ANALYSIS OF MULTIPLE PRICING PLANS FOR FOOD COMMODITIES PRODUCED IN THE SOUTH

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ANALYSIS OF MULTIPLE PRICING PLANS FOR FOOD

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The Problem

In recent years considerable effort has been exerted to increase farm incomes in order to provide farm families a "fair" level of living, or a level "comparable" with that enjoyed by other groups with comparable resources. Various types of governmental programs have been tried to achieve this objective. These include price supports, two price plans, surplus removal activities, and acreage reduction plans; but they have been only partially successful in increasing agricultural incomes. Considerable effort is now being exerted to evaluate the potential effects of an expansion of these programs to include a wider range of agricultural commodities with particular reference to effects on agricultural producers, consumers, and processors and distributors of farm products.

Multiple pricing plans are among the various types of programs which are under intensive review by farm leaders and legislators interested in probable effects of these plans on farm incomes. Multiple pricing plans have been employed in agricultural marketing, and some have been fairly successful in increasing returns to producers of commodities to which they were applied. Such plans perhaps could be used to increase sales of other agricultural products. Potentially, the increased sales of product could result in increased gross farm incomes, fewer restrictions on agricultural production, and reductions in quantities owned or

controlled by the government from the current loan and storage programs. The magnitude of these potential changes would depend on the market characteristics of each particular commodity. This study was concerned with determining the applicability of various multiple pricing plans to groups of farm commodities, primarily foods, which are important in southern agriculture, and the evaluation of probable effects on farmers' incomes.

Objectives

Specific objectives of the study were: (1) to review alternative multiple pricing plans which might be used in marketing farm products; (2) to ascertain the demand characteristics in the domestic market for each important southern agricultural food commodity, including the orders of use in the market outlets; (3) to classify the commodities into groups on the basis of similarities in demand characteristics, and (4) to analyze the effects on gross farm incomes of adopting one or more types of multiple pricing plans for each major group of commodities.

Method of Analysis

Multiple pricing plans which might be effective in increasing farm incomes were obtained primarily from secondary sources. Some of these forms of pricing have been employed in agricultural marketing. Others have been proposed as possible means of increasing producer returns. A description of the various multiple pricing plans considered in the study, along with a historical sketch of multiple pricing, is given in Chapter III.

Average annual production of each commodity by each of the 13 southern states was also obtained from secondary sources and compared with estimates of purchased consumption in order to determine whether each state and the South was a surplus or deficit producer.[1] Comparisons were made using an annual average for the period 1955-57. The estimates of per capita purchased consumption were derived from functions fitted by least squares to data from the 1955 Household Food Consumption Survey.[2] These equations expressed per capita purchased consumption as a function of personal disposable income per capita. The per capita estimates were then expanded to estimates of total purchased consumption for each area. Thus, the estimating procedure allowed for changes in purchased consumption as income and population changed over time.

Estimates of income and direct price elasticity of demand were obtained largely from previous studies. From these estimates, all possible cross price elasticities for the commodities were generated by a procedure outlined in an article by Frisch and employed by Brandow's recent demand study.[3] Consideration of these estimates of price and income

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[1]The 13 states comprising the southern region are Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia.

[2]U. S. Department of Agriculture, AMS and ARS, Food Consumption of Households in the South, Report Number 4 of Household Food Consumption Survey of 1955, December, 1956.

[3]Ragnar Frisch, "A Complete Scheme for Computing All Direct and Cross Elasticities in a Model with Many Sectors," Econometrica, Volume 27, Number 2, 1959, pp. 177-196; and G. E. Brandow, Interrelations Among Demands for Farm Products and Implications for Control of Market Supply, Bulletin 680, Pennsylvania State University Agricultural Experiment Station, August, 1961.

elasticity gave an indication of the market demand characteristics for the various commodities. Through the use of these estimates, the estimates of production and purchased consumption, and a consideration of institutional factors affecting the marketing of the various commodities, all of which are discussed in Chapter IV, the foods were assembled into groups possessing similar economic and institutional characteristics. The expected effects of the various pricing plans on returns to producers of the products were indicated. From available data, only two of the plans could be analyzed in detail, although some general considerations were given to other plans. The detailed account of the analysis is given in Chapter V. The entire study is summarized, and conclusions are given in Chapter VI.

CHAPTER II

THEORY OF MULTIPLE PRICING

The theory of multiple pricing is one segment of the more general theory of monopoly.[1] The seller of a product possessing some degree of monopoly power may, under conditions subsequently explained, act as a "market divider" as well as a "price setter." In so doing, he may to his own advantage become a "price discriminator" or "multiple pricer." Stated simply and concisely, multiple pricing is the practice of setting two or more prices for the same commodity.

> Price discrimination is the term applied to any practice whereby a seller sells a homogeneous commodity at the same time to different categories of purchasers at different prices. By this means, the seller exerts some influence over the apportionment of his output among categories of buyers, for the purpose of increasing his returns.[2]

A second definition, more inclusive than the simple one, is also given by Harris as follows:

> The definition of price discrimination is usually extended to cover practices whereby a seller systematically and simultaneously: (1) sells similar but not identical commodities, such as differently packaged or branded articles, at price differences which do not correspond to cost differences; or (2) sells under terms in which the costs of differences in services (transportation, credit, etc.), to different groups of customers, are not accurately reflected in prices charged.[3]

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[1] This is essentially the theory of price discrimination. The terms "multiple pricing" and "price discrimination" are used interchangeably throughout the thesis, although "price discrimination" is usually the more inclusive term.

[2] Edmond S. Harris, Classified Pricing of Milk, Some Theoretical Aspects, USDA, AMS, Technical Bulletin No. 1184, April, 1958, p. 34.

[3] Ibid.

The multiple pricing seller may have one or both of two major objectives: (1) to increase total returns and (2) to stabilize total returns. Other possible objectives of a group holding monopoly power include minimization of supply response by sellers to an increased level of price, and encouragement of a desired seasonal pattern of production. The two major objectives are the only ones considered in this study, and the stability objective was considered only secondarily.

Degrees of Multiple Pricing

Pigou distinguishes between what he calls three degrees of discriminating power which may exist, at least in theory.[4] He recognized that, although each is theoretically possible, they are not of equal importance from a practical point of view. In fact, he said that only the third degree is found in practice.

First Degree

First degree discrimination involves the charge of a different price for each unit of a commodity in such a way that the price obtained for each unit is equal to the demand price for the commodity. This is accomplished theoretically by charging each buyer a different price for each unit of product or by selling each buyer only one unit and charging each purchaser a different price. By such a procedure all Marshallian consumer surplus is removed and the demand curve for the commodity, although downward sloping to the right, coincides with the marginal revenue

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[4] A. C. Pigou, The Economics of Welfare, Macmillan and Company, Ltd., London, 1950, p. 279.

curve. As Pigou indicated, one never observes this degree of discrimination in practice.[5]

Although first degree discrimination is not observed in practice, Figure 1 illustrates how it would theoretically operate. Referring to Figure 1, a seller practicing first degree discrimination would sell OX_1 units of output at OX_1 different prices. Thus, the demand curve DD coincides with the marginal revenue curve. Profit would be represented by area Cefg, since average cost at output OX_1 is OC.

Second Degree

Second degree discrimination occurs when the seller is able to make n separate prices in such way that all units of the commodity with a demand price greater than P_1 are sold at a price P_1, all units with a demand price less than P_1 and greater than P_2 at a price P_2, and so on.

> Second degree discrimination covers those situations in which different prices are charged not for each unit but for each batch of goods bought.[6]

Multiple pricing of the second degree may be represented graphically as in Figure 2. Curve DD represents the demand curve for the product being sold and may be regarded as the same as curve DD in Figure 1. It is no longer the marginal revenue curve, however, since the assumption of first degree discrimination has been dropped. The seller would charge a price P_1 for each unit of the quantity OX_1, P_2 for each unit of the quantity X_1X_2, and so on.

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[5] Ibid.

[6] Sidney Weintraub, Price Theory, Pitman Publishing Corporation, New York, London, 1949, p. 311.

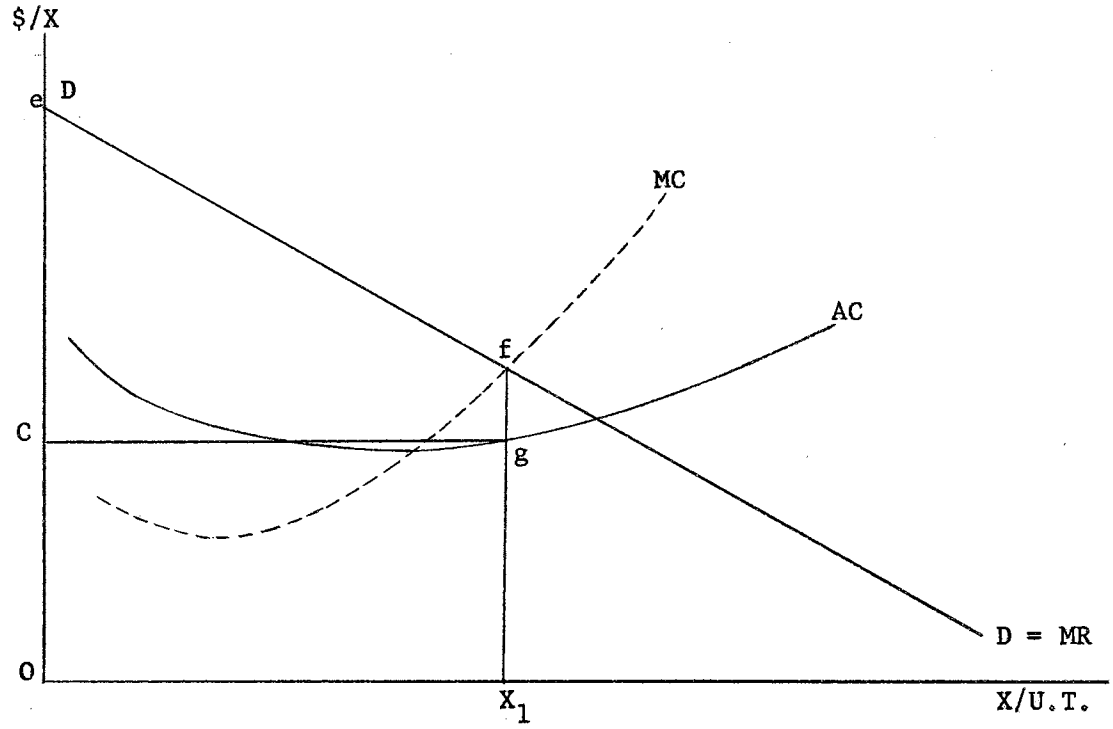

Figure 1. First Degree Price Discrimination

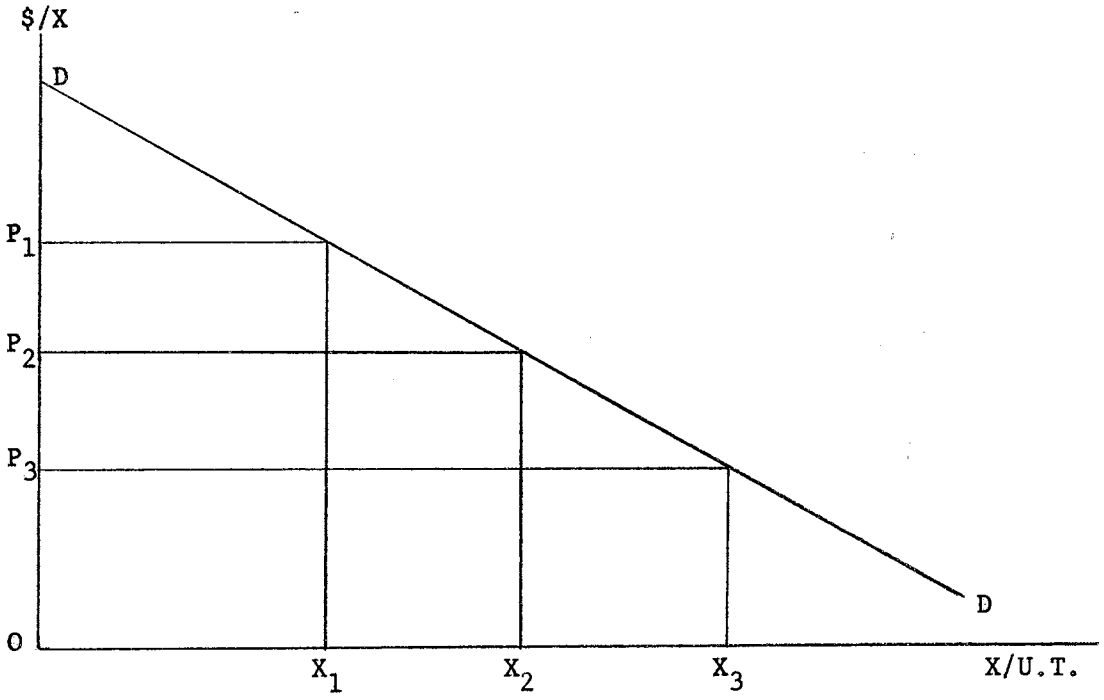

Figure 2. Second Degree Price Discrimination

Third Degree

Third degree discrimination, according to Pigou, occurs if the seller is able to distinguish from among his customers n different groups, separated from one another in some manner, and charges the same price to the members of each group but different prices among the groups. This type of discrimination is the one most commonly observed in practice. An example of this type is the case in which the primary domestic market is separated from the secondary foreign market and unequal prices are maintained in the two markets. Figure 3 illustrates the manner in which third degree multiple pricing is employed. For maximum profit, total output should be OX, where aggregate MC = aggregate MR. Line rf cuts each of the marginal revenue curves at a level where $MR_1 = MR_2$ = aggregate MC.

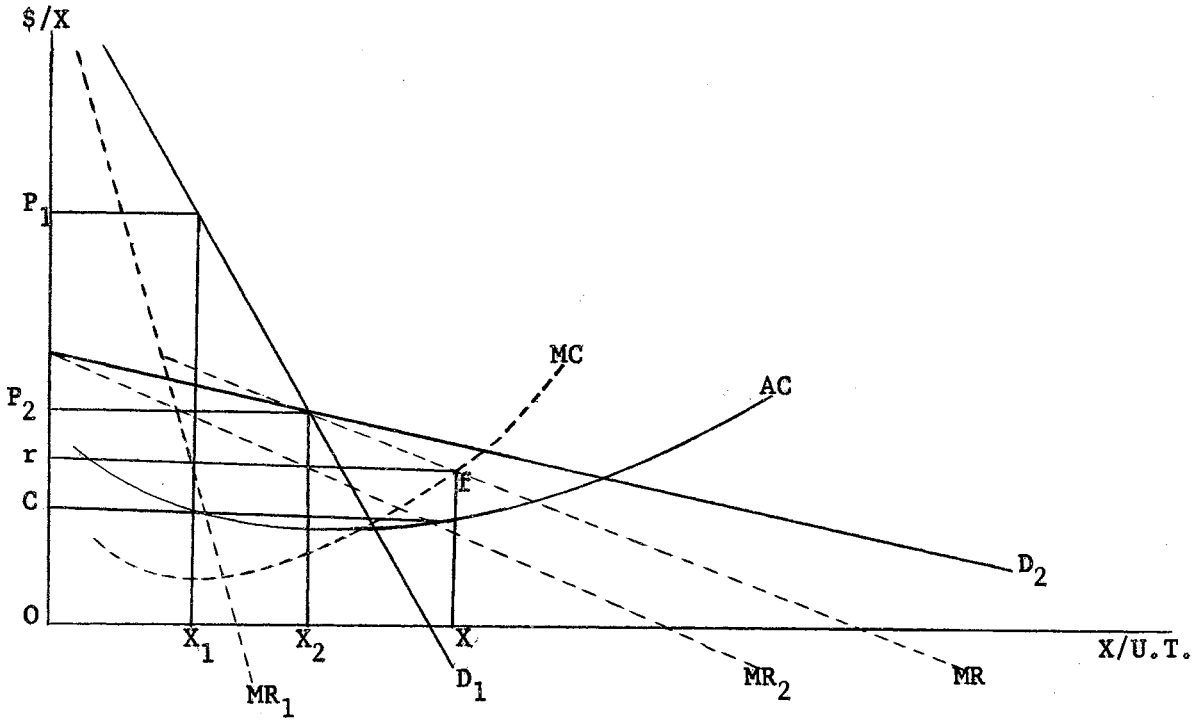

Figure 3. Third Degree Price Discrimination

Thus, lines dropped from the intersections of line rf with the marginal revenue curves MR_1 and MR_2, perpendicular to the base line, indicate that the profit maximizing quantities are OX_1 in market one and OX_2 in market two. Quantity OX_1 plus OX_2 is equal to quantity OX. Price will be P_1 in market one in which the demand is more inelastic, and P_2 in market two where demand is more elastic. At output OX average cost will be OC and total profit will be CP_1 times OX_1 plus CP_2 times OX_2. This will be the maximum profit possible from third degree discrimination.

Necessary Conditions for Multiple Pricing

Before multiple pricing can be successfully employed, certain conditions must prevail within the seller's market. The necessary conditions are examined in this section.

Monopoly Element

A seller must possess a degree of monopoly control in the market before he can use any multiple pricing scheme to an advantage. He must be able to control the supply of the product which he sells; otherwise some competitor could interfere with his multiple pricing plan.

> The ability of sellers to hold the gains from price discrimination over an extended time depends largely upon whether they can limit their output and restrict the entry of new competitors. Unless they are able to prevent added investment and increased output which the extra returns from price discrimination encourage, profits will eventually be reduced to a normal competitive level even though higher prices remain in effect.[7]

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[7]Edmond S. Harris, Classified Pricing of Milk, Some Theoretical Aspects, USDA, AMS, Technical Bulletin No. 1184, April, 1958, p. 35.

The desired control over supply may be exercised through ownership or control of strategic factors of production, restricted entry of new firms, cooperative effort by producers, and governmental legislation. For the present study, the latter was of primary interest, since multiple pricing plans for agricultural commodities are usually effected through federal government control. Cooperative selling by producers has also been employed in agricultural marketing to obtain market control.

Separable Markets

Before there can be two or more prices there must be two or more markets. Although the presence of two or more markets is necessary if multiple pricing is to be practiced, this condition is not sufficient. The markets must be kept separate since prices will differ among the various markets (as explained in the following section). If the markets are not kept separate, buyers will buy in the low priced markets and re-sell in the high priced markets, tending to defeat the purpose of the monopolist. This practice is known as arbitrage. Joan Robinson states

> ...if it is possible for an individual seller to divide his market into separable parts, price discrimination becomes practicable.[8]

Additionally, the cost of keeping the markets separate must not exceed the benefits from such a division.

Applied to Sellers or to Buyers.--Multiple pricing may be applied to producers of a product or to buyers of a product or to both producers

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[8]Joan Robinson, The Economics of Imperfect Competition, Macmillan and Company, Ltd., London, 1959, p. 180.

and buyers. If the product is sold into a single market with an inelastic demand, the control group may be able to restrict output through applying multiple pricing to sellers. This might be done even though all of the product was sold at one price in the sellers' market. Each producer would receive a base or quota price for a part of his produce and a lower surplus price for additional quantities produced. More generally, multiple pricing is applied to both producers and consumers. In such cases, multiple pricing as applied to producers is typically a means of restricting output and a means of distributing returns to the different producers.

Bases for Dividing the Market Among Buyers.--There exist several possible means of dividing the seller's market. These bases for dividing the market are conveniently presented in the following quotation:

> The market is usually divided on the basis of location, utilization, quality, or time. Separation into domestic-primary markets and foreign-secondary markets illustrates location division. Primary fluid milk markets and secondary manufacturing milk markets illustrate utilization division. Higher grade primary markets for potatoes and lower grade secondary markets illustrate quality division. Separation into holiday season primary markets for turkeys and other season secondary markets illustrates time division.[9]

Differing Elasticities of Demand

Another prerequisite to multiple pricing concerns price elasticity of demand. The elasticities must differ among the markets before multiple pricing becomes practicable.

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[9]Robert P. Story, "Multiple Pricing," The Farm Problem...What Are the Choices?, Leaflet No. 12, National Committee on Agricultural Policy, p. 1.

In the case of two separate markets, the more inelastic one is referred to as the primary market; the more elastic one as the secondary market. To maximize returns, the seller will charge the higher price in the primary market and a lower price in the secondary market. No attempt is made to increase aggregate demand through multiple pricing; the existing demand is segmented according to differences in price elasticity.

To show that discrepancies in the elasticity of demand are necessary for profitable multiple pricing and that price will ge higher in the inelastic market, the following statements are given: Since $MR = P(1 - \frac{1}{\epsilon})$ and $MR_1 = MR_2$ at the point of maximum profit (see section on operation of multiple pricing),

$$P_1(1 - \frac{1}{\epsilon_1}) = P_2(1 - \frac{1}{\epsilon_2});$$

therefore

$$\frac{P_1}{P_2} = \frac{\epsilon_1 \epsilon_2 - \epsilon_1}{\epsilon_1 \epsilon_2 - \epsilon_2}.$$

Hence, if $\epsilon_1 > \epsilon_2$ /in absolute values/, then $P_1 < P_2$.

Other Conditions

Additonal prerequisites to multiple pricing as contributed by Story are as follows: (1) a significant part of the total market supply must be sold in the higher priced primary market; (2) the secondary market must be able to absorb varying and, in some cases, expanding supplies, and this must be politically acceptable; and (3) an acceptable method must be developed for distributing primary and secondary market returns

among producers in those cases where monopoly power is centered in a group of sellers.[10]

In addition to the necessary conditions for multiple pricing, there are other factors which are conducive to its practice. Harris points out the following factors which encourage multiple pricing: (1) heavy fixed costs in the production of the commodity, (2) a variety of potential uses for the commodity, and (3) existence of joint costs in the production of several commodities.[11] Heavy fixed costs give the producer an added incentive to discover new ways of dividing the market so that output may be expanded, and these fixed costs spread out over more units. The presence of a variety of uses for a product provides an additional basis for market division--division according to product use. Finally, the existence of joint costs in the production of several commodities would allow price discrimination to be practiced, where it is economically feasible to do so, without being easily detected by consumers, since costs of producing the joint products are not clearly distinguished.

Operation of Multiple Pricing

The possibility of having producers share the administrative costs of multiple pricing applicable to their commodities and the probable effects of the operation of multiple pricing are discussed in this section. Potential effects on producers, consumers, and foreign countries are indicated.

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[10] Robert P. Story, "Multiple Pricing," The Farm Problem...What Are the Choices?, Leaflet No. 12, National Committee on Agricultural Policy, pp. 1-2.

[11] Edmond S. Harris, Classified Pricing of Milk, Some Theoretical Aspects, USDA, AMS, Technical Bulletin No. 1184, April, 1958, p. 35.

Government Supported Plans Self-Liquidating

Government sponsored multiple pricing plans for agricultural commodities can be made partially or wholly self-liquidating.[12] Unlike many other support programs for farm commodities, costs of multiple pricing plans may be borne directly by those who benefit from the plans. The government or control group may accomplish this by charging each producer a small fee, usually a designated amount per unit of product marketed, to cover the administrative and possibly other direct costs of the pricing plan. If a plan is set up to be wholly self-liquidating, it is evident that costs of the plan must not exceed the gains in revenue therefrom.

