion of retail expenditures spent for services increases from 85.8 percent to 86.4 percent. Expenditures for services increase 7.52 percent. The low income group spends $3.02 for services before an increase in income and $3.32 afterwards—an increase of 10.01 percent. The proportion of retail expenditures spent for services increases from 85.5 percent to 86.6 percent.

Expenditures for cereals are the third highest of the seven groups comprising 8.59 percent and 11.35 percent of total expenditures for all grain products of the high and low income groups respectively.

Mixes

The $1,600 and above income group decreases its retail expenditures for mixes from $2.53 to $2.47, a decline of 2.27 percent after an increase of income. The below $1,600 income group increases its expenditures from $2.02 to $2.07, an increase of 2.77 percent. Although the high group decreases its expenditures for mixes, it increases the proportion for services 0.2 percent, whereas the low group decreases the proportion for services 0.1 percent. The high group spends 91.31 percent of mix expenditures on services before an income increase and 91.48 percent after an increase in income. The low group spends 90.73 percent of its expenditures for mixes on services before the income increase and 90.55 percent afterwards. The mixes comprise 6.46 percent of the low income group's grain product budget in the primary years, and 6.48 of the high income group's grain product budget in the primary years.

Macaroni-Spaghetti

The macaroni-spaghetti product group is the least important of the seven product groups. The high income group spends $1.26 per person per year before an income increase and $1.26 after an increase. The low group spends $1.20 before an income increase and $1.21 after one. The high group's expenditures for services in the product group decrease 1.22 percent after an income increase. Services expenditures are 85.30 percent of the retail expenditures in

the primary years and decrease to 84.19 percent in the secondary years.

The expenditures for this product group is 3.22 percent of the total grain product expenditures made by the high income group and 3.87 percent of the expenditures made by the low income group.

Crackers

Persons having a per capita income of $1,600 and more spend $2.35 for crackers before an increase in income. Of the $2.35, $2.03 or 86.34 percent is for services. After an increase in income, the group spends $2.40 for crackers of which $2.07 is for services. Expenditures for services are 86.46 percent of the retail expenditures in the secondary years. Expenditures for the cracker product group increase 1.96 percent. Expenditures for services increase 2.11 percent.

Persons with a per capita income of less than $1,600 in the primary years spend $1.58 per person on crackers before an income increase, and after the increase the group also spends $1.58. The low income group spends $1.37 for services in both years.

The cracker product group is one of the less important product groups. The high income group spends 6.01 percent of its total grain product expenditures on crackers and the low group spends 5.08 percent of its total grain product expenditures on crackers.

Bread and Rolls

The single most important product group is bread and rolls. In the primary years the high income group spends 38.70 percent and the low group spends 42.33 percent of their grain product expenditures on bread and rolls. Bread and rolls is the only product group which over 1 percent of total per capita income is spent.

Persons having a per capita income of $1,600 or more in the primary years spend $15.15 on this product group before an increase in income. After the increase, expenditures increase to $15.40 per person, an increase of 1.64 percent. During the same period the expenditures for services rise faster, increasing from $13.25 to $13.49 per person, an increase of 1.87 percent. The proportion of retail expenditures spent for services purchased during the primary years is 87.45 percent and is 87.64 percent in the secondary years.

The lower income group spends less per person, but increases its expenditure level slightly more. The expenditures for bread and rolls are $13.17 in the primary years and $13.48 in the secondary years, an increase of 2.37 percent. During the primary years 86.50 percent of expenditures or $11.39 are for services. During the secondary years, $11.67 or 86.60 percent is for services, an increase of expenditures for services of 2.49 percent.

Bakery Products

The bakery products group is only second in import-

ance to bread and rolls. Together the two product groups comprise about 70 percent of all grain product expenditures. In the primary years, the high income group spends 32.31 percent of all its grain product expenditures on bakery products. During the same period, the low group spends 25.60 percent of its grain product expenditures on bakery products.

The outstanding feature of this product group is the high quantity of services in it. Of the $12.65 spent by the high income group in the primary years, $12.15 or 96.07 percent is for services. During the secondary years, the high income group spends $15.00 for bakery products of which $14.36 or 95.71 percent is for services. The expenditures for bakery products increase 18.58 percent, the most the expenditures for any product group increase. The expenditures for services increase 18.15 percent.

The low income group spends less per person. In the primary years, the low income group spends $7.96 per person for bakery products of which 95.94 percent is for services. Expenditures increase 18.09 percent in the secondary years to $9.41, of which 95.87 percent is for services.

Expenditures for the Grains

Expenditures for products made from wheat, corn, and durum make up 95 percent of all cereal product expenditures. Expenditures for wheat products alone account for 90 percent of all grain product expenditures. The expenditures for the products of the other grains are so small the data is unreliable.

Wheat

When computed cross-sectionally, the $2,000 and above income group spends 90.24 percent or $33.95 of its total retail expenditures for cereal products on wheat products. The $1,350 to $1,999 income group spends 89.00 percent or $31.09 of its total expenditures on wheat products, and the below $1,350 group spends 86.91 percent or $27.94 of its total expenditures on wheat products.

The percentage of wheat product expenditures made for services embodied in them is also related to income. The lower income groups spend a smaller percentage of their expenditures for wheat products for services. The upper income group spends 89.20 percent of its wheat product expenditures on services, the middle income group spends 88.58 percent on services, and the lower income group spends 87.24 percent on services.

The upper income group spends 9.20 percent more than the middle income group for wheat products. The middle group spends 11.28 percent more than the lower group, and the upper group spends 21.52 percent more than the lower group.

The time series calculations for wheat products give similar results. The upper income group spends $34.83 on wheat products in the primary years and $35.77 in the secondary years, an increase of 2.69 percent. Of the expenditures for wheat products in the primary years, 89.09 percent is for services embodied in them. After an increase in

income, 89.19 percent of the wheat product expenditures is for services. The expenditures for services increase 2.80 percent after an increase in income. The upper income group spends 90.59 percent of all its grain expenditures on wheat products in the primary years and 90.86 percent in the secondary years.

The income group having a per capita income of $1,350 to $1,999 in the primary years spends $31.96 or 89.45 percent of all its cereal product expenditures for wheat products. After an income increase the same group spends $35.53 or 90.03 percent of its grain product expenditures at retail for wheat products. Expenditures for services account for 88.90 percent of expenditures for wheat products in the primary years and 89.60 percent in the secondary years. Total wheat product expenditures increase 11.15 percent following an income increase. Service expenditures increase 12.02 percent.

The lower income group spends $26.74 for wheat products or 87.04 percent of its grain product expenditures for wheat products in the primary years. In the secondary years for wheat products, this group spends $28.54 or 87.53 percent of its grain product expenditures, an increase of expenditures of 6.71 percent. During the same period expenditures for services increase 7.24 percent. In the primary and secondary years 87.14 percent and 87.57 percent of retail expenditures for wheat products are for services.

Corn

Because per capita expenditure levels for corn and durum are very small, only the two income group classification will be discussed here. The cross-sectional expenditure levels for corn are inversely related to income. The $1,600 and above income group spends $.89 for corn products and the below $1,600 income group spends $1.05. The high income group spends 85.65 percent of corn product expenditures for services embodied in them and the low income group spends 85.94 percent of the corn product expenditures for services. The decrease in expenditure level from the low income group to the high income group is 14.67 percent. The high income group spends 2.35 percent of its expenditures for cereal products on corn products and the low income group spends 3.29 percent.

The time series data gives similar results. Although both income groups increase expenditures for corn products with an increase in income, the low income group increases its expenditures more. The opposite is true for wheat products.

