Outlook for the Arizona orange industry

OUTLOOK FOR THE ARIZONA ORANGE INDUSTRY

by

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ABSTRACT

Domestic consumption of oranges, in per capita terms, has shown a downward trend since World War II. Orange prices have exhibited a similar secular decline which, for producer's profitability, is unfavorable. Understanding the factors which influence Arizona orange prices would be of distinct importance to the industry. The purposes of this thesis are to determine the factors which affect Arizona orange prices and to develop supply relationships such that price forecasts may be made and evaluated in the light of the possible future returns to Arizona orange producers. These purposes were not completely fulfilled due to difficulties in estimating the supply relationships.

Several factors are suggested as important variables influencing Arizona Valencia orange prices. These variables include: the quantities of oranges produced in Arizona and in other producing areas (both aggregate and varietal production), the general level of economic activity, the production of substitute products, population, and trend. On the supply side, several variables are suggested as relevant: a measure of producer profitability, trend, a dummy variable to account for random influences due to weather, and a measure of input costs.

Using the single-equation method of least-squares multiple regression, demand equations for free-on-board, on-tree, and packinghouse door prices are developed, as are supply equations for the various producing areas. This forecasting model presupposes producer responses to price, cost, and output changes which can be analyzed within the framework of "The Cobweb Theorem."

CHAPTER I

INTRODUCTION

The agricultural industry of the United States has often been considered the major industry operating under conditions approaching "pure competition." The agricultural firm exists and operates under conditions which are largely controlled by external forces; hence, the firm's profitability and at times, its very survival, depend upon such factors as: product and input prices, consumer preferences, technology, government policies, and weather conditions which are continually in a state of flux and are generally little affected by the actions of the agricultural firm. The successful firm must then adjust to these external factors. Decisions made in response to external changes can be most effective if there is reliable knowledge concerning the future behavior of key variables and of the relationships connecting them. Since commodity price is often the principal variable to which the firm adjusts, the relationship of price to other factors and the possible future level of price are of particular importance.

The need for knowledge as to the future price is of considerable importance to orchard crops. These crops are characterized by a substantial lag between the decision to

invest and the marketing of the product. It is the purpose of this thesis to investigate the factors influencing price and to determine what future values this important decision variable is likely to assume.

Background on Orange Production in Arizona

Two areas of the state comprise the principal citrus production areas. These are the Salt River Valley area near Phoenix in Maricopa County, and the Yuma area located near the city of Yuma in Yuma County.

The first commercial groves were established in Arizona during the 1890's. These groves consisted of some 500 acres of oranges in the Salt River Valley which were destroyed by a severe freeze in 1913. There were about 2,000 commercial acres of citrus in the Salt River Valley by 1925 with nearly a third of this acreage consisting of orange trees. The first commercial citrus in Yuma County was planted in the mid-1920's. There are small groves of citrus in Pima and Pinal Counties presently, but these groves comprise a very small percentage of total commercial acreage in Arizona.

By 1940, Arizona commercial orange acreage had grown to slightly over 7,000 acres. Ninety-five per cent of this acreage was located in the Salt River Valley. The next two decades witnessed a decline in acreage in the state and a shift in emphasis from Maricopa to Yuma County. The 1960's

have been characterized by a tremendous increase in total bearing orange acreage, nearly doubling in the six years from 1960 to 1966. In 1966 there were slightly over 14,000 bearing acres of oranges in the state, with 60 per cent of this total located in Yuma County. The existence of nearly 9,000 acres of non-bearing trees in Arizona suggests a continued rapid expansion in bearing acres and in orange production.

The average annual revenue to Arizona orange producers (based on on-tree returns) for the period of analysis 1946-66[1] averaged slightly higher than three and one-half million dollars per annum.[2]

Table 1 presents a tabular display of Arizona orange revenue since the 1940-41 season. Total revenue from orange sales attributed to the fresh product has exhibited a downward trend secularly. For the 1940-45 period, the average was 96.8 per cent of total revenue from fresh sales. This average for the 1961-66 period fell to 87.7 per cent of

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1. The bulk of the work on this thesis was completed during the summer of 1967 at The University of Arizona at Tucson. The publication date reflects certain personal delays resulting in the review and final approval of the rough draft being completed in St. Louis, Missouri, in late 1971. Any discrepancies that are noted in the data result from this lag and any revisions that were made in the raw data after 1967.

2. Estimated from data found in United States Department of Agriculture, Statistical Reporting Service, Citrus Fruits by States, 1909-10--1965-66, Production, Use, Value, Statistical Bulletin #380, Washington, D. C., 1967.

Table 1. Total Revenue from Oranges in Arizona: 1940-41 through 1965-66 Seasons

Season	Fresh	Processed	Total	Per Cent Sold Fresh
	----------Dollars----------			-Per Cent-
1940-41	485,480	17,380	502,860	96.5
1941-42	653,000	5,610	658,610	99.1
1942-43	1,570,800	127,820	1,698,620	92.5
1943-44	2,564,520	64,260	2,628,780	97.6
1944-45	3,019,300	48,750	3,068,050	98.4
1945-46	3,534,520	113,050	3,647,570	96.9
1946-47	2,853,200	87,560	2,940,760	97.0
1947-48	883,570	41,140	924,710	95.6
1948-49	1,602,040	64,680	1,666,720	96.1
1949-50	600,060	239,850	839,910	71.4
1950-51	3,201,330	122,550	3,323,880	96.3
1951-52	2,030,130	52,540	2,082,670	97.5
1952-53	1,617,000	63,840	1,680,840	96.2
1953-54	2,443,050	153,700	2,596,750	94.1
1954-55	1,806,750	279,300	2,086,050	86.6
1955-56	3,204,240	149,640	3,353,880	95.5
1956-57	3,149,990	126,720	3,276,710	96.1
1957-58	5,993,260	173,010	6,166,270	97.2
1958-59	2,190,640	42,120	2,232,760	98.1
1959-60	4,238,500	223,270	4,461,770	95.0
1960-61	4,807,600	185,900	4,993,500	96.3
1961-62	5,860,400	389,690	6,250,090	93.8
1962-63	4,427,140	686,960	5,114,100	86.6
1963-64	6,138,000	1,075,900	7,213,900	85.1
1964-65	5,205,060	643,080	5,848,140	89.0
1965-66	3,818,430	717,120	4,535,550	84.2

Sources: United States Department of Agriculture, Statistical Reporting Service, Prices Received by Farmers, Citrus Fruits, Noncitrus Fruits, Tree Nuts; Agricultural Prices; Citrus Fruits by States, 1909-10--1965-66, Production, Use, Value, Washington, D. C., various annual issues.

total revenue. These percentages are particularly relevant when, for the same two five-season periods, the percentage of volume sold fresh has gone from 91.5 per cent of total orange production to 69.1 per cent of the total. For the 1940-45 seasons, fresh Valencia sales averaged about 60 per cent of estimated fresh orange revenue with Navels averaging 40 per cent. A nearly 50-50 division for the two varieties of fresh Arizona orange revenue occurred in the 1961-66 average. Navel oranges have increased their share of fresh orange revenue to Arizona producers, despite the dominance of Valencias in fresh Arizona orange sales. Valencias made up 56 per cent of total fresh Arizona sales in the 1961-66 period which is five percentage points above the 1940-45 average of 51 per cent of fresh sales. More and more Arizona oranges are being processed than ever before in the twenty-year statistical history considered. The importance of the fresh orange market to Arizona producers remains considerable, despite a trend toward processed disposal.

Of the four major orange-producing states (Florida, California, Arizona, and Texas), Arizona ranks third in the production of oranges. Arizona production ranked fourth through the 1961-62 season when Texas production began to fall sharply due largely to inclimate weather. Arizona production accounts for a little over 1.5 per cent of total U. S. orange production with Florida producing three-quarters of the oranges in the nation.

Arizona oranges comprise nearly twice the total acreage of lemons and grapefruit in the state, and produce a dollar return about equal to the total returns accruing to both lemon and grapefruit sales. Valencia oranges are the predominate variety produced by Arizona groves. This contrasts with the predominance of Navel oranges in U. S. production, since Florida and California both produce slightly more Navel oranges than Valencias. The production of Navel oranges exceeds Valencia output by about 12 million boxes per year in the U. S.

Arizona orange producers market the Valencia and Navel varieties from November through June. Arizona Valencia oranges are marketed between January 20 and June 30. Navel oranges are marketed through the period November 1-March 10. Climatic conditions in the state preclude the production of oranges during the summer months, but the two varieties overlap during the January-March period. California oranges appear on the market throughout the year, due in part to the climatic conditions of South and Central California which permits a nearly continuous stream of fruit throughout the year. California Valencias are marketed during the March 15-December 15 period, while Navels appear between November 5 and June 20.

Previous Research

The literature relating to marketing and price behavior for oranges is not extensive. There are, however, numerous studies dealing with supply and demand, or with demand relationships solely, for several citrus and non-citrus fruits. The study by J. M. Thompson is thorough; however, it was published nearly thirty years ago.[3] Thompson does not generate functional relationships but does describe the orange industry, both domestic and foreign, quite exhaustively.

A more recent study is one completed in 1953 by Sidney Hoos and J. N. Boles.[4] This study concerns itself primarily with the orange industry in California, but the authors also look at the industry in the United States and in Florida. The pre- and postwar periods are scrutinized and demand equations are developed for the periods 1924-1942 and 1945-1950. These regressions are compared to determine what the changes have been in the postwar period. Their statistical results were generally satisfactory, with free-on-board prices for California fresh-winter and

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3. J. M. Thompson, The Orange Industry: An Economic Study, Agricultural Experiment Station Bulletin No. 622 (Berkeley: University of California, College of Agriculture, 1938).

4. Sidney Hoos and J. N. Boles, Oranges and Orange Products: Changing Economic Relationships, Agricultural Experiment Station Bulletin No. 731 (Berkeley: University of California, College of Agriculture, 1953).

fresh-summer oranges as the dependent variables. Supply equations were not generated in this study.

Studies that considered only the supply relationships for oranges were not available. There were, however, several studies which incorporated an analysis of supply into a complete forecasting model. French studied the long-term price and production prospects for apples and C. C. Dennis looked at long-term equilibrium in tart cherries. French and Bressler investigated the demand for and supply of lemons. Edwards and Ricks projected the long-run price and production of Bartlett pears, and Pasour and Mathis developed relationships between profit conditions and the future production of tree fruit commodities for North Carolina apples, using a system of single equations to predict future prices. All of these studies included lagged profits as independent variables in the supply equations.

French developed two supply equations to estimate total United States apple production and total Michigan apple production.[5] The aggregate equation included a five-year average of deflated apple prices lagged eleven years. These equations were utilized with separate demand functions to project United States and Michigan apple prices.

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5. B. C. French, The Long-Term Price and Production Outlook for Apples in the United States and Michigan, Agricultural Experiment Station Bulletin No. 255 (East Lansing: Michigan State University, College of Agriculture, 1956).

Dennis projected Michigan tart cherry production using the number of non-bearing tart cherry trees as a function of the average tart cherry relative price index.[6] He then performed several modifications to his original supply function. He converted the equation to show the number of bearing trees in a future period by multiplication of the function by four. He then multiplied his bearing tree function by the 1951-60 average yield per tree to project total production. A further modification was performed as the price ratios were converted to current prices in the ratio 157.2 to 100.0. This gave the final supply equation: $Q = 209.77 + 2.24P$; where Q equals future annual production of cherries in million pounds and P is the current price per ton. This final function was then combined with a demand equation to project equilibrium prices and quantities in 1980.

French and Bressler projected California lemon production using two equations.[7] They explained both annual planting and the acreage removed each year to get the annual change in bearing acreage. Multiplying by average yield then produced an estimate of production. New plantings were

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6. C. C. Dennis, Long-Run Equilibrium in Tart Cherry Production, Agricultural Experiment Station Bulletin No. 291 (East Lansing: Michigan State University, College of Agriculture, 1963).

7. B. C. French and R. G. Bressler, "The Lemon Cycle," Journal of Farm Economics, XLIV (November, 1962), 1021-36.

explained in terms of long-run profit expectations, bearing acreage over a given age, and new plantings as affected by anticipated tree removal. Tree removals were explained by current profitability, the number of bearing trees over 25 years old, and the acreage needs of urban expansion.

California lemon prices, both fresh and processed, were forecast using per capita sales of both fresh and processed lemons in equations with disposable income and trend variables. These equations assessed both pre- and postwar time periods.

Edwards and Ricks[8] estimated Bartlett pear production using: $Y_t = 10.50 + .16X_{t-1}, + .95Y_{t-1}$, where Y is a four-year moving average of total production, X is a four-year moving average of real on-tree returns per ton, and t is time for the 1919-1962 period. Prices were projected through 1980 using the above function and a demand equation.

The demand relationship was specified as $Y_{1t} = -1.17 - 43.47X_{1t} - 77.60X_{2t} + .98X_{3t} - 46.53X_{4t} + .002X_{5t-1}$; where Y_1 is growers' returns per ton of Pacific coast Bartlett pears; X_1 is Pacific coast Bartlett production per 1,000 persons; X_2 is all Michigan and New York pear production per 1,000 persons; X_3 is real returns from California Cling

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8. J. A. Edwards and D. J. Ricks, Long-Run Projections of Bartlett Pear Prices and Production, Oregon State University Technical Bulletin No. 91 (Corvallis: Oregon State University, College of Agriculture, 1966).

peaches for canning; X_4 is June 1 canned pear stock per capita; X_5 is a two-year average of canned pear exports; t is time.

Pasour and Mathia[9] developed and compared three estimators of the future production of North Carolina apples. These two researchers did not project prices nor did they develop demand relationships. They first considered production projections from a sales-production relationship. The second method used an estimate of the proportional change in the number of bearing trees, from 1954 to 1964, to the proportion of nonbearing trees in the 1954 base period to estimate the production of apples. The third procedure was similar to the second. This technique estimated future production by projecting past planting trends to 1974.

The sales-production function, based on data from 1941 to 1964, was the value of farm level apple sales deflated by the Index of Prices Paid by farmers and used as an indicator of apple profitability. A two-year moving average of apple production and a five-year moving average of the above ratio lagged ten years were used to estimate production in 1974. The second method used to predict 1974 apple production used data from apple tree surveys in 1954 and

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9. E. C. Pasour, Jr., and G. A. Mathia, Estimates of 1974 Apple Production in North Carolina--A Comparison of Three Predictive Procedures, Economic Research Report No. 1 (Raleigh: North Carolina State University, Department of Economics, 1967).

1964. This method required the estimation of the proportional change, from 1954 to 1964, in the number of standard bearing trees to that of non-bearing trees in the 1954 base period. Yields were 1963-65 averages for standard varieties and, for varieties not in production, two different yield levels were used to predict likely levels of apple production. The third technique took expected tree plantings for standard varieties at average planting rates over the last five years. The same method was used for varieties not yet in production, and the yield used in the second method was applied to estimate 1974 apple production.

Procedure

The remainder of this thesis will be organized as follows: Chapter II will deal with a brief description of the production, marketing, and pricing processes relevant to Arizona oranges; Chapter III will describe the data, methods, and results of the statistical analysis of the demand for and supply of Arizona oranges; discuss the statistical data and sources of these data; and the uses and applicability of the data and results. Chapter IV will conclude with a summary of this research and point out areas for possible future research.

CHAPTER II

ARIZONA ORANGE PRICING, MARKETING, AND PRODUCTION

This chapter contains a discussion of the technical, institutional, economic, and organizational conditions under which Arizona orange producers operate. A discussion of the factors important in the determination of Arizona orange prices will be presented, as well as a discussion of those factors considered relevant to the supply analysis. A brief description of each supply region will be presented along with the sources of data for these regions.

Production and Utilization of Oranges in Arizona and the U.S.

Oranges, both Navels and Valencias, are grown primarily in two areas of Arizona. Commercial production takes place in the Salt River Valley area of central Arizona and on the irrigated acreage surrounding the city of Yuma in southwestern Arizona. Of the 20,450 acres of Arizona oranges in 1964, over 12,000 were within Yuma County with 8,000 acres in production in Maricopa County. Virtually all Arizona citrus is produced in these two counties, with the acreage devoted to oranges comprising about sixty per cent of the total acreage in citrus crops. Arizona orange production has grown steadily over the last half decade.

Oranges, although first in acreage in the state, are second to grapefruit in volume.

For the period 1958-59 to 1964-65, production of oranges in Arizona has grown nearly 40 per cent. The 1964-65 season produced 2,420,000 field boxes, each weighing 75 pounds. Average orange production for the 21-year period from 1944-45 to 1964-65 is 1.24 million boxes. This output ranged from a low of 610,000 boxes during the 1958-59 season to a high of 2.4 million boxes for the 1964-65 crop year.

Figure 1 charts orange production by states in millions of 75-pound boxes from 1941-42 to 1965-66. This figure suggests that while total U. S. orange production has trended steadily upward, most of this trend has been accounted for by Florida. Florida orange production has grown from a total that was smaller than California's, in the 1941-45 period, but quickly surpassed California orange output in 1945-46.

The acreage devoted to oranges in Arizona has grown and continues to expand. During the 1961-66 period, nearly 10,000 acres have been added to orange acreage in Arizona. Total Arizona orange production over the ten years 1956-66 averaged 1.3 per cent of U. S. total citrus production. This percentage has grown steadily and, for the five-year period 1961-66, averaged 1.6 per cent of U. S. citrus production.

Figure 1. Total Orange Production by States and United States, 1941-42 to 1965-66

Source: United States Department of Agriculture, Statistical Reporting Service, Citrus Fruits by States, 1909-10--1965-66, Production, Use, Value, Statistical Bulletin No. 380, Washington, D. C., 1967.

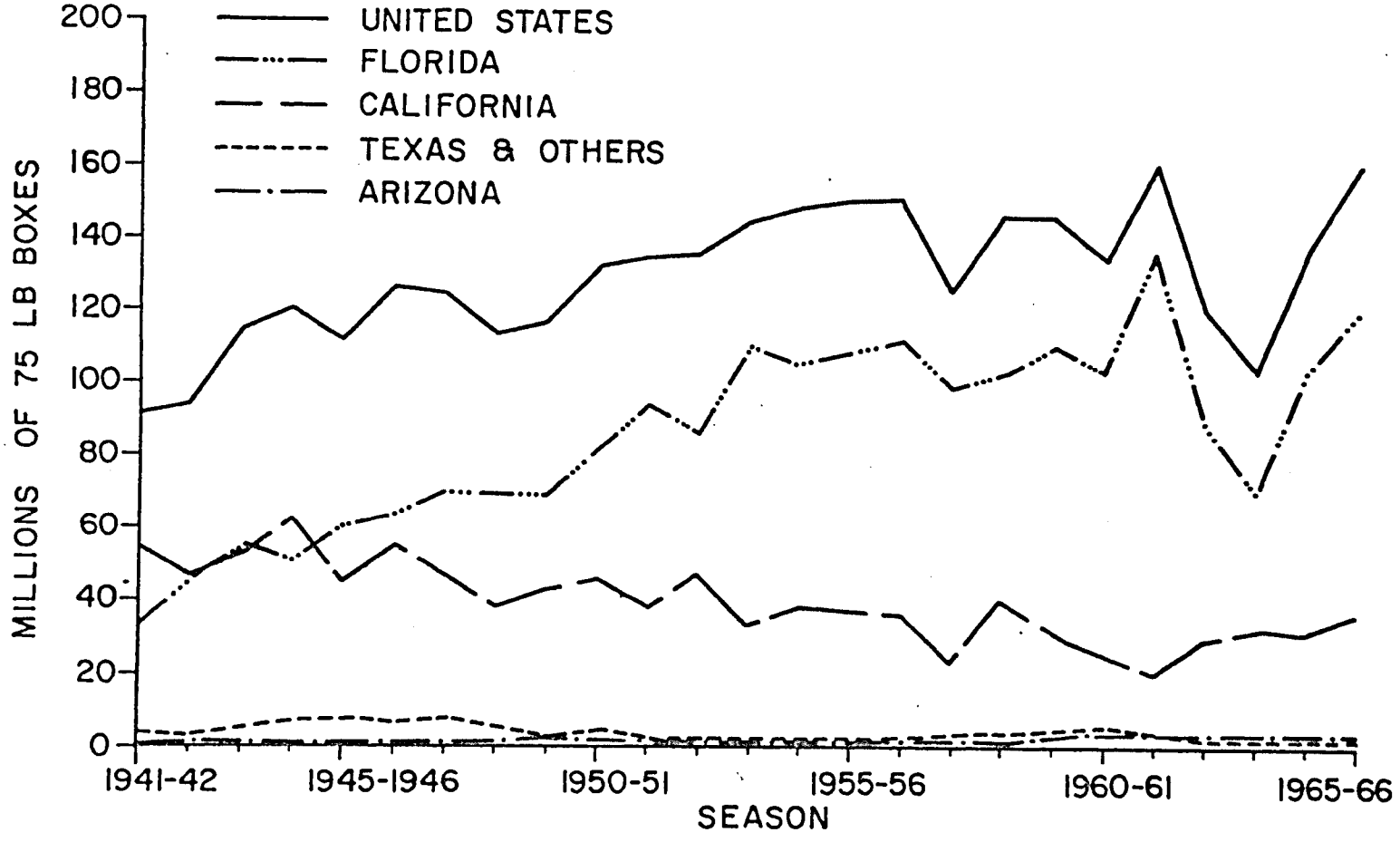

Figure 1. Total Orange Production by States and United States, 1941-42 to 1965-66

Figure 2 charts the volume of fresh sales by state and variety from 1945-46 through 1965-66. Several provocative observations can be made from this figure. The volume of fruit sold fresh in Arizona has trended upward secularly regardless of variety, while the opposite is true for California and Florida fresh sales. Additionally, the volume of Valencia oranges sold fresh from Arizona groves is generally larger than the volume of Navel oranges sold fresh. This observation is also true of California fresh sales, while Florida has the opposite situation. Figures 1 and 2 suggest that while orange production in Arizona and Florida has grown over time, much of this additional production has gone into non-fresh outlets, particularly in Florida.