Possible Effects of Multiple Pricing

On Producers.--Realization of the objective of increased producer returns is possible if the necessary conditions for multiple pricing described earlier are fulfilled. Through multiple pricing, producer returns may be increased in the short run above what they would be under a single price by allocating quantities between markets or by setting the price in the primary market so that marginal revenue in the two (or more) markets is equated.

Whether or not returns to producers in the long run may be increased above what they would be in the long run under a single price will depend upon the degree of supply control achieved by the seller of the product in question and upon the presence of existing and potential substitutes for the product. The long run consequences of a multiple

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[12] H. R. Woltman, "Multiple Pricing Schemes at Home and Abroad," Journal of Farm Economics, Volume XL, Number 5, Decmeber, 1958, p. 1746.

pricing plan which increases short run producer returns but fails to effectively control supply would include a decrease in consumption of the product in the primary market, an increase in total quantity of the product supplied, and a need for intensification of efforts to slow down the rate of increase in supply.

Under certain conditions, multiple pricing may be effective in lending stability to producer returns. The income stabilizing effect of multiple pricing was heavily stressed in the early years of government sponsored farm price support programs. However, the stability emphasized in discussions of farm programs during these early days was of a general nature. It referred to orderly marketing of farm products and included price, supply and income stability. Actually, any stability which might have been achieved through programs since the 1930's should have been attributed to the various supply control features of government programs as well as multiple pricing plans.

The problem of determining and stating general conditions under which greater income stability might be achieved through multiple pricing of various farm products is a difficult one involving several commodity characteristics which vary among commodities. In fact, although the use of multiple pricing presupposes the fulfillment of all the necessary conditions for multiple pricing, the fulfillment of these conditions alone does not guarantee that such pricing will result in stability of producer returns greater than under free pricing. Therefore one should use extreme care in claiming that the use of multiple pricing will result in increased stability of producer returns. Only a few very broad generalizations are observed here to indicate some conditions under which greater

stability of producer returns might be expected as an advantage of multiple pricing in addition to increased returns.

The following conditions are, in general, conducive to increased stability of producer returns through multiple pricing. These conditions are:

(1) Demand elasticity in the secondary market is close to unity. This prevents the fluctuations in quantities sold in this market from giving rise to large changes in total returns from the secondary market.

(2) Price in the secondary market is very low relative to price in the primary market. This condition would keep total returns in the secondary market from varying so widely with changes in quantity sold into the market.

(3) The secondary market ordinarily receives only a small proportion of the total product sold. This condition indicates a tendency for total revenue in the primary market, which should be quite stable under multiple pricing, to be much larger than the variable total revenue in the secondary market. This is particularly true when condition (2) above also holds.

(4) Planned or intended production is effectively controlled. This would indicate that uncontrollable factors such as weather are the important contributors to variations in total supply, and that total costs of production remain fairly constant in spite of these fluctuations because of the high proportion of fixed costs in the farm production process.

Increased presence of these conditions in both number and degree would indicate an increased possibility of achieving greater stability of income with multiple pricing. When the above conditions are present, an over abundant crop resulting from extremely favorable cropping conditions would bring a relatively small increase in returns, since the excess would be sold into the secondary market. If a short supply occurs in a given season, most or all of the supply would go into the primary market. Although no revenue would be derived from the secondary market, this lost revenue would be relatively small. Reference to Figure 4 will perhaps clarify this exposition.[13] This figure compares stability of returns under free pricing with total returns under multiple pricing with market 1 receiving the larger proportion of total sales. For ease of exposition, the example is limited to markets with straight line demand curves. Demand curve ΣD is the horizontal summation of individual demand curves in markets 1 and 2. Curve ΣDD is the aggregate demand curve under discrimination. Quantity OX is the total quantity sold in a "normal" year. Should total supply be increased to OX', total revenue would be increased by area XX'gf minus area P_3P_4hf under multiple pricing. This is a relatively smaller change than the loss in total revenue, area P_1P_2db minus area XX'cb, resulting from the same change in quantity under the single price situation. This ignores the increase in costs of production which would be the same under free or multiple pricing and irrelevant to the comparison being made. If total quantity were

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[13] The manner in which the demand curves in Figure 4 were derived is explained in detail in Joan Robinson's, The Economics of Imperfect Competition, Macmillan and Company, Ltd., London, 1959, pp. 195-202.

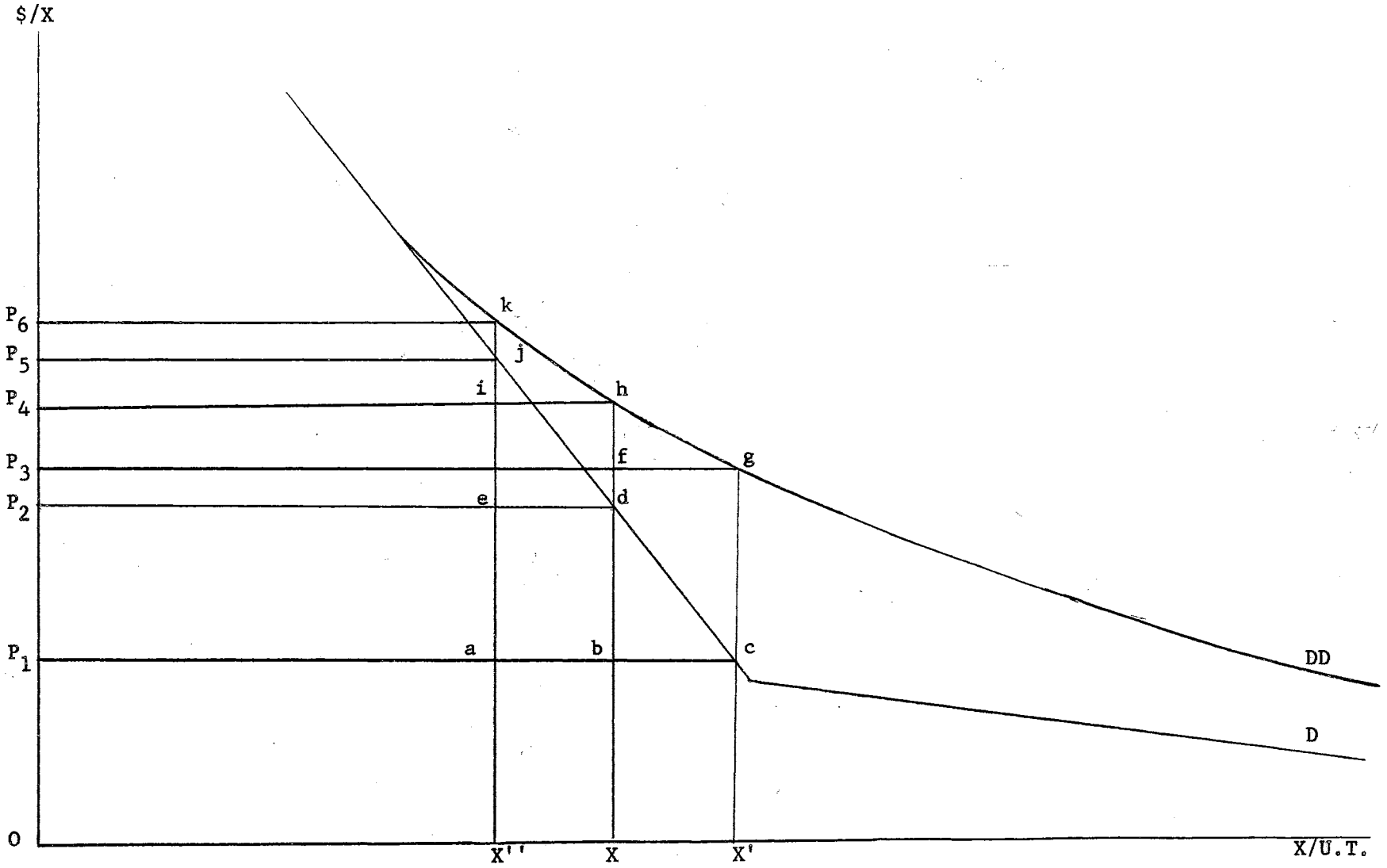

Figure 4: A Comparison of Producer Income Stability Through Multiple Pricing vs a Single Price

decreased to OX'', total revenue under multiple pricing would decrease by area X''Xhi minus area P_4P_6ki. It would decrease relatively less than the increase on total revenue under the single price area P_2P_5je minus X''Xde.

The comparison indicates that the elasticity of the demand curves facing the seller who employs multiple pricing is more nearly unity than is the elasticity of curve ΣD over the relevant range of quantity. On a theoretical basis, one would expect that stability of returns would be greater as the elasticity of demand for the product approaches unity in the appropriate interval. This would be true even if, contrary to the arbitrary example in Figure 4, both demand curves were elastic or if both were inelastic. Thus, multiple pricing would be expected to increase stability of returns only if the practice results in an aggregate demand for the product which has an elasticity of demand nearer unity than does the demand under single pricing.

The possibilities of increasing returns to sellers are greater in the short run than in the long run. Thomas and Story state that:

> Increased producer returns often stimulate output so that income benefits to producers are limited to the short run. The probelm of devising and enforcing effective supply restraints is just as difficult with multiple pricing as with other programs designed to increase returns to producers.[14]

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[14]Marion D. Thomas and Robert P. Story, "Multiple Pricing," Increasing Understanding of Public Problems and Policies, Farm Foundation, Chicago, 1958, p. 46.

Or if supply is not effectively controlled,

> ...it /multiple pricing/ may perpetuate itself by inducing increased investments until profits are normal even under discrimination, and discrimination is necessary to maintain normal profits.[15]

Harris makes the following similar statement:

> The ability of sellers to hold the gains from price discrimination over an extended time depends largely upon whether they can limit their output and restrict the entry of new competitors. Unless they are able to prevent the added investment and increased output which the extra returns from price discrimination encourage, profits will eventually be reduced to a normal competitive level even though higher prices remain in effect.[16]

Whether or not multiple pricing will initially require a greater total output by producers than the single price monopoly output will depend on the relative concavities of the demand curves in the separate markets.

> It is possible to establish the fact that total output under discrimination will be greater or less than under simple monopoly according as the more elastic of the demand curves in the separate markets is more or less concave than the less elastic demand curve; and that the total output will be the same if the demand curves are straight lines, or indeed in any other case in which the concavities are equal.[17]

Thus, multiple pricing of agricultural commodities could result in an output smaller than, larger than, or equal to that which occurs under single-price government support programs, depending on the relation of elasticities in the markets and the nature of the program employed.

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[15] Arthur Robert Burns, The Decline of Competition, McGraw-Hill Book Co., Inc., New York - London, 1936, p. 277.

[16] Edmond S. Harris, Classified Pricing of Milk, Some Theoretical Aspects, USDA, AMS, Technical Bulletin Number 1184, April, 1958, p. 35.

[17] Joan Robinson, The Economics of Imperfect Competition, Macmillan and Co., Ltd., London, 1959, p. 190.

Although the necessary control over supply of a product is realized by the control group, another possible threat to increased producer returns through multiple pricing exists in the long run. Substitute products may begin to infringe upon the market in the long run regardless of the pricing policies followed, but if prices are maintained above "normal" in the primary market through multiple pricing, the substitution of other goods in consumption may be encouraged. Thus, the effectiveness of multiple pricing in increasing producer returns may be seriously hindered by the presence of substitute goods or by the possibility of the introduction of potential substitute goods into the market.

On Consumers.--In the primary market, consumers will suffer a loss if the multiple pricing scheme restricts sales in the primary market in order to increase price. However, in the secondary market, price may be reduced somewhat, resulting in some gain to consumers in this market. The former effect would be expected to outweigh the latter, so that the net result of multiple pricing is expected to be a loss to consumers. For this reason, consumers in general are quite likely to be opposed to multiple pricing.

On Foreign Countries.--Caution should be exercised in applying multiple pricing plans involving the use of foreign markets as secondary outlets. Reactions of foreign producers of commodities "dumped" at low prices in foreign countries can be very severe in their effects. Thomas states that:

> ...the reaction of foreign countries to multiple pricing is one of the major factors that limits the use of this type of program for export commodities.[18]

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[18] Marion D. Thomas and Robert P. Story, "Multiple Pricing," Increasing Understanding of Public Problems and Policies, Farm Foundation, Chicago, 1958, p. 49.

Concerning the former and present multiple pricing plans of the United States, Woltman states that:

> The contradictions between American agricultural policies and the stated objectives of our trade policy are well known, but until recently these contradictions arose mainly on the import side. The adoption of multiple pricing, however, carries agricultural protectionism outside our own borders where it is more likely to be viewed as a calculated and gratuitous piece of of economic aggression, with the consequent possibility of complex economic and political repercussions.[19]

The success or failure of any pricing plan which utilizes a foreign market outlet will depend primarily upon the degree of competition between the product sold in the foreign market and commodities produced by one or more foreign countries. Sales at a low price of a product capable of competing with a commodity which is produced by a foreign country are quite likely to generate ill will toward the United States. Conversely, a multiple pricing plan which results in foreign sales of a commodity which do not conflict with sales of foreign producers may generate good rather than ill will for the exporting country. Any pricing plan which generates ill will by utilizing a foreign market might be called a failure, even though it was responsible for increasing net revenue to a group of producers at home.

Agricultural policy which conflicts too severely with our national foreign policies soon become unprofitable for reasons other than economic. The plans presented in this thesis are evaluated on the basis of economic considerations; the policy maker, in the application of such

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[19] H. R. Woltman, "Multiple Pricing Schemes at Home and Abroad," Journal of Farm Economics, Volume XL, Number 5, December, 1958, p. 1743.

plans, should be aware of the potential effects of the plans on foreign countries, as well as their potential effects on producers and consumers in the United States.

CHAPTER III

MULTIPLE PRICING PLANS

Various types of multiple pricing plans are considered in this chapter along with some examples of multiple pricing and special features of multiple pricing within agriculture. The schemes described are those which have been employed in or proposed for the marketing of agricultural commodities. All the more commonly used or proposed plans were included in the study in order to explore as fully as possible the possibilities of raising farm incomes through any workable form of multiple pricing of agricultural commodities.

Historical Development

Multiple pricing schemes of various types have been present in American industry for many years. However, it was not until the late 1920's that considerable interest was aroused in the possibility of increasing returns to producers of agricultural commodities through such schemes. Almost continuously since that time there has been some form of price discrimination exercised within agricultural industries.

The railroad industry was one of the first to exercise multiple pricing on a large scale. The practice "found its earliest and most flagrant expression upon a large scale in railroad rate making."[1] For

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[1]Myron W. Watkins, "Price Discrimination," Encyclopedia of the Social Sciences (1931), p. 352.

many years the industry charged widely different rates for the various types of products hauled in order to exploit more fully the demand for rail transportation services. Within other industries, use has been made of brand names to differentiate between groups or lots of the same commodity in order to set different prices and thus appeal to different groups of consumers within the markets for the products in question. Price discrimination is a common practice among doctors. For identical services, two patients may be charged different fees, the difference depending largely upon the doctor's judgment concerning the abilities of the patients to pay. Lawyers may employ similar multiple pricing practices.

Another common example of multiple pricing employed outside the agricultural industry is the public utility practice of charging varying rates for the same service or commodity. Commercial users of public utilities, which are kept separate from domestic users by the use of separate meters, manifest a higher elasticity of demand for the services than do domestic users. Typically they are charged lower rates for the same services which domestic users receive.

"Dumping" of products abroad at prices well below those received for identical products at home has also been practiced within nonagricultural industries. This practice is made possible by national boundaries which keep the markets separate and the relatively more elastic demand for the product in the aggregate foreign market.

Discriminatory pricing has been used in the sale of books and in the setting of movie admissions. These practices are based on a separation of markets by time. The higher prices are charged for original

printings of books and for first-run movies, followed at a later time by the sale of later printings or re-run movies at considerably reduced prices.

This principle of multiple pricing was brought into agriculture with the introduction of classified pricing of milk by organized dairy farmers in several markets near the close of World War I. During the following decade the practice of classified pricing, which is the practice of charging prices which differ more than differences in cost of production for milk going into various uses, came into widespread use in the larger eastern markets. Federal and state laws encouraged such organized action by milk producers. The Capper-Volstead Act of 1922 resolved any doubt regarding the right of producers to organize and work through cooperative associations in marketing their product without violating the antitrust laws, although their actions involving restraint of trade were subject to such laws.

During the late 1920's, considerable interest was generated among agricultural leaders in general concerning the possibilities of using multiple pricing plans to increase returns to producers of agricultural commodities. This idea of multiple pricing within agriculture was advanced widely with the introduction of the controversial McNary-Haugen Plan. Thomas and Story state that

> The McNary-Haugen Plan, twice passed and twice vetoed in the 1920's, is evidence of the early interest and great controversy in multiple pricing. The proposal would have utilized the domestic feed grain and foreign export outlets as secondary markets for wheat.[2]

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[2] Marion D. Thomas and Robert P. Story, "Multiple Pricing," Increasing Understanding of Public Problems and Policies, Farm Foundation, Chicago, 1958, p. 45.

The plan, in using the domestic feed grain and foreign export outlets as secondary markets, would have limited sales of wheat into food uses in order to maintain the desired price level and sold the remaining production into the secondary markets at considerably lower prices. The plan never became a law. The export-debenture plan, similar to the McNary-Haugen Plan, was also introduced during the 1920's.

During the early 1930's, the Domestic Allotment Act was introduced with purpose and content very similar to the McNary-Haugen and export-debenture plans. Each of the three plans was based on export disposal of surplus production. The discussion and debate concerning these three plans centered much attention on the possibilities of the use of multiple pricing within agriculture.

Multiple pricing was made an integral part of the Agricultural Adjustment Act of 1933. The Act gave processors, distributors, and cooperatives permission to organize into groups to exercise a centralized control over the marketing of agricultural products. The Secretary of Agriculture was authorized to license distributors in order to eliminate unfair trading practices. Amendments to the Act in 1935 replaced the licensing provision with marketing orders to be issued by the Secretary of Agriculture. The marketing agreement and order features of the amended Act were re-enacted as the Agricultural Marketing Agreement Act of 1937. This act of 1937, along with its amendments, provide the legal basis for the system of marketing orders prevalent in some sections of the agricultural industry today. Marketing of shelled and in-shell nuts afford an example of market separation and multiple pricing of a given product through marketing orders. Flows of certain

fruits and vegetables are regulated through marketing orders and agreements. Such actions are effective in maintaining different prices in the various uses or market segments.

Most purchase and storage programs for agriculture have developed into multiple pricing programs. Stocks of product have accumulated as a result of these purchase plans, and disposal programs have been developed to remove the stocks from government storage at prices below those in the domestic market.

Other examples of multiple pricing within American agriculture include the International Wheat Agreement; the various forms of export subsidies; and nonsystematic surplus disposal arrangements which include Section 32 export operations, Public Law 480, the Mutual Security Act, and the 1956 Agricultural Act. Each of these examples utilizes the more elastic foreign demands for agricultural products. Export subsidies have been paid to exporters of both cotton and wheat by the United States government.

With the heavy surplus problem of the post World War II years, considerable effort has been expended in exploring possibilities of using multiple pricing as an aid in reducing the burden imposed by surplus agricultural production. Currently, there is considerable interest in the use of marketing orders and agreements within several agricultural industries, particularly in marketing orders of national scope.

Special Features of Multiple Pricing Within Agriculture

Multiple pricing of Agricultural commodities sometimes takes on special features not specifically mentioned in standard theory texts in discussions of price discrimination.[3] A domestic seller will not normally, unless subsidies are involved, sell this product abroad at a price below his marginal cost unless he has no alternative market for an already produced quantity. In this special case only marketing costs would be relevant. However, in some cases of agricultural marketing, i.e., the fresh milk industry, this may well occur. Marginal revenue from sales of milk in surplus (manufacturing) markets may fall below marginal costs of production, since quality standards are considerably different between fluid and manufacturing grade milk. The manufacturing milk market continues to be used, however, as a surplus outlet for widely fluctuating quantities of excess fluid milk in order to cover at least a portion of production costs. Thus, in such cases where production is not directly controlled and maximum returns is not the primary objective, marginal costs could be above marginal revenue for the industry.

In many cases the producers' association is not able to set prices unilaterally in order to gain maximum returns. This represents another of the special features. Considerable concentration of power among buyers may lead to price setting through collective bargaining or by a government agency.

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[3] Edmond S. Harris, Classified Pricing of Milk, Some Theoretical Aspects, U. S. Department of Agriculture, AMS Technical Bulletin Number 1184, April, 1958, pp. 38-39; Marion D. Thomas and Robert P. Story, "Multiple Pricing," Increasing Understanding of Public Problems and Policies, Farm Foundation, Chicago, 1958, pp. 44-45.

A third special feature of multiple pricing within agriculture is that, even after prices are established, buyers rather than sellers may be in the position to make the allocation of product in the various separate markets. This is true in the fluid milk industry and may be true in the food processing industry generally.

Thomas and Story give an insight into the special nature of multiple pricing within agriculture. In the following quotation, they indicate how prices and/or supplies are fixed administratively in the primary market to take advantage of the less elastic demand in that segment of the market.

> One method is to establish prices in the primary market administratively; then allow supplies to flow to this market in the quantities demanded at the established price. The remaining supply flows to the secondary market for whatever price this market will return. With this type of multiple-price program, proportionate shares of the primary and secondary market sales are usually allocated to individual producers by some type of pooling mechanism.
>
> Another method is to allocate supplies to the primary market to increase returns from this market; then, the remaining supply is allowed to flow to the secondary market at whatever price this market will return. With this type of multiple pricing, shares in the primary market are usually allocated to producers on the basis of production in an administratively selected base period.

Description of Types of Plans

The following description of the various multiple pricing plans which might be employed effectively in agricultural marketing presupposes the possession of monopoly power by the sellers of agricultural products. As mentioned previously, such power or control may be realized through governmental regulations or through some form of producer

cooperation. Regardless of the way in which the monopoly control is obtained and maintained, the essential features of any particular multiple pricing plan will be the same.

Domestic-Foreign

Under a domestic-foreign type of multiple pricing plan, price is maintained at a predetermined level in the primary domestic market. The larger portion of total production is usually sold into the primary market. Quantities produced in addition to those which can be sold in the primary market at the established price are sold abroad for prices equal to (or perhaps less than) the effective world price. In the recent past, some surplus quantities have been sent abroad at a zero price through the various donation programs.

The predetermined price in the primary market may be maintained in one of two ways. First, the price may be administratively set and quantities sold into the primary market limited to those which will sell at that price. Second, a quota may be established for the domestic market which would result in the desired domestic price level.

It should be noted again that this type of pricing plan involves considerations other than economic. Should exported quantities under such a plan be sufficient to cause considerable opposition among foreign producers of supported commodities, the plan might be rejected in the interest of foreign relations even though it could be successful in raising incomes to domestic producers.

