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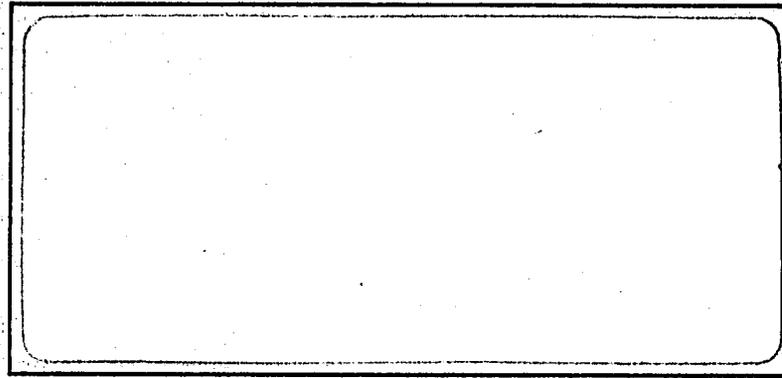
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INTERNATIONAL ECONOMIC DEVELOPMENT PROGRAM



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THE USE OF CURRENT ELASTICITIES AS A TOOL IN
MEASURING THE IMPACT OF CURRENT SUGAR POLICY

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FOREWORD

The Unemployment and Underemployment Institute was created to coordinate all international economic development activities of the 211(d) grant at Southern University.

In 1972, the Agency for International Development (AID) approved a five year grant to Southern University to strengthen and increase its capacity in economic/agricultural economics to enhance Southern's capabilities to contribute to the resolution of problems of rural unemployment and underemployment in developing countries.

The general objectives of the Institute are (a) to develop and coordinate the activities of the University for greater participation in international economic development programs; (b) to make available the capacities and expertise thus developed to public and private agencies involved in industrial development programs; and (c) to conduct research, seminars, and workshops on domestic and international development problems including cooperatives, manpower utilization, small farmers, housing, population, nutrition, leadership training, and community development.

In keeping with objective (a), the University supports several faculty members working towards advanced degrees in the area of economic development and related disciplines, supports undergraduate scholarships to foreign and U. S. nationals in the Department of Agricultural Economics and Economics, provides travel to professional seminars for faculty, foreign exposure to development experiences, and special training on techniques of program design and evaluation.

In keeping with objective (b), the Institute sponsors an International Development Seminar Series, Student-Faculty & Staff Seminar Series, and hosts foreign individuals and groups interested in economic development programs at Southern University.

Results of research projects consistent with the objectives of this program are published under the Institute's Faculty-Staff Research Paper Series. Papers published under this series reflects the diversity of interests and specialties of our faculty and staff.

The above activities of the Institute demonstrate the capacities and expertise of Southern University developed through the 211(d) program. As a result of the 211(d) grant, the Unemployment-Underemployment Institute at Southern University is in a position to offer expert and technical personnel to private and public agencies involved in international economic development programs.

T. T. Williams
Director

THE USE OF CURRENT ELASTICITIES AS A TOOL IN MEASURING THE
IMPACT OF CURRENT SUGAR POLICY

BY

Ralph D. Christy*

In the age of abundance, the Sugar Act of 1934 was passed in an attempt to aid consumers, farmworkers, and refiners by insulating American sugar from the unstable international market. These ends were met by establishing domestic subsidies, import quotas, and tariffs to keep the world's cheap sugar out of our domestic markets. Then, the age of shortages hit, reversing the objectives of the American sugar policy. As a result, December 31, 1974 marked the end of the Sugar Act.

Prior to the expiration of the Sugar Act, the measurement of the elasticity of demand for sugar in the United States by conventional statistical methods was considered difficult because the Sugar Act was administered in such a way as to produce very stable prices in the United States (Ballinger, p. 25, 1967). Analysis based on covariance cannot yield useful results when one of the factors in the analysis shows substantially no variation (Ballinger, p. 25, 1967). Such is the case as with sugar prices throughout the existence of the Sugar Act except for the recent period of time outlined in this study. More

*Paper presented at the Annual meeting of the American Agricultural Economics Association, Ohio State University, August, 1975, and published in the American Journal of Agricultural Economics, Vol. 57 No. 5, Dec., 1975. Mr. Christy is a student in Agricultural Economics and supported from 211(D) Funds.

specifically, both sugar consumption and sugar prices changed tremendously in 1974, therefore, lending themselves to statistical analysis.

In a FAO UN study by Viton and Pignolosa price, income, and consumption data were analyzed for 55 to 60 countries. Viton and Pignolosa presented in their study the trends in the consumption of sugar for two decades (1938-1958) and the factors determining sugar consumption and its growth rates. They concluded their analysis with some projects of a likely course for sugar consumption in the future.

Bates estimated the long-run effect of the Cuban embargo on the World Sugar economy to evaluate the current United States long run sugar supply policy. The efficiency of the supply policy was measured by comparing the total cost of obtaining the long run United States sugar legislation with costs under conditions of a more competitive world market.