Figure 3 charts the percentage of the total orange output of Arizona, California, and Florida that was sold in fresh form from 1945-46 to 1965-66. With the exception of Florida, the percentage of the crop sold in fresh outlets has declined relatively slowly over time. Only since about the end of the 1950's has the percentage diverted into non-fresh markets taken a substantial upward direction. Arizona and California produce much of their orange crop for fresh markets.

Figures 4 and 5 display by state and variety the percentage of each variety that is sold in fresh markets. Valencia oranges (Figure 4) demonstrate a much wider

Figure 2. Fresh Orange Sales by States and Variety: 1945-46 through 1965-66

Note: Texas varietal breakdown not available.

Source: United States Department of Agriculture, Statistical Reporting Service, Citrus Fruits by States, 1909-10--1965-66, Production, Use, Value, Statistical Bulletin No. 380, Washington, D. C., 1967.

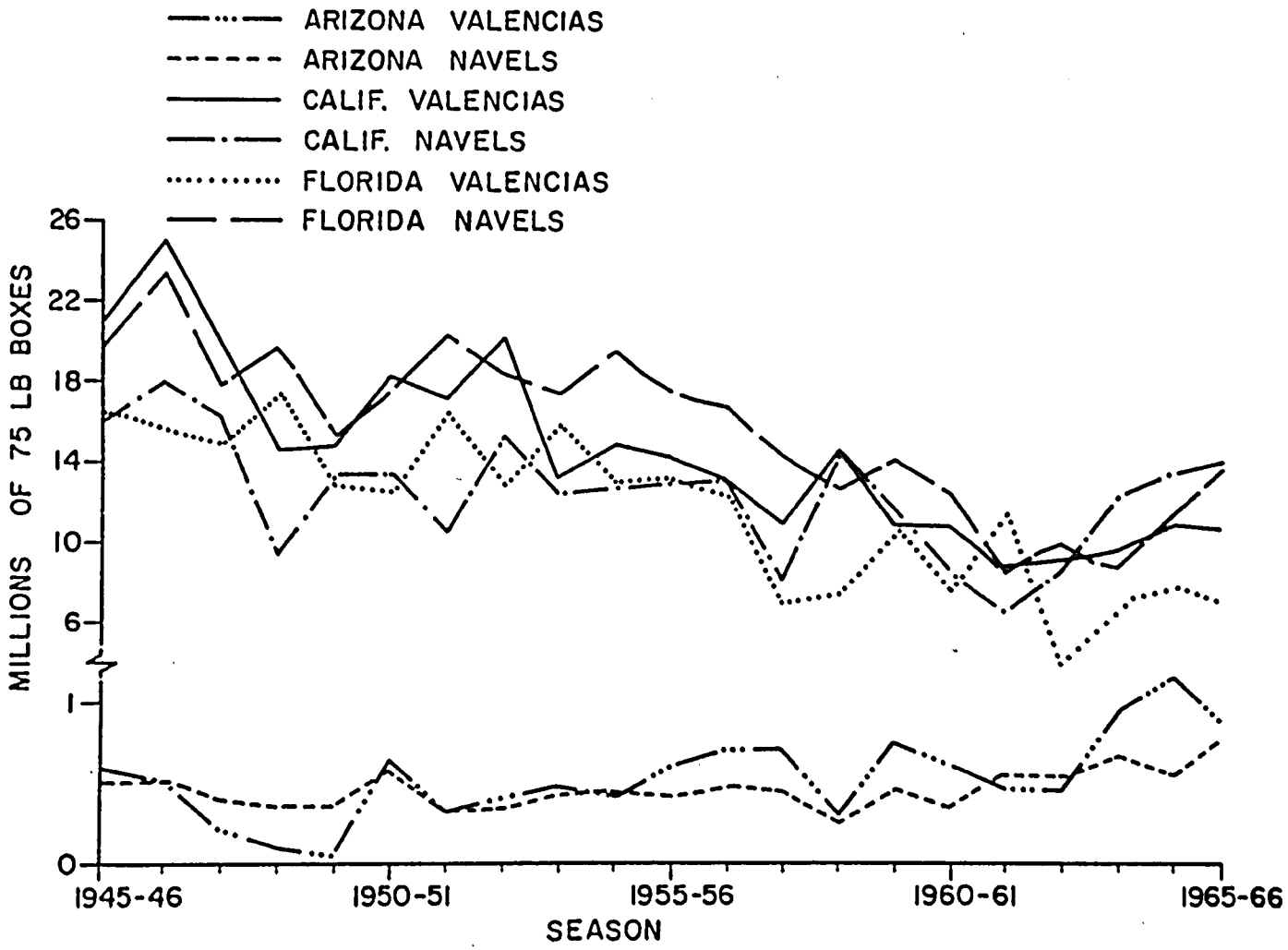

Figure 2. Fresh Orange Sales by States and Variety: 1945-46 through 1965-66

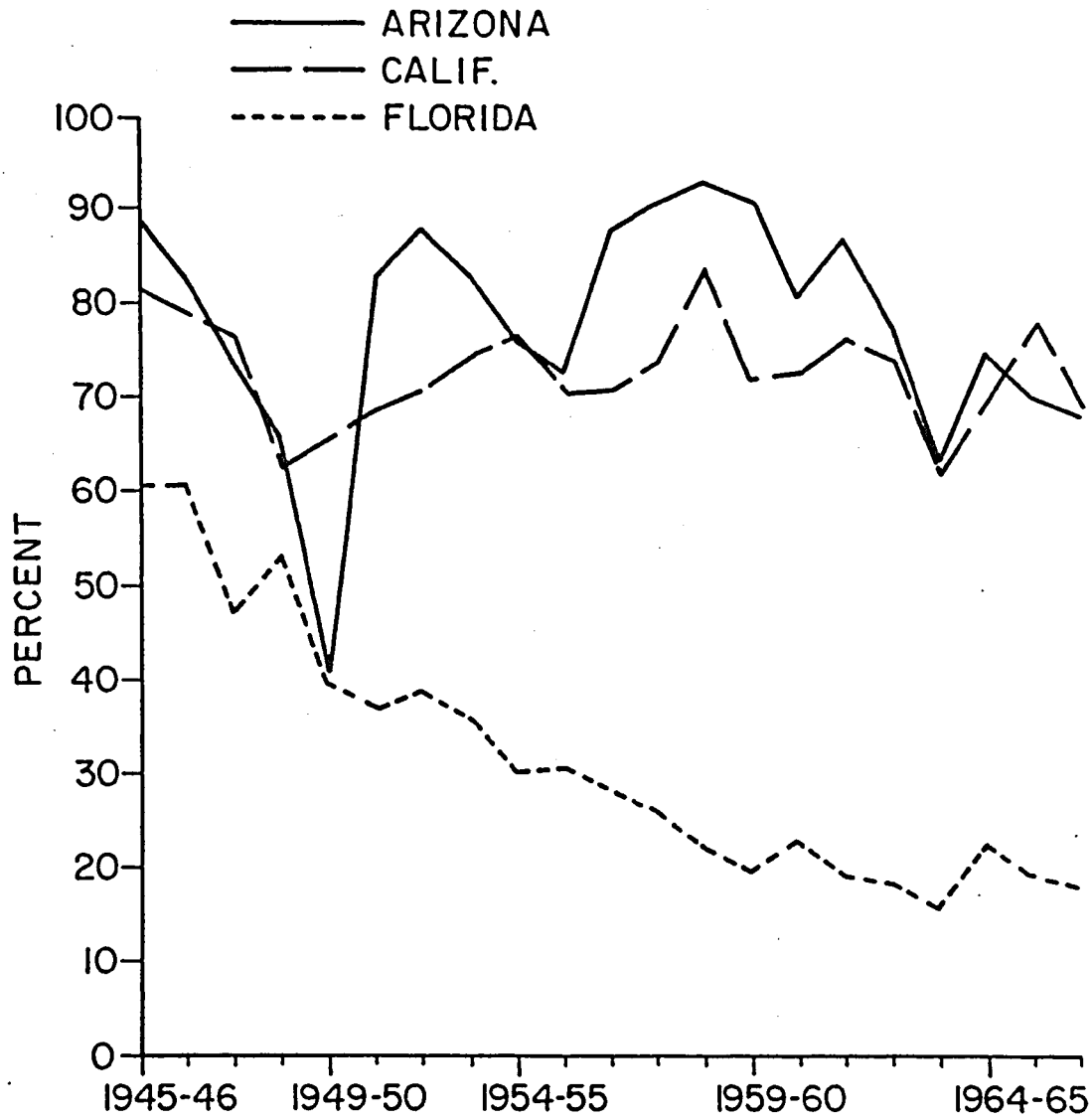

Figure 3. Percentage of State Orange Production Sold Fresh; Arizona, California, and Florida

Source: Calculated from United States Department of Agriculture, Statistical Reporting Service, Citrus Fruits by States, 1909-10--1965-66, Production, Use, Value, Statistical Bulletin No. 380, Washington, D. C., 1967.

Figure 4. Percentage of Valencia Oranges Sold Fresh; Arizona, California, Florida, 1945-46 through 1965-66

Source: Calculated from United States Department of Agriculture, Statistical Reporting Service, Citrus Fruits by States, 1909-10--1965-66, Production, Use, Value, Statistical Bulletin No. 380, Washington, D. C., 1967.

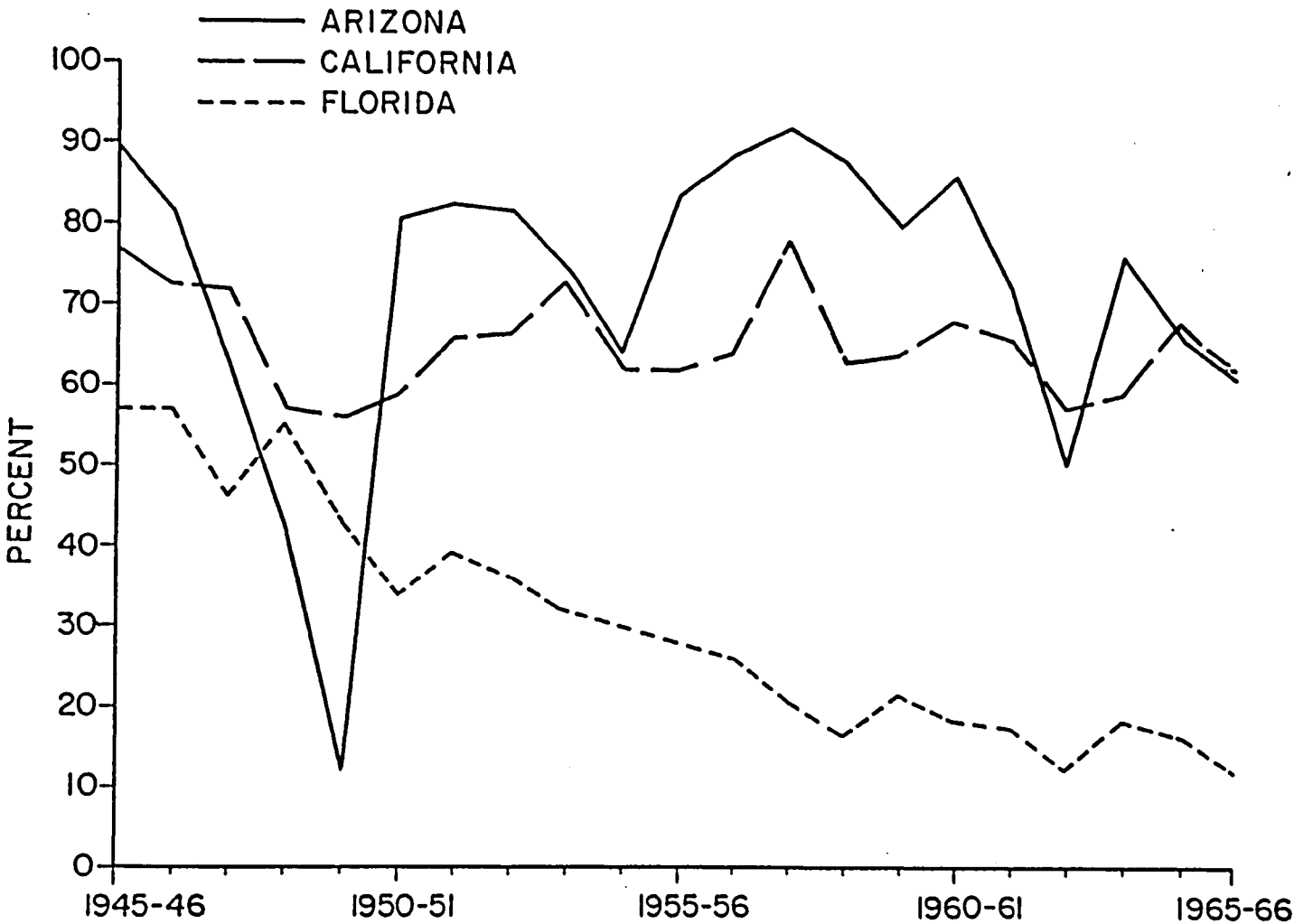

Figure 4. Percentage of Valencia Oranges Sold Fresh; Arizona, California, Florida, 1945-46 through 1965-66

Figure 5. Percentage of Navel Oranges Sold Fresh; Arizona, California, Florida, 1945-46 through 1965-66

Source: Calculated from United States Department of Agriculture, Statistical Reporting Service, Citrus Fruits by States, 1909-10--1965-66, Production, Use, Value, Statistical Bulletin No. 380, Washington, D. C., 1967.

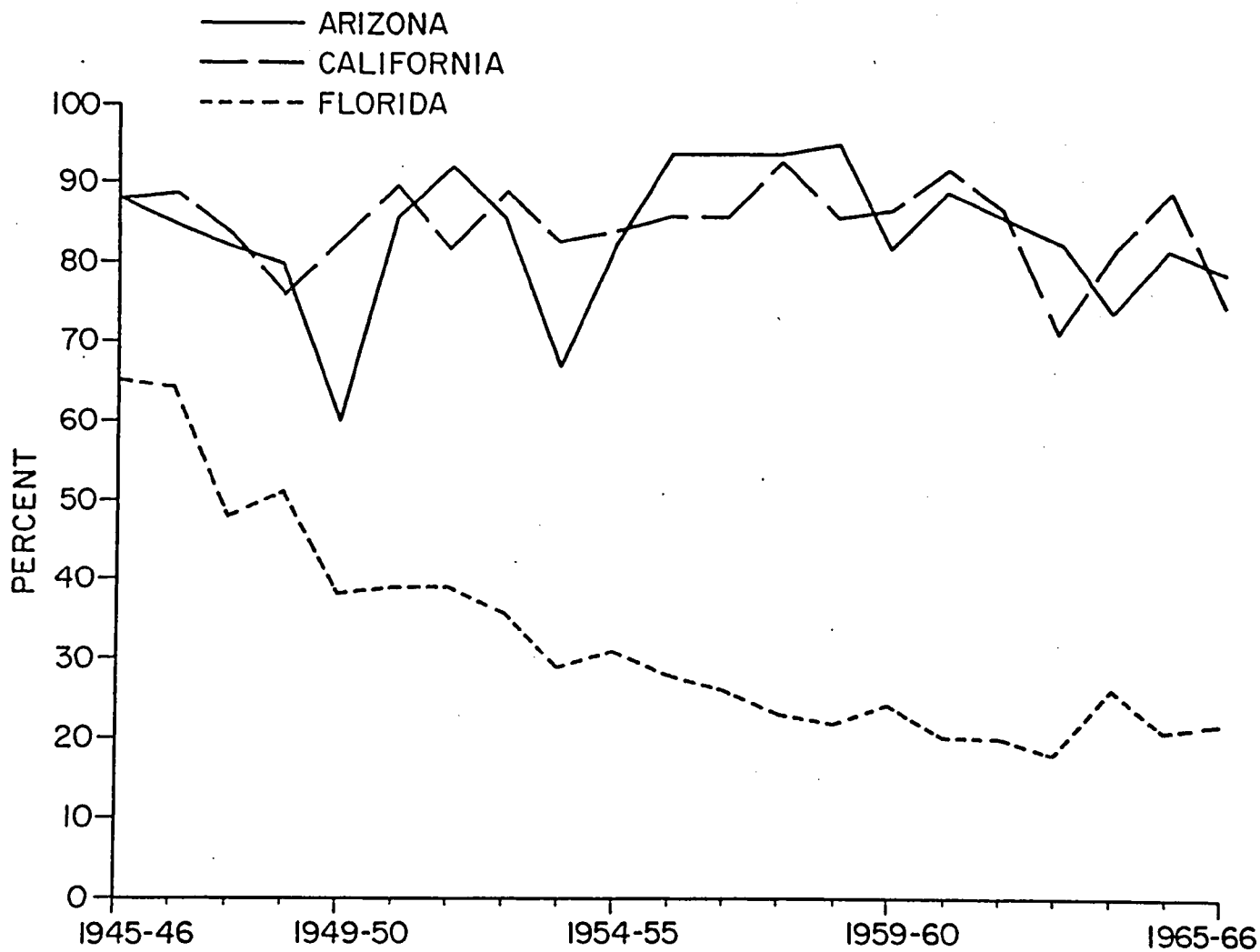

Figure 5. Percentage of Navel Oranges Sold Fresh; Arizona, California, Florida, 1945-46 through 1965-66

variation in this percentage than have Navel oranges (Figure 5). Over time, a larger percentage of the Navel oranges produced have gone to fresh markets, while an increasing share of total Valencia output has been diverted into processed markets in Arizona, California, and Florida. The negative trend in the percentage of both Valencia and Navel oranges sold fresh in Florida is quite prominent. Relatively, the percentage of Florida Valencias sold fresh has declined more than has Florida fresh Navel orange sales.

The Arizona orange crop includes Valencia and Navel types with the former comprising about 58 per cent of the total. Nearly 1.3 million boxes of Valencias were produced in 1964-65 against 930,000 boxes of Navels. Of these quantities, 966,000 boxes of Valencias were sold as fresh fruit, and 684,000 boxes of Navels were sold in fresh form. The proportion of the total orange crop sold as fresh fruit in Arizona averaged 74 per cent in 1964-65. During this same production season, 45,499,000 boxes of oranges were sold as fresh fruit in the United States. Arizona's share of these total fresh sales was about 3.7 per cent in the 1964-65 production season. Arizona's total orange output was about 2 per cent of total United States orange production.

Arizona's commercial orange production begins in early November and terminates in late June. There are two periods of peak production. The first peak occurs in

December with production then falling off to a low point in January and February. Subsequent to this low production period, output rises until a peak period in April is attained with output then declining rather sharply as the summer season approaches. During the summer and early fall months, orange production in Arizona is close to a zero level. Truck shipments comprise about 60 per cent of all Arizona citrus shipments.

Figures 6 and 7 chart the monthly percentage of annual fresh shipments from the Arizona-California desert orange area by variety. Over the 1954-55 through 1965-66 season the highest average percentage was in May (16.5 per cent of total shipments) in the case of Valencias and for Navel oranges 19.5 per cent of yearly shipments were made in March.

The most recent five-year average is plotted on Figures 6 and 7 along with the 1954-66 average. Inspection of Figure 6 suggests that relatively more fresh Arizona-California Valencia oranges are being shipped in May and September of each year, while relatively fewer fresh Valencias are shipped during June, July, and August.