Domestic Use - Destroy Surplus

The domestic use - destroy surplus scheme may be regarded as a two-price plan, although it is essentially a simple monopoly situation. The price in the primary market would be held at some predetermined level through a quota or through a directly administered price. Price in the secondary market would be zero or perhaps negative, due to costs of destroying the surplus. The gains in producer returns from the primary market must of necessity exceed the total cost of surplus disposal for such a plan to be successful.

As was true of the domestic-foreign type of multiple pricing plan, this plan has considerations other than economic. In addition to the adverse comments and attitudes which might arise on the domestic front concerning the plan, results of such a plan have been used as propaganda against the United States. For example,

> ...considerable quantities (of potatoes) from the 1946 crop were destroyed or permitted to spoil (due to large surplus disposal costs).
>
> Repercussions of this wastage were not long in forth coming. Pressure was brought to bear on the Department of Agriculture by the Department of State and by Congress to prevent at all costs recurrence of the 1946 losses. The interest of the Department of State arose from the fact that photographs of burning and spoiling potatoes had been used by communists for propaganda purposes with apparent success.[4]

For this reason, a plan of this type probably lacks practical value, even though it might be successful in increasing producer returns.

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[4]Roger W. Gray, Vernon L. Sorenson, and Willard W. Cochrane, An Economic Analysis of the Impact of Government Programs on the Potato Industry of the United States, Technical Bulletin 211, University of Minnesota, Agricultural Experiment Station, June, 1954.

Geographic Division of the Domestic Market

A geographic division of the domestic market is similar to the domestic-foreign type of arrangement discussed previously in that geographic location provides the basis for market division. Through a quota arrangement or through an administratively determined price, sales of products into the geographic division with the more inelastic demand are limited and "excess" production is sold into areas with the more elastic demand for the product. The more nearly the seller can accomplish equal marginal revenues in the two markets at a level equal to marginal cost, the more nearly will he obtain the maximum returns possible from a given geographic division of the domestic market. This type of multiple pricing plan conceivably might be employed in marketing any product for which the price elasticities of demand differ among the geographic regions into which the total market is divided. For example, in this study the total United States domestic market for various food products is divided into two geographic regions - South and Non-South - for the purpose of determining possibilities of using multiple pricing of this type to increase producer returns.

Primary-Secondary Domestic Uses

Primary and secondary markets are distinguished on the basis of the use to which a commodity is put under this arrangement. Sales into the more inelastic primary market are limited directly through a quota or indirectly through an established price. Additional quantities of the same product are sold into the more elastic secondary market in

which a different use of the product gives rise to the more elastic demand.

This plan is used extensively in the marketings of fluid milk. Surplus quantities of fluid milk are sold into manufacturing uses at prices considerably below the price in the primary fluid milk market. Incomes to producers from other perishable agricultural products could perhaps be increased through this type of pricing. The markets for the processed product would serve as secondary outlets into which "excess" fresh products could be sold at a lower price.

High Quality-Low Quality Domestic Outlets

The basis of market division in some cases of multiple pricing is the difference in the quality of product sold. Such pricing is very similar to the primary-secondary domestic uses plan discussed above. Since higher and lower qualities of the product generally are produced jointly, costs of producing the high quality product would equal costs of producing the low quality product. Quantities sold into the high quality outlets may be limited in order to sustain prices in that high quality market. Just what constitutes high quality might vary from season to season, depending upon the nature of supply. Thus, the practice of charging differing prices fulfills the definition of multiple pricing, although product grading without the market control would result in different prices for different qualities under pure competition. The better quality product may be reserved for the primary market in which the demand for the product is more inelastic and price is maintained at a higher level. Lower quality

product may be sold into a lower priced market along with "excess" quantities from the high quality market. Although this plan is similar in most respects to division of the market according to product use, quality differences rather than use of the product serve as the basis for this multiple pricing plan.

The quality differentiation plan is applicable to those commodities which may be used for food in one market and for feed or other commercial uses in another market. The higher quality product may be reserved for the food market with the lower quality product sold for other uses at a lower price.

Potatoes have been marketed under this plan. They are sold by grades and are in surplus production as far as the food market is concerned. Only the best grades are used for food while lower quality and excess high quality potatoes are sold into the feed, starch, alcohol, and flour industries; dumped abroad; or allowed to spoil.

Vary Price Over Time

Some agricultural products lend themselves to a multiple pricing plan which divides the market on the basis of time or seasons of the year. The price of the commodity is raised during periods of greatest consumption, corresponding to a primary market, and price is reduced to a lower level at other periods to encourage greater "off-season" consumption. The off-season corresponds to a secondary market for the product. Turkey affords an example of a commodity which may be sold into a holiday season primary market and an off-season secondary market.

Another type of multiple pricing plan with a temporal basis for dividing the market is commonly known as a rate-of-flow plan. Under this kind of plan, the flow of the commodity into the market is regulated so that the market is not flooded and price is not unduly depressed at the peak harvest season. Early season prices may be held higher than prices in succeeding periods through rate-of-flow control in order to more fully exploit consumers' demand for the product. This may be termed intra-seasonal or temporal multiple pricing, since early and late seasons afford the basis of dividing the market, and prices differ in the various "markets" because of controlled rates of flow. The size or rate of various flows would depend on the relative elasticities of demand for early and late marketed products. The rate-of-flow control has been employed by certain fruit growers to increase producer incomes.

Inter-Consumer Pricing

Consumers' incomes have been used as a basis for charging different prices for various quantities of the same commodity. Through this inter-consumer multiple pricing plan, a higher price is set for the higher income consumers and a lower price is set for the lower income group in order to increase consumption of products by the latter group.

As it is assumed to operate in this study, the plan involves a transfer of commodities from the high to the low income group, with total consumption being held constant. The effect of the transfer is to decrease price to the low income group and increase price to high income consumers. One would expect that for most normal goods,

responsiveness of quantity consumed to the change in price among high income consumers would be small relative to the responsiveness among low income consumers. There may be exceptions. The magnitude of the price change in either market segment would depend upon the price elasticity of demand in that market.

Food stamp plans fall into the inter-consumer type of multiple pricing. Purchases of the product by consumers in the lower income group are accompanied by the issuance of food stamps which may be used to obtain additional quantities of the product. Although this action may be regarded as an income supplement, it has the effect of reducing the unit price of the good to low income consumers. Price likely would be increased among high income consumers through the shift of product to the low income group. If the price elasticities in the two markets are sufficiently different, the transfer of product would result in increased returns to producers.

Total consumption might possibly be increased through a properly designed inter-consumer multiple pricing plan. If the high and low income segments of the market could be kept separate, prices could be reduced to the low income group through output expansion without seriously affecting consumption of the higher income group. The additional quantities sold to lower income consumers would be transferred from surplus stocks or produced so that they would not come from quantities formerly sold to higher income consumers.

Intra-Consumer Pricing

Intra-consumer pricing has been used in the retailing of fluid milk on home delivery routes.[5] Under this plan, purchasers establish a base consumption quantity during a designated base-forming period, and on the strength of this base, they may purchase a specified quantity in addition to the base quantity at a considerably reduced price during the rest of the year. Each consumer in this case is charged two prices, thus the term "intra-consumer" multiple pricing is used. Increased sales from this type of plan could possibly result in increased producer returns through the larger quantities sold, since variable costs of bottling milk are ordinarily relatively small, some excess bottling capacity is usually available, and a considerable differential typically exists between fluid and manufacturing milk prices. These factors tend to reduce the cost of producing the "extra" quantity sold to a level below the price received for it.

Products with seasonal fluctuations in production may be marketed under the intra-consumer type of multiple pricing plan. The additional quantities sold at the reduced price could be sold during the period of high production, since the reduced price would encourage the purchase of larger quantities.

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[5]For a discussion of the plan as applied to milk see: E. B. Jones and G. G. Quackenbush, "A Two-Price Plan to Sell More Milk," Quarterly Bulletin, Volume 37, Number 1, Agricultural Experiment Station, Michigan State College, East Lansing, Michigan, August, 1954, pp. 60-71.

CHAPTER IV

CHARACTERISTICS OF AGRICULTURAL COMMODITIES IN THE SOUTH RELEVANT TO THE OPERATION OF MULTIPLE PRICING

Characteristics of commodities important in southern agriculture which should be of particular interest in appraising the effects of any multiple pricing plan on producer returns are considered in this chapter. Price and income elasticities of demand, regional and state consumption and production patterns, and certain institutional factors as they might relate to the effectiveness of multiple pricing are considered.

Elasticities of Demand

Estimates of price and income elasticity of demand afford indications of the direction and magnitude of changes in consumption resulting from changes in commodity prices and consumer incomes. The estimates are necessary for combining the commodities into groups and for determining the expected effects of the various multiple pricing plans on returns to producers. All estimates of direct price elasticity used in the study are for the concept of derived demand at the farm level. They were obtained largely from secondary sources. Most of the income elasticity estimates were determined by methods subsequently outlined.

Direct Price Elasticity of Demand

Price elasticity of demand is a quantitative measure of the responsiveness of quantity of a good consumed or demanded to a change in the price of that good or of some other good. It is a number which indicates the effect of a relatively small percentage change in price on the quantity consumed. Price elasticity of demand may be expressed as:

$$\epsilon_P = \frac{\partial Q}{\partial P} \cdot \frac{P}{Q} \qquad (4.1)$$

This is the partial derivative of the demand equation, in which quantity purchased is the dependent variable and price is the independent variable, multiplied by the ratio of the relevant price (P) to the quantity demanded (Q).

The term "relevant price" is used in the discussion of price elasticity of demand in order to make a distinction between direct and cross price elasticity of demand. If the price of the commodity in question is used in equation 4.1, an estimate of direct price elasticity is obtained. When the price of some other good or service is used in the elasticity formula, an estimate of cross price elasticity of demand is the result. In subsequent discussion, price elasticity of demand refers to direct price elasticity of demand unless otherwise indicated.

The major portion of the direct price elasticity estimates were obtained from previous demand studies. Estimates for each of the meats; fish; fluid milk; strawberries and melons; cabbage, onions, and lettuce; shortening, margarine, and other oils; cereal and bakery products; sugar

and syrup; beverages; dry beans, peas, and nuts; all food; and nonfood were taken from Brandow's study.[1]

Some of these estimates are used only in order to obtain estimates of cross elasticities between the commodities of major interest.

Empirical demand functions were derived for a few commodities through the least squares estimation technique. Some of these functions afford fairly reliable estimates of price elasticity of demand. Estimates of price elasticity for processed broccoli, snap beans, lima beans, fresh broccoli, cucumbers, celery, peppers, and avocados were obtained in this manner. Derivation of the empirical demand functions is explained in Appendix A.

Finally, estimates of direct price elasticity of demand for six commodities were not available from previous studies or from the least squares analysis. These include processed peaches, fresh and processed spinach, and fresh carrots, snap beans, and sweet corn. The six estimates for these foods are included in the study at values close to the values for other commodities of a similar type.

All estimates of price elasticity are for the farm price level, and are intended to represent long run relationships. The estimates of price and income elasticity of demand used in the analysis are given in Table I.

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[1] G. E. Brandow, Interrelations Among Demands for Farm Products and Implications for Control of Market Supply, Bulletin 680, Pennsylvania State University Agricultural Experiment Station, August, 1961, pp. 40, 59.

TABLE I

ESTIMATES OF INCOME AND FARM PRICE ELASTICITY OF DEMAND FOR SELECTED FOOD COMMODITIES, UNITED STATES, 1955-57

Commodity	Price Elasticity	Income Elasticity
Meats		
Beef & Veal	-.65	.36
Chicken	-.74	.24
Lamb & Mutton	-1.78	.55
Pork	-.46	.20
Turkey	-.92	.40
Dairy & Poultry Products		
Butter (creamery)	-.65	.33
Eggs	-.25	.16
Fluid Milk & Cream	-.15	.16
Processed Dairy Products (excluding butter)	-.40	.22
Fruits		
Apples (fresh)	-.75	.16
Apples (processed)	-.20	1.07
Avocados	-.60	1.36
Grapefruit	-.56	.70
Lemons & Limes	-.59	.45
Oranges	-.62	.83
Peaches (fresh)	-2.00	1.43
Peaches (processed	-1.00	.33
Strawberries (fresh)	-1.59	.91
Melons	-.80	1.38
Vegetables		
Broccoli (fresh)	-.35	1.05
Broccoli (processed)	-1.79	1.45
Cabbage (fresh)	-.45	-.12
Carrots (fresh)	-.40	.35
Celery	-.15	.44
Cucumbers (fresh)	-.18	.37
Lettuce & Escarole	-.35	.42
Lima Beans (processed)	-.80	.35
Onions & Shallots	-.28	.50
Peppers	-.38	.36
Potatoes	-.20	.03

TABLE I (Continued)

Commodity	Price Elasticity	Income Elasticity
Vegetables (Continued)		
Snap Beans (fresh)	-.30	.19
Snap Beans (processed)	-.20	.18
Spinach (fresh)	-.35	.46
Spinach (processed)	-.40	.82
Sweet Corn (fresh)	-1.00	.50
Sweet Corn (processed)	-.64	.15
Sweet Potatoes	-1.30	1.16
Tomatoes (fresh)	-2.00	.30
Tomatoes (processed)	-.40	.20
Others		
Fish and Shell Fish	-.65	.42
Shortening	-.80	.12
Margarine	-.80	.00
Other Oils	-.46	.03
Cereal and Bakery Products	-.15	.00
Sugar and Syrup	-.30	.18
Beverages	-.36	.23
Dry Beans, Peas, and Nuts	-.29	.12

Income Elasticity of Demand

Income elasticity of demand is a quantitative measure of the effect of a change in consumer income on quantity purchased. It is a number which indicates the effect of a small percentage change in consumer income on the quantity purchased. As is true of price elasticity of demand, income elasticity of demand may be expressed through use of the partial derivative of the demand function. Thus

$$\epsilon_I = \frac{\partial Q}{\partial I} \cdot \frac{I}{Q} \qquad (4.2)$$

where $\frac{\partial Q}{I}$ is the partial derivative with respect to income (I) of the demand equation in which quantity purchased (Q) is dependent and $\frac{\partial I}{Q}$ is the ratio of income to quantity purchased for consumption.

The income elasticity estimates used in the analysis were obtained primarily from the least squares equations expressing purchased consumption as a function of disposable personal income. The specific function selected for each food was determined by the author from visual inspection of the data plotted on simple graphs. The equations, based on nine observations of different consumption and income level combinations, are given in Table II. Standard errors of regression coefficients are given in parenthesis under the coefficients in the table. The estimates of income elasticity were obtained by using the 1955 per capita disposable income level for the South ($1263). For example, the equation for beef and veal from Table II is

$$Y = -89.01 + 46.656 \log X. \qquad (4.3)$$

At the 1955 level of per capita disposable income for the South, the equation is

$$Y = -89.01 + 46.656\ (3.10140) = 55.688608 \text{ pounds per capita.} \qquad (4.4)$$

TABLE II

EQUATIONS FOR ESTIMATING PURCHASED CONSUMPTION OF FOOD IN THE SOUTH AND SOUTHERN STATES, 1955*

Commodity	Estimating Equation[a]	R^2
Meats		
Beef & Veal	$Y = -89.01 + 46.656 \log X$ (6.240)	.89
Chicken	$Y = -19.87 + 15.634 \log X$ (2.348)	.86
Lamb & Mutton	[b]	--
Pork	$Y = 43.47 + .132\ (10^{-1})X - .256(10^{-5})X^2$ (.064) (.141)	.43
Turkey	[b]	--
Dairy & Poultry Products		
Butter (creamery)	$Y = 2.14 + .116(10^{-2})X$ (.013)	.92
Eggs	$Y = -30.05 + 18.157 \log X$ (1.494)	.96
Fluid Milk & Cream	$Y = 23.87 + .243X - .404(10^{-4})X^2$ (.020) (.045)	.97
Processed Dairy Products (excluding butter)	$Y = -38.93 + 35.995 \log X$ (3.460)	.94
Fruits		
Apples (fresh)	$Y = 10.53 + .510(10^{-2})X - .127(10^{-5})X^2$ (.336) (.074)	.35
Apples (processed)	$Y = -.24 + .300(10^{-2})X$ (.086)	.67
Avocados	[b]	--
Grapefruit	$Y = 5.38 + .347(10^{-2})X$ (.103)	.88
Lemons & Limes	$Y = 5.04 + .328(10^{-2})X$ (.051)	.86

TABLE II (Continued)

Commodity	Estimating Equation[a]	R^2
Fruits (Continued)		
Oranges	$Y = 5.40 + .541(10^{-1})X - .310(10^{-4})X^2 + .530(10^{-8})X^3$ (.076) (.048) (.076)	.99
Peaches (fresh)	[b]	--
Peaches (processed)	$Y = -9.88 + 5.515 \log X$ (.861)	.85
Strawberries (fresh)	$Y = .27 + .224(10^{-2})X$ (.075)	.60
Melons	[b]	--
Vegetables		
Broccoli (fresh)	[b]	--
Broccoli (processed)	$Y = -.55 + .141(10^{-2})X$ (.010)	.96
Cabbage (fresh)	[b]	--
Carrots (fresh)	$Y = -9.53 + 5.161 \log X$ (.753)	.87
Celery	$Y = -11.10 + 5.265 \log X$ (.871)	.84
Cucumbers (fresh)	$Y = -7.32 + 3.821 \log X$ (1.234)	.58
Lettuce & Escarole	$Y = -30.54 + 14.697 \log X$ (2.090)	.88
Lima Beans (processed)	$Y = 1.44 + .242(10^{-2})X - .560(10^{-6})X^2$ (.050) (.110)	.81
Onions & Shallots	[b]	--
Peppers	$Y = -2.10 + 1.100 \log X$ (.158)	.87
Potatoes	$Y = 44.01 + .371(10^{-1})X - .146(10^{-4})X^2$ (.059) (.024)	.89
Snap Beans (fresh)	$Y = -3.17 + 3.828 \log X$ (.991)	.68

TABLE II (Continued)

Commodity	Estimating Equation[a]	R^2
Vegetables (Continued)		
Snap Beans (processed)	$Y = -1.18 + 1.902 \log X$ (.470)	.70
Spinach (fresh)	$Y = -2.13 + .993 \log X$ (.515)	.35
Spinach (processed)	$Y = .85(10^{-1}) + .301(10^{-3})X$ (.041)	.88
Sweet Corn (fresh)	$Y = 4.74 + .382(10^{-2})X$ (.075)	.79
Sweet Corn (processed)	$Y = 5.65 + .783(10^{-3})X$ (.287)	.52
Sweet Potatoes	[b]	--
Tomatoes (fresh)	$Y = -19.43 + 12.778 \log X$ (2.704)	.76
Tomatoes (processed)	$Y = 4.95 + .538(10^{-2})X$ (.033)	.97

[a] Y = annual purchased consumption per capita in pounds

X = annual per capita money income after taxes

The figure in parenthesis is the standard error of the regression coefficient. The same code factor (10^i) applies to the standard error as is used for the regression coefficient.

[b] No equation fitted; average per capita consumption for the South was used.

*Source: Estimated from data included in U. S. Department of Agriculture, AMS and ARS, Food Consumption of Households in the South, Report Number 4 of Household Food Consumption Survey 1955, December, 1956.

This indicates an annual purchased consumption of 55.7 pounds of beef and veal in the South in 1955. Income elasticity of demand is equal to .36, (.01605 x 22.67068 = .36).[2]

The income elasticity estimates for fresh broccoli and avocados were obtained from the least squares regressions explained in Appendix A. Estimates for butter, eggs, fluid milk, lamb and mutton, and turkey were obtained from Brandow's study, and those for pork, sweet potatoes, grapefruit, oranges, melons, cabbage, onions, fresh tomatoes, fresh peaches, and processed tomatoes were obtained from other previous studies.

Cross Price Elasticity of Demand

The estimates of income elasticity and direct price elasticity included in Table I are used to obtain estimates of cross price elasticity of demand. An estimate of cross price elasticity of demand is generated for every possible combination of foods. The estimates, along with estimates of direct price and income elasticity are included in Table III.

The primary reason for generating the cross elasticities of demand is to gain a better understanding of the interrelations among demands for the 39 foods considered in the analysis. In order to complete the

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[2] Income elasticity of demand = $\frac{dQ}{dI} \cdot \frac{I}{Q}$

$\frac{dQ}{dI} = \frac{\log_{10} e}{I}$ (regression coefficient). In the example above, income elasticity = $\frac{.4346}{1263}$ (46.6559) $\frac{1263}{55.6886}$ = (.000344)(46.6559)(22.67968) = .36.