The high income group spends $.87 for corn products in the primary years and $.89 in the secondary years, an increase of 1.45 percent. The low income group spends $1.01 in the primary years and $1.03 in the secondary years, an increase of 1.94 percent. During the primary years, the high group spends 85.45 percent of its corn product expenditures for services. This figure increases to 86.11 percent

after an income increase. During the primary years, the low income group spends a greater proportion of its corn products expenditures for services than the high income group. The low income group spends 85.65 percent on services during the primary years and following an income increase spends 86.55 percent of its corn product expenditures on services. Although both income groups spend a very small portion of their grain product expenditures on corn products, the low income group spends a higher portion. The low income group spends 3.25 percent and the high income group spends 2.23 percent of grain product expenditures on corn products.

Durum

The expenditure pattern of durum products is quite different from corn products. The high income group spends more for durum products than the low income group and maintains its expenditure level after an income increase whereas the low income group reduces its level of expenditures after an income increase. The high income group spends $1.20 in the primary years and $1.21 in the secondary years, an increase of 0.98 percent. The low income group spends $1.14 in the primary years and reduces its expenditures to $1.12 after an income increase, a decrease of 1.83 percent. The high income group spends 85.02 percent of durum product expenditures for services embodied in them. The low income group spends 83.66 percent of expenditures for services in the primary years. After an increase in income, the high income group decreases its proportion of retail expenditures

spent for services to 84.27 percent and the low income group increases the proportion of retail expenditures made for services to 83.78 percent. The low income group spends 3.66 percent of all its grain product expenditures on durum products and the high income group spends 3.06 percent of its grain product expenditures on durum products.

CHAPTER V

CONCLUSIONS, LIMITATIONS, AND IMPLICATIONS

Summary of Results

Income Elasticities of Demand for Cereal Products

The income elasticity for services is 0.55, only slightly higher than 0.51, the income elasticity for grain products. The income elasticity for grain is 0.21. These results indicate that as income increases the demand for grain products increases at a rate one-half the percent increase in income. Most of the increased expenditures are for services.

Income Elasticities of Demand for Grains Used as Raw Materials

The income elasticity for wheat is 0.29 for the group having a per capita income of $1,600 and more. The low income group has an income elasticity for wheat of 0.19. The high and low income groups have income elasticities for wheat products of 0.67 and 0.42 respectively. The income elasticities for services embodied in wheat products are 0.71 and 0.45. The increase in expenditures for wheat products after an increase in income follows the same pattern as the expenditures for all grain products.

As income increases the expenditures for corn decreases. The $1,600 and above group has an income elasticity for corn of -0.31. The low income group has an income elasticity for corn at -0.28. The expenditures for corn products and services in corn products increase after an income increase. The high and low income groups' income elasticities for corn products are 0.14 and 0.12 respectively. The income elasticities for services embodied in corn products are 0.21 and 0.18.

The expenditures for durum products and the cereal, durum, increase slightly when the income of the high income group increases. The low income group decreases its expenditures for durum products and the cereal, durum, when income increases. The high income group shifts expenditures to products containing more durum and less services after an income increase. The low income group does the same thing, but to a lesser extent.

Income Elasticity of Demand for the Product Groups[1]

Mill products contain the least services of any pro-

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[1]An original purpose of this thesis was to study the effect of family size on expenditure level. Accordingly each of the cross-sectional income groups was divided in two parts according to family size, 2 to 3.9 persons and 4 and more persons. It was found that expenditure for cereal products of the groups with 2 to 3.9 persons spent $40.33, $40.74, $39.74 and $40.52 for the $2,000 and more, $1,600 to $1,999, $1,350 to $1,599, and $0 - $1,349 income groups respectively. In the same order the groups with 4 and more persons spent $29.28, $36.27, $28.80, and $29.55. These results were considered to be inconclusive due to the small sample.

duct group. The elasticities for mill products, services embodied in them, and grains used as raw materials are all negative. The reduction in expenditures is greatest for those products in the group which contain larger amounts of services. As a result the income elasticity for services is the lowest of the three elasticities.

The elasticities for breakfast cereals are the second highest of any product group. Although the elasticities for services in breakfast cereals are relatively high, the income elasticity of grain is approximately zero indicating that there is a shift to breakfast cereals containing more services. Because families with the most children are in the lower income groups, the elasticities computed cross-sectionally are negative.

The high income group decreases expenditures for mixes after an income increase, but the low income group increases expenditures after an income increase. In both cases the expenditures for grains in mixes change the most. The low income group increases its expenditures for grain even more than the expenditures for services, and the high income group decreases its expenditures for grain more than its expenditures for services. Apparently it is in those products with a higher proportion of grain that demand fluctuates most.

Demand for macaroni and spaghetti products is almost unaffected by changes in income. The high income group increases purchases of products with more services when income

increases. The low income families do not increase their expenditures but buy slightly more grain.

Expenditures for cracker products increase slightly when the high income group has an increase in income but remains almost stable when the income of the low group increases. Both income groups shift to low service products after an income increase.

Expenditures for bread and rolls increase only slightly after an income increase. The increase of expenditures is almost solely for more services. Expenditures for grain are almost constant.

The bakery products group is the only group in which expenditures increase proportionately more than income. Because after an income increase there is a shift to products with a larger grain content, the elasticity coefficient for services is smaller than for grain.

The bread and rolls and bakery products groups account for almost 70 percent of grain product expenditures. Expenditures for bread and rolls are about $15.00 per person and expenditures for bakery products are between $7.00 and $12.00. Total grain expenditures vary between $29.00 and $35.00 per person.

Cross-Sectional Versus Time Series Elasticities

The elasticities computed by the cross-sectional method show no constant relation to those computed by the time series method. The two income group cross-sectional elastic-

ities for total retail expenditures, breakfast cereals, bread and roll products, and bakery products are lower than the two income group time series elasticities. The cross-sectional elasticities for the mixes and the macaroni-spaghetti groups are between the high and low income groups time series elasticities. Mill products and cracker product groups have cross-sectional elasticities higher than the time series elasticities.

It is interesting to note that those groups with the highest expenditures and time series elasticities have cross-sectional elasticities which are lower than the time-series elasticities. However, there is no reason to assume a correlation.

These results deviate from what was expected. Cross-sectional elasticities are expected to be higher than time series elasticities. It is possible that when income increases, the expenditures for some products increase rapidly and then decrease as a new equilibrium is reached. It is also possible that those products with an increasing demand in the long-run have higher time series elasticities than cross-sectional elasticities.

The Validity of the Hypotheses

The primary objective of this study is to determine the relationship between changing income and the expenditures for services in grain products. It was hypothesized that the income elasticity for services embodied in cereal products would be found to be above 1.0 and the income

elasticity for grain products and for grain embodied in them would be approximately 0.5 and 0.0 respectively. The latter two hypotheses are correct. The income elasticity for grain products is 0.51 and the income elasticity for grain is 0.21. The hypothesis that income elasticity for services would be greater than one appears to be wrong. The elasticity obtained is 0.55. The failure to achieve the predicted results could have occurred in any of three ways, incorrect data or computations, incorrect methodology or an incorrect hypothesis.

Spot checks have been made on the data tabulations as computed by the I.B.M. Research Center at Michigan State University. No mechanical mistakes were found. The calculations made by the Statistical Pool of the Agricultural Economics Department of Michigan State University were thoroughly checked by the author and the Statistical Pool. In addition checks were built into the calculations so that it was impossible for any recurrent error to have run through the entire calculations.

The methodology certainly has some limitations. The sampling techniques had some weaknesses which will be discussed more fully later in this chapter.

The general methodology of this thesis is substantiated by a completely independent source. The United States Department of Agriculture reported in the Marketing and Transportation Situation that the farmer's share of retail expenditures for grain products during the period 1955 to

1958 decreased from 16 percent to 14 percent.[2] The results of the thesis are in considerable agreement with the data of the United States Department of Agriculture. Expenditures for grain made up 12 percent of the total expenditures during the years 1955 to 1958. It is reasonable to expect the panel to spend slightly less for grain since the average income of the panel member was higher than the United States average income.