Orange Consumption Trends

Arizona oranges, as well as California desert oranges, possess characteristics which differentiate them from oranges grown in a nondesert environment. Desert

Figure 6. Percentage Distribution of Arizona-California Fresh Valencia Orange Shipments, by Months

Note: Zero is less than 0.1%.

Source: Calculated from United States Department of Agriculture, Statistical Reporting Service, Citrus Fruits by States, 1909-10--1965-66, Production, Use, Value, Statistical Bulletin No. 380, Washington, D. C., 1967.

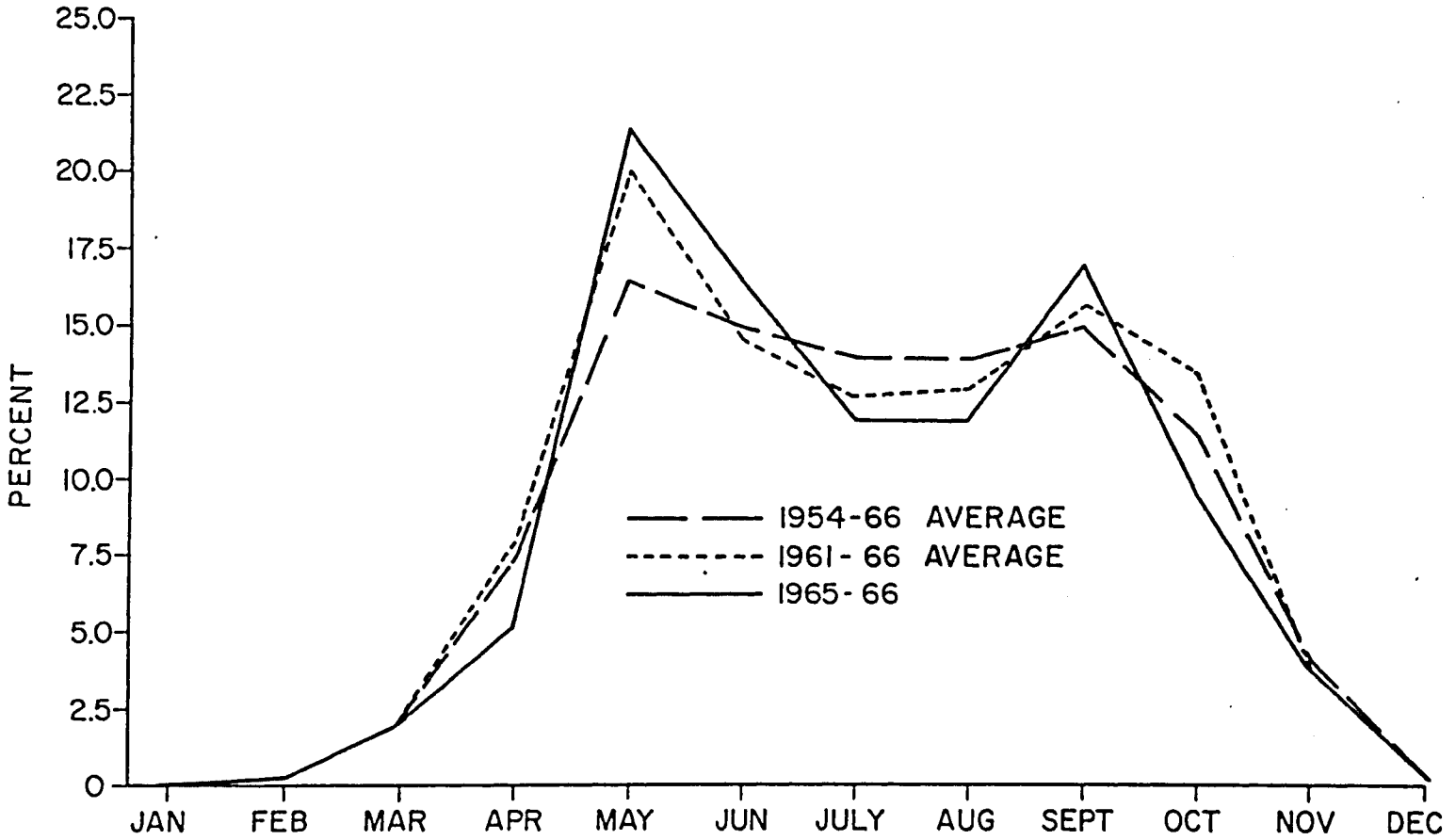

Figure 6. Percentage Distribution of Arizona-California Fresh Valencia Orange Shipments, by Months

Figure 7. Percentage Distribution of Arizona-California Fresh Navel Orange Shipments, by Months

Note: Zero is less than 0.1%.

Source: Calculated from United States Department of Agriculture, Statistical Reporting Service, Citrus Fruits by States, 1909-10--1965-66, Production, Use, Value, Statistical Bulletin No. 380, Washington, D. C., 1967.

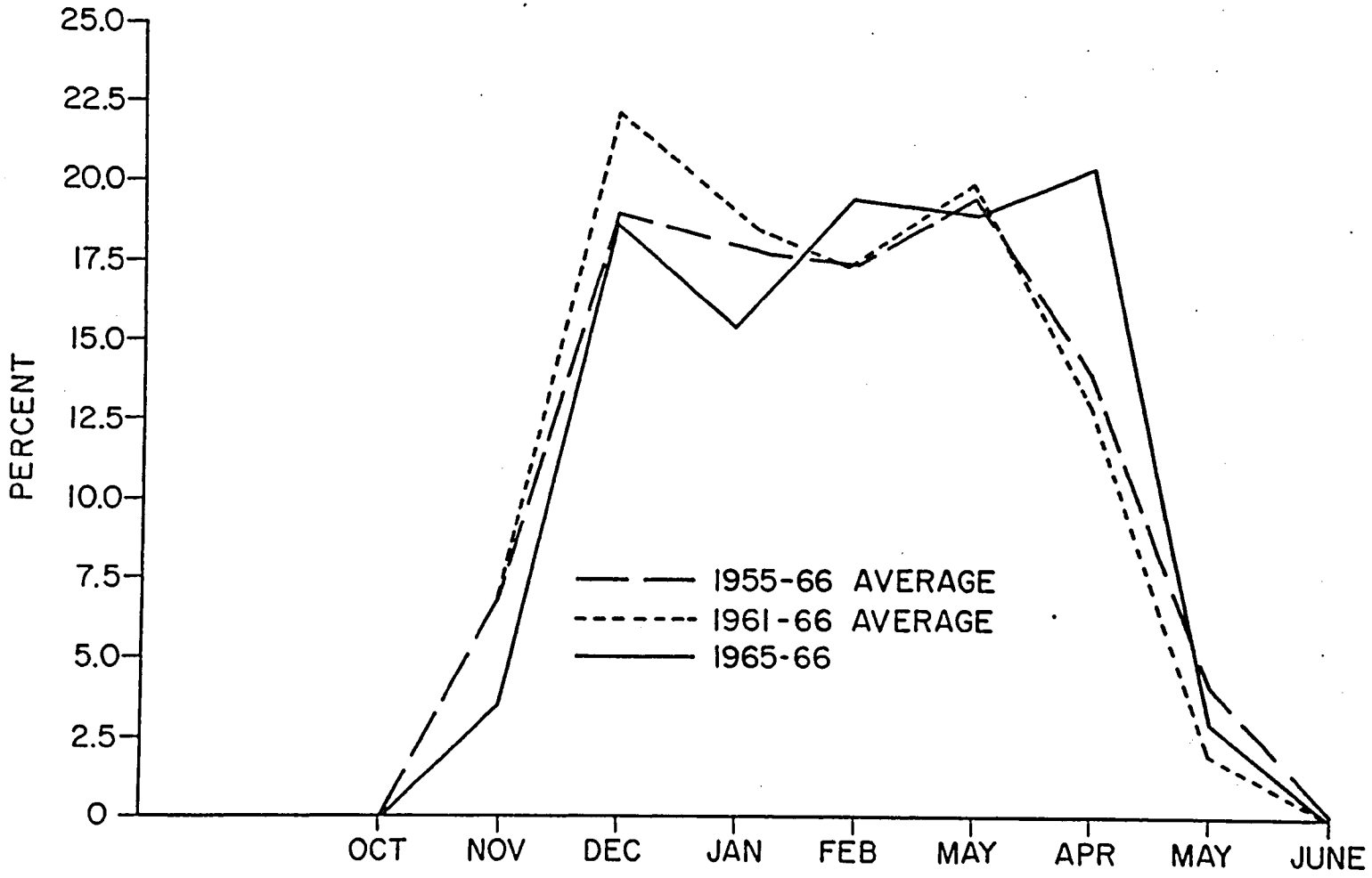

Figure 7. Percentage Distribution of Arizona-California Fresh Navel Orange Shipments, by Months

oranges possess a higher acid content, thicker peel, and better color than fresh oranges grown in a more humid climate.[10] Consumers have indicated a preference for the desert fruit which markedly influences the price received by desert growers.[11]

Consumption of fresh oranges, in per capita terms, has declined some 30 per cent in the last ten years (24.5 pounds to 17.1 pounds, 1956-1966). This trend is shown on Figure 8. There has not been an offsetting increase in the consumption of other citrus or fresh fruit, and a per capita decline in total fresh fruit consumption is in evidence. There has been considerable growth (especially within the last five years) in the consumption of processed orange products (Figure 9). The decline in aggregate fresh fruit consumption is partly offset by the increase in per capita use of processed fruits. Per capita consumption figures indicate the secular changes in demand in responses to changes in income, prices, and consumer preferences. These trends also reflect the changing supply pattern (fresh to

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10. J. S. Hill, J. S. Hillman, and P. L. Henderson, Some Economic Aspects of the Arizona Citrus Industry, Technical Bulletin No. 168 (Tucson: The University of Arizona, College of Agriculture, October, 1965).

11. Marshall R. Godwin, W. Fred Chapman, Jr., and William T. Manley, Competition between Florida and California Valencia Oranges in the Fresh Market, Agricultural Experiment Station Bulletin No. 704 (Gainesville: University of Florida, 1965).

Figure 8. Total Fresh Citrus, Total Fresh Fruit, Total Fresh Oranges and Tangerines, and Fresh Grapefruit Consumption per Capita, U. S., 1945-1966

Source: United States Department of Agriculture, Economic Research Service, U. S. Food Consumption--Sources of Data and Trends, Statistical Bulletin No. 364, Washington, D. C., 1966.

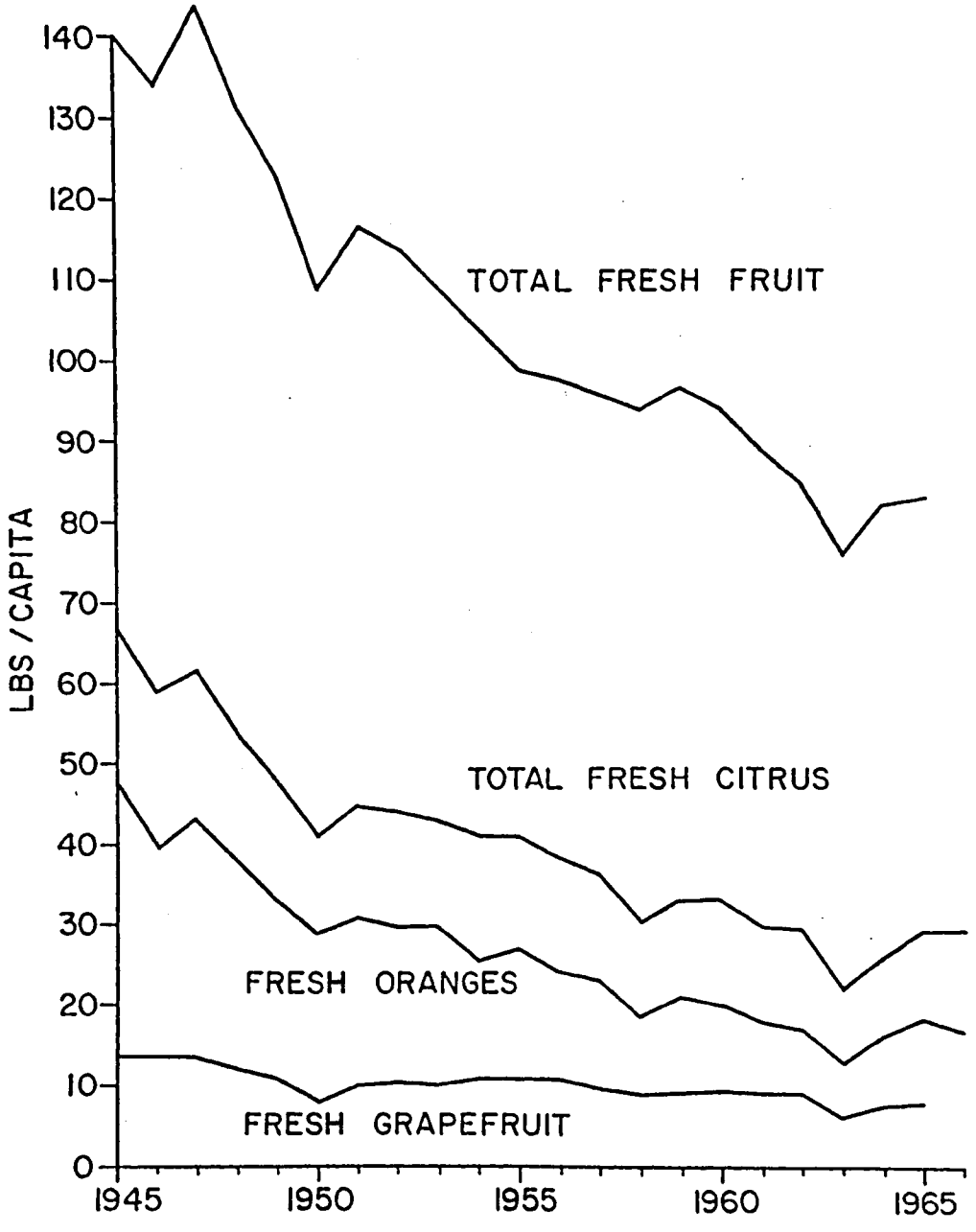

Figure 8. Total Fresh Citrus, Total Fresh Fruit, Total Fresh Oranges and Tangerines, and Fresh Grapefruit Consumption per Capita, U. S., 1945-1966

Figure 9. Total Canned Citrus, Canned Oranges, and Frozen Orange Juice, U. S., 1945-1965

Source: United States Department of Agriculture, Economic Research Service, U. S. Food Consumption--Sources of Data and Trends, Statistical Bulletin No. 364, Washington, D. C., 1966.

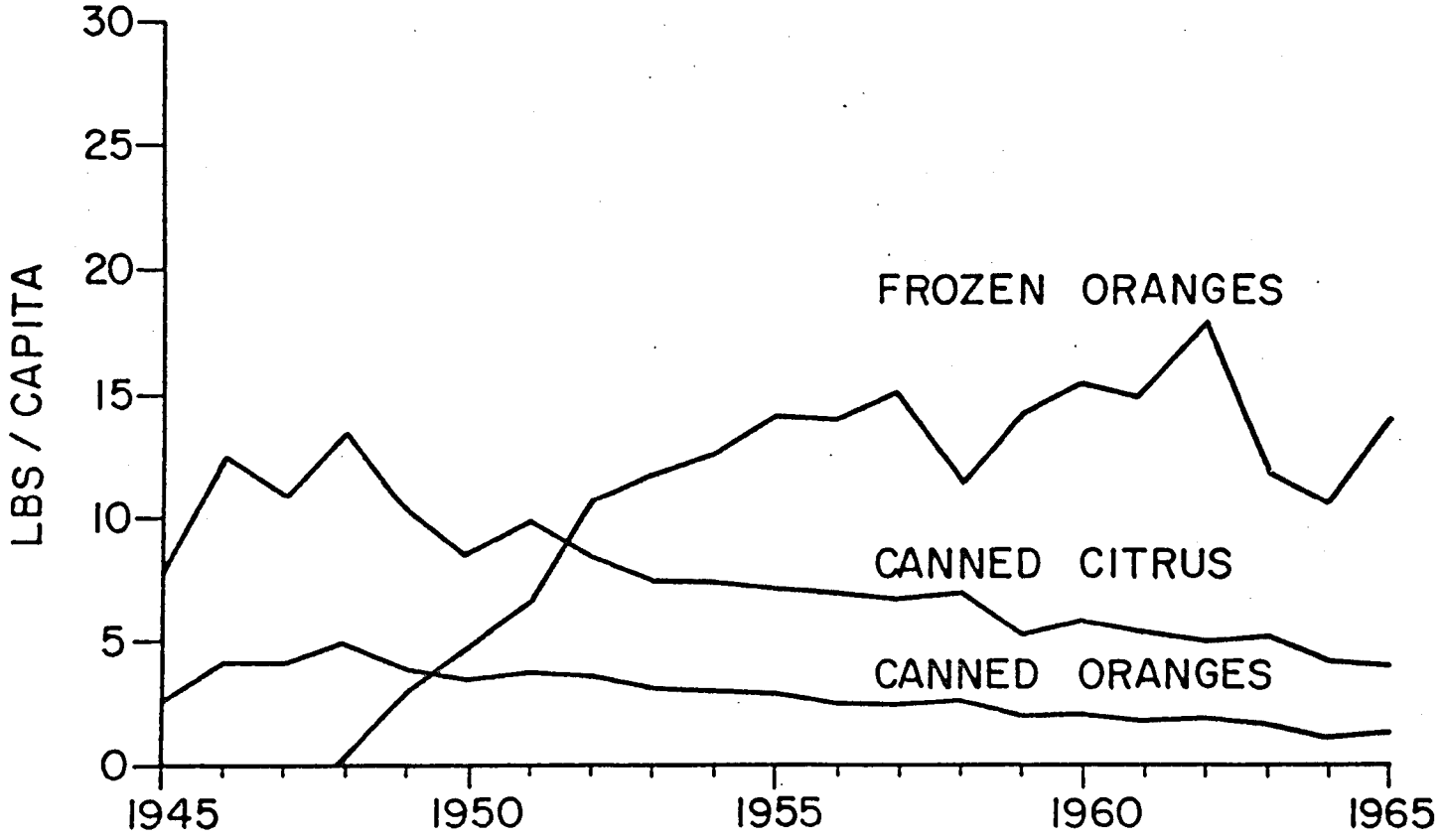

Figure 9. Total Canned Citrus, Canned Oranges, and Frozen Orange Juice, U. S., 1945-1965

processed) that has occurred in order to meet these changes in demand.

Arizona Orange Marketing

Arizona oranges are marketed in a manner that is similar to the marketing procedures used in most of the production areas. With no freezes or other abnormal conditions making fruit unmarketable, the marketing procedure centers about the packinghouse. Orange producers sell their fruit to the packinghouse where it is cleaned, graded, sized, culled, colored, cured, and packed for further distribution. Culled fruit (that fruit unsuitable for fresh consumption) is processed. The grower who engages in cooperative marketing does not receive payment for his crop until the packinghouse has sold the fruit and deducted the costs of packing from the proceeds. The packinghouse sells the fruit to the processor, wholesaler, chain operator, or jobber with the sale being conducted free-on-board point of sale. From the packinghouse customer, the fruit travels to the retail concern and then to the ultimate destination--the consumer. Producer returns from the sales of the packinghouse are prorated in accord with the percentage contribution of the producer to the total fruit handled by the packinghouse for a given period of time (the pool).

The Arizona-California area allocates the larger proportion of the total product into the fresh market. The

Florida area processes the larger proportion of its fruit, with that percentage of its total output which does enter the fresh market doing so only if the fruit has the characteristics to warrant fresh diversion. The operation of the marketing agreements affects (although the importance of such agreements is not certain) the division of the total orange crop into the two forms.

Prices

On-tree returns to orange producers is the effective price that farmers receive for their oranges. The packinghouse computes the on-tree return to a lot of fruit by deducting the costs of picking, hauling, packing, selling, and advertising from the free-on-board price. The f.o.b. price is that return which accrues to the packinghouse upon sale of the fruit to the wholesaler, retail chain, or jobber. There is a close, although imperfect relationship between the f.o.b. fresh price and the on-tree fresh price per 75-pound packed box (Table 2).