TABLE III

PRICE AND INCOME ELASTICITIES OF DEMAND AT THE FARM LEVEL, UNITED STATES, 1955-57

	Farm Price of:									
Quantity Demanded of:	1	2	3	4	5	6	7	8	9	10
1. Beef and Veal	-.650	.021	.018	.032	.006	.006	.001	-.015	.010	.008
2. Chicken	.096	-.740	.034	.067	.012	.012	.005	-.022	.023	.017
3. Lamb and Mutton	.239	.106	-1.780	.164	.029	.029	.011	-.060	.056	.042
4. Pork	.044	.020	.016	-.460	.006	.006	.002	-.011	.012	.008
5. Turkey	.089	.039	.031	.067	-.920	.010	.003	-.022	.018	.014
6. Butter (creamery)	.048	.021	.017	.037	.005	-.650	.001	-.013	.010	.008
7. Eggs	.009	.004	.003	.006	.001	.001	-.250	-.001	.002	.001
8. Fluid Milk and Cream	-.014	-.006	-.005	-.011	-.002	-.002	a	-.150	-.002	-.002
9. Processed Dairy Prod.	.025	.011	.009	.019	.003	.003	.001	-.004	-.400	.004
10. Apples (fresh)	.123	.054	.043	.093	.013	.014	.004	-.022	.026	-.750
11. Apples (processed)	-.279	-.123	-.099	-.212	-.030	-.032	-.008	.050	-.059	-.039
12. Avocados	-.276	-.122	-.097	-.209	-.030	-.032	-.008	.049	-.058	-.038
13. Grapefruit	-.085	-.037	-.030	-.064	-.009	-.010	-.002	.015	-.018	-.012
14. Lemons and Limes	-.002	-.001	-.001	-.001	-a	-a	-a	a	-a	-a
15. Oranges	-.111	-.049	-.039	-.084	-.012	-.013	-.003	.020	-.023	-.015
16. Peaches (fresh)	.022	.010	.008	.017	.002	.003	.001	-.004	.005	.003
17. Peaches (processed)	.128	.057	.045	.097	.014	.015	.004	-.023	.027	.018
18. Strawberries	.087	.038	.030	.066	.009	.010	.002	-.015	.018	.012
19. Melons	-.236	-.104	-.083	-.179	-.026	-.027	-.007	.042	-.050	-.033
20. Broccoli (fresh)	-.239	-.105	-.084	-.181	-.026	-.028	-.007	.043	-.050	-.033
21. Broccoli (processed)	-.032	-.014	-.011	-.024	-.003	-.004	-.001	.006	-.007	-.004
22. Cabbage	.139	.061	.049	.106	.015	.016	.004	-.025	.029	.019
23. Carrots	-.015	-.007	-.005	-.011	-.002	-.002	-a	.003	-.003	-.002
24. Celery	-.099	-.044	-.035	-.075	-.011	-.011	-.003	.018	-.021	-.014
25. Cucumbers	-.071	-.031	-.025	-.054	-.008	-.008	-.002	.013	-.015	-.010
26. Lettuce and Escarole	-.048	-.021	-.017	-.036	-.005	-.005	-.001	.008	-.010	-.007
27. Lima Beans (processed)	.076	.034	.027	.058	.008	.009	.002	-.014	.016	.011
28. Onions and Shallots	-.088	-.039	-.031	-.067	-.010	-.010	-.003	.016	-.018	-.012
29. Peppers	-.023	-.010	-.008	-.017	-.002	-.003	-.001	.004	-.005	-.003
30. Potatoes	.037	.016	.013	.028	.004	.004	.001	-.007	.008	.005
31. Snap Beans (fresh)	.011	.005	.004	.008	.001	.001	a	-.002	.002	.002
32. Snap Beans (processed)	-.009	-.004	-.003	-.007	-.001	-.001	-a	.002	-.002	-.001
33. Spinach (fresh)	-.060	-.026	-.021	-.045	-.007	-.007	-.002	.011	-.013	-.008
34. Spinach (processed)	-.158	-.070	-.056	-.120	-.017	-.018	-.005	.028	-.033	-.022
35. Sweet Corn (fresh)	.077	.034	.027	.058	.008	.009	.002	-.014	.016	.011
36. Sweet Corn (processed)	.101	.044	.035	.076	.011	.012	.003	-.018	.021	.014
37. Sweet Potatoes	-.055	-.024	-.020	-.042	-.006	-.006	-.002	.010	-.012	-.008
38. Tomatoes (fresh)	.366	.161	.129	.277	.040	.042	.010	-.065	.077	.051
39. Tomatoes (processed)	.031	.013	.011	.023	.003	.004	.001	-.005	.006	.004
40. Fish and Shell Fish	.021	.009	.007	.016	.002	.002	.001	-.004	.004	.003
41. Shortening	.146	.064	.052	.111	.016	.017	.004	-.026	.031	.020
42. Margarine	.183	.081	.064	.139	.020	.021	.005	-.033	.038	.025
43. Other Oils	.096	.042	.034	.073	.010	.011	.003	-.017	.020	.013
44. Cereal and Bakery Prod.	.034	.015	.012	.026	.004	.004	.001	-.006	.007	.005
45. Sugar and Syrup	.014	.006	.005	.011	.002	.002	a	-.002	.003	.002
46. Beverages	.012	.005	.004	.009	.001	.001	a	-.002	.003	.002
47. Dry Beans, Nuts, Peas	.030	.013	.010	.023	.003	.003	.001	-.005	.006	.004
48. All Food	-.068	-.011	-.007	-.032	-.005	-.008	-.011	-.025	-.022	-.002
49. Non-Food	-.016	-.005	-.001	-.017	-.001	-.002	-.008	-.018	-.011	-.002
50. All Goods and Services ($\times 10^{-3}$)	25.151	5.750	1.812	19.864	1.677	3.192	8.386	18.979	12.481	1.776

TABLE III (Continued)

Quantity Demanded of:	Farm Price of: 11	12	13	14	15	16	17	18	19	20
1.	-.004	-.001	-.002	a	-.005	a	.004	.001	-.015	-a
2.	-.008	-.001	-.003	a	-.010	a	.007	.002	-.030	-a
3.	-.022	-.003	-.008	-a	-.026	.001	.018	.004	-.079	-.001
4.	-.004	-.001	-.001	a	-.004	a	.004	.001	-.014	-a
5.	-.007	-.001	-.003	-a	-.008	a	.006	.001	-.025	-a
6.	-.004	-.001	-.001	a	-.004	a	.003	.001	-.013	-a
7.	-a	a	a	a	a	a	a	a	.001	a
8.	.001	a	.001	a	.002	a	-.001	-a	.006	a
9.	-.002	-a	-a	a	-.002	a	.002	.001	-.005	-a
10.	-.009	-.001	-.003	a	-.010	a	.007	.002	-.030	-a
11.	-.200	.002	.005	-a	.018	-a	-.013	-.003	.056	.001
12.	.015	-.600	.005	-a	.017	-a	-.013	-.003	.055	.001
13.	.005	.001	-.560	-a	.005	-a	-.004	-.001	.016	a
14.	a	a	a	-.590	-a	a	a	a	-.001	-a
15.	.006	.001	.002	-a	-.620	-a	-.005	-.001	.020	a
16.	-.001	a	-a	a	-.001	-2.000	.003	.001	-.018	-a
17.	-.007	-.001	-.002	a	-.007	.001	-1.000	.002	-.031	-a
18.	-.005	-.001	-.002	a	-.005	a	.005	-1.590	-.027	-a
19.	.013	.002	.004	-.001	.013	-.001	-.014	-.004	-.800	.001
20.	.013	.002	.004	-.001	.013	-.001	-.014	-.004	.037	-.350
21.	.002	a	.001	-a	.002	-a	-.002	-.001	.005	a
22.	-.008	-.001	-.002	a	-.008	.001	.008	.002	-.022	-a
23.	.001	a	a	-a	.001	-a	-.001	-a	.002	a
24.	.005	.001	.002	-a	.005	-a	-.006	-.002	.015	a
25.	.004	.001	.001	-a	.004	-a	-.004	-.001	.011	a
26.	.003	a	.001	-a	.003	-a	-.003	-.001	.007	a
27.	-.004	-.001	-.001	a	-.004	a	.004	.001	-.012	-a
28.	.005	.001	.002	-a	.005	-a	-.005	-.001	.014	a
29.	.001	a	a	-a	.001	-a	-.001	-a	.004	a
30.	-.002	-a	-.001	a	-.002	a	.002	.001	-.006	-a
31.	-.001	-a	-a	a	-.001	a	.001	a	-.002	-a
32.	a	a	a	-a	a	-a	-.001	-a	.001	a
33.	.003	a	.001	-a	.003	-a	-.003	-.001	.009	a
34.	.009	.001	.003	-a	.009	-.001	-.009	-.003	.025	a
35.	-.004	-.001	-.001	a	-.004	a	.004	.001	-.012	-a
36.	-.006	-.001	-.002	a	-.005	a	.006	.002	-.016	-a
37.	.003	a	.001	-a	.003	-a	-.003	-.001	.009	a
38.	-.020	-.003	-.006	.001	-.020	.002	.021	.006	-.057	-.001
39.	-.002	-a	-.001	a	-.002	a	.002	a	-.005	-a
40.	-.001	-a	-a	a	-.001	a	.001	a	-.003	-a
41.	-.008	-.001	-.003	a	-.008	.001	.009	.002	-.023	-a
42.	-.010	-.002	-.003	a	-.010	.001	.011	.003	-.028	-.001
43.	-.005	-.001	-.002	a	-.005	a	.006	.002	-.015	-a
44.	-.002	-a	-.001	a	-.002	a	.002	.001	-.005	-a
45.	-.001	-a	-a	a	-.001	a	.001	a	-.002	-a
46.	-.001	-a	-a	a	-.001	a	.001	a	-.002	-a
47.	-.002	-a	-.001	a	-.002	a	.002	a	-.005	-a
48.	-.003	-.001	-.003	-.001	-.007	-.001	-.002	-.002	-.017	-a
49.	a	a	-a	-a	a	a	-.001	a	.001	a
50.	.409	.062	.499	.388	1.210	.110	.730	.237	1.737	.027

TABLE III (Continued)

Quantity Demanded of:	Farm Price of: 21	22	23	24	25	26	27	28	29	30
1.	-a	.002	-a	-.003	-.001	-.003	a	-.002	-a	.005
2.	-a	.005	-.001	-.007	-.001	-.006	.001	-.003	-.001	.013
3.	-.001	.012	-.002	-.018	-.004	-.015	.002	-.009	-.002	.032
4.	a	.002	-a	-.003	-.001	-.003	a	-.002	-a	.006
5.	-a	.004	-.001	-.006	-.001	-.005	.001	-.003	-.001	.010
6.	-a	.002	-a	-.003	-.001	-.001	a	-.002	-a	.005
7.	a	a	a	-a	-a	a	a	a	a	-a
8.	a	-.001	a	.001	a	.001	-a	.001	a	-.002
9.	a	.001	-a	-.001	-a	-.001	a	-.001	-a	.002
10.	-a	.005	-.001	-.007	-.002	-.006	.001	-.004	-.001	.013
11.	.001	-.009	.001	.011	.002	.009	-.002	.006	.001	-.029
12.	a	-.009	.001	.011	.002	.009	-.002	.006	.001	-.030
13.	a	-.003	a	.003	.001	.002	-a	.002	a	-.009
14.	a	a	-a	-a	-a	-.001	a	-a	-a	-.001
15.	a	-.003	a	.004	.001	.003	-.001	.002	a	-.012
16.	-a	.002	-.001	-.005	-.001	-.005	a	-.003	-.001	.001
17.	-a	.005	-.001	-.007	-.002	-.006	.001	-.004	-.001	.013
18.	-a	.004	-.001	-.006	-.002	-.006	.001	-.003	-.001	.008
19.	a	-.007	a	.007	.002	.005	-.001	.004	a	-.022
20.	a	-.008	a	.009	.002	.007	-.001	.005	.001	-.025
21.	-1.790	a	-.001	-.002	-.001	-.003	-a	-.001	-.001	-.005
22.	a	-.450	-a	-.006	-.001	-.004	.001	-.003	-a	.013
23.	-a	-a	-.400	a	a	a	-a	a	a	-.002
24.	-a	-.003	a	-.150	.001	.003	-.001	.002	a	-.010
25.	-a	-.002	a	.003	-.180	.003	-a	.002	a	-.007
26.	-a	-.002	a	.002	a	-.350	-a	.001	a	-.006
27.	a	.002	-a	-.003	-.001	-.003	-.800	-.002	-a	.006
28.	-a	-.003	a	.004	.001	.003	-.001	-.280	a	-.009
29.	-a	-.001	a	.001	a	.001	-a	a	-.380	-.003
30.	a	.001	-a	-.002	-a	-.001	a	-.001	-a	-.200
31.	a	a	-a	-a	-a	-a	a	-a	-a	.001
32.	-a	-a	a	a	a	a	-a	a	a	-.001
33.	-a	-.002	a	.002	.001	.002	-a	.001	a	-.005
34.	-a	-.005	a	.007	.001	.005	-.001	.003	.001	-.014
35.	a	.002	-a	-.003	-.001	-.003	a	-.002	-a	.007
36.	a	.003	-a	-.004	-.001	-.003	.001	-.002	-a	.009
37.	-a	-.002	a	.002	.001	.002	-a	.001	a	-.005
38.	a	.012	-.001	-.015	-.003	-.012	.002	-.008	-.001	.033
39.	a	.001	-a	-.001	-a	-.001	a	-.001	-a	.003
40.	a	.001	-a	-.001	-a	-.001	a	-a	-a	.002
41.	a	.005	-a	-.006	-.001	-.005	.001	-.003	-.001	.013
42.	a	.006	-a	-.008	-.002	-.006	.001	-.004	-.001	.016
43.	a	.003	-a	-.004	-.001	-.003	.001	-.002	-a	.009
44.	a	.001	-a	-.001	-a	-.001	a	-.001	-a	.003
45.	a	a	-a	-.001	-a	-a	a	-a	-a	.001
46.	a	a	-a	-.001	-a	-a	a	-a	-a	.001
47.	a	.001	-a	-.001	-a	-.001	a	-.001	-a	.003
48.	-.001	a	-.001	-.003	-.001	-.005	-a	-.002	-.001	-.002
49.	a	-.001	-a	-a	-a	-.001	-a	-a	-a	-.005
50.	.110	.471	.511	.900	.281	1.588	.144	.536	.416	4.819

TABLE III (Continued)

Quantity Demanded of:	Farm Price of: 31	32	33	34	35	36	37	38	39	40
1.	a	-a	-a	-.001	.001	.002	-.001	.047	.001	.002
2.	a	-a	-a	-.003	.002	.005	-.002	.091	.002	.004
3.	.001	-.001	-.001	-.007	.005	.012	-.006	.230	.006	.010
4.	a	-a	-a	-.001	.001	.002	-.001	.046	.001	.002
5.	a	-a	-a	-.002	.002	.004	-.002	.077	.002	.003
6.	a	-a	-a	-.001	.001	.002	-.001	.043	.001	.002
7.	a	-a	a	a	a	a	a	.005	a	.001
8.	-a	a	a	a	-a	-.001	.001	-.011	-a	a
9.	a	-a	-a	-a	.001	.001	a	.020	.001	.001
10.	a	-a	-a	-.003	.002	.005	-.002	.094	.003	.005
11.	-.001	a	.001	.005	-.003	-.009	.004	-.162	-.005	-.008
12.	-.001	a	.001	.005	-.004	-.009	.004	-.162	-.005	-.009
13.	-a	-a	a	.001	-.001	-.002	.001	-.044	-.002	-.003
14.	-a	-a	-a	-a	a	a	a	.007	-a	a
15.	-a	-a	a	.002	-.001	-.003	.002	-.055	-.002	-.003
16.	-a	-.001	-a	-.002	.001	.002	-.002	.049	a	-a
17.	a	-.001	-.001	-.003	.002	.005	-.002	.095	.002	.004
18.	a	-.001	-a	-.002	.002	.004	-.002	.078	.001	.002
19.	-.001	-a	a	.003	-.002	-.006	.003	-.110	-.004	-.007
20.	-.001	a	.001	.004	-.003	-.007	.004	-.136	-.004	-.007
21.	-a	-.001	-a	-.001	-a	-a	-.001	.011	-.001	-.002
22.	a	-a	-a	-.002	.002	.004	-.001	.084	.003	.005
23.	-a	-a	a	a	-a	-a	.001	-.004	-a	-a
24.	-a	a	a	.002	-.001	-.003	.002	-.056	-.002	-.002
25.	-a	a	a	.001	-.001	-.002	.001	-.040	-.001	-.002
26.	-a	-a	a	.001	-a	-.001	.001	-.025	-.001	.001
27.	a	-a	-a	-.001	.001	.003	-.001	.053	.001	.002
28.	-a	a	a	.001	-.001	-.003	.002	-.048	-.002	-.002
29.	-a	-a	a	a	-a	-.001	.001	-.010	-a	-a
30.	a	-a	-a	-a	.001	.001	a	.023	.001	.002
31.	-.300	-a	-a	-a	a	a	a	.009	a	.001
32.	-a	-.200	a	a	a	-a	.001	-.004	-a	a
33.	-a	a	-.350	.001	-.001	-.002	.001	-.030	-.001	-.001
34.	-.001	a	a	-.400	-.002	-.005	.002	-.087	-.003	-.005
35.	a	-a	-a	-.001	-1.000	.003	-.001	.055	.001	.002
36.	a	-a	-a	-.002	.002	-.640	-.001	.066	.002	.003
37.	-a	a	a	.001	-.001	-.002	-1.300	-.016	-.001	-.002
38.	.001	-.001	-.001	-.006	.006	.012	-.002	-2.000	.010	.017
39.	a	-a	-a	-a	a	.001	-a	.033	-.400	.001
40.	a	-a	-a	-a	a	.001	-a	.023	a	-.650
41.	a	-a	-a	-.002	.002	.005	-.001	.158	.002	.005
42.	.001	-a	-a	-.003	.003	.006	-.001	.197	.002	.006
43.	a	-a	-a	-.002	.001	.003	-.001	.103	.001	.003
44.	a	-a	-a	-.001	.001	.001	-a	.037	a	.001
45.	a	-a	-a	-a	a	a	-a	.015	a	a
46.	a	-a	-a	-a	a	a	-a	.013	a	a
47.	a	-a	-a	-a	a	.001	-a	.032	a	.001
48.	-.001	-.001	-a	-.001	-.001	-.001	-.005	-.007	-.002	-.008
49.	-a	-.001	-a	-a	-a	-.001	a	-.002	-.001	-.001
50.	.415	.596	.109	.223	.321	.603	.556	3.249	1.034	2.450

TABLE III (Continued)

Quantity Demanded of:	Farm Price of: 41	42	43	44	45	46	47	48	49	50
1.	.010	.009	.007	.019	.003	.004	.003	-.479	.119	.360
2.	.019	.019	.015	.045	.008	.010	.006	-.319	.079	.240
3.	.049	.047	.038	.117	.019	.021	.015	-.732	.182	.550
4.	.010	.009	.007	.021	.004	.005	.003	-.266	.066	.200
5.	.016	.015	.012	.035	.005	.006	.005	-.532	.132	.400
6.	.009	.008	.007	.017	.003	.004	.002	-.439	.109	.330
7.	.001	.001	a	-.001	.001	.001	a	-.213	.053	.160
8.	-.002	-.003	-.002	-.009	-.001	-a	-.001	-.213	.053	.160
9.	.004	.004	.003	.007	.002	.002	.001	-.293	.073	.220
10.	.020	.019	.016	.048	.009	.011	.006	-.213	.053	.160
11.	-.036	-.034	-.029	-.108	-.022	-.025	-.014	-1.423	.353	1.070
12.	-.036	-.035	-.030	-.113	-.024	-.028	-.015	-1.809	.449	1.360
13.	-.010	-.010	-.009	-.037	-.008	-.010	-.005	-.931	.231	.700
14.	.001	.001	a	-.005	-.001	-.001	-a	-.599	.149	.450
15.	-.013	-.012	-.011	-.045	-.010	-.012	-.006	-1.104	.274	.830
16.	.009	.009	.006	.002	-.005	-.007	a	-1.902	.472	1.430
17.	.020	.019	.016	.046	.008	.009	.006	-.439	.109	.330
18.	.016	.015	.012	.027	.002	.002	.003	-1.210	.300	.910
19.	-.025	-.024	-.021	-.085	-.020	-.023	-.011	-1.835	.455	1.380
20.	-.030	-.029	-.025	-.093	-.019	-.022	-.012	-1.397	.347	1.050
21.	-.002	.001	-.001	-.020	-.009	-.011	-.003	-1.929	.478	1.450
22.	.018	.017	.014	.047	.010	.012	.007	.160	-.040	-.120
23.	-.001	-.001	-.001	-.009	-.002	-.002	-.001	-.466	.116	.350
24.	-.012	-.012	-.010	-.039	-.007	-.008	-.005	-.585	.145	.440
25.	-.009	-.009	-.007	-.029	-.005	-.006	-.003	-.492	.122	.370
26.	-.006	-.006	-.005	-.022	-.004	-.005	-.003	-.559	.139	.420
27.	.011	.011	.008	.023	.004	.004	.003	-.466	.116	.350
28.	-.011	-.011	-.009	-.036	-.007	-.008	-.004	-.665	.165	.500
29.	-.003	-.003	-.002	-.012	-.002	-.002	-.001	-.479	.119	.360
30.	.005	.005	.004	.012	.002	.004	.003	-.040	.010	.030
31.	.002	.002	.001	.001	.001	.001	a	-.253	.063	.190
32.	-.001	-.001	-.001	-.006	-a	a	-.001	-.239	.059	.180
33.	-.007	-.007	-.006	-.025	-.005	-.005	-.003	-.612	.152	.460
34.	-.019	-.019	-.016	-.062	-.013	-.015	-.008	-1.091	.271	.820
35.	.011	.011	.009	.021	.003	.003	.003	-.665	.165	.500
36.	.011	.013	.011	.033	.006	.008	.005	-.200	.050	.150
37.	-.005	-.004	-.005	-.029	-.009	-.011	-.004	-1.543	.383	1.160
38.	.084	.081	.067	.211	.036	.041	.027	-.399	.099	.300
39.	.003	.002	.002	.004	.001	.002	.001	-.266	.066	.200
40.	.003	.003	.002	.001	-a	-a	a	-.559	.139	.420
41.	-.800	.011	.009	.028	.006	.007	.004	-.160	.040	.120
42.	.015	-.800	.011	.035	.007	.009	.005	.000	.000	.000
43.	.008	.007	-.460	.017	.004	.005	.002	-.040	.010	.030
44.	.003	.002	.002	-.150	.003	.004	.001	.000	.000	.000
45.	.001	.001	.001	.003	-.300	.001	a	-.239	.059	.180
46.	.001	.001	.001	.003	a	-.360	.002	-.306	.076	.230
47.	.002	.002	.002	.007	.001	a	-.290	-.160	.040	.120
48.	-.002	-a	-.001	-.004	-.012	-.018	-.003	-.312	.077	.234
49.	-.002	-.002	-.002	-.022	-.007	-.008	-.003	-.140	-1.016	1.156
50.	1.733	1.347	2.113	19.029	7.999	10.119	2.840	168.989	831.011	1000.000

[a]Less than .0005 but greater than zero

[-a]Less than zero but greater than -.0005

foods category, eight additional foods are included. These are foods numbered 40 through 47 in Table III. They are not included in the analysis of effects of multiple pricing on gross returns to producers. The following procedure, which has been outlined by Frisch and others, was used in generating the estimates of cross elasticity of demand.[3]

Conditions Imposed.--Conditions imposed and assumptions made in generating the cross elasticities in the matrix comprising Table III are:

(1) The homogeneity condition states that the sum of the direct and cross price elasticities and the income elasticity in each row is zero when consumers' preferences are constant.

(2) The symmetry relation prescribes that the cross elasticities comprising a row bear the following relationship to their counterparts in the corresponding column:

$$b_{ij} = \frac{W_j}{W_i} b_{ji} - W_j(b_{iy} - b_{jy}) \qquad (4.5)$$

where:

b_{ij} = cross elasticity in the i^{th} row and j^{th} column

b_{ji} = cross elasticity in the j^{th} row and i^{th} column

W_i, W_j = proportion of total income spent on foods i and j, respectively, (expenditure weights). They are located in the "all goods and services" row of Table III.

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[3]Ragnar Frisch, "Complete Scheme for Computing All Direct and Cross Demand Elasticities in a Model with Many Sectors," Econometrica, Volume 27, Number 2, 1959, pp. 177-196; Herman Wald and Lars Jureen, Demand Analysis, John Wiley and Sons, Inc., New York, 1953, Chapter 6 and 7; and G. E. Brandow, Interrelations Among Demands for Farm Products and Implications for Control of Market Supply, Agricultural Experiment Station, Bulletin 680, Pennsylvania State University, University Park, August, 1961.

b_{iy}, b_{jy} = income elasticity of demand for foods i and j, respectively.

(3) The weighted column sum for any column is the negative of the proportion of total expenditures accounted for by the commodity which heads the column. Derivation of the expenditure weights is given in Appendix Table IV.

(4) The weighted sum of the income elasticities for all goods and services is unity.

(5) All the cross elasticities of demand between foods and nonfoods must be the same multiple of the associated income elasticity.

In addition to the conditions imposed, it is assumed that the nonfoods are want-independent of each food, that the direct price elasticities and income elasticities in Table I are those toward which the markets tend in the long run, and that the cross elasticity between any food and the nonfood group is equal to one-third the value of the income elasticity for that food. The specific value in the latter assumption is arbitrary.