To date, studies of the elasticity of demand for sugar have not added much knowledge to the people who consume, produce, and sell sugar and sugar products. It is the intention of this study to determine the impact of price and income on the demand for sugar prior to the expiration of the Sugar Act by (1) Computing the price elasticity for sugar, (2) Computing the income elasticity for sugar

and (3) Comparing the coefficients of this study to other studies. Though the time span of this study does not represent a normal period in the United States or world sugar market, the writer feels that analysis of this period is of some use in establishing long-run projections, particularly when the world's sugar market is subject to unstable conditions.

THE DATA

A major concern of most economic studies is the problem of obtaining good data. One characteristic of the economic environment of our information system is that it insulates those who provide information from those who use it (Mayer and Ahalt, p. 987). There is no exception for this study, obtaining data is one of the limiting factors.

The time period in this study is specified from January 1972 to December 1974. As stated earlier this period was chosen because of (1) the significant changes in the price and consumption trends in sugar and (2) this period marked the end of the Sugar Act.

The data used in this study was obtained from the Survey of Current Business (1973, 1974, 1975). All variables are expressed on a monthly basis (see Table 1 and Table 2).

Sugar is the most important sweetener used in the United States. Since the end of World War II, United States sugar consumption has increased on an average of about 161,000 tons (raw value) per year rising from around 7 million tons in 1948 to nearly 11 million tons in 1969 (Ballinger, P. 6, 1972). This increase has paralleled the growth of population in the United States, thus per capita consumption has remained approximately constant at slightly more than 100 pounds except for the years presented in this study. The 1973 per capita consumption of refined sugar fell significantly short of the 1972 level. For the entire year of 1974 deliveries fell short of the 1973 mark reflecting the shift in sugar consumption.

The average price for sugar in 1972 was 14¢ per pound. In 1973 the average price for a pound of sugar was 15¢. Sugar prices for 1972 and 1973 remained relatively constant compared to the spiraling prices of 1974. The New York average retail price of sugar for last year was 33¢ per pound ranging from a low of 17¢ per pound to a high of 70¢ per pound to set a new world's record for sugar prices."

The Model

There are many factors that may effect the consumption of sugar. This study analyzes two factors, price and income: "The theory of consumer behavior maintains that individual consumers attempt to

move toward those goods and services that yield the maximum satisfaction (Leftwich, p. 78). Thus in accordance with the theory of consumer behavior it is hypothesized that price has a negative coefficient and income has a positive coefficient.

Regression analysis is used to estimate linear models of sugar consumption. "Price is expected to have a lag effect on sugar consumption therefore the following models are specified."

Model I

$$Q_s = f (P_{t-1}, I)$$

Q_s = monthly per capita quantity of sugar consumed at the retail level, annual basis.

P_{t-1} = Price in previous period (1 month).

I = Per capita disposable income.

Model II

$$Q_s = f (P_{d\ t-1}, I_d)$$

Q_s = Per capita quantity of sugar consumed at retail level

$P_{d\ t-1}$ = Real price in previous period (deflated 1967 index)

I_d = Real per capita disposable income (deflated 1967 index)

"Price elasticity is defined as the responsiveness of a percentage change in consumption given a percentage change in price."

$$E_p = \frac{\% \text{ change } Q}{\% \text{ change } P}$$

'Income elasticity is defined as the responsiveness of a percentage change in consumption given a percentage change in income.'

$$E_I = \frac{\% \text{ change } Q}{\% \text{ change } I}$$

EMPIRICAL RESULTS

The estimated coefficients of retail demand for sugar were obtained by two linear regression models.

Model I

$$Q_s = 43.2 - 78.4 (P_{t-1}) + .013 (I)$$

(40.2)* (.009)**

$R^2 = .10$, DF = 34, *Significant at 5% level,
**Significant at 10% level

Model II

$$Q_s = 45.6 - 60.4 (P_{d \ t-1}) + .015 (I_d)$$

(42.4)** (.035)

$R^2 = .06$, DF = 34, *Significant at 5% level;
**Significant at 10% level

All coefficients in the models yielded the expected signs. That is the coefficient for price was negative as hypothesized and was significant at the 5 per cent level in Model I and the 10 per cent level in Model II. Indicating that price has a significant

impact on sugar consumption. The coefficient for income was positive as hypothesized and was significant at the 10 percent level in Model I however, was not significant in Model II. Therefore income has little impact on sugar consumption.

Price and income elasticities derived from both models are inelastic at the mean values.

Model I

Price Elasticity = -0.16

Income Elasticity = 0.57

Model II

Price Elasticity = -0.09

Income Elasticity = 0.57

In Model I price elasticity was estimated to be -0.16 indicating that for a 100 percent change in price, quantity demanded will change in the opposite direction by approximately 16 percent. Income elasticity was 0.67 indicating that for a 100 percent change in income sugar consumption will change in a positive direction by approximately 67 percent. This model utilized current prices and current income instead of real value. The elasticities in Model II yielded similar results in that the price elasticity was -0.09 and income elasticity was 0.57.