Figure 10 shows that the average differential between these two prices for the period 1946-66 was $1.84 and the range of this difference for this period had a low value of $1.06 and a high of $2.35. The relationship between these two prices was close despite considerable yearly variation. The scatter diagram relating f.o.b. and on-tree price suggests that there is a fixed minimum charge

Table 2. Prices for Arizona Oranges, 1940-41 through 1965-66

Year	F.O.B. Fresh	Packing-house door Fresh	On-Tree Fresh	On-Tree Processed	Packing-house door Processed	F.O.B. Fresh minus On-Tree
	(in dollars per packed 75-pound box)					
1940-41	2.18	1.21	1.06	0.79	0.94	1.12
1941-42	2.07	1.16	1.00	0.51	0.66	1.07
1942-43	3.58	2.62	2.38	1.66	1.91	1.20
1943-44	3.81	2.87	2.58	0.54	0.84	1.23
1944-45	3.94	3.02	2.77	0.65	0.92	1.17
1945-46	4.45	3.46	3.19	0.95	1.22	1.26
1946-47	4.16	3.07	2.80	0.44	0.70	1.36
1947-48	3.12	1.78	1.49	0.22	0.54	1.63
1948-49	4.37	3.57	3.31	0.28	0.52	1.06
1949-50	2.86	1.71	1.46	0.41	0.65	1.40
1950-51	4.21	2.93	2.67	0.57	0.84	1.54
1951-52	4.70	3.38	3.09	0.74	1.03	1.61
1952-53	3.82	2.42	2.10	0.48	0.79	1.72
1953-54	4.43	2.98	2.67	0.58	0.90	1.76
1954-55	4.17	2.51	2.19	0.98	1.30	1.98
1955-56	5.06	3.48	3.16	1.29	1.61	1.90
1956-57	4.48	3.02	2.69	1.28	1.61	1.79
1957-58	6.92	5.51	5.18	2.37	2.70	1.74
1958-59	5.88	4.36	3.94	1.17	1.59	1.94
1959-60	5.52	3.95	3.50	0.83	1.28	2.02
1960-61	7.00	5.06	4.76	1.43	1.73	2.24
1961-62	7.33	5.65	5.20	1.33	1.78	2.13
1962-63	6.80	4.99	4.49	1.24	1.74	2.31
1963-64	5.82	4.22	3.72	2.03	2.53	2.10

Table 2.--Continued

1964-65	5.31	3.61	3.06	0.92	1.47	2.25
1965-66	4.66	2.86	2.31	0.96	1.51	2.35

Sources: United States Department of Agriculture, Statistical Reporting Service, Prices Received by Farmers: Citrus Fruits, Noncitrus Fruits, Tree Nuts; and Agricultural Prices, Washington, D. C., various annual issues.

Figure 10. Arizona f.o.b. Fresh Orange Prices, On-Tree Fresh Prices, and Their Differential, 1945-46--1965-66

Source: United States Department of Agriculture, Statistical Reporting Service, Prices Received by Farmers, Citrus Fruits, Noncitrus Fruits, Tree Nuts, Statistical Bulletin No. 322, Washington, D. C., 1962.

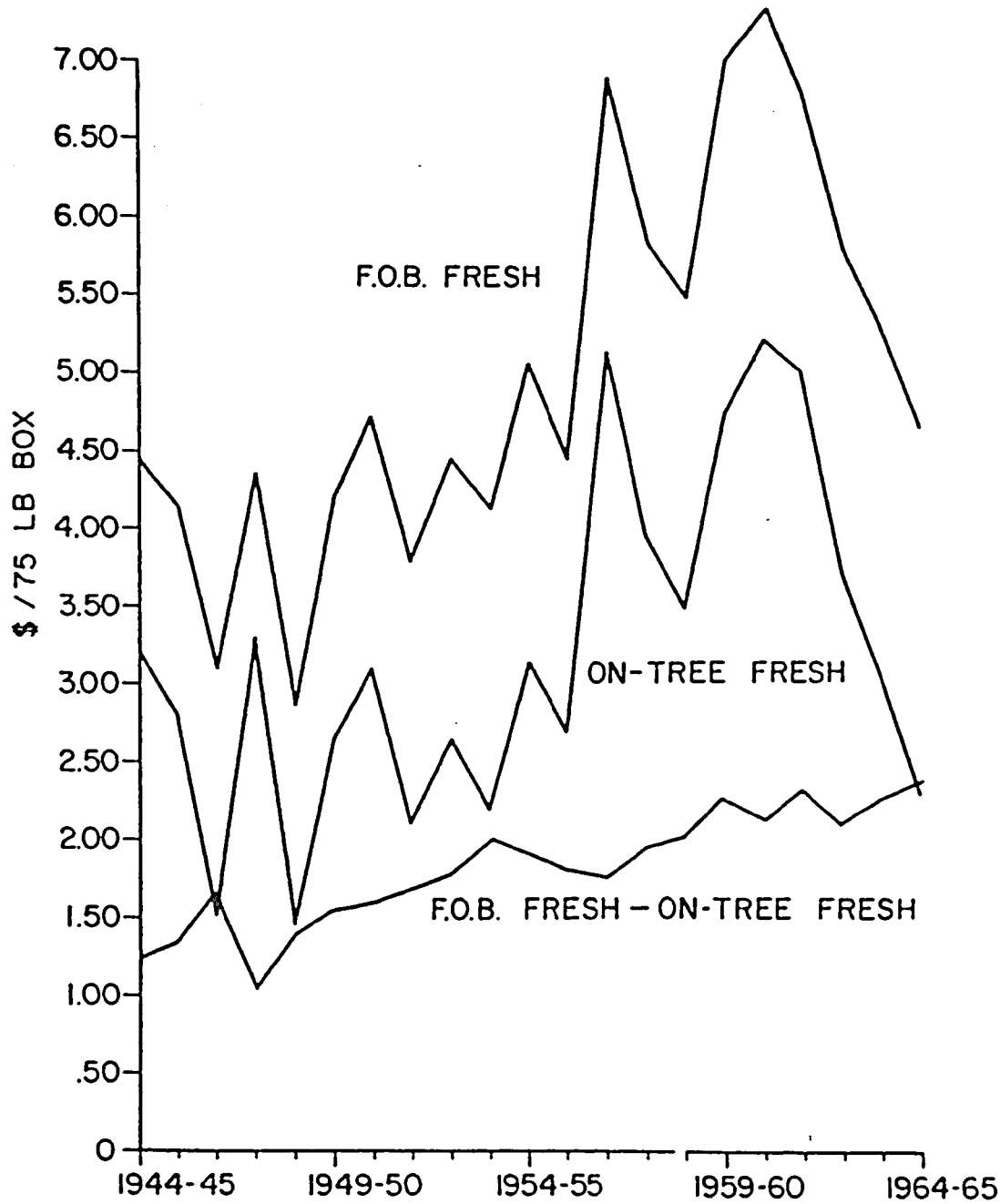

Figure 10. Arizona f.o.b. Fresh Orange Prices, On-Tree Fresh Prices, and Their Differential, 1945-46--1965-66

in existence and that a functional relationship does exist. The slope of this function is positive and suggests the possibility that f.o.b. price can be expressed as a constant markup plus a constant (and certainly low) percentage of the on-tree orange price.

The differential between these two average prices is rising over time. This positive trend suggests several things with regard to the returns Arizona orange producers can expect. The costs of processing, packaging, and distributing fresh oranges are on an up trend which pushes the differential higher. This raises the necessary return per box the packinghouse must receive in order to maintain returns to the producer. When supply and demand conditions force the market price of fresh oranges down, the costs of processing and distributing oranges are not likely to move in the same direction, and if they do, not by the same magnitude. Since this differential is essentially a measure of these packinghouse costs it resists downward movement and the result is materially depressed on-tree prices during a period of weakening demand or oversupply of fresh oranges.

Fresh orange prices demonstrate a very definite seasonal pattern which is inversely related to fresh orange shipments. As the production season advances, the fresh orange price for Arizona Valencias declines. This movement attains a low value in late March and moves upward thereafter. Arizona price movements are affected by the seasonal

pattern of California production. This effect is also an inverse relationship due to similar production conditions which prevail in California production regions.

There is considerable variation about the seasonal price pattern. This variation gives an indication of the price uncertainty which faces Arizona orange growers. If accurate estimates of yearly price changes could be made, the fresh orange price outlook could be determined. Reliable price projections would provide orange producers with information of probable future profitability and suggest the need for contraction or expansion of orange acreage or production.

Table 3 shows the price situation which Arizona producers face relative to the United States seasonal average and to the average prices in the other three major producing areas. Due largely to the high percentage of output that is sold in the fresh form, Arizona enjoys a relatively favorable price position. The last five production seasons show this favorable situation weaken, but Arizona on-tree returns have remained generally above the season average for the entire United States.

Demand and Supply Factors

Prices for Arizona oranges are theoretically determined by those factors that have been referred to previously and are ultimately determined by the interaction

Table 3. On-Tree Prices for All Oranges by States and for United States, 1940-41 through 1965-66

Year	Arizona	California	Florida	Texas	United States[a]
	(dollars per 75-pound packed box)				
1940-41	1.05	1.30	.66	.72	1.05
1941-42	.99	1.49	.92	.86	1.27
1942-43	2.30	2.63	1.45	1.62	1.95
1943-44	2.37	2.80	1.51	1.85	2.18
1944-45	2.63	2.45	1.84	1.91	2.18
1945-46	2.98	2.84	1.97	1.82	2.35
1946-47	2.42	1.41	.79	1.38	1.12
1947-48	1.19	1.41	.52	1.12	.92
1948-49	2.33	1.54	1.16	1.02	1.30
1949-50	.85	1.63	1.78	1.77	1.70
1950-51	2.35	1.66	1.37	.90	1.48
1951-52	2.84	1.71	.67	2.75	1.03
1952-53	1.86	1.38	1.07	1.23	1.20
1953-54	2.20	2.31	1.05	1.16	1.38
1954-55	1.88	2.01	1.14	1.16	1.41
1955-56	2.97	2.43	1.54	1.31	1.80
1956-57	2.58	2.46	1.17	1.12	1.53
1957-58	5.01	4.25	1.78	1.23	2.33
1958-59	3.77	2.66	2.39	1.93	2.47
1959-60	3.01	3.30	1.63	1.49	2.04
1960-61	4.38	3.78	2.45	1.82	2.73
1961-62	4.41	3.48	1.38	1.36	1.72
1962-63	3.31	3.64	2.26	3.29	2.65
1963-64	3.31	3.51	3.70	2.99	3.62
1964-65	2.44	2.84	2.04	2.55	2.26
1965-66	1.88	1.87	1.63	1.97	1.69

a. Weighted average of prices received by Arizona, California, Florida, and Texas growers, weighted by quantity.

Source: United States Department of Agriculture, Statistical Reporting Service, Prices Received by Farmers: Citrus Fruits, Noncitrus Fruits, Tree Nuts; and Agricultural Prices, Washington, D. C., various annual issues.

of supply and demand forces within the economy. Since the production of oranges in other areas will quickly be felt in price quotations, it follows that production in non-Arizona areas must be included as a factor impinging on Arizona orange price. Figure 3 suggests that the percentage of total production accounted for by Arizona remains at an average of less than 1.5 per cent of U. S. production over the seven-season period of 1959-66.

An interactive demand and supply model for Arizona oranges is particularly applicable in a situation where consumption and supply are uncontrolled by Arizona growers, yet their return is related to the decisions of distant consumers and orange producers in Florida and Texas. Additionally there is evidence that the demanders are changing their preferences for fresh fruits, including fresh oranges, to fruits processed by various methods. This declining demand prevails despite or perhaps because of an expanded disposable per capita income.

Declining per capita use is only one of the economic and behavioral questions that a demand and supply model can help clarify. The supply picture bodes equally serious questions for Arizona producers. Production appears to be shifting to the East, where the largest body of consumers resides, thereby raising the spector of a transportation and distribution disadvantage for the Arizona orange producer. Secondly, the number of producers is quite large and make

decisions that affect only their own production and require considerable forethought. This stems from the 5 to 7 year lag that orange production requires from the decision to invest in producer facilities to fruition of a commercial grove. The investment required is large in terms of both the dollars and the time required before a return can be expected.

Transportation costs affect the price received for Arizona oranges. These costs increase with distance. Arizona fresh Valencia oranges are shipped, via rail and truck, to all major cities in the country. These costs can preclude the shipment of Arizona oranges to Midwestern and Eastern markets during periods of time when Texas and Florida production is at a peak.

CHAPTER III

THE STATISTICAL ANALYSIS

Demand Analysis

The regression analysis on the price of Arizona oranges was done with the primary objective of forecasting future levels of these prices and to determine those factors impinging upon Arizona price. Although attempts were made to explain both Valencia and Navel prices in terms of the independent variables that were suggested by theory, substantial departure exists in the final results versus those results anticipated *a priori*.

Independent variables were specified and plotted against time, against each other, and then selected to be regressed against the several dependent variables that were analyzed. Table 4 lists the variables used in the demand analysis.

Prices of Arizona oranges are used as dependent variables since orange production, as is the case of most agricultural commodities, can be regarded as predetermined within a production season (i.e., production is largely independent of price within a given production period). Therefore, the causality is directed toward price and price does not materially affect the independent variables, and

Table 4. Dependent and Independent Variables Used in Orange Demand Analysis

Dependent Variables:

On-tree fresh Arizona Valencia orange price per 75-pound box.
Packinghouse door, fresh Arizona Valencia orange price per 75-pound box.
On-tree Arizona Navel orange price per 75-pound box.
On-tree fresh Arizona Navel orange price per 75-pound box.
On-tree Arizona Valencia orange price per 75-pound box.
Free-on-board fresh Arizona orange price per 75-pound box.
Free-on-board fresh Arizona Valencia orange price per 75-pound box.
Free-on-board fresh Arizona Navel orange price per 75-pound box.
Packinghouse door Arizona orange price per 75-pound box.
Packinghouse door Arizona Valencia orange price per 75-pound box.
Packinghouse door Arizona Navel orange price per 75-pound box.
Packinghouse door fresh Arizona Navel orange price per 75-pound box.

Independent Variables:

Arizona orange production per capita.
Domestic orange production per capita.
Domestic orange production minus X_3 per capita.
Domestic fresh orange consumption in pounds per capita.
Disposable personal income per capita.
Domestic Navel orange production per capita.
California Navel orange production per capita.
Florida early and midseason orange production per capita.
Arizona Valencia orange production per capita.
Domestic Valencia orange production per capita.
Florida Valencia orange production per capita.
California orange production per capita.
Domestic orange production minus Arizona and Florida Valencia production per capita.
Domestic orange production minus X_8 per capita.
Arizona and California orange production per capita.
Domestic orange production per capita minus X_{19}.
Domestic processed orange production per capita.
Domestic non-orange citrus production per capita.
Domestic fresh citrus consumption per capita.
Consumption of all non-citrus fruits in fresh equivalents per capita.
Arizona Navel orange production per capita.
Domestic fruit consumption in fresh equivalents per capita.

price can realistically be considered as the appropriate dependent variable.

Deflated values of price and disposable income were not used because some believe that deflation assumes a constant relationship between the original series and the deflator.[12] This assumption may be invalid since agricultural prices have been shown to fluctuate much more widely than the general price level during a business cycle; and a relatively small change in the general price level has been observed during the postwar period. Income, price, and production data were placed in per capita terms to account for changes in demand due to the growth of population. On the basis of the scatter diagrams, the period of analysis was defined to include the postwar seasons, 1946-47 through 1965-66.

The postwar period was selected as the relevant time segment because scatter diagrams suggested that a change in the relationship between orange pricing and production had occurred during the second world war. Prior to this world upheaval, the general movement of orange price and production was positive. An expanded production went at higher prices as demand changed more than the change in orange output. After the war years this relationship between

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12. Geoffrey Shepherd, Agricultural Price Analysis (5th edition; Ames, Iowa: Iowa State University Press, 1963).

orange prices and production changed from positive to negative, with increments of increased production associated with generally lower prices.

Disposable income and orange price data are average seasonal values as reported by the U. S. Department of Agriculture. United States population and disposable income per capita were relevant for the major portion of the production season; i.e., January 1, 1966 population figures were used to compute the 1965-66 production per capita datum. Orange production data, by state and variety, are taken from the Department of Agriculture, Economic Research Service.

The single equations method of least squares regression[13] was used to determine the factors that are important in explaining Arizona Valencia orange prices and to estimate the degree to which these factors are significant. Although on-tree fresh Valencia and f.o.b. fresh Valencia returns were of primary interest in the regression analysis, several prices were specified as dependent variables. Regression analysis was performed on all these variables, with the results tabulated in Appendix A with the usual measures of statistical reliability. Dependent variables were subjected

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13. Mordecai Ezekiel and K. A. Fox, Methods of Correlation and Regression Analysis--Linear and Curvilinear (3rd edition; New York: John Wiley and Sons, 1965), pp. 151-203, 279-347.

to regression analysis to determine the best fit, in logarithms to the base e, in first differences, and in the usual linear form. The computations were performed using a standard regression program and the computer facilities of the Numerical Analysis Laboratory at The University of Arizona. The final demand equations dealing with f.o.b., packinghouse door, and on-tree returns to Arizona orange producers are tabulated in Table 5.

Table 5 is a compilation of the demand equations for fresh Arizona Valencia orange prices that were the most satisfactory. These equations come from Appendix A, Tables 13 for the f.o.b. Valencia price (X_1), 17 for the packinghouse door Valencia price (X_2), and 9 for the on-tree Valencia price (X_3). Arizona Navel orange prices, regardless of the level in the market at which the prices were made, the form in which the fruit was disposed of, or the degree to which the average prices were aggregated, did not prove to be satisfactorily explained by the independent variables available to this author. The coefficients of the independent variables in equations explaining Arizona Navel orange prices proved to be statistically close to zero.

The demand equations, in Table 5, are those that exhibit the most consistent results for fresh Valencia prices. All three prices were explained by the same three independent variables and exhibited t-ratios that were

Table 5. Demand Equations for Arizona Valencia Oranges

Code	Dep. Var.	Constant Term	X_7	X_{19}	X_{20}	R^2	S.E.
0	X_1	15.3159	-0.0014*[b]	-22.0788**[c]	-4.9729**	.78	.57
			(0.0005)[a]	(3.0749)	(1.5842)		
5	X_1	17.1566	-0.4252**	-0.9387**	-0.4355**	.87	.0836
			(0.1404)	(0.0990)	(0.1224)		
0	X_2	13.8074	-0.0017**	-20.5559**	-4.6192*	.71	.60
			(0.0006)	(3.2822)	(1.6775)		
5	X_2	22.3322	-0.7867**	-1.2579**	-0.6167**	.83	.1209
			(0.2043)	(0.1445)	(0.1778)		
0	X_3	12.8371	-0.0016*	-19.4650**	-4.2725*	.68	.60
			(0.0006)	(3.2962)	(1.6846)		
5	X_3	22.7909	-0.8073**	-1.3157**	-0.6329**	.82	.1349
			(0.2281)	(0.1613)	(0.1985)		

a. Numbers in parentheses refer to standard errors of the regression coefficients.

b. Coefficients with one asterisk were found to be significant at the five per cent level ("t" test).

c. Coefficients with two asterisks were found to be significant at the one per cent level ("t" test).

Definition of Independent Variables:

X_7 = U. S. disposable personal income per capita (current dollars).
X_{19} = Total Arizona and California orange production per capita (75-pound packed boxes).
X_{20} = Total domestic orange production minus Arizona and California production in per capita terms (75-pound packed boxes).

Table 5.--Continued

Definition of Dependent Variables:

X_1 = Free-on-board fresh price per 75-pound packed box, Arizona Valencia oranges.
X_2 = Packinghouse door fresh price per 75-pound packed box, Arizona Valencia oranges.
X_3 = On-tree fresh price per 75-pound packed box, Arizona Valencia oranges.

Code:

0 = No data transformation.
5 = Logarithms to the base "e."

significant at the five per cent level or higher. The signs on all three independent variables for both forms of the equations are negative. This is particularly interesting in the case of the income variable, which might be expected to be positive. Arizona Valencia orange prices have tended to fall in spite of rising disposable income. The variable is statistically significant and strongly suggests the need for further research rather than the simple conclusion that oranges are economically inferior goods.

As shown by the low t-ratios in Appendix A, Tables 8 through 19, Arizona orange production was not a highly significant explanatory variable by variety or in total. Summing California and Arizona orange output resulted in an independent variable which did explain a significant percentage of the variation in most dependent variables. It was noted that regression equations in which Arizona's orange output was significant had very low coefficients of determination. This suggests that, although Arizona production has a significant influence on Arizona prices, there is some other variable or set of independent variables that this author was unable to identify.

Arizona produced approximately 1.5 per cent of the total production of oranges in the United States on an average for 1959-66. This low percentage of domestic output tends to support the weak impact that Arizona's orange output has on the prices which Arizona producers receive.

This is also consistent with the theoretical model of a perfect competitor who does not materially affect the market price by varying his selling volume of a commodity, but who is materially affected by the changes of all other sellers of the same or a similar commodity. The Arizona orange grower faces a pricing situation which results in his average season price being largely, or perhaps wholly, determined by conditions which are external to and independent of conditions facing the Arizona grower. It would appear to be most advantageous for the Arizona producer to divert good quality fruit into the more profitable fresh market, especially because of the lack of processing facilities in Arizona and California.