Computational Procedure.--The procedure used in deriving the cross elasticities of demand requires that direct price and income elasticities be given. Thus, these estimates are assembled as described earlier in Chapter IV. Cross elasticities showing the effects of food prices on purchases of nonfood goods and services, which appear in the nonfood column of Table III, are assumed to equal one-third the value of their corresponding income elasticities. From these column values, the corresponding values in the row for nonfood were computed by the symmetry relation. Within this framework of direct price elasticities,

income elasticities, and cross elasticities between food and the nonfood group, the cross elasticities of demand for the foods are calculated by the following procedure:

(1) The total of food cross elasticities in a row is found by subtracting the direct price elasticity, the income elasticity, and the nonfood cross elasticity in the row from zero (the homogeneity relation). This sum of food cross elasticities in each row is designated R_j. The R_j value for beef and veal, for example is equal to $0 - (-.65) - (.36) - (.119) = .171$.

(2) Since the weighted sum of the food cross elasticities in column 1 is equal to the negative of the expenditure weight for the food represented by column 1, the individual cross elasticities in the column are chosen so that they are proportionate to the R_j values and the weighted sum is the desired amount. For beef and veal, the negative of the expenditure weight is equal to -.025151. This figure minus the weighted price elasticity for beef and veal ($-.65 \times .025151 = -.016348$) minus the weighted cross elasticity between nonfood and beef and veal ($-.016 \times .831011 = -.013296$) gives a total of .004493 for the weighted sum of cross elasticities of beef and veal with other food commodities in the beef and veal column. The cross elasticities in the beef and veal column are made proportionate to their R_j values, weighted by the expenditure weights, and summed. This weighted sum is expressed as a percentage of .004493, and each cross elasticity in the beef and veal column is adjusted by this percentage.

(3) From the first column, the first row is completed by the symmetry relation. For example, the cross elasticity showing the effect

of a one percent change in price of chicken on the quantity of beef and veal purchased is found from equation 4.5 to be equal to

$$\frac{.005750(.096)}{.025151} - .005750(.36 - .24) = .021.$$

(4) The weighted sum of the cross elasticities in the second column is then determined, and the individual values determined as in (2) above except that the computations apply only to the missing cross elasticities. That is, nonfood and beef and veal statistics are given and both are used in determining the weighted sum of residual cross elasticities of chicken with the remaining food commodities.

(5) Repetition of the column-row steps complete the matrix of elasticities.

The signs of the cross elasticities generally appear to be consistent with economic theory. Many of the entries possessing negative signs, which indicates a complementary relationship between the two commodities involved, are essentially equal to zero and indicate independence between demands for the two goods. Due to rounding difficulties, the elasticity estimates in the original matrix carry some nonsignificant digits. The estimates are rounded to three digits in Table III. All the conditions are met except for these slight rounding difficulties.

Regional Consumption and Production

Estimates of purchased consumption and production of each commodity are obtained in order to ascertain, for each commodity, whether the South was a deficit or surplus producer of the commodity during the

1955-57 period. The derivation of the purchased consumption and production estimates and the implications of the estimates relative to multiple pricing plans, are outlined below.

Consumption Estimates

Estimates of consumption of the various food commodities are based on the comprehensive survey of food consumption made in 1955 by the United States Department of Agriculture for the United States and for regions including the South.[4] Generally, the consumption data used in the study represent purchases for home consumption by households of two or more persons. All levels of urbanization are included. Home consumption of nonpurchased food, either by urban families or by farm families is excluded.

Average family or per person purchases reported for the nation, or for a major region, cannot be used for an individual state. The level of food purchases is related to the amount of income available to the families, and this income varies from one state to the next. Therefore, a relationship of income and food purchases for each food commodity is estimated for the South. The nine income groups reported in the survey are used. Consumption of each food by each income group is divided by the average number of persons in the family and multiplied by 52 weeks. This gives an estimate of annual per capita consumption, based on weekly consumption. The income reported by each family group is also calculated on a per person basis.

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[4]U. S. Department of Agriculture, AMS and ARS, Food Consumption of Households in the South, Report Number 4 of Household Food Consumption Survey 1955, December, 1956.

The estimates of annual purchases of each food were plotted against the corresponding average per capita money income after taxes for each group, and curves with equations shown in Table II were fitted. The equations are used to estimate the individual state purchases of each food at the 1955 and 1959 levels of per capita disposable income (Appendix B, Table V).

The estimates obtained from this procedure are subject to seasonal variation since they are based on estimated purchases during the spring months. Therefore, the estimates were adjusted for seasonality of consumption. A conversion factor was obtained by comparing commodity by commodity, estimated United States annual consumption, based on weekly data with actual United States annual consumption (Appendix B, Table VI).[5]

Per capita estimates of annual purchased consumption for each state, adjusted for seasonality, were multiplied by state population (Appendix B, Table V) for the two years to obtain the estimated total annual purchased consumption of each food in pounds. By comparing estimates of total consumption in each state for 1955 and for 1959, an average annual increment in consumption was obtained. The annual increment was added to the 1955 estimates to obtain an estimate of purchased consumption of each food in 1956. These estimates are regarded as average for the 1955-57 period. Since the estimates of purchased

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[5]Annual consumption data were obtained from United States Department of Agriculture, AMS, Consumption of Food in the United States, 1909-52, Agricultural Handbook Number 62, September, 1957, and Supplement for 1956.

consumption from the procedure outlined are in terms of retail weight, they were converted to a farm-weight basis by use of standard conversion factors shown in Appendix B, Table VI.[6]

Production Estimates

Estimates of the production of the various commodities for each state were obtained directly from Agricultural Statistics.[7] Annual production of each commodity was obtained for the years 1955 through 1957 and an average for the three years was computed. These production estimates, which were converted to the appropriate units, are given in Table VII of Appendix B.

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[6] Taken from or based on factors contained in: U. S. Department of Agriculture, ARS, Food Yields Summarized by Different Stages of Preparation, Agricultural Handbook Number 102, June, 1956; and U. S. Department of Agriculture, "Consumption and Utilization of Agricultural Products," Major Statistical Series of the United States Department of Agriculture, Volume 5, Agricultural Handbook Number 118, December, 1957.

[7] U. S. Department of Agriculture, Agricultural Statistics, 1956-57-58. Fluid milk and cream and processed dairy products represent exceptions. Total marketings of all milk as reported in Agricultural Statistics were divided into fluid and processed milk on the following basis:

$P_w = P_a + P_c\ (1-X)$, where

X = proportion of the total utilized as fluid milk

P_w = price of all milk, wholesale

P_a = price of fluid milk

P_c = price of milk used for manufactured dairy products

Therefore, $X = \frac{P_w - P_c}{P_a - P_c}$. P_w is a weighted average price. The quantity weights can be determined if all prices are known. For example, if more milk were sold into fluid uses, the wholesale price of all milk would be higher with other prices constant. The formula permits the determination of the utilization of fluid milk from the three prices at a given time.

Comparison of Production and Purchased Consumption

In order to determine whether each state was a surplus or deficit producer of the various commodities during the study period, average annual production for the years 1955-57 was compared with purchased consumption estimates extrapolated to 1956. These comparisons are included in Appendix B, Table VII. In Table IV, the production-purchased consumption comparison is made for the South. Production and consumption data for the South represent aggregation of data for the individual states.

The South in 1955-57 was a surplus producer of all the individual meats except pork, eggs, half the fruits, and eight of the 20 vegetables under consideration. Only two commodities among the animal products groups, butter and processed dairy products excluding butter, were in substantial deficit conditions during this period. Among the fruits, serious deficit positions existed only for processed and fresh apples and for lemons and limes. The South was also deficit in the production of broccoli, lettuce and escarole, onions and shallots, potatoes, processed snap beans, processed spinach, processed sweet corn, and fresh tomatoes.

It should be noted that these comparisons are for the purchased consumption, rather than total consumption, and production. Inclusion of consumption of food consumed on farms where produced would no doubt show a more serious deficit in production of some foods. It should also be noted that some individual food products are aggregated which may conceal both surplus and deficit conditions for commodities within the group. For example, the processed dairy products group includes

TABLE IV

PRODUCTION-PURCHASED CONSUMPTION BALANCE OF 39 SELECTED FOOD COMMODITIES, SOUTH, 1955-57 ANNUAL AVERAGE

Commodity	Units	Production	Purchased Consumption	Surplus
Meats (live wieght equivalent)				
Beef & Veal	1000 lbs.	7,407,803	5,944,915	1,462,888
Chicken	1000 lbs.	2,578,026	1,249,475	1,328,551
Lamb & Mutton	1000 lbs.	241,543	110,313	131,230
Pork	1000 lbs.	3,161,913	4,104,287	-942,374
Turkey	1000 lbs.	270,939	114,263	156,676
Dairy & Poultry Products				
Butter (creamery)	1000 lbs.	78,142	146,347	-68,205
Eggs	million eggs	12,370	10,534	1,836
Fluid Milk & Cream	million lbs.	11,297	12,299	-1,002
Processed Dairy Products (excluding butter)	million lbs.	3,958	13,123	-9,165
Fruits				
Apples (fresh)	1000 lbs.	266,824	909,797	-642,973
Apples (processed)	1000 lbs.	61,784	203,119	-141,335
Avocados	1000 lbs.	26,600	5,018	21,582
Grapefruit	1000 lbs.	3,074,640	431,105	2,643,535
Lemons & Limes	1000 lbs.	30,640	310,871	-280,231
Oranges	1000 lbs.	8,166,420	1,066,649	7,099,771
Peaches (fresh)	1000 lbs.	178,856	218,717	-39,861
Peaches (processed)	1000 lbs.	233,128	293,962	-60,834
Strawberries (fresh)	1000 lbs.	47,456	37,620	9,836
Melons	1000 cwt.	28,176	20,374	7,802
Vegetables				
Broccoli (fresh)	1000 lbs.	545	2,145	-1,600
Broccoli (processed)	1000 lbs.	16,855	56,051	-39,196
Cabbage (fresh)	1000 lbs.	850,800	551,470	299,330
Carrots (fresh)	1000 lbs.	340,200	227,260	112,940
Celery	1000 lbs.	403,500	350,330	53,170
Cucumbers (fresh)	1000 lbs.	248,000	146,669	101,331
Lettuce & Escarole	1000 lbs.	306,300	858,813	-552,513
Lima Beans (processed)	1000 lbs.	195,300	119,139	76,161
Onions & Shallots	1000 lbs.	123,600	385,673	-262,073
Peppers	1000 lbs.	169,300	77,284	92,016
Potatoes	million lbs.	2,166	3,733	-1,567

TABLE IV (Continued)

Commodity	Units	Production	Purchased Consumption	Surplus
Vegetables (Continued)				
Snap Beans (fresh)	1000 lbs.	315,500	334,265	-18,765
Snap Beans (processed)	tons	64,243	91,761	-27,518
Spinach (fresh)	1000 cwt.	698	315	383
Spinach (processed)	tons	25,880	36,467	-10,587
Sweet Corn (fresh)	tons	218,150	221,772	-3,622
Sweet Corn (processed)	1000 lbs.	-	467,372	-467,372
Sweet Potatoes	1000 cwt.	15,406	6,079	9,327
Tomatoes (fresh)	1000 cwt.	9,786	19,688	-9,902
Tomatoes (processed)	1000 cwt.	3,136	3,700	-564

several individual foods. Although the South is listed as a deficit producer of processed dairy products as a group, the surplus or deficit conditions for the components of the group are hidden. The comparison of production and purchased consumption was not made for various grades of foods. For example, all grades of beef and veal are considered together and the comparison does not reveal whether or not the South was a surplus producer of choice beef. Also, the comparisons of purchased consumption and production are for an average of the years 1955-57. The production-purchased consumption balance for any commodity could have varied within the three-year period.

Institutional Factors

There are certain "outside" forces, both domestic and foreign, present in the marketing of some of the food commodities which may affect both the way in which multiple pricing might be employed and its effectiveness in increasing returns to producers. These are usually called institutional factors. Examples of these forces are sometimes classified as industrial organization, governmental intervention, and social institutions. These factors are discussed in general terms in this chapter. They are not considered directly in the analysis of effects of multiple pricing on total returns to producers.

Domestic Institutional Factors

Industrial Organization.--The extent to which a particular industry is organized could be of particular importance to the effectuation of a successful multiple pricing plan. Central control over the

production and distribution of a commodity through governmental or cooperative action could be much more easily achieved in the highly centralized citrus industry than in the potato industry, for example. Generally, the more centrally located or organized an industry, the easier it would be to achieve the necessary control for effective multiple pricing.

The way in which producer prices are established in an industry may also affect the possibility of establishing multiple pricing. Pricing practices have been and are being used in some agricultural industries which might prove very useful in the operation of multiple pricing. These include various types of "pooling" arrangements through which producer payments are made, formula pricing as found in the milk industry, and the use of price differentials based on distance or location zones. These schemes might be incorporated directly into a multiple pricing scheme for a commodity.

Grades and Standards.--A satisfactory system of grading would complement, and in some cases be utilized by, a multiple pricing scheme. An effective grading system for a commodity would aid in the full satisfaction or exploitation of the demand for the commodity by the various consumers. In some cases, different grades of a commodity might be sold into different uses at prices differing more than the difference in costs of producing the two or more grades of a commodity involved. In other cases, one grade may be sold at one time into two different uses at different prices. Ordinarily, the better developed a commodity's system of grading becomes, ceteris paribus, the greater is the probability

that a form of multiple pricing could be effectively and easily employed to increase returns to producers.

Government Activity.--Both state and federal regulation of product flows may affect the degree of success with which a form of multiple pricing may be employed. State lines sometimes become, through state legislation, barriers to interstate movement of agricultural products. The state laws could in some cases be used as a means of geographically dividing a market for multiple pricing. In addition, some pricing policies for agricultural commodities provided by state legislation might serve as a pattern for a multiple pricing procedure.

Federal government legislation is an institution which might affect the operation of a multiple pricing scheme. The various types of compensatory payments tried and proposed could be incorporated into such schemes. Some of the present orders now in operation under federal legislation, i.e., milk marketing orders may be regarded as a form of multiple pricing. Producers of commodities for which the government has passed regulatory legislation have experienced a degree of group or central control which would be necessary for multiple pricing. This "education" no doubt would affect producer acceptance of multiple pricing. The precise direction of effect would depend upon the commodity involved and the farmers' experience with government regulation.

Social Forces.--Characteristics of our society as a whole and of segments of the population are forces related to multiple pricing and its effectiveness in increasing producer incomes. Seasonal patterns of consumption of some foods have become generally accepted over the years and may be utilized in effecting multiple pricing plans, e.g., consumption of turkey during the Thanksgiving holiday season. Some foods are

regarded as being consumed by low-income or high-income groups. This distinction perhaps could be used as a basis for multiple pricing. Religious beliefs which favor or disfavor consumption of certain foods are also social forces which must be considered in multiple pricing schemes.

Foreign Institutional Factors

Foreign institutional factors which are of importance in domestic multiple pricing schemes are largely those instituted by our federal government. Tariff regulations and other import controls have afforded protection for the domestic producer which has been vital for the "dumping" programs proposed and tried in the past. Such protection is necessary for the success of the foreign-domestic type of pricing plan considered in this study.

Excess export penalties might become of importance in considering this plan also. Duties against our exports by foreign importing countries would directly affect the effectiveness of this plan in raising producer incomes. Thus, governmental regulations of foreign trade may determine whether the domestic-foreign type of multiple pricing is possible. If the plan is possible for a given commodity, such regulation may determine the effectiveness of the plan in achieving the desired goal. Also, government regulation may, through additional costs imposed, force an otherwise workable domestic-foreign pricing plan to become uneconomical.

CHAPTER V

ANALYSIS OF EFFECTS OF MULTIPLE PRICING PLANS ON GROSS FARM INCOME

The price and income elasticities of demand, estimated production-purchased consumption balances, and appropriate institutional factors for the various food products are considered simultaneously in this chapter in an effort to evaluate the effects of different types of multiple pricing on gross returns to producers of the products. Primary emphasis is placed on two of the multiple pricing plans discussed in Chapter III. These two plans are the geographic division of the domestic market into two or more separate markets and the inter-consumer division of the seller's market into two or more segments on the basis of income differences among consumers.

The effects of other multiple pricing plans are not emphasized. The contribution of this study to the evaluation of the effects of these other multiple pricing plans lies largely in a setting forth of the problems involved in such evaluation and in indicating the additional information needed before a satisfactory evaluation may be obtained.

Method of Analysis

In the analysis of the expected effects of multiple pricing on returns to producers, the commodities are first aggregated into groups possessing similar market characteristics. In most previous

studies reviewed, the grouping was accomplished through aggregating individual foods into the larger food sub-groups such as meats, dairy and poultry products, fruits, vegetables, and fats and oils, without regard for the demand characteristics of the individual commodities. In this study, the foods are aggregated into eight groups through a consideration of the income and direct price elasticity estimates for the individual food products.

By using the equations for estimating per capita purchased consumption described in Chapter IV, and a knowledge of income levels, estimates of consumption levels and of income elasticities are obtained for the South and Non-South, and for high and low income groups. Estimates of price elasticity of demand are then generated for each of these groups of consumers. These estimates of price elasticity of demand and estimates of total consumption, expanded from per capita purchased consumption estimates, for the various geographic and income groups are used to analyze the effects of hypothetical shifts of product from one market to the other. Shifts of specified quantities of product are postulated, and the expected effects on total returns to producers as a group are ascertained.

The estimates of cross price elasticity shown in Table III of Chapter IV, along with the production-purchased consumption balance for the South and the applicable institutional factors, are used to modify and condition results of these analyses based on income and direct price elasticities of demand. Consideration of these factors is needed to give a better understanding of the potential effectiveness of multiple pricing plans and the problems associated with the instigation of such plans.

Analysis

Aggregation of Commodities into Groups

In aggregating the food commodities into groups possessing similar demand characteristics, the estimates of income and price elasticity of demand shown in Table I of Chapter IV are used. It is assumed that the estimates of income elasticity of demand and estimates of price elasticity of demand are both normally distributed. Through this assumption and the use of Student's "t" distribution, one-third of the estimates of income elasticity would be expected to fall within the interval $\pm$ .431333 standard deviations of the mean of the observed income elasticities. The same is true of the price elasticity estimates. The standard deviation of the income elasticities is .408994 and the mean is .457447. Thus, low income elasticities of demand are considered to be those of value .28 and under; the high elasticities are considered to be those of value .64 and over; and the estimates with values between .28 and .64 are considered to be in the medium range.

The mean of the price elasticities is -.647660; the standard deviation is .489180. From these values, the low price elasticities of demand are postulated to occur in the interval -.43 and under (in absolute value), high price elasticities in the interval -.86 and above (in absolute value), and medium price elasticities of demand are postulated to occur in the interval between -.43 and -.86.

The 47 commodities were classified by both income and price elasticity into low, medium, and high to obtain the nine groups shown in Table V. Commodities tend to fall along the diagonal to a greater

TABLE V

TWO-WAY CLASSIFICATION OF 47 FOOD COMMODITIES SHOWING THE AGGREGATION INTO NINE COMMODITY GROUPS, UNITED STATES, 1955-57

Price of Elasticity of Demand	Income Elasticity of Demand: Low (.28)	Medium (.64)	High
Low	Eggs Fluid Milk & Cream Processed Dairy Products Potatoes Snap Beans, fresh Snap Beans, proc. Tomatoes, processed Cereal & Bakery Prod. Sugar & Syrup Beverages Dry Beans, Peas, Nuts	Carrots Celery Cucumbers Lettuce & Escarole Onions & Shallots Spinach, fresh	Apples, processed Broccoli, fresh Spinach, processed
Medium (.43)	Chicken Pork Apples, fresh Cabbage Sweet Corn, processed Shortening Margarine Other Oils	Beef & Veal Butter Lemons & Limes Lima Beans, processed Peppers Fish & Shell Fish	Avocados Grapefruit Oranges Melons
High (.86)	(none)	Lamb & Mutton Turkey Peaches, processed Sweet Corn, fresh Tomatoes, fresh	Peaches, fresh Strawberries Broccoli, processed Sweet Potatoes

extent than at the high price elasticity-low income elasticity or high income elasticity-low price elasticity corners of the classification table.

On a theoretical basis, this is expected. As consumer incomes become higher, a small percentage change in income would be expected to produce smaller changes in purchased consumption. Also, at the higher levels of consumer income, consumer responsiveness to small changes in price should be less than at lower income levels, because of the smaller "income effect" of the price change. At low income levels, it is expected that small changes in income or price would produce relatively large changes in purchased consumption, since the change in income, whether direct or indirect through a price change, represents a relatively large percentage of total income when income is low. Thus, it was hypothesized that there would be a positive relation between price elasticity of demand and income elasticity of demand.

The chi-square test given in Table VI supports the hypothesis. It indicates the presence of a positive correlation between price and income elasticity of demand among the commodities. Referring to Table VI, the numbers in parentheses indicate the "expected" frequencies for the various cells. The appropriate number for degrees of freedom is $(3-1)(3-1) = 4$, since the estimation of the "expected" figures removes one degree of freedom from the income elasticity calculations and one from the price elasticity calculations.

Since the chi-square test supports the hypothesis of a positive relation between the estimates of income and price elasticity of demand,

TABLE VI

A CHI-SQUARE TEST FOR SIGNIFICANT DIFFERENCE AMONG NUMBERS OF FOODS OCCURRING INTO THE NINE CLASSIFICATION GROUPS

		Income Elasticity of Demand			
		Low	Medium	High	Total
Price Elasticity of Demand	Low	11(8)	6(7)	3(5)	20
	Medium	8(7)	6(7)	4(3)	18
	High	0(4)	5(3)	4(2)	9
Total		19	17	11	47

$$\chi^2 = \frac{(11-8)^2}{8} + \frac{(6-7)^2}{7} + \text{---} + (4-2)^2 = 9.937;\ \text{d.f.} = 4$$

χ^2 tabulated = 9.488 at the .05 probability level.

Therefore the null hypothesis of independence was rejected.

a simple regression was fitted to the data in which price elasticity was expressed as a linear function of income elasticity. The regression obtained is as follows:

$$Y = -.399920 - \underset{(.158972)}{.541570X} \qquad (5.1)$$

where

Y = price elasticity of demand

X = income elasticity of demand.

The number in parenthesis under the regression coefficient is the standard error of the regression coefficient. The "t" value for the regression coefficient is 3.406701, and is significant at the .01 level of probability. This regression equation was used in the analysis of the effects of pricing plans to generate estimates of price elasticity of demand corresponding to the different income levels among groups of consumers. Although the R^2 value of .21 indicates that only a relatively small proportion of the total variation in price elasticity was accounted for by variations in income elasticity, the function was used to obtain estimates of price elasticity in different submarkets for foods which appear along the diagonal of Table V.