The third possible cause of the unpredicted results is an incorrect hypothesis. An important tool in our analysis will be the following formula which was first presented in Chapter I:

$$e_s = e_t + \frac{g_2 + g_1}{s_2 + s_1} (e_t - e_g)$$

where

e_s = the income elasticity of services

e_g = the income elasticity of grain

e_t = the income elasticity of total product

g_1 = expenditures for grain in the primary years

g_2 = expenditures for grain in the secondary years

s_1 = expenditures for services in the primary years

s_2 = expenditures for services in the secondary years

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[2]Agricultural Marketing Service, U.S. Department of Agriculture. The Marketing and Transportation Situation (January, 1957 and January, 1959) pp. 48-49.

Substituting our hypothesis into this formula we find that the expenditures for services and grains must be equal.

$$1.0 = 0.5 + \frac{g_1 + g_2}{s_1 + s_2}(0.5 - 0)$$

$$s_1 + s_2 = g_1 + g_2$$

If the income elasticity for services is above one, then the proportion of services to grains must be lower.

$$2.0 = 0.5 + \frac{g_1 + g_2}{s_1 + s_2}(0.5 - 0)$$

$$3(s_1 + s_2) = g_1 + g_2$$

In order to have an income elasticity for services of two, only 33 percent of all expenditures could be for services.

Therefore, the expenditures for services over the two year period must be no more than 50 percent of the sum of expenditures over the two year period. But there are no grain products with less than 50 percent services. Therefore, it is impossible that the sum of the expenditures for services be less than 50 percent of the total expenditures over the two year period. Thus our hypothesis of an income elasticity for services of greater than 1.0 could not possibly have been valid. This was learned as the study progressed.

The Limitations of the Study

The Sample

The directors of the consumer panel, Doctors Quacken-

bush and Shaffer attempted to make the panel representative of the City of Lansing. The method of selection of the panel was discussed in Chapter II and need not be repeated here. The representativeness was maintained by making periodic samples of Lansing and adjusting the panel accordingly. Sample censuses were made in 1950, 1954, 1956, and 1958.

The final sample census was made in 1958 and compared to a survey of the final panel. The results of the sample census indicated that those families with fewer children and more education had a proportionately larger representation in the panel than actually existed in the Lansing population. The sample census showed that 27 percent of all families had children under ten years of age whereas only 15 percent of the panel had children under ten. Forty-six percent of the panel were families in which the wife was over 40 years of age and with no children in the household, although only 37 percent of the sample census population were in the same category.

The sample census showed 44 percent of the housewives of Lansing had 12 or 13 years of education. In the panel, 36 percent of the housewives had 12 or 13 years of education. On the other hand, 20 percent of all Lansing housewives had 14 or more years of education, but 29 percent of the panel housewives had 14 or more years of education.

The characteristics used to select and maintain the sample were almost purely demographic, and one can naturally expect some unrepresentativeness due to a self-selection

bias. The directors of the panel were quite conscious of this problem and attempted to make some measurement of it after the panel was concluded. The final sample survey included questions which gave some indications of non-demographic characteristics. The final panel was asked the same questions.

The final sample census showed that the panel members tended to be more economical than the average population. Ten percent more of the final consumer panel than the sample survey home canned and gardened. Whereas 43 percent of the sample census neither home canned nor gardened, only 36 percent of the final panel did neither. A question was asked regarding what determines the size of the family's food bill. Forty-seven percent of the panel indicated that the amount of money available and willingness to spend determined the size of the food bill, and 49 percent said that it was a function of what the family wanted to eat. On the other hand, the sample census showed 36 percent thought their food bill was determined economically and 58 percent thought they determined their food bill hedonistically.[3]

Still another question seemed to draw out the same differences in characteristics. The final panel and sample survey were asked how their food budget was determined.

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[3]Gerald G. Quackenbush and James D. Shaffer. Collecting Food Purchase Data by Consumer Panel — A Methodological Report on the M.S.U. Consumer Panel, 1951-58. Technical Bulletin 279 (East Lansing, Michigan State University, 1960) pp. 14-15.

There were no significant differences in the number of responses to: (1) our food budget is what is left over after having paid the necessary bills, (2) we have a fixed food budget, and (3) we have no budget, but do have in mind a general maximum amount. It was found that 58 percent of the panel and 50 percent of the sample survey felt they bought what they wanted but were not extravagant. On the other hand only 1 percent of the panel, but 7 percent of the sample survey stated that they bought just what they wanted without concern for the cost of food.[4] These latter questions are of course subject to the disadvantage that some of the possible answers are socially unacceptable and there would be some hesitancy in giving them, particularly so for the panel since they had quite a bit of contact with the parties making the survey. On the other hand, the results of the above series of questions are consistent so that it may be concluded that there was some self-selection bias causing the panel to be more economically oriented than the population-at-large.

In addition to the survey discussed above, a survey of a psychological nature was made and compared to a similar survey of the panel members. One portion of the psychological questionnaire attempted to determine differences in the role perception of the housewife. The panel members indicated they awarded more importance than the sample sur-

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[4] Ibid., p. 15.

vey respondents to such things as keeping up one's own appearance, cooking, serving a variety of meals, efficient home, sewing, and baking skill. Those checked less often by the panel members were, a companion to her children, raising children, cooperative, working in local civic projects. The panel members more often perceived their role to be in the area of good housekeeping and less often in the affairs of family and community.[5]

The second part of the questionnaire had to do with self-perception. The results were consistent with the role perception, demographic, and budget determination questionnaires.[6]

We can conclude that the average homemaker who was willing to participate in the sample was more conscious of food and food expenditures and probably spent less on food than other persons of similar demographic characteristics.

The application of these conclusions to the results of the thesis is very difficult. Assuming that the lower and upper income groups had lower expenditure levels in the same proportion to income, then the cross-sectional elasticities would be unaffected. The time series elasticities would be reduced by the same amount in each income group. There would be a tendency for the income elasticity of services to

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[5] Ibid., p. 16.

[6] Ibid., p. 16.

be even further reduced since the person described above would tend to keep expenditures for high service products low.

Conditioning

The greatest problem of a consumer panel operating over a long time period is that participation in the panel is a learning experience. The maintenance of a weekly food purchase diary enables the housewife to evaluate the efficiency of her purchasing activities. If a record is kept at home, weekly comparisons can be made. The directors of the panel recognized this problem and queried the final panel members about it.

Of the 282 families who responded, 246 or 88 percent felt that participation in the panel had an effect on their knowledge of prices. Of these 246, 148 or 53 percent of the 282 respondents felt that participation had a great effect on their knowledge of food prices. Of the 282, 178 felt that keeping the diary caused them to be more price conscious and could give specific examples of how their expenditure pattern changed as a result. Seventy-two percent of the panel thought that participation had at least a little effect on a person's ability to do a better job of food buying. Forty-six percent thought participation had a considerable effect on one's ability to buy food efficiently. Seventy-three percent indicated they changed stores as a re-

sult of being a member of the panel.[7]

Contradicting the above statements was the response to a question regarding the food purchasing pattern. Of those responding, 38 percent indicated no effect on their food purchasing pattern, 39 percent indicated only minor effects on their food purchasing pattern, and only 23 percent indicated considerable effects on their food purchasing pattern.[8]

A few questions were asked to determine what proportion of the panel used the diary with the conscious attempt to change their purchasing pattern. Thirty-eight percent indicated they sometimes added up the amount spent in a week. Fifty-eight families or 21 percent indicated they kept a record of food purchases after having sent in the diary. Of the 58 families, 26 had kept food records before joining the panel. Of the total number of respondents 42 or 15 percent indicated they had kept records before joining the panel and 101 or 36 percent thought they would in the future. Nine families indicated they had kept records before joining, but would not continue to do so and 68 families indicated they hadn't before, but would continue to do so after the panel was discontinued.[9]

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[7] Ibid., pp. 24-25.

[8] Ibid., pp. 25-26.

[9] Ibid., pp. 26-27.