Results of the Statistical Analysis

Appendix A, Tables 8 through 19, contain equations which are (for each dependent variable): the initial equations which were run; the subsequent equations which were fitted after deletion of some independent variables (due to multicolinearily or lack of significant regression coefficients); and the form of the data used along with a display of reliability indicators and results.

The initial formulations included a large number of variables, and a consequent lowering of the degrees of freedom. The coefficient of multiple determination and the standard error of estimates were generally satisfactory, at

the five per cent level of significance. The first difference formulation generally resulted in a somewhat lower coefficient of determination than the linear and logarithmic forms of the equations. Hence, the first difference form was not carried out for all equations and is reported only for the initial equations on which this transformation was performed. With the data expressed as first differences the coefficient of determination represents the proportion of the variation about the trend explained by the equations. The "on-tree" price equations are in all instances less satisfactory statistically, than the equations explaining f.o.b. prices.

It was observed that the partial correlation between total domestic orange production (X_4) and total domestic production less total Arizona production (X_5) was .96 suggesting that these two variables were practically identical for statistical purposes. The income variable (X_7) and the trend variable (X_{21}) were also seen to be highly intercorrelated (.98). Consequently, variables X_5 and X_{21} were dropped from the regressions due to this multicollinearity.

The economic interpretation of the final demand equations (Table 5) can be summarized as follows:

1. A one per cent change in per capita disposable income is associated with an inverse (instead of the direct change expected for most commodities) change

of 0.43 per cent in the f.o.b. fresh price for Arizona Valencia oranges, a 0.81 per cent decline in the fresh on-tree price of Arizona Valencia oranges, and a 0.79 per cent fall in the packinghouse door fresh Arizona Valencia orange price. The strong intercorrelation between the trend and income variables (X_{21} and X_7) suggests that the income variable is acting as a proxy variable for other factors.

2. A one per cent change in California-Arizona total production is associated with an opposite change of 0.94 per cent in the f.o.b. fresh Arizona Valencia price, a 1.32 per cent change in the fresh on-tree Valencia price, and a 1.26 per cent change in the fresh Arizona Valencia price at the packinghouse door.
3. A one per cent change in non Arizona-California production is associated with an inverse change of 0.44 per cent in f.o.b. fresh Valencia price, 0.63 per cent in fresh on-tree Valencia price, and 0.62 per cent change in the fresh packinghouse door price for Arizona Valencia oranges.
4. An increase of $100 in per capita income is associated with a decline of $0.14 in the f.o.b. price, $0.17 in the packinghouse door price, and $0.16 in

the on-tree price per packed 75-pound box of Arizona Valencia oranges.

5. A change of one pound per capita in the production of oranges in Arizona and California is associated with an inverse change of $0.29 in the f.o.b. price, $0.27 in the packinghouse door price, and $0.26 in the on-tree price for Arizona Valencia oranges.
6. An increase of one pound per capita in the production of oranges in the Rest-of-the-United States (non Arizona-California) is associated with a decline of $0.07 in the f.o.b. price, $0.06 in the packinghouse door price, and $0.05 in the on-tree price for Arizona Valencia oranges.

Supply Analysis

The regression equations for orange supply were developed for four-year moving averages of production and estimated income per acre. Moving averages were used to negate the effect of alternate-year bearing characteristics of citrus fruits. However, acreage data remained in annual values. Price and revenue estimates reflect the relative profitability of citrus production through time and were assumed to be major factors in grower's production decisions. Harvesting and production costs were not included explicitly as independent variables for two reasons: (1) time series data were either not available or were unreliable over time,

or (2) the cost information available indicated that these costs had increased fairly modestly during the period of time included in the analysis.[14] Harvesting costs expanded 50 per cent in the decade of the 1950's and marketing costs have risen two to three per cent per year over the same period. The index of prices paid by farmers for production items was used as an indicator of changes in the overall costs of producing oranges and was used to reduce estimated returns per bearing acre to "real" returns, i.e., returns to orange production for which some adjustment was made for changes in agriculture cost levels.

Regression equations predicting orange acreage and orange production were developed for the major production regions and for the composite production area of Arizona and California. This procedure was used since an attempt to explain total bearing acreage and domestic production via a single equation would not take into account major differences in the resources of each geographic area. Constructing supply equations for each region can account for such regional differences as: (1) acreage, yield, and production trends; (2) locational advantages; (3) cost differences; and (4) sudden shifts in production due to weather.

Table 6 lists the dependent and independent variables used in the supply analysis. The lags used, in those

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14. Hill, Hillman, and Henderson, op. cit.

Table 6. Dependent and Independent Variables Used in Orange Supply Analysis

Dependent Variables:

Arizona and California orange production; four-year moving average; 75-pound boxes.
Florida orange production; four-year moving average; 75-pound boxes.
Arizona and California bearing orange acreage.
Florida bearing orange acreage.
Texas orange production, four-year moving average; 75-pound boxes.
Arizona orange production, four-year moving average; 75-pound boxes.
Arizona bearing orange acreage.
Texas bearing orange acreage.

Independent Variables:

Zero-one variable, Florida orange production; 1953-62 seasons are one; zero elsewhere.
Zero-one variable, Florida orange acreage; 1961-62 and 1964-66 seasons are one; zero elsewhere.
Zero-one variable, Florida orange acreage; 1962-66 seasons are one; zero elsewhere.
Zero-one variable, Texas orange acreage; 1961-66 seasons are one; zero elsewhere.
Trend variable.
Zero-one variable, Texas orange production; 1957-62 seasons are one; zero elsewhere.
Zero-one variable, Florida orange production; 1953-57 and 1958-62 seasons are one; zero elsewhere.
Zero-one variable, Arizona orange acreage; 1960-66 seasons are one; zero elsewhere.
Arizona and California revenue per bearing acre; lagged; unweighted and weighted by percentage Arizona production is of California production.
Florida total revenue per bearing acre in four-year moving average, lagged and deflated by index of prices paid.
Florida on-tree orange price per 75-pound box, lagged and deflated by prices paid index.
Arizona and California revenue per bearing acre, four-year moving average, lagged and weighted or unweighted.
Florida revenue per bearing acre, four-year moving average, lagged and weighted or unweighted.
Florida on-tree orange price per 75-pound box; four-year moving average, deflated by prices paid index.
Arizona revenue per bearing acre, four-year moving average, lagged.

Table 6.--Continued

Texas revenue per bearing acre, four-year moving average, lagged.
Texas on-tree orange price lagged and deflated by prices paid index.

independent variables which were lagged, were nine and eleven year lags. The Arizona and California revenue per bearing acre variable data were generated using two methods. The first was a simple average and the second was a weighted approach that uses weights which were generated using the percentage that Arizona production is of California orange output. Where these methods are employed in regression equations in Appendix B they are referred to as "weighted" or "unweighted" in the definition of the variables on each table.

The weighted approach was attempted because of the high degree of significance noted in the demand regressions for California production. This association was especially prevalent in those demand functions attempting to explain Navel orange price for Arizona (Appendix A, Tables 11 and 18). Because of the larger volume of production in California, the weighted method accentuates the California component of the revenue variable.

Lagged revenue was considered relevant in the orange supply analysis because often there is a considerable lag between revenue generation and the response to that revenue on the part of the producer. This is particularly true for oranges since the time required from the decision to invest and the production of oranges is so lengthy. Periods of time during which oranges produce relatively good per acre revenue tend to stimulate large investments in new orange

acreage which often results in heavier supplies in later years and pressure on revenue per bearing acre.

Zero-one variables were used to account for variations in the data that were not accounted for by the independent variables specified. An additional use for these dummy variables was to account for different linear trends that appeared in some of the data. Zero-one variables on Florida bearing acreage were specified to account for different and distinct blocks of data during the 1961-62 and 1964-66 seasons. The 1957-62 period was one in which climatic abnormalities arose in Texas orange production. A zero-one variable was applied to this situation in an effort to explain Texas orange production satisfactorily. Zero-one variables were applied in many instances to improve statistical and analytical results where possible.

The remainder of this section will discuss the supply equation for each production region. A complete listing of all preliminary supply equations is given in Appendix B, Tables 20 through 23. These tables list the results of the regression analysis along with the usual reliability indicators. The final supply equations, listed in Table 7, were computed from data given in Appendix D, Tables 36 through 38. The variables included in the final supply equations are redefined below:[15]

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15. All regression equations are based on 1946-47 through 1965-66 production and acreage data.

Table 7. Final Orange Production and Bearing Acreage Equations

Code	Dep. Var.	Constant Term	X_5 (Z)	X_8 (T)	X_9 (Z)	X_{15} (I)	X_{16} (N)	X_{18} (N)	X_{19} (I)	X_{23} (P)	R^2	S.E.
0	X_1 (S)	3502.8980		-78.3068** (19.9466)[a]			3.0756** (1.0792)				.86	205.0000
5	X_1 (S)	7.8890		-0.1807** (0.0585)			0.1160 (0.0829)				.75	.0671
0	X_3 (S)	62.7707			157.8918** (29.1737)				0.7572[c] (0.2798)		.71	43.5000
5	X_3 (S)	3.1057			0.8308** (0.1396)				0.4039** (0.1063)		.77	.2219
0	X_{10} (A)	150.8046		-3.1141** (0.6589)		0.1664** (0.0356)					.92	6.8000
5	X_{10} (A)	4.5773		-0.1315** (0.0144)		0.1390** (0.0294)					.97	.0260
0	X_{11} (A)	377.5414	59.4846** (17.2947)					0.8200 (0.4511)		-21176.1000** (7386.6000)	.73	22.1000
5	X_{11} (A)	10.3826	0.2344 (0.2129)					0.0626 (1.0684)		-0.7720 (0.8135)	.47	.2444

a. Numbers in parentheses are standard errors of the regression coefficients.
b. Coefficients with two asterisks were found to be significantly different from zero at the one per cent level ("t" test).
c. Coefficients with a single asterisk were significant at the five per cent level ("t" test).

Definition of Independent Variables:

X_5 = Zero-one variable on Florida bearing acreage; 1961-62 = 1; 1965-66 = 1; zero elsewhere.
X_8 = Trend variable.
X_9 = Zero-one variable on Texas production; 1957-62 = 1; zero elsewhere.
X_{15} = Arizona and California estimated total revenue per bearing acre, in a four-year moving average, lagged eleven years (weighted).
X_{16} = Arizona and California estimated total revenue per bearing acre, in a four-year moving average, lagged nine years (weighted).
X_{18} = Florida estimated total revenue per bearing acre, in a four-year moving average, lagged nine years.
X_{19} = Texas estimated total revenue per bearing acre, in a four-year moving average, lagged eleven years.
X_{23} = Florida on-tree orange price, deflated by the prices paid index for production items, lagged nine years and in a four-year moving average.

Definition of Dependent Variables:

X_1 = Total Arizona and California orange production, in 75# packed boxes, in a four-year moving average.
X_3 = Total Texas orange production, in 75# packed boxes, in a four-year moving average.
X_{10} = Total Arizona and California bearing acreage in annual values.
X_{11} = Total Florida bearing acreage in annual values.

Code:

0 = No data transformation.
5 = Logarithm to the base "e."

S = Total production of oranges, in a four-year moving average in 75-pound packed boxes.

A = Total bearing acreage of oranges in annual values.

I = Computed estimate of total revenue per bearing acre in a four-year moving average, lagged eleven years. (Total revenue equals on-tree price for all oranges times the average yield per bearing acre and divided by an index of prices paid by farmers for production items, 1910-14 100.)[16]

N = Estimates of total revenue per bearing acreage, in a four-year moving average, lagged nine years.

P = On-tree price for oranges, in a four-year moving average, lagged nine years and deflated by an index of prices paid by farmers for production items; 1910-14 100.

T = Trend variable.

Z = Zero-one variable.

Arizona and California

The supply equations estimating Arizona-California orange production and bearing acreage are:[17]

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16. The deflation in this variable was performed to adjust estimated revenue for changes in the costs of production and to introduce an element of production costs into the analysis.

17. Figures in parentheses are standard errors of the regression coefficients. * = significant at the five per cent level; ** = significant at the one per cent level; S.E. = standard error of the estimate; R^2 = coefficient of determination.

$$S = 3502.8980 - \underset{(19.9466)^{**}}{78.3068T} + \underset{(1.0792)^{**}}{3.0756N}$$

$$S.E. = 205.00$$

$$R^2 = 0.86 \qquad (1)$$

$$A = 4.5773 - \underset{(0.0144)^{**}}{0.1315T} + \underset{(0.0294)^{**}}{0.1390I}$$

$$S.E. = 0.2219$$

$$R^2 = 0.77 \qquad (2)$$

Equation (1) explaining total production is in linear form whereas (2), explaining total bearing acreage, is in logarithms to the base "e." Both (1) and (2) have been run in linear and logarithmic forms (see Table 7) with Equations (1) and (2) demonstrating the most satisfactory results. Economic interpretation of these equations can be summarized as follows:

1. An increase of one per cent in revenues per bearing acre is associated with an increase of 0.12 per cent in production nine years later.
2. An increase of one per cent in revenues per acre results in a 0.14 per cent rise in bearing acreage eleven years later.
3. A $10.00 change in revenue per bearing acre is directly associated with a change in Arizona-California production of 308 thousand 75-pound boxes nine years later.

4. A $10.00 change in revenue per bearing acre is positively correlated with a 0.98 acre change in bearing acreage following an eleven year lag.

Florida

The supply equation estimating Florida total bearing acreage is:

$$A = 377.5414 + \underset{(17.2947)^{**}}{59.4846Z} + \underset{(0.4511)}{0.8200N} - \underset{(7.386.6)}{21.176.1P}$$

S.E. = 22.10

$R^2 = 0.73$

Florida total production was not satisfactorily explained. The equations which were attempted to determine the factors important to Florida orange production are listed in Appendix B, Table 21. On-tree price was significant only for the supply equation for Florida. A zero-one variable was used to account for the freezes that occurred in 1957 and 1962. The tabular displays in Appendix B, Table 21, record the several attempts which were made to explain Florida orange production. These regressions range from those using different lag periods on the variables to the use of dummy variables in an effort to determine changes in slope and intercept. None of these equations were entirely satisfactory.

The economic interpretation of the Florida supply equation indicates that a change in the on-tree price per

75-pound box of oranges would be associated with an inverse change in bearing acreage. This result does considerable violence to economic theory and must therefore be taken into consideration. Further analysis of this situation (Appendix B, Table 22) shows the sign of this variable to be emphatically negative. This situation would tend to raise two important questions.

Either the data used in these equations were not satisfactory, which is an unanswered question, or there is some economic phenomena occurring that requires analysis. The data for all regression equations were checked by several persons and by the author. This leaves the source of the information as a possible source of erroneous data.

The second question concerned the decision criteria of Florida producers. If the given equation is not negated due to statistical errors, then it may be that the supply situation in Florida is not one that is wholly rational. This is visualized as a decline in on-tree price leading to an increase in bearing acreage. To answer this question several attempts were made to support such an hypothesis with available evidence. Scatter diagrams of on-tree price on yearly planting of Florida orange trees were used to determine the response of producers to inclement weather, and plots of price and bearing acreage. The results were inconclusive. Additional consideration regarding this

question will be found in the summary and conclusions to this paper.

Texas

The supply equation estimating Texas total production is:

$$S = 3.1057 + \underset{(0.1396)}{0.8308Z^{**}} + \underset{(0.1063)}{0.4039I^{**}}$$

$$S.E. = 0.2219$$

$$R^2 = 0.77$$

Bearing acreage in Texas was not satisfactorily explained (see Appendix B, Table 23). Data regarding bearing acreage were not available following the 1962 freeze and were estimated by the author. This may explain the lack of a satisfactory regression equation for Texas bearing acreage. The zero-one variable was included to account for the severe freeze in the 1961-62 season.

An economic interpretation of this equation may be given as:

1. A one per cent change in revenue per bearing acre is associated with a similar change in total production of .40 per cent.
2. A $10.00 increase in revenue per bearing acre is associated with an increase of 404 thousand 75-pound boxes.

Data used in Texas supply equations (Appendix D, Table 38) suggests that Texas orange supply is highly volatile, responding to what appears to be a ten-year freeze cycle in that state. This situation has adversely affected revenue per bearing acre for the Texas producer, and has left gaps in the available data on oranges in Texas. Appendix B, Table 23, shows that the equation generated for Texas orange production, while being somewhat better than those for bearing acreage, are still not satisfactory. The Texas equations, while suggesting significant factors, require an investigation improving the historical information to get better results.

CHAPTER IV

SUMMARY AND CONCLUSIONS

The demand analysis indicated there are a number of factors which influence or are closely associated with the price of Arizona Valencia oranges. These include the production of oranges in the rest-of-the United States, consumer preferences, quality of the product, marketing agreement policies and the general level of economic activity. The analysis clearly indicated that Arizona production is not a significant factor. Price flexibilities indicate that the two major factors are disposable personal income, and the production of Arizona and California oranges. The income variable is outside the influence of Arizona producers and the remaining variable is unlikely to be significantly influenced by Arizona production despite the secular decline in California production. Arizona and California production are much less important factors for the packinghouse door and on-tree prices of Arizona Valencias, but for the free-on-board fresh price this variable is the most important factor. This is as expected since fresh desert product has demonstrated a superior quality over oranges produced elsewhere. The analysis suggests that Arizona producers are not

in a position to materially affect the price that the industry receives for its fresh product.

A secular decline in per capita consumption of oranges has been operative for the last 10 to 15 years. This decline has been operating to the disadvantage of producers. The analysis does not suggest that this trend can be explained by either higher prices for oranges or larger supplies and lower prices for competing fruits. An alternative hypothesis of a negative income elasticity is not well supported due to the high intercorrelation between the income and trend variables. The analysis does not suggest a ready explanation for the observed per capita decline in consumption except that some change in consumer preferences has been operating.

The lack of significance of Arizona production suggests that the impact of the marketing committees may not be felt by Arizona producers. This is supported, albeit not clearly, by the lack of restriction imposed by the committees on Arizona production. The administrative committees' influence on Arizona price appears to be low with the exact nature of this influence being unclear.

The supply analysis did not result in relationships which were wholly satisfactory. The inability to explain Florida total production and Texas bearing acreage, combined with the negative sign of the price variable on Florida bearing acreage, preclude the forecast of future prices for

fresh Arizona oranges. The analysis does suggest that a substantial increase in production in non-Arizona regions will lower the price that Arizona producers receive. The extent of such an increase, as well as the nature of such an adverse change were not quantifiable.

There are a number of items suggested for further research. These include determinations as to what the exact nature of the preference pattern of consumers may be and what, if any, changes have occurred; additional work should be done in the development of supply equations for the orange production areas of the United States, with special efforts directed to Florida supply and the role played by speculation in supply response; an analysis of the effectiveness of marketing agreements might very well prove of significant interest when the apparent dependence of Arizona producers on non-Arizona conditions is noted. Greater efforts need to be made to explain Navel orange prices in Arizona, particularly fresh prices. The relative growth of Navel orange sales has been quite dramatic in Arizona and with a larger share of farm orange revenue attributed to Navel oranges, a better understanding of the demand and supply condition is potentially fruitful.

APPENDIX A

RESULTS OF DEMAND ANALYSIS

Table 8. Results of Regression Analysis: On-Tree Price per 75-Pound Packed Box, All Arizona Oranges, All Methods of Sale

Code	Dep. Var.	Constant Term	X_3	X_4	X_5	X_7	X_8	X_{14}	X_{19}	X_{20}	X_{21}	X_{26}	R^2	S.E.
0	X_2	-4.5693		-138.6486*[b]	127.7829*	0.0000	-5.5663	-9.4307			10.1433	0.0859*	.64	.63
				(55.9943)[a]	(55.9481)	(0.0009)	(7.0865)	(7.3550)			(7.1405)	(0.0413)		
5	X_2	-25.8447		-31.9112	29.6500	0.8106	-0.9329	-0.8408			0.9155	+6.9244	.51	.2999
				(20.1641)	(19.7949)	(0.8135)	(1.3283)	(0.4680)			(0.9130)	(3.3180)		
5	X_2	-34.1874		-32.3762	30.4353	2.3146**[c]						5.3045	.28	.3633
				(23.4036)	(23.2596	(0.7862)						(3.4795)		
0	X_2	7.9373				-0.0009			-14.5172**	-0.3648			.43	.80
						(0.0008)			(4.4778)	(2.2566)				
0	X_2	3.2031	-239.3230	-2.2361		0.0010*							.22	.94
			(116.4460)	(2.5782)		(0.0008)								
0	X_2	6.8702	-101.5169			-0.0004		-12.4364*					.46	.78
			(106.2230)			(0.0010)		(4.5694)						
0	X_2	7.9373				-0.0009			-14.5172**	-0.3648			.43	.80
						(0.0008)			(4.4778)	(2.2566)				
0	X_2	-5.7903		-4.2302		0.0019						44.4297	.07	1.02
				(3.9258)		(0.0012)						(46.4567)		
5	X_2	-44.7552		-1.7856		2.1749*						6.6201	.25	.3713
				(1.1148)		(0.7960)						(3.4045)		
5	X_2	2.2572	-0.4704		-0.3679	1.1514*							.19	.3859
			(0.3217)		(0.7584)	(0.4934)								
5	X_2	12.9251				-0.2867			-1.0774*	0.0889			.38	.3376
						(0.5743)			(0.4105)	(0.4982)				
0	X_2	3.4220	-247.9974*		-2.3956	0.0017*							.25	.91
			(112.7727)		(2.5080)	(0.0007)								
0	X_2	7.6647				-0.0009			-14.2367**				.47	.77
						(0.0007)			(3.9554)					

a. Numbers in parentheses refer to standard errors of the regression coefficients.
b. Coefficients with one asterisk were found to be significantly different from zero at the five per cent level ("t" test).
c. Coefficients with two asterisks were significant at the one per cent level ("t" test).