The "heroic" assumption is that the positive relation postulated between income elasticity and price elasticity of demand would hold for individual commodities in submarket classifications. This assumption permits the derivation of price elasticity estimates for submarkets, such as South and Non-South, from income elasticities found for the submarkets through the equations in Table II of Chapter IV. Price elasticity estimates are not derived for commodities which appear

off the diagonal of Table V. These foods appear to represent exceptions to the positive relation postulated between income elasticity and price elasticity based on the evidence in Table V and Table II. Price elasticity estimates for seven of the foods off the diagonal, if they had been derived through the regression equation which expresses price elasticity as a function of income elasticity, would not have differed between submarkets. Each would have been equal to -.39992, since income elasticity for these foods was essentially zero for any income level (Table II). These foods are turkey, melons, onions and shallots, avocados, fresh broccoli, lamb and mutton, and fresh cabbage. Since there is no basis for distinguishing different price elasticities of demand for consumers in the South and Non-South or in high and low income groups for the commodities off the diagonal of Table V, the direct evaluation of the effects of multiple pricing is limited to commodities appearing along the diagonal. Possible indirect effects of this pricing on the other foods, however, may be observed.

Evaluation of Multiple Pricing Possibilities

Geographic Division of the Domestic Market.--To evaluate the effects of a multiple pricing plan involving geographic division of the domestic market, a knowledge or estimate of differences in price elasticity between the submarkets is essential. Once this is ascertained, shifts of product can be postulated and their effects on producer income calculated.

The 1955 level of personal disposable income per capita for the South ($1263) and for Non-South ($1781) were inserted into the equations (Table II, Chapter IV) for estimating per capita purchased-consumption to obtain an estimate of per capita purchased-consumption and income elasticity for each of these foods in the South and Non-South.[1] Once the income elasticity is obtained for a given level of income, the price elasticity of demand for that income level can be derived directly through the relation

$$\epsilon_P = -.399920 - .541570\ \epsilon_I \qquad (5.2)$$

The estimates of purchased consumption per capita, income elasticity of demand, and price elasticity of demand are included in Table VII for the two regions, South and Non-South.

The estimate of per capita purchased consumption of each food was expanded to total purchased consumption for the regions South and Non-South by use of 1955 population data (Table V, Appendix B). These estimates of total consumption by each region in 1955, along with the estimates of price elasticity generated from the two 1955 income levels, are used to evaluate the effects on total producer returns of shifting

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[1] Estimates were not obtained for cereal and bakery products, sugar and syrup, beverages, dry beans, or fish since these commodities were not of direct interest to the analysis. Neither were estimates obtained for fresh peaches and sweet potatoes, since purchased consumption of these commodities showed little response to changes in income (Table II of Chapter IV). The relations given in this table indicate zero income elasticities for fresh peaches and sweet potatoes. This is somewhat inconsistent with the positive income elasticities for these foods used in other parts of this study, which were taken from other studies and derived in a different way.

TABLE VII

PURCHASED CONSUMPTION PER CAPITA, INCOME ELASTICITY OF DEMAND, AND PRICE ELASTICITY OF DEMAND FOR SPECIFIED FOOD COMMODITIES, SOUTH AND NON-SOUTH, 1955

Commodity	South			Non-South		
	Purchased Consumption Per Capita	Income Elasticity of Demand	Price Elasticity of Demand	Purchased Consumption Per Capita	Income Elasticity of Demand	Price Elasticity of Demand
	Pounds			Pounds		
Low Elasticity						
Eggs	26.3	.296	-.560	29.0	.272	-.547
Fluid Milk & Cream	266.1	.668	-.762	328.2	.537	-.691
Processed Dairy Products	72.7	.215	-.516	78.1	.200	-.508
Potatoes	67.7	.006	-.403	63.9	-.411	-.177
Snap Beans, fresh	8.7	.191	-.503	9.3	.179	-.497
Snap Beans, processed	4.7	.175	-.495	5.0	.165	-.489
Tomatoes, processed	11.8	.578	-.713	14.5	.659	-.757
Medium Elasticity						
Beef & Veal	55.7	.364	-.597	62.7	.324	-.575
Butter	3.6	.406	-.620	4.2	.490	-.666
Lemons & Limes	9.2	.451	-.644	10.9	.537	-.691
Lima Beans, processed	3.6	.352	-.591	4.0	.191	-.503
Peppers	1.3	.365	-.598	1.5	.324	-.576
High Elasticity						
Strawberries, fresh	3.1	.913	-.894	4.3	.936	-.907
Broccoli, processed	1.2	1.446	-1.183	2.0	1.280	-1.093

quantities of the various food products from the less elastic to the more elastic region. Since the elasticities of demand derived in this manner are usually higher in the South than in the Non-South region, shifts of product are usually made from outside the South to the South. Processed tomatoes, butter, strawberries, and lemons and limes represent exceptions to this rule because of the nature of the functions used to generate estimates of purchased-consumption and income elasticity. They are linear functions of the form $Y = a + bX$, with the constant term and the regression coefficient both positive in sign. Such functions are income inelastic throughout all levels of income (X), but become relatively more income elastic at higher income levels ($\frac{dy}{dx} \cdot \frac{x}{y} < 1$ always, but increases in value as X is increased). Therefore, estimated income elasticity, and consequently estimated price elasticity, is higher in the Non-South than in the South for these foods.

In order to obtain estimates of the percentage change in total producer returns which would be expected to occur as a result of the proposed shifts of product between markets, the following relation is

utilized (TR^c multiplied by 100 gives the percentage change in total revenue):

$$TR^c = (1 + P_1^c)(1 + Q_1^c)\frac{Q_1}{Q_1+Q_2} + (1 + P_2^c)(1 + Q_2^c)\frac{Q_2}{Q_1+Q_2} - 1 \quad (5.3)^2$$

where

TR^c = relative change in total revenue = $\frac{\Delta TR}{TR}$

P_1^c = relative change in price in market one = $\frac{\Delta P_1}{P}$

Q_1^c = relative change in purchased consumption in market one = $\frac{\Delta Q_1}{Q_1}$

P_2^c = relative change in price in market two = $\frac{\Delta P_2}{P}$

Q_2^c = relative change in purchased consumption in market two = $\frac{\Delta Q_2}{Q_2}$

It is assumed for the analysis that the quantity of any food shifted from one region to another should be sufficiently small to preclude a price change greater than about 30 percent in either market. Price changes of great magnitudes would render the elasticity estimates obtained in the manner described unreliable.

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[2] The derivation of this relation is as follows:

$TR_1 = PQ_1 + PQ_2 = P(Q_1 + Q_2)$, $Q_1 + Q_2$ = fixed

$TR_2 = P_1Q_1' + P_2Q_2'$, $P_1 \neq P_2$, $Q_1' + Q_2' = Q_1 + Q_2$, $Q_1 \neq Q_1'$, $Q_2 \neq Q_2'$

$$TR^c = \frac{TR_2 - TR_1}{TR_1} + \frac{P_1Q_1' + P_2Q_2'}{P(Q_1 + Q_2)} - 1$$

$$TR^c = \frac{P(1 + P_1^c)Q_1(1 + Q_1^c) + P(1 + P_2^c)Q_2(1 + Q_2^c)}{P(Q_1 + Q_2)} - 1$$

$$TR^c = \frac{P\left[(1 + P_1^c)Q_1(1 + Q_1^c) + (1 + P_2^c)Q_2(1 + Q_2^c)\right]}{P(Q_1 + Q_2)} - 1$$

$$TR^c = (1 + P_1^c)(1 + Q_1^c)\frac{Q_1}{Q_1+Q_2} + (1 + P_2^c)(1 + Q_2^c)\frac{Q_2}{Q_1+Q_2} - 1$$

Multiple pricing through geographic division of the market is exemplified by its application to potatoes. A transfer of 500 million pounds of potatoes is postulated to be made from the Non-South with a price elasticity of -.177 to the South with a price elasticity of -.403. Based on 1955 data, the original price and consumption levels and the new levels would be as follows:

Purchased consumption before the quantity shift (million pounds):

South = 3684.876

Non-South = 9554.121

Change in purchased consumption (percentage):

South = 13.6

Non-South = -5.2

Change in price of potatoes (percentage):

South = -33.6

Non-South = 29.5

Using the relation expressed as equation 5.3,

$$TR^c = (1.295)(.948)(.722) + (.664)(1.136)(.278) - 1$$

$$= .8864 + .2097 - 1 = .0961 = 9.61 \text{ percent increase} \quad (5.4)$$

This indicates a possibility of using multiple pricing for potatoes to increase producer returns.

One would expect that when price elasticities of demand for a product differ widely between the South and Non-South that some gains in total returns could be obtained through a geographic division of the market. However, the analyses of effects of geographic market division on total returns for the 14 commodities along the diagonal of Table V showed that

total returns for only one product, potatoes, changed by as much as one percent.

Several factors would affect the amount by which price elasticity of demand would have to differ between submarkets before substantial changes in total producer returns could be obtained by inter-market movements of products. Relative proportions of total consumption accounted for by each submarket, the form of the function which expresses purchased consumption of the product as a function of income, and the level of price elasticity of demand in the submarkets would affect the change in total producer returns resulting from a product shift. In general however, it appears that considerably greater differences in price elasticity than those found between submarkets for the 1955 data (except for potatoes) would be necessary before substantial changes in total returns could be obtained through shifts of reasonable quantities of product. For situations in which the proportion of total purchased consumption accounted for by each submarket did not differ extremely, and the price elasticity of demand was in the range -.15 to -.35 in the less elastic submarket, differences in price elasticity of about .5 to .6 would have been required to obtain 8 to 12 percent increases in total producer returns through reasonable quantity movements between submarkets. These differences are considerably larger than the ones obtained for any commodity, except potatoes, under either of the two multiple pricing plans analyzed.

There would be many administrative problems associated with the operations of such a plan even if it should happen to be politically

feasible in the case of potatoes. The primary purpose of this analysis is to determine the possibility of using such a pricing plan to increase producer returns and does not include the specification of any particular administrative plan.

Inter-Consumer Multiple Pricing.--Differences in income among consumer groups would be expected to produce different income and price elasticities of demand among the various groups. Such income differences provide the basis for the type of multiple pricing which has been called inter-consumer multiple pricing. In this study, the low income group is defined to consist of households with money income after taxes of less than $4,000 annually. For the United States, the number of persons in housekeeping households of two or more persons from all urbanizations with money income after taxes of less than $4,000 in 1955 was obtained.[3] This number was compared with a number of persons in the same type households receiving $4,000 or more income annually. From the comparison, it was determined that 46.69 percent of the 1955 United States population had low income according to the definition used in the study. From the same source of data, it was determined that the low income group received an average annual money income after taxes of $674 per capita, whereas the high income group received an income of $1731 per capita. The $1731 level of income is essentially the same as the $1781 determined earlier as the average annual per capita income for the region Non-South. Therefore, elasticities and levels of purchased consumption are considered to be the same for these two groups--high income and Non-South.

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[3] U. S. Department of Agriculture, AMS and ARS, Food Consumption of Households in the United States, Report Number 1 of Household Food Consumption Survey 1955, December, 1956, pp. 5, 7.

The two income levels are not directly comparable, however. The average income within the high income group was this low, primarily because the figure was derived from data for "housekeeping" households of two or more persons for the year 1954. The income figure for the Non-South region was for 1955 and was derived from total disposable personal income and total population for that region. Since primary interest was in the relative income positions of high and low income consumers, the estimates of income for the high and low income groups were considered to be satisfactory for this analysis, even though total population was not accurately reflected, and the average income figures are not directly comparable with those used for the South and Non-South in the preceding section.

The equations in Table II of Chapter IV were used to estimate purchased consumption per capita, income elasticity, and price elasticity within the high income and the low income groups. These estimates are given in Table VIII. The estimates of purchased consumption were then weighted by the percentage of total population contributed by each group to obtain the percentage of total United States purchased consumption accounted for by each of the groups. This was done for each of the food commodities appearing along the diagonal of Table V. Once these estimates of quantities of purchased consumption accounted for by the high and low income groups had been obtained, shifts of product are postulated to be made from the group with the low price elasticity to the one with a higher price elasticity. Effects on total producer returns were observed through the use of equation 5.3.

TABLE VIII

PURCHASED CONSUMPTION PER CAPITA, INCOME ELASTICITY OF DEMAND, AND PRICE ELASTICITY OF DEMAND FOR SPECIFIED FOOD COMMODITIES, HIGH AND LOW INCOME CONSUMERS, 1955

Commodity	High Income Consumers			Low Income Consumers		
	Purchased Consumption Per Capita	Income Elasticity of Demand	Price Elasticity of Demand	Purchased Consumption Per Capita	Income Elasticity of Demand	Price Elasticity of Demand
	Pounds			Pounds		
Low Elasticity						
Eggs	29.0	.272	-.547	21.3	.370	-.601
Fluid Milk & Cream	328.2	.537	-.691	169.2	.751	-.806
Processed Dairy Products	78.1	.200	-.508	62.9	.249	-.535
Potatoes	63.9	.411	-.177	62.4	.189	-.502
Snap Beans, fresh	9.3	.179	-.497	7.7	.217	-.518
Snap Beans, processed	5.0	.165	-.489	4.2	.197	-.507
Tomatoes, processed	14.5	.659	-.757	8.6	.423	-.629
Medium Elasticity						
Beef & Veal	62.7	.324	-.575	43.0	.472	-.656
Butter	4.2	.490	-.666	2.9	.267	-.545
Lemons & Limes	10.9	.537	-.691	7.3	.305	-.565
Lima Beans, processed	4.0	.191	-.503	2.8	.399	-.616
Peppers	1.5	.324	-.576	1.0	.475	-.657
High Elasticity						
Strawberries, fresh	4.3	.936	-.907	1.8	.848	-.859
Broccoli, processed	2.0	1.280	-1.093	.4	2.372	-1.684

Of the products considered, only for potatoes would product shifts make an appreciable change in total producer returns. The relation shows that by transferring 400 million pounds of potatoes from the high income to the low income group, total returns could be increased by 9.6 percent. The high income group consumed an estimated 53.9 percent (7,136 million pounds) of the total United States purchased consumption of potatoes in 1955. The low income group consumed the remaining 6,103 million pounds. Using the price elasticities of demand for potatoes from Table VIII (-.177 for high and -.502 for low income consumers) and transferring 400 million pounds of potatoes from the high to the low income group, the percentage change in total revenue is

$$TR^{c}\ (100) = \left[(1.316)(.944)(.539) + (.869)(1.066)(.461) - 1 \right] 100$$
$$= 9.6 \text{ percent} \qquad (5.5)$$

Effects of Demand Interrelations.--The cross price elasticities of demand included in Table III of Chapter IV are used to obtain some idea of the effects on other products of interest of applying geographic market division or inter-consumer multiple pricing to the 14 commodities along the diagonal of Table V. Cross elasticity estimates (from Table III) for foods in the three groups below the diagonal of Table V are consistently substitutes for each other. The same is true for the three groups above the diagonal. This is indicated by positive cross elasticities between each pair of these foods, which implies that a small percentage increase in the price of one food would result in an increase in purchased consumption of the other.

Foods below the diagonal are complementary with foods above the diagonal, and vice versa. Complementarity is indicated by negative

cross elasticities which implies that a small percentage increase in the price of one food would cause a decrease in purchased consumption of the other.

Foods below the diagonal are substitutes for those along the diagonal, except for fluid milk, processed snap beans, peppers, and sweet potatoes. These foods are complementary with foods along the diagonal. In some cases, processed broccoli and lemons and limes are also complementary with foods along the diagonal. Foods above the diagonal are complementary with foods along the diagonal. The exceptions are fluid milk, processed snap beans, peppers, sweet potatoes, and in some cases eggs, processed broccoli, and lemons and limes.

The interrelations among demands for foods which occurred in different locations in Table V are based on only the signs of the cross elasticity estimates, and at best give only directional effects. Many of the cross elasticities are very low in magnitude. In addition, the estimates of cross elasticity are for the United States, and not for the submarkets. Where direct price and income elasticities differ substantially between submarkets, the cross elasticities may also vary between these submarkets. This difference would affect the demand interrelations included in Table III.

The demand interrelations would be expected to have a qualifying effect on any multiple pricing plan employed in marketing a product. Consumption of substitute products would be favored in those areas in which the price of the multiple priced product is raised appreciably. Consumption of a complementary product should be decreased at the same

time, since consumption of the multiple priced good in question would be diminished through the increase of its own price. In the case of multiple pricing accomplished through a geographic division of the market, the direction of the substitution effect would be exactly opposite in the two markets. The relative magnitudes of the effects would depend upon the degrees of substitutability and complementarity involved. For example, the transfer of 500 million pounds of potatoes from the Non-South to the South, through geographic division of the domestic market, would be expected to result in an increased consumption of foods such as beef and veal, pork, and fresh tomatoes which are complementary with potatoes; and a decreased consumption of substitutes for potatoes such as fluid milk and cream, processed apples, and melons in the South. These changes would be small, however, due to the small magnitudes of cross elasticities for these combinations of foods (Table III).

The way in which the effects of multiple pricing might be affected through the demand interrelations among products would be the same under market division on the basis of income differences as under multiple pricing where geographic location serves as the basis for market separation. Increasing the price of a multiple priced product to one group would be expected to induce a decreased consumption of complementary products and an increase in consumption of substitutes within that group. The effects would be opposite in the other submarket where the price is lowered.

Effects of the Production-Purchased Consumption Balance.--The situation for a given product relevant to the production-purchased consumption balance for the product in the South might also condition the effectiveness of multiple pricing through division of the market into South and Non-South. For instance, if the South were a surplus producer of a product which is shifted from the Non-South region to the South through the multiple pricing plan, the change in transfer costs should represent, at least in part, a saving rather than an added cost. This would afford an added incentive for the use of the multiple pricing plan.

The conditioning effects of the production-purchased consumption balance for the South on inter-consumer multiple pricing are not so clearly evident as in the case of geographic market division. Some conditioning effects would be expected, however, since there is a positive correlation between income levels in the South and the low income group.

Effects of Multiple Pricing on Goals of Rural People.--Goals and values of rural people as they might be related to agricultural policy have been developed by the members of technical committee SM-14 and discussed by Blakley.[4] Eight separate values or goals were discussed. They were (1) equity in real income distribution; (2) economic efficiency, both firm and social; (3) economic growth; (4) individual freedom; (5) national and economic security; (6) the democratic creed--dignity

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[4]Leo V. Blakley, "Goals and Values of Rural People as Related to Agricultural Policy," unpublished Manuscript, Department of Agricultural Economics, Oklahoma State University, Stillwater, 1962.

of the individual and equality of opportunity; (7) preservation of the family farm; and (8) governmental participation of the degree necessary to insure maintenance of other goals and freedoms. Five of the eight goals or values may be directly related to the two multiple pricing plans analyzed in this study. The other two goals seem less directly related to the two pricing plans.

One objective of the multiple pricing plans discussed in this study is to afford a more equitable or fair level of income for producers of agricultural products. Thus, if successfully employed, such pricing should make a positive contribution to the achievement of the goal or value of equity in real income distribution. This aid to the agricultural producer, whose income has been low relative to that of individuals with similar resources in other occupations, would tend to remove the differences in real income and afford realization of the equity goal to a greater extent than was prevalent before such pricing occurred.

Economic efficiency probably would be affected through multiple pricing. Firm efficiency might be increased through an improved income position of producers. However, multiple pricing interferes with the free working of the pricing system, and might be expected to reduce economic efficiency for this reason. Thus, multiple pricing would be expected to affect efficiency, but the direction of the net effect on efficiency is uncertain.

Under any form of multiple pricing which might be employed by a group of producers, some individual freedom would be surrendered to the control group. The government or some other control group would decide on quantities to be produced, and on the quantity of product to be sold

into the various submarkets. The individual producer would surrender the right to make these decisions for himself in exchange for an increased return, since centralized control would be essential to the employment of multiple pricing. Freedom of making certain managerial decisions and access to a free market are both given up when multiple pricing is employed. Thus, the pricing plans under discussion would hinder the achievement of the goal of individual freedom. To some extent, achievement of this goal would be sacrificed in order to facilitate achievement of other goals.

Multiple pricing, as discussed in this study, may be expected to aid in a greater realization of the goal of economic security. The individual producer might be given a more secure position through a successful multiple pricing plan if incomes were stabilized under the multiple pricing plan. Thus the plan could contribute to the attainment of the goal of economic security for each individual whose income is so affected. To the extent that low income consumers could be assured an adequate nutritional diet, such a plan could also contribute to their economic security.

The concept of the family farm is subject to quite wide variations between two time periods and among individuals. However, increased returns and potentially greater stability of returns to producers, which could perhaps be attained through multiple pricing, would help to provide an atmosphere in which the farm family could achieve a level of real income comparable with that received by other groups who employ comparable resources. Multiple pricing may be expected to encourage some producers to continue farming who might otherwise abandon the family farm for alternative employment.

Employment of multiple pricing of the types analyzed in this study may be regarded as the utilization of government participation to aid in the achievement of other desirable goals or values. It would violate one goal of those individuals who desire to have no government participation at all. However, it would represent a compromise which would please other individuals, a sacrifice of a relatively small amount of personal freedom in order to achieve more completely the other goals of equity in income distribution, economic security, and preservation of the family farm. Through government control of a limited degree, as would be required for multiple pricing, achievement of other goals discussed above may be enhanced.

Additional Information Needed.--The information necessary for a detailed analysis of the effects of the remaining six types of multiple pricing plans on producer returns was not obtained in this study. In this section, some indication of the kinds of additional information needed for these analyses will be pointed out. For any type of multiple pricing plan, it would be necessary to have some idea of the quantities sold in the two or more markets before multiple pricing occurred. This would serve as a basis for measuring quantity changes and their effects on returns. Under any type of multiple pricing, the plan would work best when the less elastic market is the larger.

The effectiveness of the domestic-foreign type of pricing plan would depend to a great extent upon the foreign price elasticity of demand for each product. These elasticities were not determined in this study. The foreign demand would have to be more elastic than the domestic demand before the plan could be effective. Characteristics of

products which affect their exportability would be an important consideration. Institutions such as tariffs imposed through federal legislation would be of particular importance in assessing the additional costs brought on by the pricing plan, particularly if these tariffs were borne by the producer. It should be emphasized that, although such a plan might effectively increase producer returns, it might be unacceptable for reasons other than economic.

For an analysis of the effects of the primary-secondary domestic uses type of multiple pricing, one would need to develop more fully the various nonfood use possibilities for each of the foods considered in this study. Once the possible uses are established for each product, some empirical study of elasticity of demand in each of the uses would be needed in order to determine the effects on producer returns of shifting product between uses. Table V indicates that possibilities of using different food uses (fresh and processed) as a basis for market division are limited. Fresh and processed apples have considerably different elasticities of demand which might offer some possibility for multiple pricing. The same is true of fresh and processed tomatoes. Elasticities of similar magnitude are observed for fresh and processed forms of the other foods.

The effects of multiple pricing, based on high quality-low quality domestic market outlets, were not evaluated in this study. One would need to determine product quality characteristics which might possibly be used to separate the market for the product. Elasticities of demand for the two qualities of product would also be needed for such an analysis.