The final question asked was what effect on total food expenditures did participation in the panel have. Of the 282 respondents, 231 indicated no effect, 49 indicated some effect, and two did not respond to the question. Those who indicated some effect reported an average decrease of expenditures of $1.89 or $.29 per week per family on an entire panel basis.[10]

The question of whether participation in the panel affected expenditures remains unanswered. The responses to the several questions are quite contradictory and one's biases tend to determine the conclusion one draws. Doctors Quackenbush and Shaffer felt that the $.29 figure was a good estimate of the effect of conditioning. This writer disagrees because most of the panel had no measure of their expenditure before joining the panel and the expenditure pattern changes so slowly that the conditioning probably was not observable to the panel member.

Conclusions and Implications

The hypothesis that the income elasticity of demand for services in grain products is greater than one is not valid. Eighty-eight percent of grain product expenditures are for services and as a result, the expenditures for services can not increase very much relative to grain.

The income elasticity of a product is not necessarily

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[10] Ibid., pp. 27-28.

related to the quantity of services in the product. The bread and rolls product group has a high proportion of services and a low income elasticity.

In the future as income increases, the demand for grains can be expected to increase only slowly. Demand expansion plans which allow the consumer free choice of his purchases can be expected to have a negligible effect on the demand for grains.

The only product group which will have a proportionate increase in expenditures as income increases is bakery products. The demand for the other product groups with the exception of mill products will increase only slightly in response to income increases assuming a stable or increasing population. Since the income elasticity of mill products is negative, demand will increase only if population grows at a rate fast enough to make up for a negative income elasticity or if other factors change.

APPENDIX A

Table 1

Income Elasticities of Demand for Grain Products, for Market Services Embodied in Them, and for the Grains Used as Raw Materials Computed by the Cross-Sectional Method

Income Groups		Elasticities		
Low Income	High Income	Grain Products	Services	Grains
$1,350-$1,999	$2,000-	0.1283	0.1399	0.0386
$0,000-$1,349	$1,350-$1,999	0.1829	0.2129	-0.0711
$0,000-$1,349	$2,000-	0.1622	0.1859	-0.0106
$0,000-$1,599	$1,600-	0.2502	0.2741	0.0752

Table 2

Income Elasticities of Demand for Grain Products, for Market Services Embodied in Them, and for the Grains Used as Raw Materials Computed by the Time Series Method

Income Group	Grain Products	Services	Grains
$0,000-	0.5093	0.5493	0.2090
$2,000-	0.2247	0.2397	0.1060
$1,350-$1,999	0.9363	1.0045	0.3951
$0,000-$1,349	0.2819	0.3086	0.1050
$1,600-	0.6314	0.6734	0.2970
$0,000-$1,599	0.3792	0.4142	0.1330

Table 3

Income Elasticities of Demand for Mill Products, for Market Services Embodied in Them, and for the Grains Used as Raw Materials Computed by the Cross-Sectional Method

Income Groups		Elasticities		
Low Income	High Income	Mill Products	Services	Grains
$1,350-$1,999	$2,000-	0.1936	0.2101	0.1743
$0,000-$1,349	$1,350-$1,999	0.0993	0.1642	0.0250
$0,000-$1,349	$2,000-	0.1618	0.2019	0.1156
$0,000-$1,599	$1,600-	0.1372	0.1447	0.1284

Table 4

Income Elasticities of Demand for Mill Products, for Market Services Embodied in Them, and for the Grains Used as Raw Materials Computed by the Time Series Method

Income Group	Mill Products	Services	Grains
$2,000-	-0.6577	-1.2324	0.0181
$1,350-$1,999	-1.4376	-1.8174	-0.9964
$0,000-$1,349	-0.0181	-0.2493	0.2372
$1,600-	-0.7340	-1.1207	-0.2857
$0,000-$1,599	-0.4557	-0.8191	-0.0427

Table 5

Income Elasticities of Demand for Breakfast Cereals, for Market Services Embodied in Them, and for the Grains Used as Raw Materials Computed by the Cross-Sectional Method

Income Groups		Elasticities		
Low Income	High Income	Breakfast Cereals	Services	Grains
$1,350-$1,999	$2,000-	-0.1648	-0.1698	-0.1350
$0,000-$1,349	$1,350-$1,999	-0.0363	-0.0198	-0.1423
$0,000-$1,349	$2,000-	-0.1153	-0.1100	-0.1471
$0,000-$1,599	$1,600-	-0.1518	-0.1528	-0.1455

Table 6

Income Elasticities of Demand for Breakfast Cereals, for Market Services Embodied in Them, and for the Grains Used as Raw Materials Computed by the Time Series Method

Income Group	Breakfast Cereals	Services	Grains
$2,000-	0.3348	0.4468	-0.3560
$1,350-$1,999	0.7345	0.7946	0.3477
$0,000-$1,349	0.4974	0.5653	0.0981
$1,600-	0.6219	0.6910	0.1935
$0,000-$1,599	0.5027	0.5815	0.0167

Table 7

Income Elasticities of Demand for Mixes, for Market Services Embodied in Them, and for the Grains Used as Raw Materials Computed by the Cross-Sectional Method

Income Groups		Elasticities		
Low Income	High Income	Mixes	Services	Grains
$1,350-$1,999	$2,000-	0.1693	0.1796	0.0581
$0,000-$1,349	$1,350-$1,999	0.4015	0.4204	0.2121
$0,000-$1,349	$2,000-	0.2881	0.3030	0.1341
$0,000-$1,599	$1,600-	0.0811	0.0877	0.0129

Table 8

Income Elasticities of Demand for Mixes, for Market Services Embodied in Them, and for the Grains Used as Raw Materials Computed by the Time Series Method

Income Group	Mixes	Services	Grains
$2,000-	-0.3840	-0.3677	-0.5680
$1,350-$1,999	0.0726	0.0137	0.6516
$0,000-$1,349	0.2130	0.2452	-0.0920
$1,600-	-0.2192	-0.2005	-0.4128
$0,000-$1,599	0.1668	0.1551	0.2773

Table 9

Income Elasticities of Demand for Macaroni-Spaghetti Products Group, for Market Services Embodied in them, and for the Grains Used as Raw Materials Computed by the Cross-Sectional Method

Income Groups		Elasticities		
Low Income	High Income	Macaroni-Spaghetti Products	Services	Grains
$1,350-$1,999	$2,000-	0.0020	0.0039	-0.0095
$0,000-$1,349	$1,350-$1,999	-0.1366	-0.0786	-0.4352
$0,000-$1,349	$2,000-	-0.6290	-0.0345	-0.2099
$0,000-$1,599	$1,600-	0.0242	0.0540	-0.1345

Table 10

Income Elasticities of Demand for Macaroni-Spaghetti Products Group, for Market Services Embodied in Them, and for the Grains Used as Raw Materials Computed by the Time Series Method

Income Group	Macaroni-Spaghetti Products	Services	Grains
$2,000-	0.4132	0.3441	0.7936
$1,350-$1,999	-0.0223	-0.0832	0.3284
$0,000-$1,349	-0.1099	-0.0958	-0.1799
$1,600-	0.0075	-0.1169	0.6993
$0,000-$1,599	0.0359	0.0685	-0.1367

Table 11

Income Elasticities of Demand for Cracker Product Group, for Market Services Embodied in Them, and for the Grains Used as Raw Materials Computed by the Cross-Sectional Method

Income Groups		Elasticities		
Low Income	High Income	Cracker Products Group	Services	Grains
$1,350-$1,999	$2,000-	0.0866	0.0870	0.0838
$0,000-$1,349	$1,350-$1,999	0.5613	0.5890	0.3909
$0,000-$1,349	$2,000-	0.3141	0.3273	0.2330
$0,000-$1,599	$1,600-	0.4120	0.4184	0.3720

Table 12

Income Elasticities of Demand for Cracker Products Group, for Market Services Embodied in Them, and for the Grains Used as Raw Materials Computed by the Time Series Method