Definition of Independent Variables:

X_3 = Total Arizona orange production per capita in 75-pound packed boxes.
X_4 = Total domestic orange production per capita in 75-pound packed boxes.
X_5 = Total domestic orange production (less total Arizona production) per capita in 75-pound packed boxes.
X_7 = United States disposable personal income per capita (in current dollars).
X_8 = Total domestic navel orange production per capita in 75-pound packed boxes.
X_{14} = Total California orange production per capita in 75-pound packed boxes.
X_{19} = Total Arizona and California orange production per capita in 75-pound packed boxes.
X_{20} = Total domestic orange production (less Arizona and California production) per capita in 75-pound packed boxes.
X_{21} = Total domestic processed orange production per capita in 75-pound packed boxes.
X_{26} = Total domestic fruit consumption in fresh equivalent pounds per capita (farm weight).

Definition of Dependent Variable:

X_2 = On-tree price per 75-pound packed box, all Arizona oranges, all methods of sale.

Code:

0 = No data transformation.
5 = Logarithms to the base "e."

Table 9. Results of Regression Analysis: On-Tree Fresh Price per Packed 75-Pound Box, Arizona Valencia Oranges

Code	Dep. Var.	Constant Term	X_3	X_4	X_5	X_6	X_7	X_{11}	X_{12}	X_{14}	X_{19}	X_{20}	R^2	S.E.
0	X_1	11.2589		-5.1313 (2.7486)[a]		0.0748 (0.0856)	-0.0007 (0.0013)	-94.3380 (147.4920)	0.3658 (3.7793)	-19.2873**[b] (6.0972)			.64	.64
0	X_1	13.0164		-4.2711*[c] (1.6536)			-0.0017** (0.0006)			-15.5556** (3.1686)			.69	.60
0	X_1	12.9014			-4.1355* (1.6671)		-0.0017* (0.0006)			-15.5580** (3.2079)			.68	.60
5	X_1	14.6778	-0.3141 (0.2136)		-1.2624* (0.5036)		0.4915 (0.3276)						.34	.2562
0	X_1	7.6453	-205.5149 (104.6563)		-6.2267 (2.3275)		0.0011 (0.0007)						.37	.85
0	X_1	9.0213				0.0060 (0.0816)	-0.0013 (0.0009)				16.9398* (6.4440)		.55	.71
0	X_1	12.8371					-0.0016* (0.0006)				-19.4650** (3.2962)	-4.2725* (1.6846)	.68	.60
5	X_1	22.7909					-0.8073** (0.2281)				-1.3157** (0.1613)	-0.6329** (0.1985)	.82	.1349
0	X_1	9.1586					-0.0013* (0.0006)				-16.5449** (3.5478)		.58	.69
0	X_1	6.9130		-5.6275* (2.5122)			0.0004 (0.0006)						.26	.92

a. Numbers in parentheses refer to standard errors of the regression coefficients.
b. Coefficients with two asterisks were found to be significantly different from zero at the one per cent level of significance ("t" test).
c. Coefficients with one asterisk were significant at the five per cent level ("t" test).

Definition of Independent Variables:

X_3 = Total Arizona orange production per capita in 75-pound packed boxes.
X_4 = Total domestic orange production per capita in 75-pound packed boxes.
X_5 = Total domestic orange production (less total Arizona production) per capita in 75-pound packed boxes.
X_6 = Total domestic fresh orange consumption in pounds per capita.
X_7 = U. S. disposable personal income (in current dollars).
X_{11} = Total Arizona Valencia orange production per capita in 75-pound packed boxes.
X_{12} = Total domestic Valencia orange production per capita in 75-pound packed boxes.
X_{19} = Total Arizona and California orange production per capita in 75-pound packed boxes.
X_{20} = Total domestic orange production (less total Arizona and California production) per capita in 75-pound packed boxes.

Definition of Dependent Variable:

X_1 = On-tree fresh price per packed 75-pound box, Arizona Valencias.

Code:

0 = No data transformation.
5 = Logarithms to the bare "e."

Table 10. Results of Regression Analysis: On-Tree Price per 75-Pound Packed Box, Arizona Navels, All Methods of Sale

Code	Dep. Var.	Constant Term	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{19}	X_{20}	X_{25}	R^2	S.E.
0	X_2	6.7944		3.7620 (7.1024)[a]	-0.1210 (0.1225)	0.0000 (0.0016)			-6.1359 (11.6391)			-596.6860 (339.1020)	.31	.98
5	X_2	10.7761		1.2959 (2.2519)	-1.3192 (1.2510)	-0.3032 (1.2407)			-0.4840 (1.2308)			-0.6054 (0.3760)	.28	.3854
0	X_2	4.5052		8.1309 (5.1706)		0.0003 (0.0007)	-36.0089 (20.9393)	-13.2740 (22.4524)	24.2896 (19.8230)				.48	.85
0	X_2	2.3494				0.0009 (0.0011)		-44.3541 (26.8377)		8.0916 (12.6044)	2.1726 (2.5682)		.39	.91
0	X_2	4.6969		7.2798 (4.8572)		0.0002 (0.0007)	-45.1870**[b] (13.7421)		34.7108** (8.8696)				.50	.83
0	X_2	0.1154	0.8312 (6.4216)			0.0014 (0.0008)	-0.5034 (11.0781)						.05	1.14
0	X_2	6.4425			-0.1266 (0.0668)	-0.0008 (0.0013)	2.2847 (4.8322)						.23	1.03
0	X_2	0.3935		-2.2645 (6.7060)		0.0013 (0.0008)	5.4378 (11.6258)						.07	.39
0	X_2	0.1298	0.5770 (3.0320)			0.0014 (0.0007)							.11	1.11

a. Numbers in parentheses refer to standard errors of the regression coefficients.
b. Coefficients with two asterisks were found to be significantly different from zero at the one per cent level ("t" test).

Definition of Independent Variables:

X_4 = Total domestic orange production per capita in 75-pound packed boxes.
X_5 = Total domestic orange production (less total Arizona production) per capita in 75-pound packed boxes.
X_6 = Fresh domestic consumption of fresh oranges in pounds per capita.
X_7 = United States disposable personal income per capita (in current dollars).
X_8 = Total domestic Navel orange production per capita in 75-pound packed boxes.
X_9 = Total California Navel orange production per capita in 75-pound boxes.
X_{10} = Total Florida early and midseason orange production per capita in 75-pound boxes.
X_{19} = Total Arizona and California orange production per capita in 75-pound boxes.
X_{20} = Total domestic orange production (less total Arizona and California production) per capita in 75-pound boxes.
X_{25} = Total Arizona Navel orange production per capita in 75-pound boxes.

Definition of Dependent Variable:

X_2 = On-tree price per packed 75-pound box, Arizona Navels, all methods of sale.

Code:

0 = No data transformation.
5 = Logarithms to the base "e."

Table 11. Results of Regression Analysis: Fresh On-Tree Price per 75-Pound Packed Box, Arizona Navels and On-Tree Price per 75-Pound Packed Box, Arizona Valencias, All Methods of Sale

Code	Dep. Var.	Constant Term	X_3	X_4	X_5	X_7	X_8	X_9	X_{10}	X_{14}	X_{18}	X_{19}	X_{20}	R^2	S.E.
0	X_1	5.8732			7.7986 (5.0897)[a]	0.0002 (0.0007)	-32.1428 (20.6110)	-19.4346 (22.1014)	18.7248 (19.5131)					.49	.83
0	X_1	7.1357				-0.0004 (0.0009)	-10.5963 (10.9245)					-8.8851 (6.1883)	6.1126 (6.4961)	.32	.96
0	X_1	6.1538			6.5524 (4.8514)	0.0001 (0.0007)	-45.5806**[b] (13.7255)		+33.9827** (8.8589)					.50	.83
0	X_1	1.9010				0.0012* (0.0008)	0.6602 (6.3499)				-2.2215 (6.7226)			.07	1.12
0	X_1	6.6270				-0.0003 (0.0009)						-12.0555*[c] (5.2449)	0.3753 (2.6806)	.33	.96
0	X_2	9.1837			-1.4005 (2.2784)	-0.0013 (0.0008)				-15.0381** (4.3839)				.44	.92
0	X_2	9.3142		-1.5525 (2.2802)		-0.0013 (0.0008)				-15.0039** (4.3692)				.45	.82
5	X_2	15.46991				-0.3629 (0.5592)						-1.2215** (0.3945)	-0.1223 (0.4874)	.44	.3332
0	X_2	9.0415				-0.0011 (0.0008)						-16.1483** (4.6109)	-1.5127 (2.3200)	.44	.83
0	X_2	4.2416	-2,093.190 (1,229.582)		-3.5315 (2.7345)	0.0015 (0.0008)								.19	1.00
0	X_2	7.7268				-0.0010 (0.0008)						-15.0906** (4.2426)		.46	.81
5	X_2	14.3672				-0.3390 (0.5491)						-1.1939** (0.3819)		.47	.3244
0	X_2	3.4182		-2.8580 (2.8831)		0.0007 (0.0007)								.10	1.05

a. Numbers in parentheses refer to standard errors of the regression coefficients.
b. Coefficients marked by two asterisks were found to be significantly different from zero at the one per cent level ("t" test).
c. Coefficients marked by one asterisk were significant at the five per cent level ("t" test).

Definition of Independent Variables:

X_3 = Total Arizona orange production per capita in 75-pound packed boxes.
X_4 = Total domestic orange production per capita in 75-pound packed boxes.
X_5 = Total domestic orange production (less total Arizona production) per capita in 75-pound packed boxes.
X_7 = United States disposable personal income per capita (in current dollars).
X_8 = Total domestic Navel orange production per capita in 75-pound packed boxes.
X_9 = Total California Navel orange production per capita in 75-pound packed boxes.
X_{10} = Total Florida early and midseason orange production per capita in 75-pound packed boxes.
X_{14} = Total California orange production per capita in 75-pound packed boxes.
X_{18} = Total domestic orange production (less total domestic Navel production) per capita in 75-pound packed boxes.
X_{19} = Total Arizona and California orange production per capita in 75-pound packed boxes.
X_{20} = Total domestic orange production (less total Arizona and California production) per capita in 75-pound packed boxes.

Definition of Dependent Variables:

X_1 = Fresh on-tree price per 75-pound packed box for Arizona Navel oranges.
X_2 = On-tree price per 75-pound packed box, Arizona Valencia oranges. All methods of sale.

Code:

0 = No data transformation.
5 = Logarithms to the base "e."

Table 12. Results of Regression Analysis: Free-on-Board Price per 75-Pound Box; all Arizona Oranges Sold in Fresh Form

Code	Dep. Var.	Constant Term	X_3	X_5	X_6	X_7	X_{19}	X_{20}	X_{21}	X_{22}	X_{23}	X_{24}	R^2	S.E.
0	X_1	-14.2830	-48.7040	10.7105	-1.1550*	0.00002			-14.1611	0.0241	0.5169	0.2106	.58	.82
			(132.5530)[a]	(22.9772)	(0.4899)	(0.0016)			(24.5234)	(0.0885)	(0.3726)	(0.1026)		
1	X_1	1.1168	-58.6560	-0.7018	0.0375	-0.0140*							.11	1.18
			(123.5830)	(3.5363)	(0.1494)	(0.0065)								
0	X_1	10.2812	-139.778	-2.1067	-0.1155	0.0001							.45	.94
			(145.7920)	(2.8712)	(0.0796)	(0.0018)								
5	X_1	13.8198	-0.1246	0.1737	-0.9492*	-0.4349							.50	.1827
			(0.1657)	(0.4525)	(0.4218)	(0.5950)								
1	X_1	1.1138	-54.5280		0.0221	-0.0142*							.17	1.14
			(117.8540)		(0.1236)	(0.0062)								
0	X_1	9.4831	-102.3800		-0.1409	-0.0002							.46	.93
			(134.6070)		(0.0707)	(0.0017)								
0	X_1	5.9496	-265.4140*	-3.9155		0.0024**[c]							.41	.98
			(121.3060)	(2.6746)		(0.0008)								
5	X_1	14.2506	-0.1469		-0.8512*	-0.3346							.53	.1778
			(0.1509)		(0.3268)	(0.5202)								
0	X_1	9.3727			0.0312	-0.0004	-19.1852*						.62	.78
					(0.0899)	(0.0010)	(7.1032)							
0	X_1	9.3158	-717.4390			-0.0001	-15.5591**						.62	.78
			(1,095.563)			(0.0010)	(4.6193)							
0	X_1	11.6904				-0.0008	-18.4336**	-1.8732					.63	.77
						(0.0007)	(4.2191)	(2.1563)						
0	X_1	9.9516				-0.0006	-16.9962**						.64	.77
						(0.0007)	(3.9959)							

a. Numbers in parentheses refer to standard errors of the regression coefficients.
b. Coefficients marked by an asterisk were found to be significantly different from zero at the five per cent level ("t" test).
c. Coefficients marked by two asterisks are significant at the one per cent level ("t" test).

Definition of Independent Variables:

X_3 = Total production of Arizona oranges per capita in 75-pound boxes.
X_5 = Total domestic orange production per capita (less total Arizona production) in 75-pound boxes.
X_6 = Fresh domestic orange consumption in pounds per capita.
X_7 = United States disposable personal income per capita (in current dollars).
X_{19} = Total Arizona and California orange production per capita in 75-pound boxes.
X_{20} = Total domestic orange production (less total Arizona and California production) per capita in 75-pound boxes.
X_{21} = Total domestic processed orange diversion per capita in 75-pound boxes.
X_{22} = Domestic production of citrus (not oranges) in pounds per capita.
X_{23} = Total domestic fresh citrus consumption in pounds per capita (farm weight).
X_{24} = United States consumption of all non-citrus fruits in fresh equivalent pounds per capita (farm weight). Includes both fresh and processed fruits.

Definition of Dependent Variable:

X_1 = Free-on-board fresh price per 75-pound box of all Arizona oranges.

Code:

0 = No data transformation.
1 = First differences of the observations.
5 = Logarithms to the base "e."

Table 13. Results of Regression Analysis: Free-on-Board Price per Packed 75-Pound Box for Fresh Arizona Valencia Oranges

Code	Dep. Var.	Constant Term	X_3	X_4	X_5	X_6	X_7	X_{11}	X_{13}	X_{14}	X_{15}	X_{19}	X_{20}	R^2	S.E.
0	X_1	10.8932					0.0009	-299.243	-0.6908		-11.0686*[b]			.45	.91
							(0.0013)[a]	(184.488)	(5.7184)		(4.7643)				
5	X_1	12.3737					0.3599	-0.1617	-0.0373		0.8840			.40	.1822
							(0.4283)	(0.1366)	(0.3102)		(0.4832)				
0	X_1	15.2002		-4.9711**[c]			-0.0012	-98.454		-16.9336**				.77	.59
				(1.6322)			(0.0008)	(122.498)		(3.3844)					
5	X_1	20.7980		-0.5995**			-0.3754	-0.0996		-0.7645**				.88	.0819
				(0.1645)			(0.1764)	(0.0611)		(0.0962)					
0	X_1	12.9504			1.1150	0.0696	-0.0007		-13.3686	-27.3256				.80	.56
					(3.5978)	(0.0668)	(0.0008)		(7.0663)	(6.1838)**					
0	X_1	14.7360			-4.3881	-0.1531*	-0.0013	-108.456						.55	.83
					(2.4231)	(0.0667)	(0.0016)	(188.734)							
0	X_1	9.6503	-259.7759*		-7.1616**		0.0016*							.49	.89
			(108.8351)		(2.4204)		(0.0007)								
0	X_1	15.3159					-0.0014*					-22.0788**	-4.9729**	.78	.57
							(0.0005)					(3.0749)	(1.5842)		
5	X_1	17.1566					-0.4252**					-0.9387**	-0.4355**	.87	.0836
							(0.1404)					(0.0990)	(0.1224)		
0	X_1	15.6575			-4.6856**		-0.0017**			-18.0066**				.77	.59
					(1.6243)		(0.0006)			(3.1253)					
5	X_1	9.3358	-0.2450		-0.7139		0.5754*							.36	.1883
			(0.1602)		(0.3653)		(0.2352)								
0	X_1	15.7839		-4.8348**			-0.0017**			-18.0053				.78	.58
				(1.6053)			(0.0006)			(3.0760)					
0	X_1	11.4292					-0.0012					-19.1451**		.67	.70
							(0.0007)					(3.6126)			

a. Numbers in parentheses refer to standard errors of the regression coefficients.
b. Coefficients with one asterisk were found to be significantly different from zero at the five per cent level ("t" test).
c. Coefficients with two asterisks were significant at the one per cent level ("t" test).

Definition of Independent Variables:

X_3 = Total Arizona orange production per capita in 75-pound packed boxes.
X_4 = Total domestic orange production per capita in 75-pound packed boxes.
X_5 = Total domestic orange production (less total Arizona production) per capita in 75-pound packed boxes.
X_6 = Total domestic fresh orange consumption in pounds per capita.
X_7 = U. S. disposable personal income per capita (in current dollars).
X_{11} = Total Arizona Valencia orange production per capita in 75-pound packed boxes.
X_{15} = Total domestic orange production (less Arizona production and Florida Valencia production) per capita in 75-pound packed boxes.
X_{19} = Total Arizona and California orange production per capita in 75-pound packed boxes.
X_{20} = Total domestic orange production (less Arizona and California production) per capita in 75-pound packed boxes.

Definition of Dependent Variable:

X_1 = Free-on-board fresh price per packed 75-pound box, Arizona Valencias.

Code:

0 = No data transformation.
5 = Logarithms to the base "e."

Table 14. Results of Regression Analysis: Free-on-Board, Fresh Price per 75-Pound Packed Box, Arizona Navels

Code	Dep. Var.	Constant Term	X_3	X_4	X_5	X_6	X_7	X_8	X_{10}	X_{19}	X_{20}	R^2	S.E.
0	X_1	4.6508	7.661 (153.551)[a]		5.4228 (6.7857)	0.1026 (0.1473)	0.0017 (0.0019)	-60.1075*[b] (21.3716)	50.0774* (21.5980)			.56	.91
5	X_1	10.5036	0.1175 (0.2197)		1.6377 (1.2257)	-0.4107 (0.7023)	-0.1940 (0.7069)	-3.8070* (1.7602)	1.9412 (1.1649)			.49	.1998
0	X_1	6.8751			8.1023 (5.0573)		0.0008 (0.0007)	-50.9138**[c] (14.3082)	37.1597** (9.2350)			.60	.85
0	X_1	1.9697		1.2317 (6.7840)			0.0021* (0.0008)	-3.1259 (11.7033)				.22	1.20
5	X_1	1.4840	-0.2773 (0.1862)		-0.1265 (0.4390)		0.9506** (0.2856)					.36	.2234
0	X_1	3.3256	-291.9482* (129.682)		-1.3732 (2.8828)		0.0030** (0.0008)					.41	1.05
0	X_1	7.6034					0.0002 (0.0010)			-13.2273* (5.4716)	0.9012 (2.7964)	.47	1.00
5	X_1	7.2517					0.1671 (0.3451)			-0.5422* (0.2441)	0.1055 (0.3004)	.46	.2043
0	X_1	9.0868				-0.1366 (0.0686)	-0.0003 (0.0013)					.40	1.05
0	X_1	2.1319			-0.4077 (3.1739)		0.0020* (0.0008)					.27	1.17

a. Numbers in parentheses refer to standard errors of the regression coefficients.
b. Coefficients with one asterisk were found significantly different from zero at the five per cent level ("t" test).
c. Coefficients with two asterisks are significant at the one per cent level ("t" test).