In considering the effects of multiple pricing, based on a variation of price over time, one would need to determine the foods for which demands vary seasonally. Foods which are sold in considerably larger quantities at holiday seasons than at other times would offer possibilities. Foods for which "early" and "late" season markets can be distinguished would also offer possibilities. Not only would knowledge of separable markets be needed, it would be necessary to determine how the price elasticity of demand for the product varies between the markets. Without some knowledge of this elasticity, flows of commodity into the various markets might be controlled in such a way that producer returns would be decreased rather than increased. Turkey, chicken, and some of the fresh fruits and vegetables seem to offer possibilities for multiple pricing, which might or might not result in increased producer returns, depending upon the market characteristics of these products in their different "time" markets.

Intra-consumer pricing is largely unexplored. However, it appears to offer opportunities for increasing returns to producers of some commodities, particularly those with serious surplus problems. Problems of keeping the base and additional quantities separated are yet unsolved for most products, since most of the food commodities are distributed through retail outlets. The effectiveness of this type of plan, if politically and administratively feasible, would depend upon the price elasticity of demand which exists for the "typical" consumer at each price level (base price and excess price). Some knowledge of the added costs of producing and processing the extra quantity sold in

this manner would be needed for a complete evaluation of the effects of the plan. Such costs should be very low for many products which are already produced in surplus quantities.

The domestic use-destroy surplus type of plan might be politically unacceptable, as was mentioned in Chapter III. However, this consideration is not relevant to this study. It would perhaps be possible to increase returns to producers of some farm products through such a scheme. The more inelastic the domestic demand for a product relative to export demand, ceteris paribus, the more likely this plan could be effective in increasing producer returns. The plan would be more successful for commodities for which total costs of producing the reduced quantity of product would be equal to or lower than total costs of producing the larger, uncontrolled quantity. For products produced under conditions of decreasing average cost as quantity is increased, the condition concerning relative total costs might not hold.

The conditioning effects which might be produced by demand interrelations would need to be considered in analyzing the effects of any of these six types of plans. The matrix of elasticities given in Table III of Chapter IV should provide an indication of the direction in which these forces would be expected to operate in any given case.

Economic Implications

Results of this study indicate only a very limited possibility of increasing returns to southern producers of food products, on an individual commodity basis, through the two specific types of multiple pricing analyzed. However, only two plans are analyzed in any detail.

Although the possibility of increasing returns by multiple pricing through geographic market division or through market division on the basis of consumer income differences appears to be small on the basis of this study, additional study of the other plans discussed in Chapter III could lead to some means of increasing returns to producers of some individual food commodities.

Conditioning effects on multiple pricing, contributed by the demand interrelations observed in this study, would be expected to be applicable in any form of multiple pricing which potentially might be used in agricultural marketing. Effects of these substitute and complementary relations would need to be considered in any type of administered pricing considered by policy makers.

The production-purchased consumption balance for the South could conceivably affect and condition the effects of most potential forms of multiple pricing of interest to southern producers. The demand interrelationships previously mentioned should be observed simultaneously with the deficit or surplus condition for a commodity in appraising the direction and magnitude of the conditioning effects contributed by these demand interrelations.

This study provides background material for further study concerning other types of multiple pricing of farm products. Although the analysis in this study indicates only very limited potentials for the two plans considered in greatest detail, it does not rule out multiple pricing as a possible means of aiding in the solution of the agricultural surplus problem. Multiple pricing plans not analyzed in detail in this study might prove to be successful means of increasing producer returns if the necessary conditions as outlined are fulfilled.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Much study has been conducted concerning the various possible ways in which incomes to producers of agricultural products may be increased. Experiments have been conducted, primarily through government sponsored programs of various forms, in an endeavor to achieve an improved income position for the agricultural producer. None of these means of reaching the objective of improved farm incomes can lay claim to complete success. A serious need for additional information pertaining to other ways of reaching the stated objective still exists. This study represents a part of a much larger endeavor to provide additional information concerning an evaluation of various plans through which the position of agricultural producers may be improved.

The present study has one general objective; to evaluate the effectiveness of specified forms of multiple pricing of selected southern food products in increasing returns to producers of those products. Specific objectives of the study are (1) to review alternative multiple pricing plans which might possibly contribute to an improved income position of southern agricultural producers, (2) to determine the general competitive relations in the domestic market for each of the selected food products, (3) to classify the products into groups of commodities possessing similar characteristics of demand, and (4) to analyze the effects on gross farm incomes which the adoption of

one or more types of multiple pricing plans might be expected to produce. Multiple pricing to which the stated objectives refer is defined as the practice of setting two or more prices in separable markets for the same commodity. Differences in prices are understood to be greater than differences in costs of production and/or transportation between the two or more markets.

Effective application of multiple pricing in any seller's market presupposes the possession of an element of monopoly power by the seller. This power is essential to manipulation of product flows into various market segments. Necessary market control of farm products may be accomplished in one of two principal ways--cooperative producer action or governmental regulation of one or more phases of the marketing process. The latter avenue to achievement of the necessary control has been the more important one in the past.

Possession of monopoly power by the seller is only one of the several conditions necessary for effective multiple pricing. Other prerequisites are (1) the seller must be able to maintain two or more separate markets for his product to preclude inter-market shipments which would tend to eliminate the price differentials, (2) the price elasticity of demand must differ significantly among the separate markets, (3) the higher priced primary market should absorb a large part of the total market supply, (4) the secondary market should be able to consume varying and expanding supplies of product, and (5) a satisfactory method of distributing primary and secondary market returns among producers must be devised for cases in which monopoly power is centered in a group of producers.

Multiple pricing as applied to agricultural products sometimes takes on features not prevalent in other industries which employ this pricing technique. These special features of multiple pricing in agricultural marketing include the liklihood that an agricultural producer may sell "excess" quantities of a commodity into the secondary market at a price below marginal costs of production as a regular practice; the possibility that prices may be set through collective bargaining rather than unilaterally, due to the presence of considerable market power among buyers of some agricultural products; and the possibility that buyers rather than sellers may make the allocation of product among the various market outlets.

Examples of multiple pricing as it has been practiced within agricultural industries include (1) the federal market order programs for milk which utilize the separate demands for milk going into fluid and manufacturing uses, (2) marketing orders for shelled and in-shell nuts which are based on different forms in which the product is marketed, (3) marketing orders for certain fruits and vegetables which are usually based on different elasticities of demand among "time markets" which may be kept separated by the seller of product, (4) many of the government purchase and storage programs which have resulted in movements of product from storage at prices well below market prices, (5) the various forms of export subsidies paid by the federal government which effectively keep the domestic price to producers above that in the foreign market, and (6) the International Wheat Agreement which also utilizes the more elastic demand for the product in the foreign market.

Eight different types of multiple pricing plans are described in the study. The domestic-foreign plan limits sales into the less elastic home market and sells the excess abroad. In the domestic use-destroy surplus arrangement, the home market receives limited or controlled supplies, and excess production is destroyed. Geographic division of the domestic market is a third pricing plan which utilizes different segments of the home market which possess differing price elasticities of demand for the product. The primary-secondary domestic uses plan divides the home market on the basis of different uses into which the commodity may go. A similar arrangement is the high quality-low quality domestic outlets plan in which different prices are charged for different qualities of a product. The plan in which sellers vary price over time divides the home market into different "seasonal" markets which have differing elasticities of demand. Inter-consumer pricing is another form of multiple pricing. It divides the domestic market into submarkets on the basis of differing consumer incomes. Finally, intra-consumer pricing is a plan in which each consumer of a good is charged different prices for different quantities of a product purchased. Two of these multiple pricing plans are analyzed in greater detail than the others. These are the geographic division of the domestic market and the inter-consumer plans.

Product characteristics which would be expected to affect the effectiveness of any form of multiple pricing of southern farm products are discussed under three broad headings. These are elasticities of demand, regional and state production and purchased consumption patterns, and institutional factors.

Estimates of income and price elasticity of demand were obtained for each product from previous studies and from least squares analyses. With these estimates and the assumption that all the nonfood products are want-independent of each food product, estimates of cross price elasticity of demand between each pair of foods are generated. The income, direct price, and cross price elasticity estimates provide an indication of the demand interrelations which would likely affect the effectiveness of any form of multiple pricing.

Institutional factors related to the operation of multiple pricing are outlined. These "outside" forces included various types of industrial organization, government intervention in marketing, and social institutions.

Aggregation of the individual commodities into groups possessing similar demand characteristics is accomplished through a two-way classification of the products. These are divided into high, medium, and low price elasticity of demand and high, medium, and low income elasticity of demand, then arranged in a two-way classification table. A chi-square test indicates that there is a significant difference in the number of foods appearing in each of the nine cells of the table.

Estimates of income elasticity are derived for each food at alternative levels of income from the equations for estimating per capita purchased consumption as a function of consumer income. Price elasticity estimates for individual foods were obtained from income elasticity estimates. In this way, different income and price elasticities of demand are obtained for high income and low income consumers, and for the South and Non-South regions. The derived

elasticity estimates are used in evaluating possible effects of multiple pricing through geographic division of the domestic market and of inter-consumer multiple pricing.

Through the use of different elasticity estimates for different groups and a knowledge of quantities of product consumed before multiple pricing occurred, an idea of the direction and magnitude of changes in total producer returns through multiple pricing is obtained. Arbitrary amounts of product are transferred from the market with the less elastic demand to the market with the more elastic demand. Quantitative effects of the product shifts on total returns are observed through the change in total returns. Results of the shifts of product between consuming markets indicate that potato producers could possibly increase their returns through multiple pricing. Shifts of potatoes from high to low income consumers or from the Non-South to the South could possibly increase producer returns from nine to ten percent above what they were in 1955 under free pricing. Similar shifts of quantities of other products failed to produce more than a one percent increase in producer returns. In fact, it appeared that considerably larger differences in price elasticity of demand between submarkets than those observed for the 1955 data would be necessary before multiple pricing would be successful in increasing returns.

There is some indication that multiple pricing based on primary and secondary domestic uses might be successful in increasing producer returns, although additional data and research would be required for a full evaluation of the effects of this type of pricing. Fresh and processed tomatoes, as well as fresh and processed apples, possess considerably different elasticities of demand, which would indicate that

division of markets into processed and fresh market segments might be a satisfactory basis for multiple pricing of these products.

Demand interrelations among the various foods are observed through estimates of cross price elasticity of demand. Both substitutes and complements are found for those foods to which the two types of multiple pricing are applied. Multiple pricing of one food would tend to increase the consumption of its substitutes and decrease purchases of its complements in the higher priced primary market. In the secondary market, consumption of complements would be encouraged while consumption of substitutes would be discouraged. These demand interrelations must be given very serious consideration before the full effects of any multiple pricing plan can be evaluated.

Estimates of purchased consumption for the South are based on data from secondary sources for all urbanizations. Estimates of purchased consumption are made for the South and for each southern state for the 1956 level of disposable personal income. The estimates of per capita purchased consumption of each food are converted to total purchased consumption for each state and for the South and compared with the 1955-57 annual average production. The comparison affords a picture of the South's surplus-deficit situation for each commodity and for each state during the study period. This balance will have a conditioning effect on the operation of any multiple pricing plan. Surplus production of a food in the South will tend to keep additional costs associated with multiple pricing low, since some former costs of transferring products from South to Non-South could be saved. This savings would be conducive

to multiple pricing. Multiple pricing giving rise to shipments of a food into the South would tend to increase the surplus of its substitutes in the South and decrease the surplus of its complements in the South.

All the statements concerning interrelations among demands for the foods are somewhat limited because of the nature of the cross elasticity estimates. Many of these estimates are very low in magnitude and only the signs are considered. Thus, the conditioning effects of the interrelations should be regarded as directional only. Also, the cross elasticity estimates apply to the United States rather than to each submarket. When price elasticity varies considerably between two submarkets, it is likely that cross elasticities may also vary between the submarkets.

On the basis of the analyses of this study, it must be concluded that multiple pricing of the two types considered in greatest detail offers only limited possibility of increasing producer returns under 1955 demand and supply conditions. Further study is essential to conclusions concerning effects of the remaining six plans. This study does not indicate many promising avenues for increasing returns through multiple pricing. However, it may set the stage for additional work to determine the effects of other forms of multiple pricing which may hold some promise of increasing returns to agricultural producers.

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A P P E N D I C E S

APPENDIX A

DERIVATION OF EMPIRICAL DEMAND EQUATIONS FOR SELECTED FOOD COMMODITIES BY MULTIPLE LINEAR REGRESSION AND RESULTING ESTIMATES OF PRICE AND INCOME ELASTICITY, UNITED STATES, 1940-59

Empirical demand functions were derived by least squares for some of the food commodities studied in an endeavor to estimate income and price elasticity of demand for those commodities. The functions were derived only for the commodities for which no elasticity estimates were available from previous studies.

Production of each commodity was obtained from Agricultural Statistics[1] and assumed to be equal to consumption in each year. The form of the equations was

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 \qquad (AA.1)$$

where

Y = annual production (consumption) per capita

X_1 = farm price of the commodity

X_2 = disposable personal income per capita

X_3 = change in disposable personal income per capita from the previous year

X_4 = production (consumption) lagged by one year

Results for each of the 16 foods are presented in Appendix B, Table I.

It was obvious from a consideration of the "t" values obtained for the price variable that some of the regression coefficients were not significantly different from zero, thus were not suitable as a basis

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[1] U. S. Department of Agriculture, Agricultural Statistics, 1956-60.

for elasticity estimates. The same was true of some of the regression coefficients for the income variable. For purposes of this study, regression coefficients which were at least equal to one standard deviation were tentatively used to generate estimates of price and income elasticity. Price elasticity estimates for most foods for which the regression coefficient for X_1 (price) was negative and at least equal to one standard deviation are shown in Table II of Appendix B.

Significant results were not obtained for fresh broccoli, carrots, spinach, and snap beans; or for processed sweet corn, spinach, peaches, and lima beans. The elasticity estimates for these eight foods were derived from a second attempt to obtain significant price and income regression coefficients. In the second analysis, the form of the equation was:

$$Y = a + b_1X_1 + b_2 X_2 + b_3X_3 + b_4X_4 + b_5X_5 \qquad (AA.2)$$

where

Y = annual production (consumption) per capita

X_1 = farm price of the commodity

X_2 = disposable personal income per capita

X_3 = change in disposable personal income per capita from the previous year

X_4 = production (consumption) lagged by one year

X_5 = time

Variables X_4 and X_5 were deleted from equations for fresh broccoli, fresh spinach, processed peaches, and processed lima beans; and

variable X_5 alone was deleted from the equation for processed spinach. Results are presented in Table III of Appendix B.

Referring to Table II in Appendix B, all the estimates of price and income elasticity except income elasticity of avocados were computed in the following manner:

$$\text{Price elasticity} = b_1 \frac{\text{mean of } X_1}{\text{mean of } Y}$$

Example (celery): $\text{Price elasticity} = -.002989 \frac{4.151}{.08485} = -.15$

$$\text{Income elasticity} = b_2 \frac{\text{mean of } X_2}{\text{mean of } Y}$$

Example (celery): $\text{Income elasticity} = .000011 \frac{1338.42}{.08485} = .17$

All the price elasticity estimates given in Appendix B, Table III were used in the analysis of the various multiple pricing plans. Since alternative sources of income elasticity estimates were available, only the estimates of income elasticity for fresh broccoli and avocados were used from this table.

A P P E N D I X B

B A S I C D A T A

APPENDIX TABLE I

TABULATION OF EMPIRICAL LINEAR DEMAND FUNCTIONS FOR SIXTEEN FOOD COMMODITIES, UNITED STATES, 1940-59

Commodity	Variable	Constant Term	Partial Regression Coefficient	Standard Error of Coefficient	"t"	Mean	R^2
Processed Broccoli	Y	-.005702				.002995	.86
	X_1		-.000635	.000211	-3.01	8.460500	
	X_2		.000011	.000003	3.67	1338.420000	
	X_3		-.000006	.000004	-1.50	77.195000	
	X_4		-.062092	.296591	-.21	.002715	
Fresh Broccoli	Y	.001489				.005950	.60
	X_1		-.000045	.000177	-.25	8.460500	
	X_2		.000002	.000003	.67	1338.420000	
	X_3		-.000009	.000006	-1.50	77.195000	
	X_4		.525721	.211112	2.49	.005800	
Celery	Y	.075348				.084850	.63
	X_1		-.002989	.000918	-3.26	4.151000	
	X_2		.000011	.000008	1.38	1338.420000	
	X_3		-.000013	.000019	-.68	77.195000	
	X_4		.104353	.196649	.53	.084450	
Fresh Carrots	Y	.008485				.095350	.47
	X_1		.012021	.009469	1.27	2.844000	
	X_2		.000010	.000022	.45	1338.420000	
	X_3		-.000001	.000055	.02	77.195000	
	X_4		.411558	.269739	1.53	.094950	
Processed Sweet Corn	Y	.056002				.167500	.17
	X_1		.000894	.001593	.56	19.632500	
	X_2		.000071	.000049	1.45	1338.420000	
	X_3		.000046	.000092	.50	77.195000	
	X_4		-.026230	.247051	.11	.163700	
Cucumbers	Y	.009857				.021000	.72
	X_1		-.000755	.000656	-1.15	4.906500	
	X_2		.000005	.000004	1.25	1338.420000	
	X_3		-.000014	.000008	-1.75	77.195000	
	X_4		.466966	.217069	2.15	.020900	

APPENDIX TABLE I (Continued)

Commodity	Variable	Constant Term	Partial Regression Coefficient	Standard Error of Coefficient	"t"	Mean	R^2
Green Peppers	Y	.003647				.013600	.86
	X_1		-.000635	.000245	-2.59	8.051000	
	X_2		.000008	.000003	2.67	1338.420000	
	X_3		-.000014	.000006	2.33	77.195000	
	X_4		.396524	.161032	2.46	.013400	
Fresh Spinach	Y	.000790				.016150	.96
	X_1		.000314	.000718	.43	5.033500	
	X_2		-.000002	.000004	-.50	1338.420000	
	X_3		.000005	.000005	1.00	77.195000	
	X_4		.931884	.096822	9.62	.016850	
Processed Spinach	Y	.010512				.014500	.43
	X_1		.000050	.000054	.93	45.895000	
	X_2		.000018	.000006	3.00	1338.420000	
	X_3		.000008	.000012	.67	77.195000	
	X_4		-.130916	.256172	-.51	.014050	
Processed Apples	Y	.205191				.205500	.41
	X_1		-.029832	.014870	2.01	1.774500	
	X_2		.000079	.000068	1.16	1338.420000	
	X_3		.000344	.000155	2.22	77.195000	
	X_4		-.385053	.201518	-1.91	.206300	
Processed Peaches	Y	.080752				.184200	.13
	X_1		-.001572	.010218	-.15	1.969500	
	X_2		.000055	.000045	1.22	1338.420000	
	X_3		.000012	.000106	.11	77.195000	
	X_4		.178225	.255000	.70	.182200	
Fresh Strawberries	Y	.049331				.016350	.90
	X_1		-.000398	.000093	-4.28	20.459500	
	X_2		-.000020	.000005	-4.00	1338.420000	
	X_3		.000027	.000010	2.70	77.195000	
	X_4		.022268	.147364	.15	.017200	
Fresh Avocados	Y	.003086				.004050	.78
	X_1		-.000009	.000002	-4.50	271.396000	
	X_2		.000008	.000002	4.00	1338.420000	
	X_3		-.000004	.000003	-1.33	77.195000	
	X_4		-.157498	.200150	-.79	.003750	

APPENDIX TABLE I (Continued)

Commodity	Variable	Constant Term	Partial Regression Coefficient	Standard Error of Coefficient	"t"	Mean	R^2
Processed Lima Beans	Y	-.000006				.009050	.80
	X_1		.000030	.000027	1.11	133.647000	
	X_2		-.000002	.000003	-.67	1338.420000	
	X_3		-.000004	.000007	-.57	77.195000	
	X_4		.917220	.161619	5.68	.008850	
Fresh Snap Beans	Y	.029369				.035650	.79
	X_1		.001673	.000841	1.99	7.948500	
	X_2		-.000018	.000009	-2.00	1338.420000	
	X_3		.000002	.000012	.17	77.195000	
	X_4		.450872	.252561	1.79	.036450	
Processed Snap Beans	Y	-.016521				.033850	.72
	X_1		-.000063	.000062	-1.02	106.904500	
	X_2		.000038	.000018	2.11	1338.420000	
	X_3		.000008	.000018	.44	77.195000	
	X_4		.158981	.307760	.52	.032500	

APPENDIX TABLE II

ESTIMATES OF PRICE AND INCOME ELASTICITIES OF DEMAND DERIVED FROM EMPIRICAL LINEAR DEMAND FUNCTIONS, UNITED STATES, 1940-59

Commodity	Price Elasticity	Income Elasticity
Avocados	-.60	1.36*
Broccoli, fresh	-.35	1.05
Broccoli, processed	-1.79	4.92
Celery	-.15	.17
Cucumbers	-.18	.29
Lima Beans, processed	-.80	.31
Green Peppers	-.38	7.95
Snap Beans, processed	-.20	1.50

*This estimate was obtained as follows:

$$\text{Income Elasticity} = (b_2+b_3)\frac{\text{mean of } X_2}{\text{Mean of } Y} = .000004\ \frac{1338.42}{.00405} = 1.36$$

where

b_2 and b_3 are partial regression coefficients for X_2 and X_3, respectively.