Income Group	Cracker Products Group	Services	Grains
$2,000-	0.0524	0.1042	-0.2740
$1,350-$1,999	0.1034	0.1036	0.1055
$0,000-$1,349	0.0515	0.0775	-0.1083
$1,600-	0.1852	0.1991	0.0975
$0,000-$1,599	-0.0221	0.0080	-0.2153

Table 13

Income Elasticities of Demand for Bread and Rolls Product Group, for Market Services Embodied in Them, and for the Grains Used as Raw Materials Computed by the Cross-Sectional Method

Income Groups		Elasticities		
Low Income	High Income	Bread and Rolls Product Group	Services	Grains
$1,350-$1,999	$2,000-	0.0782	0.0958	-0.0443
$0,000-$1,349	$1,350-$1,999	-0.0843	-0.0561	-0.2638
$0,000-$1,349	$2,000-	0.0071	0.0308	-0.1502
$0,000-$1,599	$1,600-	0.1178	0.1386	-0.0203

Table 14

Income Elasticities of Demand for Bread and Rolls Product Group, for Market Services Embodied in Them, and for the Grains Used as Raw Materials Computed by the Time Series Method

Income Group	Bread and Rolls Product Group	Services	Grains
$2,000-	-0.2579	-0.2331	-0.4402
$1,350-$1,999	0.5712	0.5812	0.5051
$0,000-$1,349	0.0772	0.0863	0.0193
$1,600-	0.1555	0.1765	0.0080
$0,000-$1,599	0.1429	0.1498	0.0987

Table 15

Income Elasticities of Demand for Bakery Products Group, for Market Services Embodied in Them, and for the Grains Used as Raw Materials Computed by the Cross-Sectional Method

Income Groups		Elasticities		
Low Income	High Income	Bakery Products Group	Services	Grains
$1,350-$1,999	$2,000-	0.2828	0.2825	0.2892
$0,000-$1,349	$1,350-$1,999	0.6193	0.6212	0.5719
$0,000-$1,349	$2,000-	0.4541	0.4548	0.4362
$0,000-$1,599	$1,600-	0.6247	0.6256	0.6060

Table 16

Income Elasticities of Demand for Bakery Products Group, for Market Services Embodied in Them, and for the Grains Used as Raw Materials Computed by the Time Series Method

Income Group	Bakery Products Group	Services	Grains
$2,000-	1.0463	0.9706	2.7892
$1,350-$1,999	2.0593	2.0616	2.0065
$0,000-$1,349	0.7369	0.7367	0.7408
$1,600-	1.6222	1.5873	2.4355
$0,000-$1,599	1.0125	1.0081	1.1154

Table 17

Cross-Sectional Income Elasticities for Wheat Products, Wheat, and Services Embodied in Wheat Products

Income Groups		Elasticities		
Low Income	High Income	Wheat Products	Services	Wheat
$1,350-$1,999	$2,000-	0.1524	0.1644	0.0555
$0,000-$1,349	$1,350-$1,999	0.2350	0.2683	-0.0084
$0,000-$1,349	$2,000-	0.2007	0.2233	0.0291
$0,000-$1,599	$1,600-	0.2964	0.3193	0.1218

Table 18

Elasticities for Wheat Products, Wheat, and Services Embodied in Wheat Products Computed by the Time Series Method

Income Group	Wheat Products	Services	Wheat
$2,000-	0.2533	0.2636	0.1696
$1,350-$1,999	0.9971	1.0703	0.3884
$0,000-$1,349	0.3086	0.3319	0.1474
$1,600-	0.6684	0.7134	0.2942
$0,000-$1,599	0.4176	0.4486	0.1890

Table 19

Cross-Sectional Income Elasticities for Corn Products, Corn, and Services Embodied in Corn Products

Income Groups		Elasticities		
Low Income	High Income	Corn Products	Services	Corn
$1,350-$1,999	$2,000-	-0.2691	-0.2816	-0.1925
$0,000-$1,349	$1,350-$1,999	0.0273	0.0382	-0.0370
$0,000-$1,349	$2,000-	-0.1476	-0.1502	-0.1321
$0,000-$1,599	$1,600-	-0.2259	-0.2307	-0.1969

Table 20

Elasticities for Corn Products, Corn, and Services Embodied in Corn Products Computed by the Time Series Method

Income Group	Corn Products	Services	Corn
$2,000-	-0.5790	-0.4904	-1.0889
$1,350-$1,999	0.2090	0.2531	-0.0679
$0,000-$1,349	0.3118	0.3798	-0.0993
$1,600-	0.1377	0.2111	-0.3050
$0,000-$1,599	0.1173	0.1807	-0.2756

Table 21

Cross-Sectional Income Elasticities for Durum Products, Durum, and Services Embodied in Durum Products

Income Groups		Elasticities		
Low Income	High Income	Durum Products	Services	Durum
$1,350-$1,999	$2,000-	-0.0424	-0.0415	-0.0473
$0,000-$1,349	$1,350-$1,999	-0.0854	-0.0217	-0.4032
$0,000-$1,349	$2,000-	-0.0653	-0.0348	-0.2172
$0,000-$1,599	$1,600-	0.0203	0.0521	-0.1449

Table 22

Elasticities for Durum Products, Durum, and Services Embodied in Durum Products Computed by the Time Series Method

Income Group	Durum Products	Services	Durum
$2,000-	0.4036	0.3311	0.7887
$1,350-$1,999	-0.2265	-0.2904	0.1548
$0,000-$1,349	-0.1149	-0.0946	-0.2125
$1,600-	0.0927	0.0093	0.5569
$0,000-$1,599	-0.1130	-0.1039	-0.1594

APPENDIX B

Table 1

Income and Family Size of Those Families Observed Before and After an Income Change (Time Series)1/

Income Groups	Average Per Capita Income	
	Before Income Increase	After Income Increase
$2,000-	$2974.0957	$3302.9255
$1,600-$1,999	$1742.3077	$1935.2747
$1,350-$1,599	$1477.5962	$1644.1538
$0 -$1,350	$1016.8000	$1255.8286

(cont')

Income Groups	Number of Families	Number of Persons	Average Family Size	Increase of Income
$2,000-	65	150.4	2.31	11.06%
$1,600-$1,999	29	92	3.17	11.08%
$1,350-$1,599	29	104	3.59	11.27%
$0 -$1,350	48	175	3.65	23.51%

1/ The income of the middle group of the three income group classification and the two group classification may be derived by multiplying income of each group above by the number of persons in the group, adding this product for the appropriate income groups and dividing by the total number of persons. The same method may be used to derive the expenditures for the two and three income group classifications utilizing the expenditure data which is included in this Appendix.

Table 2

Cereal Product Expenditures and Expenditures for Services Embodied in Cereal Products of Four Income Groups Before and After an Income Change (Time Series)

Income Group	Cereal Product Expenditures		Service Expenditures	
	Before Income Increase	After Income Increase	Before Income Increase	After Income Increase
$2,000-	$38.4521	$39.3680	$34.1021	$34.9694
$1,600-$1,999	$40.2227	$45.6888	$35.6476	$40.8284
$1,350-$1,599	$31.7565	$33.9499	$28.0449	$30.1589
$0 -$1,349	$30.7247	$32.6025	$26.6218	$28.4078

(continued)

Income Group	Change of Expenditures		Proportion of Services to Retail Expenditures	
	Cereal Product Expenditures	Service Expenditures	Before Income Increase	After Income Increase
$2,000-	2.38%	2.54%	88.69%	88.83%
$1,600-$1,999	13.59%	14.53%	88.63%	89.36%
$1,350-$1,599	6.91%	7.54%	88.31%	88.83%
$0 -$1,349	6.11%	6.71%	86.65%	87.13%

(continued)

Income Group	Proportion of Income Spent on Grain Products	
	Before Income Increase	After Income Increase
$2,000-	1.29%	1.19%
$1,600-$1,999	2.31%	2.36%
$1,350-$1,599	2.15%	2.06%
$0 -$1,349	3.02%	2.60%