Definition of Independent Variables:

X_3 = Total Arizona orange production per capita in 75-pound packed boxes.
X_4 = Total domestic orange production per capita in 75-pound packed boxes.
X_5 = Total domestic orange production (less total Arizona production) per capita in 75-pound packed boxes.
X_6 = Total domestic fresh orange consumption in pounds per capita.
X_7 = U. S. disposable personal income per capita (in current dollars).
X_8 = Total domestic Navel orange production per capita in 75-pound packed boxes.
X_{10} = Total Florida early and midseason orange production per capita in 75-pound boxes.
X_{20} = Total domestic orange production (less Arizona and California production) per capita in 75-pound boxes.

Definition of Dependent Variable:

X_1 = Free-on-board fresh price per packed 75-pound box, Arizona Navel oranges.

Code:

0 = No data transformation.
5 = Logarithms to the base "e."

Table 15. Results of Regression Analysis: Packinghouse Door Price per 75-Pound Box, All Arizona Oranges, All Methods of Sale

Code	Dep. Var.	Constant Term	X_4	X_5	X_6	X_7	X_{11}	X_{12}	X_{14}	X_{19}	X_{20}	R^2	S.E.
0	X_1	5.2810	-1.5419 (3.6555)[a]		0.0639 (0.1138)	0.0007 (0.0017)	-151.9200 (196.1550)	1.2013 (5.0203)	-15.7431 (8.1089)			.40	.85
5	X_1	9.3551	0.2520 (1.1195)		0.1686 (1.0997)	0.2429 (1.1607)	-0.0582 (0.2482)	-0.1425 (0.8073)	-0.9323 (0.5697)			.33	.3160
0	X_1	7.0157		-0.0198 (2.1816)		-0.0005 (0.0008)			-13.4366**[b] (4.1978)			.48	.79
0	X_1	7.1645	-0.1922 (2.1886)			-0.0005 (0.0008)			-13.3825** (4.1936)			.48	.79
0	X_1	7.0692				-0.0004 (0.0008)				-13.4311** (4.2957)	-0.1333 (2.1954)	.49	.78
0	X_1	7.1818	0.2243 (2.5658)		-0.1275 (0.0608)	-0.0007 (0.0011)						.33	.90
0	X_1	7.0157		-0.0198 (2.1816)		-0.0005 (0.0008)			-13.4366 (4.1978)			.48	.79
0	X_1	6.9544				-0.0004 (0.0007)				-13.3400** (3.9054)		.52	.76
0	X_1	1.9029	-1.3453 (2.6874)			0.0013 (0.0007)						.19	.98

a. Numbers in parentheses refer to standard errors of the regression coefficients.
b. Coefficients marked by two asterisks were found to be significantly different from zero at the one per cent level ("t" test).

Definition of Independent Variables:

X_4 = Total domestic orange production per capita in 75-pound boxes.
X_5 = Total domestic orange production (less total Arizona production) per capita in 75-pound boxes.
X_6 = Fresh domestic orange consumption in pounds per capita.
X_7 = United States disposable personal income per capita (in current dollars).
X_{11} = Total Arizona Valencia production per capita in 75-pound boxes.
X_{12} = Total domestic Valencia production per capita in 75-pound boxes.
X_{14} = Total California orange production per capita in 75-pound boxes.
X_{19} = Total Arizona and California orange production per capita in 75-pound boxes.
X_{20} = Total domestic orange production (less total Arizona and California production) per capita in 75-pound boxes.

Definition of Dependent Variable:

X_1 = All Arizona oranges; all methods of sale, packinghouse door price per 75-pound packed box.

Code:

0 = No data transformation.
5 = Logarithms to the base "e."

Table 16. Results of Regression Analysis: Packinghouse Door Price per 75-Pound Box, Arizona Valencia Oranges, All Methods of Sale

Code	Dep. Var.	Constant Term	X_4	X_5	X_6	X_7	X_{11}	X_{13}	X_{14}	X_{19}	X_{20}	X_{23}	R^2	S.E.
0	X_2	2.1333		6.1035	-0.0394	0.0018	-145.961	-19.7717	-26.9703*			0.1318	.47	.82
				(5.8266)[a]	(0.5250)	(0.0019)	(190.9760)	(10.6119)	(10.7244)			(0.3559)		
0	X_2	6.2604	5.9714			-0.0001		-15.4044	-19.2094				.53	.78
			(5.1328)			(0.0008)		(9.8335)	(5.4369)					
0	X_2	8.4247				-0.0006		-4.9730	-15.1251**[c]				.52	.78
						(0.0008)		(4.1458)	(4.2000)					
0	X_2	8.0009		-1.1832		-0.0007			-13.6787**				.48	.81
				(2.2406)		(0.0008)			(4.3112)					
0	X_2	8.1284	-1.3315			-0.0007			-13.6436**				.48	.81
			(2.2432)			(0.0008)			(4.2983)					
0	X_2	7.9902				-0.0006				-14.7206**	1.2970		.49	.81
						(0.0008)				(4.4305)	(2.2643)			
0	X_2	2.7664	-2.5100			0.0012							.21	1.00
			(2.7484)			(0.0007)								
0	X_2	6.8736				-0.0005				-13.8342**			.51	.79
						(0.0007)				(4.0686)				

a. Numbers in parentheses refer to standard errors of the regression coefficients.
b. Coefficients marked by an asterisk were found to be significantly different from zero at the five per cent level ("t" test).
c. Coefficients marked by two asterisks are significantly at the one per cent level ("t" test).

Definition of Independent Variables:

X_4 = Total domestic orange production per capita in 75-pound boxes.
X_5 = Total domestic orange production (less total Arizona production) per capita in 75-pound boxes.
X_6 = Fresh domestic orange consumption in pounds per capita.
X_7 = U. S. disposable personal income per capita (in current dollars).
X_{11} = Total Arizona Valencia orange production per capita in 75-pound boxes.
X_{13} = Total Florida Valencia production per capita in 75-pound boxes.
X_{14} = Total California orange production per capita in 75-pound boxes.
X_{19} = Total Arizona and California orange production per capita in 75-pound boxes.
X_{20} = Total domestic orange production (less total Arizona and California production) per capita in 75-pound boxes.
X_{23} = Total domestic fresh citrus consumption in pounds per capita (farm weight).

Definition of Dependent Variable:

X_2 = All methods of dale, Arizona Valencias, packinghouse door price per 75-pound box.

Code:

0 = No data information.

Table 17. Results of Regression Analysis: Packinghouse Door Fresh Price per Packed 75-Pound Box, Arizona Valencias

Code	Dep. Var.	Constant Term	X_3	X_4	X_5	X_7	X_{11}	X_{13}	X_{14}	X_{19}	X_{20}	R^2	S.E.
0	X_2	12.0592			0.8718	-0.0010	-74.050	-11.5784	-19.7238**[b]			.72	.59
					(3.8131)[a]	(0.0009)	(123.392)	(7.3365)	(4.2979)				
5	X_2	22.2251				-0.8358**			-1.2195**		-0.5818**	.82	.1250
						(0.2167)			(0.1458)				
0	X_2	13.9867		-4.6121*[c]		-0.0018**			-16.3073**			.71	.50
				(1.6490)		(0.0006)			(3.1590)				
0	X_2	13.8626			-4.4657*	-0.0018**			-16.3099**			.70	.60
					(1.6657)	(0.0006)			(3.2052)				
0	X_2	8.4078	-227.0014*		-6.7070*	0.0011						.40	.86
			(105.5219)		(2.3467)	(0.0007)							
5	X_2	14.8464	-0.3308		-1.2401*	0.4663						.37	.2360
			(0.1967)		(0.4638)	(0.3017)							
0	X_2	13.8801				-0.0019**			-20.8677**		-4.4873*	.70	.60
						(0.0006)			(3.3535)		(1.6782)		
0	X_2	13.8074				-0.0017**				-20.5559**	-4.6192*	.71	.60
						(0.0006)				(3.2822)	(1.6775)		
5	X_2	22.3322				-0.7867**				-1.2579**	-0.6167**	.83	.1209
						(0.2043)				(0.1445)	(0.1778)		
0	X_2	9.8305				-0.0014				-17.3988**		.59	.70
						(0.0007)				(3.6223)			

a. Numbers in parentheses refer to standard errors of the regression coefficients.
b. Coefficients marked with two asterisks were found to be significantly different from zero at the one per cent level of significance ("t" test).
c. Coefficients marked with one asterisk were significant at the five per cent level ("t" test).

Definition of Independent Variables:

X_3 = Total Arizona orange production per capita in 75-pound packed boxes.
X_4 = Total domestic orange production per capita in 75-pound packed boxes.
X_5 = Total domestic orange production (less total Arizona production) per capita in 75-pound packed boxes.
X_7 = U. S. disposable personal income per capita (in current dollars).
X_{11} = Total Arizona Valencia orange production per capita in 75-pound packed boxes.
X_{13} = Total Florida Valencia orange production per capita in 75-pound packed boxes.
X_{14} = Total California orange production per capita in 75-pound packed boxes.
X_{19} = Total Arizona and California orange production per capita in 75-pound packed boxes.
X_{20} = Total domestic orange production (less total Arizona and California production) per capita in 75-pound packed boxes.

Definition of Dependent Variable:

X_2 = Packinghouse door fresh price per packed 75-pound box, Arizona Valencia oranges.

Code:

0 = No data transformation.
5 = Logarithms to the base "e."

Table 18. Results of Regression Analysis: Packinghouse Door Price per 75-Pound Box, All Methods of Sale for Arizona Navels

Code	Dep. Var.	Constant Term	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{18}	X_{19}	X_{20}	X_{25}	R^2	S.E.
5	X_2	1.6400		+0.9767 (1.9193)[a]	-0.1448 (1.2274)	+0.5626 (1.1766)		-0.7845 (0.4488)	-0.3438 (1.0235)					.35	.33
5	X_2	9.8861		+2.2306 (1.8709)	-1.2511 (0.8295)	-0.2411 (0.9902)	-1.5515 (1.4401)						-0.4658 (0.2982)	.38	.32
0	X_2	3.9019		+7.0582 (7.0662)	-3.3720 (12.8290)	+0.0006 (0.0015)		-3.9997*[b] (1.8338)	-8.8906 (11.3570)					.41	.94
0	X_2	7.0680		+8.6235 (6.2480)	-0.1188 (0.0820)	+0.0002 (0.0014)	-15.3495 (10.1509)						-5.5404 (3.0732)	.43	.92
0	X_2	5.4259				-0.0001 (0.0009)	-9.0652 (11.1551)				-8.1822 (6.3190)	+6.5710 (6.6333)		.35	.98
0	X_2	0.3441				+0.0016 (0.0008)	+2.6752 (6.4049)			-1.8541 (6.7808)				.13	1.14
0	X_2	3.9800				+0.0006 (0.0006)		-28.1974* (10.5683)				+1.6967 (2.4825)		.45	.90
0	X_2	0.1301	0.4970 (3.0334)			0.0017* (0.0007)								.18	1.11

a. Numbers in parentheses refer to standard errors of the regression coefficients.
b. Coefficients marked by an asterisk were found to be significantly different from zero at the five per cent level ("t" test).

Definition of Independent Variables:

X_4 = Total domestic orange production per capita in 75-pound boxes.
X_5 = Total domestic orange production (less total Arizona production) per capita in 75-pound boxes.
X_6 = Fresh domestic orange consumption in pounds per capita.
X_7 = United States disposable personal income per capita (in current dollars).
X_8 = Total domestic Navel production per capita in 75-pound boxes.
X_9 = Total California Navel production per capita in 75-pound boxes.
X_{10} = Total Florida early and midseason orange production per capita in 75-pound boxes.
X_{18} = Total domestic orange production (less total domestic Navel production) per capita in 75-pound boxes.
X_{19} = Total California and Arizona orange production per capita in 75-pound boxes.
X_{20} = Total domestic orange production (less California and Arizona total production) per capita in 75-pound boxes.
X_{25} = Total Arizona Navel orange production per capita in 75-pound packed boxes.

Definition of Dependent Variable:

X_2 = Packinghouse door price per 75-pound box for Arizona Navel oranges sold fresh and processed.

Code:

0 = No data transformation.
5 = Logarithms to the base "e."

Table 19. Results of Regression Analysis: Packinghouse Door Fresh Price per 75-Pound Packed Box, Arizona Navels

Code	Dep. Var.	Constant Term	X_3	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{19}	X_{20}	X_{25}	R^2	S.E.
0	X_1	5.0157		7.1819	-0.0236	0.0007		-46.5021	-11.2467				.47	.92
				(6.9162)[a]	(0.1256)	(0.0015)		(17.9478)	(11.1159)					
0	X_1	8.4874		9.5010	-0.1333	0.0000	-16.6378					-460.2660	.40	.97
				(6.6077)	(0.0867)	(0.0015)	(10.7353)					(325.0110)		
5	X_1	12.5156		2.2590	1.3696	-0.4846	-1.6749					-0.3442	.39	.2962
				(1.7070)	(0.7569)	(0.9035)	(1.3139)					(0.2721)		
5	X_1	5.0162		1.0261	-0.3036	0.3311		-0.7601	-0.5053				.40	.2938
				(1.7028)	(1.0099)	(1.0438)		(0.3981)	(0.9080)					
0	X_1	3.5132				0.0012		-49.2156		8.6344	0.9351		.47	.92
						(0.0011)		(26.9473)		(12.6559)	(2.5787)			
0	X_1	5.3361				0.0006		-32.3404**[c]			0.5383		.49	.90
						(0.0006)		(10.5135)			(2.4696)			
0	X_1	7.1774		0.9346	-0.1357	-0.0005							.31	1.05
				(2.9747)	(0.0713)	(0.0013)								
0	X_1	1.5891		-2.1642		0.0016	2.8076						.16	1.16
				(6.8900)		(0.0009)	(11.9274)							
0	X_1	6.5454				-0.0001				-12.5819*[b]	0.4838		.40	.98
						(0.0009)				(5.3764)	(2.7477)			
5	X_1	8.2304				0.1361				-0.7451	0.1030		.39	.2970
						(0.5018)				(0.3549)	(0.4367)			
0	X_1	2.5902	-268.5613**	-1.6126		0.0026							.34	1.03
			(126.8321)	(2.8207)		(0.0008)								

a. Numbers in parentheses refer to standard errors of the regression coefficients.
b. Coefficients with one asterisk were found to be significantly different from zero at the five per cent level of significance ("t" test).
c Coefficients with two asterisks were significant at the one per cent level ("t" test).

Definition of Independent Variables:

X_3 = Total Arizona orange production per capita in 75-pound packed boxes.
X_5 = Total domestic orange production (less total Arizona production) per capita in 75-pound packed boxes.
X_6 = Total domestic fresh orange consumption in pounds per capita.
X_7 = United States disposable personal income per capita (in current dollars).
X_8 = Total domestic Navel orange production per capita in 75-pound packed boxes.
X_9 = Total California orange production per capita in 75-pound packed boxes.
X_{10} = Total Florida early and mid-season orange production per capita in 75-pound packed boxes.
X_{19} = Total Arizona and California orange production per capita in 75-pound packed boxes.
X_{20} = Total domestic orange production (less total Arizona and California production) per capita in 75-pound packed boxes.
X_{25} = Total Arizona Navel orange production per capita in 75-pound packed boxes.

Definition of Dependent Variable:

X_1 = Packinghouse door-fresh price per 75-pound packed box, Arizona Navels.

Code:

0 = No data transformation.
5 = Logarithms to the base "e."

APPENDIX B

RESULTS OF SUPPLY ANALYSIS

Table 20. Results of Regression Analysis: Arizona-California Orange Supply

Code	Dep. Var.	Constant Term	X_8	X_{13}	X_{14}	X_{15}	X_{16}	R^2	S.E.
0	X_1	3580.9819	-86.2378**[b] (20.7047)[a]		2.8914*[c] (1.2516)			.84	221.8
5	X_1	7.2642	-0.0841* (0.0369)	0.1884* (0.0777)				.81	0.0588
0	X_1	2410.7733				4.8476** (0.7886)		.77	218.4
5	X_1	6.5686				0.2968** (0.0442)		.80	0.06
0	X_1	2909.7859	-31.4765 (36.2384)			3.6791* (1.5644)		.76	221.2
5	X_1	7.2420	-0.0905 (0.0733)			0.2029* (0.0873)		.81	0.0586
0	X_1	2310.2135					6.1767** (1.0910)	.70	304.1
0	X_1	2318.9786		5.1570** (1.0274)				.69	254.5
0	X_1	3082.4503	-52.4266 (34.9645)	3.0849 (1.6876)				.72	240.0

a. Numbers in parentheses refer to standard errors of the regression coefficients.
b. Coefficients with two asterisks were found to be significantly different from zero at the one per cent level ("t" test).
c. Coefficients with one asterisk were significant at the five per cent level ("t" test).

Definition of Independent Variables:

X_8 = Trend variable.
X_{13} = Arizona and California estimated total revenue per bearing acre, in a four-year moving average, lagged eleven years (unweighted).
X_{14} = Arizona and California estimated total revenue per bearing acre, in a four-year moving average, lagged nine years (unweighted).
X_{15} = Arizona and California estimated total revenue per bearing acre, in a four-year moving average, lagged eleven years (weighted).
X_{16} = Arizona and California estimated total revenue per bearing acre, in a four-year moving average, lagged nine years (weighted).

Definition of Dependent Variable:

X_1 = Total Arizona and California orange production in 75-pound packed boxes in a four-year moving average.

Code:

0 = No data transformation.
5 = Logarithms to the base "e."

Table 21. Results of Regression Analysis: Florida Orange Supply

Code	Dep. Var.	Constant Term	X_4	X_6	X_8	X_{17}	X_{18}	X_{23}	R^2	S.E.
0	X_2	13513.1784			-424.5442*[b]		96.0437*	-22.5536*	.37	616.8
					(183.6126)[a]		(37.7895)	(8.3214)		
0	X_2	12960.0240			-129.3275	0.9752		-2.8194*	.26	427.7
					(74.3875)	(6.1436)		(1.2089)		
0	X_2	1001.1784		51.9810		0.3047		-0.0593	.23	43.9
				(33.0578)		(0.5707)		(0.0901)		
0	X_2	1002.9990				0.8013		-0.1218	.10	47.4
						(0.5128)		(0.0873)		
0	X_2	981.7346		102.2419*			-0.1427		.39	61.0
				(35.7458)			(0.6639)			
0	X_2	988.6396		61.5686		0.1090			.27	42.5
				(28.7301)		(0.4716)				
0	X_2	10450.324					15.2234	-3.9582	.13	728.5
							(16.9627)	(2.5239)		
0	X_2	8903.4498	1332.7898**[c]				3.2923		.57	512.0
			(330.6342)				(5.9455)			
0	X_2	971.9383				0.5362			.01	49.6
						(0.4983)				

a. Numbers in parentheses refer to standard errors of the regression coefficients.
b. Coefficients with one asterisk were found to be significantly different from zero at the five per cent level ("t" test).
c. Coefficients with two asterisks were significant at the one per cent level ("t" test).

Definition of Independent Variables:

X_4 = Zero-one variable on Florida orange production; 1953-62 = 1; zero elsewhere.
X_6 = Zero-one variable on Florida orange production; 1953-57 and 1958-62 = 1; zero elsewhere.
X_8 = Trend variable.
X_{17} = Florida estimated total revenue per bearing acre in a four-year moving average, lagged eleven years. (Total revenue estimate was deflated by the index of prices paid by farmers for production items.)
X_{18} = Florida estimated total revenue per bearing acre in a four-year moving average, lagged nine years. (Total revenue estimates were deflated by the index of prices paid by farmers for production items.)
X_{23} = Florida on-tree orange price per packed 75-pound box, lagged nine years and deflated by the index of prices paid by farmers for production items.

Definition of Dependent Variable:

X_2 = Florida total orange production in 75-pound packed boxes and in a four-year moving average.

Code:

0 = No data transformation.