APPENDIX TABLE III

TABULATION OF EMPIRICAL LINEAR DEMAND FUNCTIONS FOR EIGHT FOOD COMMODITIES, UNITED STATES, 1940-59

Commodity	Variable	Constant Term	Partial Regression Coefficient	Standard Error of Coefficient	"t"	Mean	R^2
Fresh Broccoli	Y	.002792				.005950	.44
	X_1		-.000246	.000182	-1.35	8.460500	
	X_2		.000005	.000003	1.67	1338.420000	
	X_3		-.000013	.000007	-1.86	77.195000	
Fresh Carrots	Y	-.037356				.095350	.73
	X_1		.008282	.007016	1.18	2.844000	
	X_2		.000113	.000032	3.53	1338.420000	
	X_3		-.000117	.000051	-2.29	77.195000	
	X_4		.001738	.226333	.01	.094950	
	X_5		.003127	.000839	3.73	10.500000	
Processed Sweet Corn	Y	.102039				.167500	.24
	X_1		.003209	.002647	1.21	19.632500	
	X_2		-.000025	.000100	-.25	1338.420000	
	X_3		.000131	.000120	1.09	77.195000	
	X_4		-.045238	.246103	-.18	.163700	
	X_5		.003159	.002893	1.09	10.500000	
Fresh Spinach	Y	.036020				.016150	.68
	X_1		.004134	.001551	2.67	5.033500	
	X_2		-.000032	.000007	-4.57	1338.420000	
	X_3		-.000026	.000012	2.17	77.195000	
Processed Spinach	Y	-.009024				.014500	.43
	X_1		.000053	.000066	.80	45.895000	
	X_2		.000018	.000007	2.57	1338.420000	
	X_3		.000008	.000012	.67	77.195000	
	X_4		.000664	.001860	.36	5.033500	
Processed Peaches	Y	.115717				.184200	.11
	X_1		-.000688	.009976	-.07	1.969500	
	X_2		.000053	.000039	1.36	1338.420000	
	X_3		.000013	.000098	.13	77.195000	
Processed Lima Beans	Y	.009220				.009050	.39
	X_1		-.000054	.000039	-1.38	133.647000	
	X_2		.000007	.000005	1.40	1338.420000	
	X_3		-.000022	.000011	-2.00	77.195000	

APPENDIX TABLE III (Continued)

Commodity	Variable	Constant Term	Partial Regression Coefficient	Standard Error of Coefficient	"t"	Mean	R^2
Fresh Snap Beans	Y	.020983				.035650	.83
	X_1		-.000470	.001425	-.33	7.948500	
	X_2		.000014	.000020	.70	1338.420000	
	X_3		-.000015	.000015	-1.00	77.195000	
	X_4		.302004	.249702	1.21	.036450	
	X_5		-.001013	.000563	-1.80	10.500000	

APPENDIX TABLE IV

DERIVATION OF EXPENDITURE WEIGHTS USED IN GENERATING THE CROSS ELASTICITY MATRIX

Commodity	Value of Purchased Consumption Per Household Per Week	Value of Total U.S. Purchased Consumption Per Year*	Value of Total Purchased Consumption Adjusted For Seasonality**	Expenditure Weights (Expenditure on Each as Percent of Total Disposable Income)***
	Dollars	- Million Dollars -		
Meats				
Beef and Veal	2.48	6214.751	6821.932	.025151
Chicken	.93	2330.532	1559.592	.005750
Lamb and Mutton	.21	526.249	491.464	.001812
Pork	2.00	5011.896	5387.788	.019864
Turkey	.11	275.654	454.884	.001677
Dairy and Poultry Products				
Butter (creamery)	.39	977.320	865.710	.003192
Eggs	.82	2054.877	2274.543	.008386
Fluid Milk and Cream	2.04	5112.134	5147.919	.018979
Processed Dairy Prod. (excluding butter)	1.22	3057.257	3385.301	.012481
Fruits				
Apples (fresh)	.16	400.952	481.704	.001776
Apples (processed)	.04	100.238	110.893	.000409
Avocados	.02	50.119	16.705	.000062
Grapefruit	.09	225.535	135.479	.000499
Lemons and Limes	.06	150.357	105.250	.000388
Oranges	.20	501.190	328.229	.001210
Peaches (fresh)	.01	25.059	29.805	.000110
Peaches (processed)	.08	200.476	198.110	.000730
Strawberries (fresh)	.11	275.654	64.227	.000237
Melons	.10	250.595	471.043	.001737
Vegetables				
Broccoli (fresh)	.01	25.059	7.370	.000027
Broccoli (processed)	.02	50.119	29.741	.000110
Cabbage (fresh)	.07	175.416	127.791	.000471
Carrots (fresh)	.08	200.476	138.629	.000511
Celery	.08	200.476	243.999	.000900
Cucumbers	.05	125.297	76.318	.000281
Lettuce and Escarole	.17	426.011	430.825	.001588
Lima Beans (processed)	.04	100.238	39.193	.000144
Onions and Shallots	.08	200.476	145.305	.000536
Peppers	.04	100.238	112.848	.000416

APPENDIX TABLE IV (Continued)

Commodity	Value of Purchased Consumption Per Household Per Week	Value of Total U.S. Purchased Consumption Per Year*	Value of Total Purchased Consumption Adjusted For Seasonality**	Expenditure Weights (Expenditure on Each as Percent of Total Disposable Income)***
	Dollars	- Million Dollars -		
Vegetables (Continued)				
Potatoes	.46	1152.736	1307.203	.004819
Snap Beans (fresh)	.06	150.357	112.602	.000415
Snap Beans (processed)	.09	225.535	161.686	.000596
Spinach (fresh)	.02	50.119	29.480	.000109
Spinach (processed)	.01	25.059	60.387	.000223
Sweet Corn (fresh)	.04	100.238	87.007	.000321
Sweet Corn (processed)	.08	200.476	163.588	.000603
Sweet Potatoes	.03	75.178	150.754	.000556
Tomatoes (fresh)	.22	551.309	881.387	.003249
Tomatoes (processed)	.13	325.773	280.523	.001034
Other				
Fish	.52	1303.093	664.577	.002450
Shortening	.23	576.368	470.086	.001733
Margarine	.18	451.071	365.368	.001347
Other Oils	.24	601.428	573.041	.002113
Cereal and Bakery Products	2.58	6465.346	5161.286	.019029
Sugar and Sirup	.39	977.320	2169.553	.007999
Beverages	1.02	2556.067	2744.705	.010119
Dry Beans, Peas, and Nuts	.25	626.487	770.203	.002840
Total			45836.035	.168989

*Derived from value of consumption per household per week by multiplying by the following adjustment: $\frac{52 \text{ weeks}}{3.43 \text{ Persons per household}}$ U. S. Population for 1955 (165.3 million) = 2505.948.

**Conversion factors given in Appendix Table VI.

***Disposable personal income for U. S. given in Appendix Table V.

APPENDIX TABLE V

DISPOSABLE PERSONAL INCOME AND TOTAL POPULATION, THIRTEEN SOUTHERN STATES, SOUTH, UNITED STATES, 1955, 1956, 1959

State	Disposable Personal Income*		Population		
	1955	1959	1955	1956	1959
	Millions of Dollars			(Thousands)	
Alabama	3387	4105	3079	3112	3193
Arkansas	1787	2158	1763	1747	1744
Florida	5471	8271	3678	3937	4761
Georgia	4494	5455	3644	3705	3838
Kentucky	3400	4029	2987	2990	3125
Louisiana	3595	4630	2899	2984	3166
Mississippi	1937	2321	2097	2145	2185
North Carolina	5079	6150	4325	4402	4530
Oklahoma	3008	3670	2172	2222	2276
South Carolina	2403	2867	2297	2325	2417
Tennessee	3970	4813	3397	3415	3501
Texas	12893	16040	8773	8945	9513
Virginia	5025	6198	3570	3704	3992
Total (South)	56449	70707	44681	45633	48241
United States	271240	335141	165300	168200	177100

*Not available for 1956.

Sources: Population data taken from Statistical Abstract of the United States, 1959 & 1960.
Income data taken from Survey of Current Business, August, 1960, p. 13.

APPENDIX TABLE VI

CONVERSION FACTORS TO CONVERT UNITED STATES WEEKLY TO UNITED STATES ANNUAL CONSUMPTION AND RETAIL FOOD WEIGHT TO FARM WEIGHT, 47 FOOD COMMODITIES

Commodity	Annual as Percent Of Annual Estimated From Weekly Consumption	Farm Weight of Foods as Percent Of Retail Weight
Meats		
Beef and Veal	109.77	212.8
Chicken	66.92	142.9
Lamb and Mutton	93.39	227.3
Pork	107.50	149.3
Turkey	165.02	133.3
Dairy and Poultry Products		
Butter (creamery)	88.58	100.0
Eggs	110.69	103.1
Fluid Milk and Cream	100.70	100.0
Processed Dairy Products (excluding butter)	110.73	357.1
Fruits		
Apples (fresh)	120.14	111.1
Apples (processed)	110.63	111.1
Avocados	33.33	109.9
Grapefruit	60.07	105.3
Lemons and Limes	70.00	105.3
Oranges	65.49	105.3
Peaches (fresh)	118.94	112.4
Peaches (processed)	98.82	90.1
Strawberries (fresh)	23.30	112.4
Melons	187.97	114.9
Vegetables		
Broccoli (fresh)	29.41	114.9
Broccoli (processed)	59.34	163.9
Cabbage (fresh)	72.85	117.6
Carrots (fresh)	69.15	111.1
Celery	121.71	116.3
Cucumbers (fresh)	60.91	116.3
Lettuce and Escarole	101.13	123.5
Lima Beans (processed)	39.10	185.2
Onions and Shallots	72.48	116.3
Peppers	112.58	114.9
Potatoes	113.40	107.5
Snap Beans (fresh)	74.89	112.4
Snap Beans (processed)	71.69	119.0
Spinach (fresh)	58.82	123.5

APPENDIX TABLE VI (Continued)

Commodity	Annual as Percent Of Annual Estimated From Weekly Consumption	Farm Weight of Foods as Percent Of Retail Weight
Vegetables (Continued)		
Spinach (processed)	240.98	140.8
Sweet Corn (fresh)	86.80	116.3
Sweet Corn (processed)	81.60	188.7
Sweet Potatoes	200.53	116.3
Tomatoes (fresh)	159.87	133.3
Tomatoes (processed)	86.11	79.4
Other		
Fish	51.00	-
Shortening	81.56	-
Margarine	81.00	-
Other Oils	95.28	-
Cereal and Bakery Products	79.83	-
Sugar and Sirup	221.99	-
Beverages	107.38	-
Dry Beans, Peas, and Nuts	122.94	-

APPENDIX TABLE VII

PRODUCTION-PURCHASED CONSUMPTION BALANCE OF THIRTY-NINE SELECTED FOOD COMMODITIES, 1955-57 ANNUAL AVERAGE, THIRTEEN SOUTHERN STATES

State		Beef and Veal	Chicken	Lamb and Mutton	Pork	Turkey
		- 1000 lbs. Liveweight -				
Alabama	Production	438,163	274,885	3,329	289,899	3,781
	Surplus	51,601	192,267	-4,192	15,415	-4,012
Arkansas	Production	401,105	216,492	2,614	133,732	34,454
	Surplus	188,294	170,557	-1,643	-19,916	30,046
Florida	Production	328,922	46,133	307	100,520	3,691
	Surplus	-219,278	-66,671	-9,251	-264,526	-6,209
Georgia	Production	326,482	717,917	1,937	412,811	6,354
	Surplus	-152,293	617,081	-7,003	81,120	-2,904
Kentucky	Production	471,815	68,508	41,705	383,894	6,111
	Surplus	92,178	-12,343	34,390	115,945	-1,466
Louisiana	Production	434,572	56,981	2,476	96,947	1,204
	Surplus	48,342	-24,243	-4,702	-169,957	-6,233
Mississippi	Production	539,208	169,435	3,327	160,010	2,933
	Surplus	293,492	115,547	-1,803	-22,227	-2,380
North Carolina	Production	184,943	330,861	2,765	376,080	24,720
	Surplus	-372,472	212,724	-7,827	-14,168	13,748
Oklahoma	Production	1,036,105	37,191	12,792	156,929	15,109
	Surplus	738,776	-24,530	7,471	-44,063	9,597
South Carolina	Production	123,301	55,569	350	150,721	21,153
	Surplus	-159,821	-5,429	-5,282	-53,027	15,318
Tennessee	Production	402,710	81,117	18,033	387,296	3,411
	Surplus	-33,238	-11,284	9,746	82,070	-5,172
Texas	Production	2,393,207	316,669	130,402	305,236	72,946
	Surplus	1,157,677	61,875	108,718	-520,642	50,485
Virginia	Production	327,270	206,269	21,505	207,839	75,072
	Surplus	-170,390	103,001	12,608	-128,398	65,857

APPENDIX TABLE VII (Continued)

State		Butter	Eggs	Fluid Milk and Cream	Proc. Dairy Products	Apples, Fresh
		1000 lbs.	Mil.	- Mil. lbs. -		1000 lbs.
Alabama	Production	-	814	527	80	-
	Surplus	-9,455	123	-240	-790	-60,798
Arkansas	Production	4,398	587	443	429	10,898
	Surplus	-815	205	30	-56	-23,076
Florida	Production	-	565	933	-	-
	Surplus	-13,628	-396	-258	-1,180	-80,939
Georgia	Production	191	1,256	733	27	-
	Surplus	-11,541	407	-251	-1,032	-73,597
Kentucky	Production	16,864	1,063	949	1,061	9,225
	Surplus	7,581	386	189	210	-50,156
Louisiana	Production	223	373	618	-	-
	Surplus	-9,247	-311	-179	-853	-59,226
Mississippi	Production	5,411	621	616	365	-
	Surplus	-639	176	155	-205	-40,168
North Carolina	Production	2,292	1,645	868	144	42,248
	Surplus	-11,348	653	-260	-1,099	-44,289
Oklahoma	Production	25,033	833	1,075	263	-
	Surplus	17,695	309	442	-384	-44,607
South Carolina	Production	147	532	330	64	-
	Surplus	-6,782	24	-222	-579	-45,070
Tennessee	Production	10,941	961	814	1,019	11,446
	Surplus	273	185	-68	47	-56,239
Texas	Production	6,354	2,289	2,244	109	-
	Surplus	-24,303	119	-427	-2,558	-183,186
Virginia	Production	6,288	832	1,147	396	193,007
	Surplus	-5,996	-44	87	-686	118,379

APPENDIX TABLE VII (Continued)

State		Apples, Proc.	Avocados	Grapefruit	Lemons and Limes	Oranges
				- 1000 lbs. -		
Alabama	Production	-	-	-	-	-
	Surplus	-11,960	-332	-27,034	-19,960	-73,059
Arkansas	Production	2,014	-	-	-	-
	Surplus	-4,259	-188	-14,662	-10,970	-40,888
Florida	Production	-	26,600	2,848,000	30,640	7,994,970
	Surplus	-21,022	26,179	2,806,199	1,462	7,903,699
Georgia	Production	-	-	-	-	-
	Surplus	-16,003	-393	-34,411	-24,890	-87,381
Kentucky	Production	1,863	-	-	-	-
	Surplus	-10,092	-322	-26,702	-19,624	-71,248
Louisiana	Production	-	-	-	-	15,480
	Surplus	-13,025	-470	-26,858	-20,105	-54,671
Mississippi	Production	-	-	-	-	-
	Surplus	-6,722	-225	-16,808	-12,671	-48,172
North Carolina	Production	8,776	-	-	-	-
	Surplus	-9,237	-467	-39,565	-28,875	-103,433
Oklahoma	Production	-	-	-	-	-
	Surplus	-10,808	-240	-22,126	-15,656	-51,566
South Carolina	Production	-	-	-	-	-
	Surplus	-8,412	-248	-19,547	-14,590	-54,285
Tennessee	Production	2,378	-	-	-	-
	Surplus	-11,708	-365	-30,947	-22,586	-80,882
Texas	Production	-	-	226,640	-	155,970
	Surplus	-46,724	-955	133,046	-65,559	-52,098
Virginia	Production	46,753	-	-	-	-
	Surplus	28,638	-391	-37,051	-26,208	-86,245

APPENDIX TABLE VII (Continued)

State		Peaches, Fresh	Peaches, Proc.	Straw-berries, Fresh	Melons	Broc-coli, Fresh	Broc-coli, Proc.
		- 1000 lbs. -			1000 cwt.	-1000 lbs.-	
Alabama	Production	7,174	9,242	1,205	1,812	-	-
	Surplus	-7,740	-9,956	-1,058	423	-146	-3,119
Arkansas	Production	23,752	29,864	7,235	1,105	-	-
	Surplus	15,313	19,268	6,032	319	-83	-1,580
Florida	Production	-	-	5,540	7,835	-	-
	Surplus	-18,952	-26,961	1,735	6,070	-186	-6,130
Georgia	Production	23,461	31,355	-	5,181	-	-
	Surplus	5,739	7,670	-2,975	3,530	-174	-4,374
Kentucky	Production	2,255	2,929	6,343	-	-	-
	Surplus	-12,247	-15,908	4,087	-1,351	-142	-3,155
Louisiana	Production	1,394	1,870	10,385	347	-	-
	Surplus	-12,840	-17,230	7,967	-979	-140	-3,573
Mississippi	Production	5,175	6,249	-	1,089	-	-
	Surplus	-4,995	-6,037	-1,317	142	-100	-1,591
North Carolina	Production	16,941	22,275	2,003	837	-	-
	Surplus	-4,063	-5,348	-1,372	-1,120	-206	-4,828
Oklahoma	Production	1,649	2,287	888	898	-	-
	Surplus	-8,900	-12,369	-1,087	-85	-103	-3,080
South Carolina	Production	61,887	78,129	82	2,653	34	666
	Surplus	50,719	64,039	-1,526	1,613	-75	-1,468
Tennessee	Production	3,256	4,280	8,265	-	-	-
	Surplus	-13,172	-17,323	5,624	-1,530	-161	-3,776
Texas	Production	9,240	13,080	1,052	6,102	345	11,155
	Surplus	-33,754	-47,719	-7,424	2,097	-78	-2,390
Virginia	Production	22,672	31,568	4,459	316	166	5,034
	Surplus	5,032	7,040	1,151	-1,327	-6	-130

APPENDIX TABLE VII (Continued)

State		Cabbage	Carrots	Celery	Cucumbers	Lettuce and Escarole
			- 1000 lbs. -			
Alabama	Production	9,400	-	-	3,600	-
	Surplus	-27,887	-14,811	-21,776	-5,933	-55,392
Arkansas	Production	-	-	-	1,500	-
	Surplus	-21,001	-8,168	-11,916	-3,758	-30,344
Florida	Production	283,000	-	403,500	155,800	107,300
	Surplus	234,663	-20,897	371,928	142,272	27,313
Georgia	Production	57,500	-	-	3,800	3,600
	Surplus	12,867	-18,307	-27,200	-8,009	-65,486
Kentucky	Production	1,800	-	-	-	-
	Surplus	-34,518	-14,540	-21,433	-9,363	-54,494
Louisiana	Production	31,700	-	-	6,100	-
	Surplus	-4,177	-14,766	-21,941	-3,426	-55,781
Mississippi	Production	35,000	-	-	-	-
	Surplus	9,863	-9,449	-13,627	-6,056	-34,760
North Carolina	Production	114,000	-	-	29,300	10,400
	Surplus	61,272	-21,332	-31,556	15,549	-69,806
Oklahoma	Production	-	-	-	-	-
	Surplus	-26,778	-11,346	-17,038	-7,336	-43,209
South Carolina	Production	40,900	-	-	22,500	5,000
	Surplus	13,083	-10,861	-15,871	15,519	-35,409
Tennessee	Production	22,100	-	-	-	-
	Surplus	-19,142	-16,683	-36,819	-10,752	-62,721
Texas	Production	207,500	340,200	-	5,900	180,100
	Surplus	97,972	293,091	-71,059	-24,595	6
Virginia	Production	47,800	-	-	19,500	-
	Surplus	3,014	-18,991	-28,521	7,220	-72,329

APPENDIX TABLE VII (Continued)

State		Lima Beans, Proc.	Onions and Shallots	Peppers	Potatoes	Snap Beans, Fresh
			- 1000 lbs. -		Mil. lbs.	1000 lbs.
Alabama	Production	-	-	-	188	5,300
	Surplus	-7,765	-26,299	-5,022	-67	-16,937
Arkansas	Production	-	-	-	55	2,000
	Surplus	-4,274	-14,881	-2,764	-88	-10,407
Florida	Production	-	-	115,700	682	180,800
	Surplus	-10,940	-33,419	108,574	361	150,860
Georgia	Production	-	8,500	-	25	11,200
	Surplus	-9,610	-22,750	-6,224	-279	-15,797
Kentucky	Production	-	-	-	98	-
	Surplus	-7,623	-25,571	-4,936	-150	-21,736
Louisiana	Production	-	17,400	7,700	38	10,200
	Surplus	-7,751	-7,700	2,679	-206	-11,533
Mississippi	Production	-	-	3,200	40	8,000
	Surplus	-4,937	-17,933	7	-130	-6,634
North Carolina	Production	-	2,000	19,700	340	43,700
	Surplus	-11,192	-35,037	12,456	-20	11,999
Oklahoma	Production	-	-	-	25	-
	Surplus	-5,954	-18,602	-3,865	-155	-16,436
South Carolina	Production	-	-	-	67	18,800
	Surplus	-5,686	-19,693	-3,679	-123	2,337
Tennessee	Production	-	-	-	83	5,300
	Surplus	-8,754	-28,969	-5,666	-199	-19,495
Texas	Production	-	93,800	19,000	159	3,600
	Surplus	-24,689	17,988	2,929	-572	-64,085
Virginia	Production	195,300	1,900	4,000	368	26,600
	Surplus	185,336	-29,207	-2,471	66	-900

APPENDIX TABLE VII (Continued)

State		Snap Beans, Proc.	Spinach, Fresh	Spinach, Proc.	Sweet Corn, Fresh	Sweet Corn, Proc.
		tons	1000 cwt.	tons	tons	1000 lbs.
Alabama	Production	-	-	-	7,250	-
	Surplus	-6,117	-20	-2,225	-6,892	-31,251
Arkansas	Production	4,700	56	8,180	2,350	-
	Surplus	1,282	45	6,990	-5,394	-17,523
Florida	Production	19,707	-	1,233	159,350	-
	Surplus	11,510	-30	-2,398	138,342	-41,610
Georgia	Production	-	-	-	3,600	-
	Surplus	-7,413	-25	-2,893	-14,138	-37,723
Kentucky	Production	-	-	-	2,400	-
	Surplus	-5,976	-20	-2,208	-11,522	-30,498
Louisiana	Production	303	-	-	-	-
	Surplus	-5,664	-20	-2,346	-14,336	-30,352
Mississippi	Production	667	18	-	-	-
	Surplus	-3,372	5	-1,320	-8,895	-20,842
North Carolina	Production	6,667	-	-	16,000	-
	Surplus	-2,044	-29	-3,293	-4,525	-44,395
Oklahoma	Production	3,567	19	10,900	2,350	-
	Surplus	-938	3	9,000	-8,879	-22,874
South Carolina	Production	933	15	-	2,850	-
	Surplus	-3,600	0	-1,592	-7,457	-23,227
Tennessee	Production	11,267	-	-	-	-
	Surplus	4,453	-23	-2,579	-15,977	-34,723
Texas	Production	10,900	399	5,567	13,350	-
	Surplus	-7,635	333	-2,540	-33,804	-94,090
Virginia	Production	5,533	191	-	8,700	-
	Surplus	-2,003	164	-3,183	-10,096	-38,265

APPENDIX TABLE VII (Continued)

State		Sweet Potatoes	Tomatoes, Fresh	Tomatoes, Proc.
			- 1000 cwt. -	
Alabama	Production	790	303	-
	Surplus	375	-991	-233
Arkansas	Production	304	214	161
	Surplus	69	-503	34
Florida	Production	126	6,092	971
	Surplus	-401	4,306	616
Georgia	Production	748	501	-
	Surplus	255	-1,111	-295
Kentucky	Production	289	37	97
	Surplus	-114	-1,230	-133
Louisiana	Production	4,973	44	-
	Surplus	4,577	-1,234	-239
Mississippi	Production	1,082	72	-
	Surplus	799	-765	-145
North Carolina	Production	2,502	120	-
	Surplus	1,918	-1,734	-340
Oklahoma	Production	127	-	7
	Surplus	-166	-975	-182
South Carolina	Production	1,028	222	67
	Surplus	718	-731	-102
Tennessee	Production	666	252	13
	Surplus	209	-1,198	-253
Texas	Production	1,260	1,455	856
	Surplus	65	-2,577	61
Virginia	Production	1,511	473	963
	Surplus	1,021	-1,158	647

VITA

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