Table 3

Expenditures for Cereal Product Groups and the Services in Those Groups of Four Income Groups Before and After an Income Change (Time Series)

Product Group	Income Groups	Product Group Expenditures		Service Expenditures	
		Before Income Increase	After Income Increase	Before Income Increase	After Income Increase
Mill Products	$2,000-	$2.0208	$1.8862	$1.1238	$ .9875
	$1,600-$1,999	$1.5604	$1.4210	$ .8261	$ .7528
	$1,350-$1,599	$1.6609	$1.3538	$ .9366	$ .7087
	$0 -$1,349	$1.6349	$1.6287	$ .8766	$ .8318
Breakfast Cereals	$2,000-	$3.5043	$3.6294	$3.0017	$3.1456
	$1,600-$1,999	$3.1362	$3.5228	$2.6961	$3.0280
	$1,350-$1,599	$3.8871	$4.0843	$3.3578	$3.5687
	$0 -$1,349	$3.3175	$3.6838	$2.8143	$3.1701
Mixes	$2,000-	$2.8197	$2.7085	$2.5878	$2.4900
	$1,600-$1,999	$2.0646	$2.0923	$1.8643	$1.8950
	$1,350-$1,599	$2.3004	$2.3078	$2.1059	$2.0841
	$0 -$1,349	$1.8483	$1.9330	$1.6656	$1.7538
Macaroni-Spaghetti	$2,000-	$1.2091	$1.2626	$1.0270	$1.0647
	$1,600-$1,999	$1.3416	$1.2598	$1.1514	$1.0580
	$1,350-$1,599	$1.1226	$1.1895	$0.9556	$1.0209
	$0 -$1,349	$1.2523	$1.2237	$1.0423	$1.0215
Crackers	$2,000-	$1.9983	$2.0093	$1.7226	$1.7415
	$1,600-$1,999	$2.9090	$3.0105	$2.5158	$2.5965
	$1,350-$1,599	$1.7862	$1.7444	$1.5643	$1.5347
	$0 -$1,349	$1.4598	$1.4757	$1.2469	$1.2674

(continued)

Table 3 (continued)

Expenditures for Cereal Products Groups and the Services in Those Groups of Four Income Groups Before and After an Income Change (Time Series)

Product Group	Income Groups	Change of Expenditures After an Income Increase: Product Group Expenditures	Change of Expenditures After an Income Increase: Service Expenditures	Proportion of Services in Product Group Expenditures: Before Income (Increase)	Proportion of Services in Product Group Expenditures: After Income (Increase)
Mill Products	$2,000-	-6.66%	-12.13%	55.61%	52.35%
	$1,600-$1,999	-8.93%	- 8.87%	52.94%	52.98%
	$1,350-$1,599	-18.49%	-24.33%	56.39%	52.35%
	$0 -$1,349	-0.38%	- 5.11%	53.62%	51.07%
Breakfast Cereals	$2,000-	3.57%	4.79%	85.66%	86.67%
	$1,600-$1,999	12.33%	12.31%	85.97%	85.95%
	$1,350-$1,599	5.07%	6.28%	86.38%	87.38%
	$0 -$1,349	11.04%	12.64%	84.83%	86.06%
Mixes	$2,000-	-3.94%	-3.78%	91.78%	91.93%
	$1,600-$1,999	1.34%	1.65%	90.30%	90.57%
	$1,350-$1,599	0.32%	-1.04%	91.54%	90.31%
	$0 -$1,349	4.58%	5.30%	90.12%	90.73%
Macaroni-Spaghetti	$2,000-	4.42%	3.67%	84.94%	84.33%
	$1,600-$1,999	-6.10%	-8.11%	85.82%	83.98%
	$1,350-$1,599	5.96%	6.83%	85.12%	85.83%
	$0 -$1,349	-2.28%	-2.00%	83.23%	83.48%
Crackers	$2,000-	0.55%	1.10%	86.20%	86.67%
	$1,600-$1,999	3.49%	3.21%	86.48%	86.25%
	$1,350-$1,599	-2.34%	-1.89%	87.58%	87.98%
	$0 -$1,349	1.09%	1.64%	85.42%	85.88%

(continued)

Table 3 (continued)

Expenditures for Cereal Product Groups and the Services in Those Groups of Four Income Groups Before and After an Income Change (Time Series)

Product Group	Income Groups	Proportion of Total Retail Expenditure Spent on Product Group		Product Group Expenditures as a Percent of Income	
		Before Income Increase	After Income Increase	Before Income Increase	After Income Increase
Mill Products	$2,000-	5.26%	4.79%	.07%	.06%
	$1,600-$1,999	3.88%	3.11%	.09%	.07%
	$1,350-$1,599	5.23%	3.99%	.11%	.08%
	$0 -$1,349	5.32%	5.00%	.16%	.13%
Breakfast Cereals	$2,000-	9.11%	9.22%	.12%	.11%
	$1,600-$1,999	7.80%	7.71%	.18%	.18%
	$1,350-$1,599	12.24%	12.03%	.26%	.25%
	$0 -$1,349	10.80%	11.30%	.33%	.29%
Mixes	$2,000-	7.33%	6.88%	.09%	.08%
	$1,600-$1,999	5.13%	4.58%	.12%	.11%
	$1,350-$1,599	7.24%	6.80%	.16%	.14%
	$0 -$1,349	6.02%	5.93%	.18%	.16%
Macaroni-Spaghetti	$2,000-	3.14%	3.21%	.04%	.04%
	$1,600-$1,999	3.34%	2.76%	.08%	.07%
	$1,350-$1,599	3.54%	3.50%	.08%	.07%
	$0 -$1,349	4.08%	3.75%	.12%	.10%
Crackers	$2,000-	5.20%	5.10%	.07%	.06%
	$1,600-$1,999	7.23%	6.59%	.17%	.16%
	$1,350-$1,599	5.62%	5.14%	.12%	.11%
	$0 -$1,349	4.75%	4.53%	.14%	.12%

(continued)

Table 3 (continued)

Expenditures for Cereal Product Groups and the Services in Those Groups of Four Income Groups Before and After an Income Change (Time Series)

Product Groups	Income Groups	Product Group Expenditures		Service Expenditures	
		Before Income Increase	After Income Increase	Before Income Increase	After Income Increase
Bread and Rolls	$2,000-	$15.0589	$14.6575	$13.2446	$12.9250
	$1,600-$1,999	$15.2893	$16.5661	$13.2496	$14.3931
	$1,350-$1,599	$11.8220	$12.2745	$10.3115	$10.6997
	$0 -$1,349	$13.9687	$14.1973	$12.0318	$12.2524
Bakery Products	$2,000-	$11.8411	$13.2144	$11.3945	$12.6152
	$1,600-$1,999	$13.9215	$17.8163	$13.3442	$17.1050
	$1,350-$1,599	$ 9.1774	$10.9956	$ 8.8135	$10.5422
	$0 -$1,349	$ 7.2431	$ 8.4602	$ 6.9443	$ 8.1108

(continued)

Product Groups	Income Groups	Change of Expenditures After an Income Increase		Proportion of Services in Product Group Expenditures	
		Product Group Expenditures	Service Expenditures	Before Income Increase	After Income Increase
Bread and Rolls	$2,000-	-2.67%	-2.41%	87.95%	88.18%
	$1,600-$1,999	8.35%	8.63%	86.66%	86.88%
	$1,350-$1,599	3.83%	3.76%	87.22%	87.17%
	$0 -$1,349	1.64%	1.83%	86.13%	86.30%
Bakery Products	$2,000-	11.60%	10.71%	96.23%	95.47%
	$1,600-$1,999	27.98%	28.18%	95.85%	96.01%
	$1,350-$1,599	19.81%	19.61%	96.03%	95.88%
	$0 -$1,349	16.80%	16.80%	95.87%	95.87%

(continued)

Table 3 (continued)