"A demand schedule for the period of study can be derived by holding income constant and plugging into Models I and II the actual sugar prices. Elasticity coefficients derived from Model I yielded elastic responses for prices above 70¢ while for prices below 70¢ inelastic coefficients were obtained. All coefficients in the demand schedule from Model II are inelastic."

IMPLICATIONS AND CONCLUSIONS

The United States has a large stake in the world sugar economy. Therefore, this nation should be in the forefront in performing research that will enable policy makers to establish long run realistic projections. Relevant studies should take place as a means to develop policies that will influence and establish trends in sugar consumption. As a result of this study the following conclusions are made:

- (1) Price and income elasticity in this study were inelastic in agreement with other studies.
- (2) Price had a significant impact on sugar consumption.
- (3) Income has little effect on sugar consumption in relatively high income groups.
- ✓(4) Relative high sugar prices yield elastic responses.

Whether the U.S. sugar market operates under a "free market" or "control market", policy makers will find the concept of elasticity a useful tool in formulating policies for the industry." With price having a significant impact on sugar consumption, policies that use the price mechanism as an allocation should be taken under consideration. The high level of income in the United States exerts little impact on sugar consumption, therefore, implementing policies based on income will have minor effect.

There are other factors such as starch sweeteners and non-caloric sweeteners that have and will continue to have an impact on sugar consumption. The world's sugar problems are not likely to be solved overnight. It will continue to take research that will parallel itself to our dynamic society.

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TABLE 1. MONTHLY PRICE AND REAL PRICE OF SUGAR

Date	Price	Real Price
1972	Cent per lb.	Cent per lb.
January	.14	.11
February	.14	.11
March	.14	.11
April	.14	.11
May	.14	.11
June	.13	.11
July	.13	.11
August	.13	.11
September	.13	.11
October	.14	.11
November	.14	.11
December	.14	.11
1973		
January	.14	.11
February	.14	.11
March	.14	.11
April	.14	.11
May	.15	.11
June	.15	.11
July	.15	.11
August	.15	.11

TABLE 1. Contd.

Date	Price	Real Price
1973	Cent per	Cent per
September	.16	.11
October	.16	.12
November	.16	.12
December	.17	.12
1974		
January	.17	.12
February	.17	.12
March	.20	.14
April	.23	.16
May	.25	.17
June	.28	.19
July	.32	.22
August	.35	.25
September	.38	.25
October	.43	.28
November	.50	.32
December	.70	.45

Deflated price 1967 index.

Sources (Survey of Current Business 1973, 1974, 1975).

TABLE 2. MONTHLY PER CAPITA CONSUMPTION OF SUGAR

Date	Consumption
1972	Pounds
January	78.0
February	68.6
March	100.7
April	76.9
May	92.8
June	102.3
July	95.5
August	110.5
September	105.1
October	81.5
November	79.8
December	73.3
1973	
January	74.3
February	70.0
March	99.9
April	84.3
May	93.6
June	100.6
July	97.4
August	113.7

TABLE 2. Contd.

Date	Consumption
1973	Pounds
September	97.0
October	88.9
November	84.2
December	86.9
1974	
January	91.9
February	81.7
March	87.1
April	85.0
May	98.1
June	93.3
July	99.8
August	106.7
September	94.0
October	98.2
November	82.4
December	43.7

Sources (Survey of Current Business 1973, 1974, 1975).

TABLE 3. CORRELATION MATRIX

	Consumption	Def-Price	Def-Income	^{Current} Lag-Price	Lag-Income
Consumption	1.000	0.147	0.012	0.320	0.341
Def-Price		1.000	0.077	0.242	0.238
Def-Income			1.000	0.032	0.054
<i>CIF</i> Lag-Price				1.000	0.117
<i>CIF</i> Lag-Income					1.000

Table 4. Price and Income Elasticities of Sugar From Various
Studies

Author	Year	Price Elasticity	Income Elasticity
Viton	1938	-0.75	0.78
Viton	1951	-0.06	0.73
Viton	1956	-0.55	0.59
Shepard	1963	-0.17	-

Source: (Viton, Shepard).

Table 5. Demand Schedule and Elasticities Derived From Model

Price	Quantity	Elasticity
Cents	Pour	
.14	93	-.11
.15	92	-.12
.16	91	-.13
.17	90	-.14
.20	88	-.17
.23	86	-.20
.25	84	-.23
.28	82	-.26
.32	78	-.30
.35	76	-.35
.38	74	-.40
.43	70	-.47
.50	64	-.60
.70	49	-1.1

Table 6. Demand Schedule and Elasticities Derived From Model II.

Price	Quantity	Elasticity
Cent	Pound	
.11	99	-.06
.12	90	-.07
.14	89	-.09
.16	88	-.10
.17	87	-.11
.19	86	-.13
.22	84	-.15
.25	82	-.18
.28	80	-.20
.32	78	-.24
.45	70	-.38

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