Expenditures for Cereal Product Groups and the Services in Those Groups of Four Income Groups Before and After an Income Change (Time Series)

Product Groups	Income Groups	Proportion of Total Retail Expenditure Spent on Product Group		Product Group Expenditures as a Percent of Income	
		Before Income Increase	After Income Increase	Before Income Increase	After Income Increase
Bread and Rolls	$2,000-	39.16%	37.23%	.51%	.44%
	$1,600-$1,999	38.01%	36.26%	.88%	.86%
	$1,350-$1,599	37.23%	36.15%	.80%	.75%
	$0 -$1,349	45.46%	43.55%	1.37%	1.13%
Bakery Products	$2,000-	30.79%	33.57%	.40%	.40%
	$1,600-$1,999	34.61%	38.99%	.80%	.92%
	$1,350-$1,599	28.90%	32.39%	.62%	.67%
	$0 -$1,349	23.57%	25.95%	.71%	.67%

Table 4

Expenditures for Products Made from Wheat, Durum, and Corn and the Cereals in Those Products Before and After an Income Increase for Four Income Groups (Time Series)

		Expenditures for Product Made From the Grains		Cereal Expenditures	
	Income Groups	Before Income Increase	After Income Increase	Before Income Increase	After Income Increase
Wheat	$2,000-	$34.8327	$35.7696	$3.7983	$3.8668
	$1,600-$1,999	$36.3712	$41.5278	$4.0115	$4.2177
	$1,350-$1,599	$28.0606	$30.2171	$3.1359	$3.2343
	$0 -$1,349	$26.7424	$28.5369	$3.4385	$3.5468
Durum	$2,000-	$ 1.1576	$ 1.2076	$ .1775	$ .1928
	$1,600-$1,999	$ 1.2637	$ 1.2150	$ .1830	$ .1867
	$1,350-$1,599	$ 1.0921	$ 1.0830	$ .1572	$ .1591
	$0 -$1,349	$ 1.1675	$ 1.1396	$ .2035	$ .1946
Corn	$2,000-	$ .8476	$ .7979	$ .1288	$ .1149
	$1,600-$1,999	$ .9145	$ 1.0260	$ .1244	$ .1361
	$1,350-$1,599	$ 1.1182	$ 1.0628	$ .1527	$ .1405
	$0 -$1,349	$ .9454	$ 1.0095	$ .1402	$ .1373

(continued)

Table 4 (continued)

Expenditures for Products Made from Wheat, Durum, and Corn and the Cereals in Those Products Before and After an Income Increase for Four Income Groups (Time Series)

		Change of Expenditures		Proportion of Cereal Expenditures in Expenditures for Products	
	Income Groups	Retail	Cereal	Before Income Increase	After Income Increase
Wheat	$2,000-	2.69%	1.80%	10.90%	10.81%
	$1,600-$1,999	14.18%	5.14%	11.03%	10.12%
	$1,350-$1,599	7.69%	3.14%	11.18%	10.70%
	$0 -$1,349	6.71%	3.15%	12.86%	12.43%
Durum	$2,000-	4.32%	8.62%	15.35%	15.97%
	$1,600-$1,999	-3.85%	2.02%	14.48%	15.37%
	$1,350-$1,599	-0.83%	1.21%	14.39%	14.69%
	$0 -$1,349	-2.39%	-4.37%	17.43%	17.08%
Corn	$2,000-	-5.86%	-10.79%	15.20%	14.40%
	$1,600-$1,999	12.19%	9.41%	13.60%	13.27%
	$1,350-$1,599	-4.95%	-7.99%	13.66%	13.22%
	$0 -$1,349	6.78%	-2.07%	14.83%	13.60%

(continued)

Table 4 (continued)

Expenditures for Products Made from Wheat, Durum, and Corn and the Cereals in Those Products Before and After an Income Increase for Four Income Groups (Time Series)

		Retail Expenditures for Products Made From the Grains as a Percent of Total Cereal Product Expenditures		Percent of Income Expended for the Grains' Products	
	Income Groups	Before Income Increase	After Income Increase	Before Income Increase	After Income Increase
Wheat	$2,000-	90.59%	90.86%	1.17%	1.08%
	$1,600-$1,999	90.42%	90.89%	2.09%	2.15%
	$1,350-$1,599	88.36%	89.00%	1.90%	1.84%
	$0 -$1,349	87.04%	87.53%	2.63%	2.27%
Durum	$2,000-	3.01%	3.07%	.04%	.04%
	$1,600-$1,999	3.14%	2.66%	.07%	.06%
	$1,350-$1,599	3.44%	3.19%	.07%	.07%
	$0 -$1,349	3.80%	3.50%	.11%	.09%
Corn	$2,000-	2.20%	2.03%	.03%	.02%
	$1,600-$1,999	2.27%	2.25%	.05%	.05%
	$1,350-$1,599	3.52%	3.13%	.08%	.06%
	$0 -$1,349	3.08%	3.10%	.09%	.08%

Table 5

Income and Family Size of Four Income Groups
(Cross Sectional)

Income Group	Income	Number of Families	Number of Persons	Average Family Size
$2,000-	$2941.6999	140	346.84	2.4774
$1,600-$1,999	$1765.8000	64	200	3.1250
$1,350-$1,599	$1470.3883	56	204	3.6429
$0 -$1,349	$1022.5658	80	304	3.8000

Table 6

Expenditures for Cereal Products and Services in Cereal Products of Four Income Groups
(Cross Sectional)

Income Groups	Retail Expenditures	Service Expenditures	Proportion of Services in Retail Expenditures	Retail Expenditures as a Percent of Income
$2,000-	$37.6245	$33.4083	88.79%	1.28%
$1,600-$1,999	$38.5547	$34.1139	88.48%	2.18%
$1,350-$1,599	$31.3904	$27.5807	87.86%	2.13%
$0 -$1,349	$32.1488	$27.8909	86.76%	3.14%

Table 7

Expenditures for Cereal Product Groups and the Services in Those Groups of Four Income Groups (Cross Sectional)

Product Group	Income Groups	Expenditures in the Product Group	Service Expenditures	Proportion in Services in Product Group Expenditures
Mill Products	$2,000-	$1.8522	$1.0109	54.58%
	$1,600-$1,999	$1.6494	$0.8700	52.75%
	$1,350-$1,599	$1.6626	$0.9202	55.35%
	$0 -$1,349	$1.5830	$ .8309	52.49%
Breakfast Cereals	$2,000-	$3.3561	$2.8863	86.00%
	$1,600-$1,999	$3.5148	$3.0166	85.83%
	$1,350-$1,599	$3.8647	$3.3476	86.62%
	$0 -$1,349	$3.7529	$3.2112	85.57%
Mixes	$2,000-	$2.3957	$2.1989	91.79%
	$1,600-$1,999	$1.8597	$1.6865	90.69%
	$1,350-$1,599	$2.4790	$2.2719	91.65%
	$0 -$1,349	$1.8091	$1.6364	90.45%
Macaroni-Spaghetti	$2,000-	$1.2096	$1.0278	84.97%
	$1,600-$1,999	$1.2955	$1.1046	85.26%
	$1,350-$1,599	$1.1225	$0.9479	84.45%
	$0 -$1,349	$1.2856	$1.0628	82.67%
Crackers	$2,000-	$2.0315	$1.7582	86.55%
	$1,600-$1,999	$2.2007	$1.8982	86.25%
	$1,350-$1,599	$1.6695	$1.4502	86.86%
	$0 -$1,349	$1.4952	$1.2773	85.43%
Bread and Rolls	$2,000-	$14.4094	$12.6623	87.88%
	$1,600-$1,999	$15.2008	$13.2250	87.00%
	$1,350-$1,599	$12.3733	$10.7607	86.97%
	$0 -$1,349	$14.3109	$12.2899	85.88%
Bakery Products	$2,000-	$12.3700	$11.8638	95.91%
	$1,600-$1,999	$12.8339	$12.3122	95.93%
	$1,350-$1,599	$ 8.2187	$ 7.8821	95.90%
	$0 -$1,349	$ 7.9121	$ 7.5824	95.83%

(continued)

Table 7 (continued)

Expenditures for Cereal Product Groups and the Services in Those Groups of Four Income Groups (Cross Sectional)

Product Group	Income Groups	Product Group Expenditures as a Percent of Total Retail Expenditures	Product Group Expenditures Percent of Income
Mill Products	$2,000-	4.92%	0.06%
	$1,600-$1,999	4.28%	0.09%
	$1,350-$1,599	5.30%	0.11%
	$0 -$1,349	4.92%	0.15%
Breakfast Cereals	$2,000-	8.92%	0.11%
	$1,600-$1,999	9.12%	0.20%
	$1,350-$1,599	12.31%	0.26%
	$0 -$1,349	11.67%	0.37%
Mixes	$2,000-	6.37%	0.08%
	$1,600-$1,999	4.82%	0.11%
	$1,350-$1,599	7.90%	0.17%
	$0 -$1,349	5.63%	0.18%
Macaroni-Spaghetti	$2,000-	3.21%	0.04%
	$1,600-$1,999	3.36%	0.07%
	$1,350-$1,599	3.58%	0.08%
	$0 -$1,349	4.00%	0.13%
Crackers	$2,000-	5.40%	0.07%
	$1,600-$1,999	5.71%	0.12%
	$1,350-$1,599	5.32%	0.10%
	$0 -$1,349	4.65%	0.15%
Bread and Rolls	$2,000-	38.30%	0.49%
	$1,600-$1,999	39.43%	0.86%
	$1,350-$1,599	39.42%	0.84%
	$0 -$1,349	44.51%	1.40%
Bakery Products	$2,000-	32.88%	0.42%
	$1,600-$1,999	33.29%	0.73%
	$1,350-$1,599	26.18%	0.56%
	$0 -$1,349	24.61%	0.77%

Table 8

Expenditures of Four Income Groups for the Products Made From Wheat, Durum, and Corn and the Cereals in Those Products (Cross Sectional)

	Income Groups	Expenditures for Products Made From the Grain	Cereal Expenditures	Proportion of Cereal in Expenditures for Products From the Grain
Wheat	$2,000-	$33.9536	$3.6671	10.80%
	$1,600-$1,999	$34.7033	$3.8688	11.15%
	$1,350-$1,599	$27.5534	$3.2404	11.76%
	$0 -$1,349	$27.9410	$3.5652	11.91%
Durum	$2,000-	$ 1.1226	$0.1732	15.43%
	$1,600-$1,999	$ 1.2310	$0.1852	15.04%
	$1,350-$1,599	$ 1.0715	$0.1709	15.95%
	$0 -$1,349	$ 1.1959	$0.2139	17.89%
Corn	$2,000-	$ 0.8724	$0.1266	14.51%
	$1,600-$1,999	$ 0.9298	$0.1309	14.08%
	$1,350-$1,599	$ 1.1071	$0.1520	13.73%
	$0 -$1,349	$ 1.0067	$0.1439	14.29%

(continued)

	Income Groups	Expenditures for Products Made from the Grain as a Percent of Total Retail Expenditures	Expenditures for Products Made from the Grain as a Percent of Income
Wheat	$2,000-	90.24%	1.15%
	$1,600-$1,999	90.01%	1.97%
	$1,350-$1,599	87.78%	1.87%
	$0 -$1,349	86.91%	2.73%
Durum	$2,000-	2.98%	0.04%
	$1,600-$1,999	3.19%	0.07%
	$1,350-$1,599	3.41%	0.07%
	$0 -$1,349	3.72%	0.12%
Corn	$2,000-	2.32%	0.03%
	$1,600-$1,999	2.41%	0.05%
	$1,350-$1,599	3.53%	0.08%
	$0 -$1,349	3.13%	0.10%

APPENDIX C

Derivation of Formula Showing Interrelationship of the Income Elasticities of Retail Expenditures and its Two Components

Given various expenditures t_1, t_2, S_1, S_2, g_1, g_2 and incomes y_1 and y_2 where

t_1 = expenditures at retail during the first time period

t_2 = expenditures at retail during the second time period

S_1 = expenditures for services during the first time period

S_2 = expenditures for services during the second time period

g_1 = expenditures for grain during the first time period

g_2 = expenditures for grain during the second time period

y_1 = income during the first time period

y_2 = income during the second time period

then the elasticities can be written as

$$E_t = \frac{t_2 - t_1}{t_2 + t_1} \frac{y_2 + y_1}{y_2 - y_1} \quad (1)$$

$$E_s = \frac{S_2 - S_1}{S_2 + S_1} \frac{y_2 + y_1}{y_2 - y_1} \quad (2)$$

$$E_g = \frac{g_2 - g_1}{g_2 + g_1} \frac{y_2 + y_1}{y_2 - y_1} \quad (3)$$

where

E_t = the income elasticity of retail expenditures

E_s = the income elasticity of service expenditures

E_g = the income elasticity of grain expenditures

by definition

$$t_1 = g_1 + S_1 \quad (4)$$

$$t_2 = g_2 + S_2 \quad (5)$$

Combining (4) and (5) with (1) is defined as

$$E_t = \frac{(S_2 - S_1)(y_2 + y_1) + (g_2 - g_1)(y_2 + y_1)}{(S_2 + S_1)(y_2 - y_1) + (g_2 + g_1)(y_2 - y_1)} \quad (1.1)$$

Further simplification yields

$$E_t = \frac{(S_2 - S_1)(y_2 + y_1)}{(S_2 + S_1)(y_2 - y_1)} + \frac{(g_2 - g_1)(y_2 + y_1)}{(S_2 + S_1)(y_2 - y_1)}$$

$$-E_t \frac{(g_2 + g_1)}{(S_2 + S_1)} \quad (1.2)$$

Since $\frac{(S_2 - S_1)(y_2 + y_1)}{(S_2 + S_1)(y_2 - y_1)} = E_s$ (1.3)

it can be combined with 1.2 to give

$$E_t = E_s + \frac{(g_2 - g_1)(y_2 + y_1)}{(S_2 + S_1)(y_2 - y_1)} - E_t \frac{(g_2 + g_1)}{(S_2 + S_1)} \quad (1.4)$$

Multiplying (1.4) by the identity $\frac{g_2 + g_1}{g_2 + g_1}$

the following form is obtained

$$E_t = E_s + \frac{(g_2 - g_1)(y_2 + y_1)}{(g_2 + g_1)(y_2 - y_1)} \frac{(g_2 + g_1)}{(S_2 + S_1)}$$

$$- E_t \frac{(g_2 + g_1)}{(S_2 + S_1)} \quad (1.5)$$

Since $\frac{(g_2 - g_1)(y_2 + y_1)}{(g_2 + g_1)(y_2 - y_1)} = E_g$ (1.6)

substituting (1.6) into (1.5)

$$E_t = E_s + E_g \frac{(g_2 + g_1)}{(S_2 + S_1)} - E_t \frac{(g_2 + g_1)}{(S_2 + S_1)} \quad (1.7)$$

$$E_t = \frac{E_s (S_2 + S_1) + E_g (g_2 + g_1)}{t_1 + t_2} \tag{1.8}$$

In terms of Es, (1.8) can be written

$$E_s = E_t + \frac{(g_1 + g_2)}{(S_1 + S_2)} (E_t - E_g) \tag{1.9}$$

The use of (4) and (5) allows (1.9) to be written as either of the following equations

$$E_s = \frac{(t_2 + t_1)}{(S_2 + S_1)} E_t - (1 - \frac{t_2 + t_1}{S_2 + S_1}) E_g \tag{1.10}$$

$$E_s = \frac{(t_2 + t_1)}{(S_2 + S_1)} E_t - \frac{(g_2 + g_1)}{(S_2 + S_1)} E_g \tag{1.11}$$

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