Table 22. Results of Regression Analysis: Bearing Acreage for Arizona-California and Florida

Code	Dep. Var.	Constant Term	X_5	X_6	X_8	X_{13}	X_{14}	X_{15}	X_{16}	X_{17}	X_{18}	X_{21}	X_{22}	X_{23}	R^2	S.E.
0	X_{10}	176.21			-5.027**[b] (0.295)[a]		0.163** (0.021)								.97	4.900
0	X_{10}	176.94			-4.795** (0.312)				0.156** (0.020)						.97	5.000
5	X_{10}	4.56			-0.140** (0.014)	0.143** (0.032)									.97	.027
0	X_{10}	155.30			-3.554** (0.768)	0.155** (0.046)									.89	8.200
0	X_{10}	98.21				0.307** (0.054)									.70	13.500
0	X_{10}	103.37						0.289** (0.040)							.79	11.300
0	X_{11}	447.44		-27.997*[c] (11.348)						0.012 (0.156)				-0.123** (0.025)	.71	13.500
0	X_{11}	387.87	73.131** (13.934)							0.179 (0.231)				-0.072 (0.039)	.69	21.300
0	X_{11}	414.10		-25.626 (21.482)						-0.244 (0.279)					-.04	25.600
0	X_{11}	473.94		-13.878 (11.170)							-0.706 (0.150)				.67	14.400
0	X_{11}	351.39										0.171 (0.170)	0.036 (0.143)		.01	25.100
0	X_{11}	473.79									-0.722** (0.154)				.66	14.800
0	X_{11}	392.56								-0.116 (0.263)					-.08	26.100

a. Numbers in parentheses refer to standard errors of the regression coefficients.
b. Coefficients with two asterisks were found significantly different from zero at the one per cent level ("t" test).
c. Coefficients with one asterisk were significant at the five per cent level ("t" test).

Definition of Independent Variables:

X_5 = Florida zero-one variable on acreage; 1961-62 and 1964-66 seasons = one, zero elsewhere.
X_6 = Florida zero-one variable on acreage; 1962-66 seasons = one, zero elsewhere.
X_8 = Trend variable.
X_{13} = Arizona and California estimated total revenue per bearing acre, in a four-year moving average, lagged eleven years (unweighted).
X_{14} = Arizona and California estimated total revenue per bearing acre, in a four-year moving average, lagged nine years (unweighted).
X_{15} = Arizona and California estimated total revenue per bearing acre, in a four-year moving average, lagged eleven years (weighted).
X_{16} = Arizona and California estimated total revenue per bearing acre, in a four-year moving average, lagged nine years (weighted).
X_{17} = Florida estimated total revenue per bearing acre, in a four-year moving average, lagged eleven years.
X_{18} = Florida estimated total revenue per bearing acre, in a four-year moving average, lagged nine years.
X_{21} = Florida estimated total revenue per bearing acre; annual values through 1961-62 season, zero elsewhere.
X_{22} = Florida estimated total revenue per bearing acre; annual values 1962-66 seasons, zero elsewhere.
X_{23} = Florida on-tree orange price per 75-pound packed box, in a four-year moving average, lagged nine years (deflated by an index of prices by farmers for production items).

Definition of Dependent Variables:

X_{10} = Arizona and California total bearing acreage in annual values.
X_{11} = Florida total bearing acreage in annual values.

Code:

0 = No data transformation.
5 = Logarithms to the base "e."

Table 23. Results of Regression Analysis: Texas and Arizona Orange Supply

Code	Dep. Var.	Constant Term	X_7	X_8	X_9	X_{10}	X_{13}	X_{20}	X_{23}	X_{24}	R^2	S.E.
0	X_3	3302.3475	-1788.4854**[b] (524.7441)[a]				-9.7071*[c] (4.4202)				.47	593.4
0	X_3	2001.5620		-3.2979 (150.1635)			-0.0003 (10.0841)				-.22	898.0
0	X_3	2261.7359					0.2167 (0.5498)			-0.1300 (0.1671)	-.14	86.9
0	X_3	149.4363			102.7916* (38.2835)			-0.0180 (0.3673)			.40	59.0
0	X_{25}	1647.0314				-2.2313 (2.1503)					.01	358.9
0	X_{25}	207.2734		100.7102** (20.3698)		2.0398 (1.4591)					.70	196.3
0	X_{25}	983.0767				0.9644 (1.3156)			681.6290** (134.4971)		.71	192.8
0	X_{26}	6.9611				0.0011 (0.0070)			2.6755** (0.7206)		.58	1.0
0	X_{26}	4.7312		0.3384* (0.1279)		0.0029 (0.0092)					.40	1.2
0	X_{26}	9.5692				-0.0115 (0.0093)					.04	1.6
0	X_{27}	37.0739	-21.7233* (8.8399)				-0.0933 (0.0745)				.28	10.0
0	X_{27}	20.7222					0.0269 (0.0688)				-.08	12.2

a. Numbers in parentheses refer to standard errors of the regression coefficients.
b. Coefficients with two asterisks were found to be significantly different from zero at the one per cent level ("t" test).
c. Coefficients with one asterisk were significant at the five per cent level ("t" test).

Definition of Independent Variables:

X_7 = Texas zero-one variable on acreage; 1961-66 = one, zero elsewhere.
X_8 = Trend variable.
X_9 = Texas zero-one variable on production; 1957-62 = one, zero elsewhere.
X_{10} = Arizona estimated total revenue per bearing acre, in a four-year moving average, lagged eleven years.
X_{13} = Texas estimated total revenue per bearing acre in a four-year moving average, lagged eleven years.
X_{20} = Texas estimated total revenue per bearing acre in a four-year moving average, lagged nine years.
X_{23} = Arizona zero-one variable on acreage; 1960-66 = one, zero elsewhere.
X_{24} = Texas on-tree price lagged nine years and deflated by an index of prices paid by farmers for production items.

Definition of Dependent Variables:

X_3 = Total Texas orange production, in 75-pound packed boxes, in a four-year moving average.
X_{25} = Total Arizona orange production, in 75-pound packed boxes, in a four-year moving average.
X_{26} = Arizona bearing acreage in annual values.
X_{27} = Texas bearing acreage in annual values.

Code:

0 = No data transformation.

APPENDIX C

CONSUMPTION, PRODUCTION, PRICE, AND SHIPMENT DATA

Table 24. Population and Income Estimates for the United States, 1955-80

Year	Population[a]	Per Capita Disposable Income
	(mil.)	(current dollars)
1955	165.1	1,660
1956	168.0	1,742
1957	171.1	1,803
1958	174.0	1,826
1959	177.1	1,904
1960	180.7	1,937
1961	183.8	1,983
1962	186.7	2,064
1963	189.4	2,136
1964	192.1	2,272
1965	194.6	2,411
1966	196.8	2,567
1967	199.0	2,718
1968	201.3	2,850
1969	203.6	2,986
1970	206.0	3,130
1971	208.5	3,278
1972	211.1	3,424
1973	213.7	3,578
1974	216.5	3,739
1975	219.4	3,907
1976	222.3	4,083
1977	225.4	4,267
1978	228.6	4,459
1979	231.8	4,660
1980	235.2	4,842

a. Total civilian population, included are 50 states.

Source: Demand Analysis Section, ERS, United States Department of Agriculture, "Working Data for Demand Analysis," April 1967 edition.

Table 25. Consumption of Ten Major Fresh Fruits and Total Fresh Fruits, Pounds per Capita, United States, 1932-66

Year	Oranges Tangerines	Grape-fruit	Lemons	Total Citrus	Apples	Bananas	Peaches	Grapes	Pears	Plums Prunes	Straw-berries	Total Fresh Fruit
1932	26.0	7.4	3.2	36.7	39.2	16.8	9.3	7.8	5.3	2.8	4.3	125.9
1933	28.0	7.9	3.5	39.4	40.0	13.9	10.0	6.9	5.1	2.3	4.1	124.8
1934	28.4	7.7	3.6	39.8	25.3	16.5	11.3	7.4	6.8	2.9	3.5	116.3
1935	32.1	8.3	4.1	44.6	32.9	18.9	14.5	7.4	6.2	2.5	3.5	133.2
1936	31.6	10.2	4.3	46.2	27.6	20.1	10.9	6.3	6.0	2.7	2.9	125.6
1937	28.7	12.3	3.4	44.5	33.6	23.0	14.2	7.4	6.6	2.6	3.4	138.6
1938	35.1	9.6	4.3	49.1	28.2	20.5	13.1	5.6	6.4	2.7	2.9	131.7
1939	43.4	13.7	4.2	61.4	30.7	18.8	15.3	6.0	6.5	2.7	3.3	148.2
1940	41.0	11.1	4.5	56.7	29.7	17.3	13.1	6.3	7.1	2.5	3.3	139.1
1941	40.7	12.2	4.7	57.7	31.7	16.6	18.6	6.2	6.4	2.4	3.1	146.0
1942	41.2	12.1	4.3	57.7	28.1	8.0	14.6	6.2	6.7	2.4	3.4	130.0
1943	42.6	12.5	5.0	60.3	24.9	6.9	8.4	5.6	5.4	2.2	1.8	118.4
1944	50.1	13.0	4.9	68.2	25.5	9.0	17.9	4.9	7.1	2.7	1.2	140.1
1945	47.8	13.5	5.1	66.6	22.9	12.1	18.2	5.6	7.3	2.3	1.3	139.9
1946	40.3	14.0	4.7	59.1	23.0	14.7	16.6	5.7	6.8	2.7	1.6	133.9
1947	43.4	13.9	4.8	62.2	25.4	21.5	14.8	6.6	5.9	2.3	1.9	143.7
1948	37.5	12.3	4.5	54.4	26.3	22.4	11.3	5.8	4.4	2.1	1.8	131.6
1949	32.8	10.9	4.1	47.9	24.7	20.8	11.6	5.2	5.5	2.4	1.6	123.1
1950	28.9	8.2	4.0	41.3	22.7	20.9	7.8	5.4	4.1	1.8	1.6	108.6
1951	30.7	10.3	4.0	45.1	25.7	20.5	9.4	5.9	4.0	2.3	1.8	117.4
1952	29.9	10.5	3.9	44.4	21.6	20.6	10.7	6.0	4.4	1.7	1.6	113.8
1953	29.8	9.7	3.7	43.4	20.9	19.5	10.3	4.8	3.9	2.1	1.4	108.9
1954	26.5	11.0	3.6	41.2	20.0	18.9	10.0	5.1	3.7	1.4	1.2	104.4
1955	26.9	10.7	3.4	41.2	19.6	17.8	6.1	5.0	3.4	1.8	1.2	98.9
1956	24.5	10.5	3.2	38.5	18.9	18.0	9.0	4.7	3.7	1.9	1.5	98.4
1957	23.4	9.5	3.3	36.5	19.3	18.0	8.6	3.9	3.7	1.6	1.7	96.2
1958	18.5	8.7	3.0	30.5	22.6	17.2	10.5	4.1	3.5	1.2	1.5	93.7
1959	21.2	9.1	2.9	33.4	23.0	18.2	9.7	3.9	3.2	1.7	1.3	97.1
1960	20.4	9.5	2.9	33.1	20.1	20.4	9.5	3.9	2.6	1.2	1.3	94.5
1961	17.8	9.3	2.8	30.2	18.5	19.5	9.5	3.4	2.5	1.4	1.6	89.3
1962	17.0	8.6	2.8	28.9	19.4	16.2	8.1	4.0	2.7	1.4	1.6	84.9
1963	12.8	6.4	2.5	22.1	18.4	16.6	7.6	3.7	2.0	1.5	1.6	76.1
1964	15.6	7.5	2.4	26.1	20.1	17.0	6.6	3.6	2.4	1.7	1.6	81.8
1965	17.9	8.2	2.3	29.0	18.4	17.3	7.2	3.7	1.8	1.6	1.4	82.9
1966[a]	17.1	b	b	29.1	b	b	b	b	b	b	b	b

a. Preliminary.

b. Data not available.

Source: United States Department of Agriculture, Economic Research Service, U. S. Food Consumption--Sources of Data and Trends (Washington, D. C.), various annual issues.

Table 26. United States Orange Production by States, 1930-1966

Year	Arizona	California	Florida	Texas	Other[a]	United States
			(thousands of packed 75-pound boxes)			
1930-31	130	32,834	20,160	300	350	53,774
1931-32	135	32,347	14,640	624	455	48,201
1932-33	137	31,981	17,400	390	574	50,482
1933-34	145	26,543	19,080	576	300	46,584
1934-35	159	42,044	18,720	780	625	62,328
1935-36	224	30,622	19,080	932	296	51,154
1936-37	205	27,838	22,920	2,400	469	53,832
1937-38	327	42,853	28,680	1,728	457	74,045
1938-39	401	38,659	35,880	3,378	679	78,997
1939-40	555	41,463	30,720	2,832	434	76,004
1940-41	493	47,393	34,320	3,180	305	85,691
1941-42	678	53,546	32,640	3,420	238	90,522
1942-43	749	45,511	44,640	3,060	408	94,368
1943-44	1,129	53,347	55,440	4,260	288	114,464
1944-45	1,181	62,114	51,360	5,280	432	120,367
1945-46	1,242	45,184	59,760	5,760	396	112,342
1946-47	1,232	54,958	64,440	6,000	492	127,122
1947-48	801	47,052	70,080	6,240	360	124,533
1948-49	729	37,997	69,960	4,080	360	113,126
1949-50	1,011	42,976	70,200	2,112	444	116,743
1950-51	1,437	46,416	80,760	3,240	360	132,213
1951-52	749	39,434	94,320	360	60	134,923
1952-53	924	47,258	86,640	1,200	60	136,082
1953-54	1,201	33,264	109,560	1,080	120	145,225
1954-55	1,130	39,420	106,080	1,800	210	148,640
1955-56	1,150	38,370	109,200	1,920	234	150,874
1956-57	1,290	35,900	111,600	1,920	138	150,848
1957-58	1,250	23,200	99,000	2,400	246	126,096

Table 26.--Continued

1958-59	610	40,200	103,200	760	264	147,034
1959-60	1,500	30,800	109,800	3,240	312	145,652
1960-61	1,160	25,000	104,040	4,200	330	134,730
1961-62	1,440	20,500	136,080	2,760	306	161,086
1962-63	1,560	28,600	89,400	48	18	119,626
1963-64	2,200	31,700	69,960	288	18	104,166
1964-65	2,420	31,200	103,440	1,056	12	138,128
1965-66	2,420	35,700	120,480	1,560	b	160,160

a. Includes Alabama, Louisiana, and Mississippi.

b. Production too small to warrant estimation.

Source: United States Department of Agriculture, Statistical Reporting Service, Citrus Fruits by States, 1909-10--1965-66, Production, Use, Value, Washington, D. C., various annual issues.

Table 27. Total Orange Production by Variety and States, 1930-1966

Year	Valencia			Navel and Others[a]			All Varieties
	Arizona	California	Florida	Arizona	California	Florida	Texas[b]
	(thousands of packed 75-pound boxes)						
1930-31	c	15,881	c	c	14,863	c	278
1931-32	c	16,227	c	c	18,598	c	593
1932-33	c	15,773	c	c	13,560	c	368
1933-34	c	14,026	c	c	10,622	c	492
1934-35	60	20,750	5,610	85	16,347	12,562	722
1935-36	81	15,521	7,338	131	12,708	11,269	872
1936-37	28	10,653	8,429	133	10,431	13,590	2,324
1937-38	143	22,595	11,641	170	14,549	15,396	1,620
1938-39	214	17,220	14,010	171	13,949	20,069	3,286
1939-40	365	21,918	7,921	173	15,437	17,384	2,730
1940-41	259	23,910	12,185	199	16,618	17,062	3,089
1941-42	313	25,535	11,911	340	19,659	15,392	3,326
1942-43	332	24,854	17,842	328	12,122	18,821	2,976
1943-44	510	27,741	17,064	484	18,700	24,803	4,138
1944-45	587	30,348	14,707	503	19,885	19,116	5,114
1945-46	590	20,921	16,614	518	16,061	19,722	5,250
1946-47	497	25,219	15,845	522	17,972	23,232	5,528
1947-48	191	20,017	15,199	402	16,371	17,896	5,797
1948-49	113	14,750	17,502	371	9,339	19,756	3,517
1949-50	49	14,943	12,751	362	13,350	15,320	1,830
1950-51	626	18,406	12,547	573	13,498	17,375	1,926
1951-52	325	17,346	16,382	332	10,614	20,389	324
1952-53	418	20,195	12,764	352	15,179	18,254	900
1953-54	479	13,375	15,940	436	12,264	17,476	1,014
1954-55	460	15,000	13,004	425	12,816	19,584	1,476
1955-56	598	14,330	13,279	416	13,070	17,400	1,548

Table 27.--Continued

1956-57	702	13,150	12,158	469	13,280	16,781	1,428
1957-58	696	10,978	7,337	461	8,485	14,392	2,088
1958-59	300	14,600	7,516	256	14,530	12,689	2,159
1959-60	750	10,822	10,822	461	11,550	14,096	2,537
1960-61	620	10,880	7,631	390	8,250	12,493	3,060
1961-62	577	8,630	11,250	550	6,460	13,848	1,480
1962-63	456	9,190	4,070	530	8,800	9,946	30
1963-64	966	9,800	6,538	684	12,350	8,852	240
1964-65	1,148	10,960	7,752	553	13,510	11,573	952
1965-66	891	10,600	7,024	762	14,090	13,463	1,336

a. Primarily Navels in Arizona and California, plus some tangerines prior to the 1961-62 season in California. Florida production excludes tangerines while Texas production includes small quantities of tangerines. Florida and Texas are primarily early and midseason fruit.

b. Varietal breakdown unavailable.

c. Data not available.

Source: United States Department of Agriculture, Statistical Reporting Service, Citrus Fruits by States, 1909-10--1965-66, Production, Use, Value, Washington, D. C., various annual issues.

Table 28. Total Processed and Fresh Orange Production by States, 1934-1966

Year	Processed				Fresh			
	Arizona	California	Florida	Texas	Arizona	California	Florida	Texas
	(thousands of 75-pound packed boxes)							
1934-35	3	3,442	318	a	145	37,097	18,172	722
1935-36	1	1,612	256	a	212	28,229	18,607	872
1936-37	36	5,598	660	5	161	21,084	21,999	2,324
1937-38	2	4,373	1,331	40	313	37,144	27,037	1,620
1938-39	2	4,532	1,421	19	385	31,169	34,079	3,286
1939-40	6	2,737	5,124	35	538	37,355	25,296	2,730
1940-41	22	5,414	4,809	18	458	40,528	29,247	3,089
1941-42	11	7,331	5,125	23	653	45,194	27,303	3,326
1942-43	77	7,626	7,726	16	660	36,976	36 663	2,976
1943-44	119	5,816	13,213	52	994	46,441	41,867	4,138
1944-45	75	9,978	17,213	88	1,090	50,233	33,823	5,114
1945-46	119	7,213	23,064	432	1,108	36,982	36,336	5,250
1946-47	119	10,564	23,863	388	1,019	43,191	39,077	5,528
1947-48	187	9,443	36,505	359	593	36,388	33,095	5,797
1948-49	231	12,765	32,222	479	484	24,089	37,258	3,517
1949-50	585	13,528	41,649	198	411	28,293	28,071	1,830
1950-51	215	13,659	50,298	1,230	1,199	31,904	29,922	1,926
1951-52	71	10,557	57,009	0	657	27,960	36,771	324
1952-53	133	11,191	55,082	240	770	35,374	31,018	900
1953-54	265	6,871	75,484	30	915	25,639	33,416	1,014
1954-55	285	10,801	72,832	270	825	27,816	32,588	1,476
1955-56	116	10,173	77,861	300	1,014	27,400	30,679	1,548
1956-57	99	8,780	81,881	420	1,171	26,430	28,939	1,428
1957-58	73	3,255	76,611	240	1,157	19,463	21,729	2,088
1958-59	36	10,470	82,215	529	556	29,130	20,205	2,159
1959-60	296	7,710	84,084	619	1,211	22,530	24,918	2,537

Table 28.--Continued

1960-61	130	5,360	83,088	1,056	1,010	19,130	20,124	3,060
1961-62	293	4,940	110,052	1,238	1,127	15,090	25,098	1,480
1962-63	554	10,080	74,694	0	986	17,990	14,016	30
1963-64	530	8,800	53,802	34	1,650	22,150	15,390	240
1964-65	699	6,030	83,227	90	1,701	24,470	19,325	952
1965-66	747	10,410	99,033	182	1,653	24,690	20,487	1,336

a. Data not available.

Source: United States Department of Agriculture, Statistical Reporting Service, Citrus Fruits by States, 1909-10--1965-66, Production, Use, Value, Washington, D. C., various annual issues.

Table 29. Total Orange Production for Processing by Variety and State, 1930-1966

Year	Valencia			Navel and Others[a]			All Varieties
	Arizona	California	Florida	Arizona	California	Florida	Texas[b]
	(thousands of packed 75-pound boxes)						
1930-31	c	1,144	c	c	755	c	d
1931-32	c	1,631	c	c	698	c	d
1932-33	c	2,161	c	c	291	c	d
1933-34	c	704	c	c	82	c	d
1934-35	3	2,794	198	d	648	120	d
1935-36	1	1,157	136	d	455	120	d
1936-37	37	4,234	349	d	1,364	311	5
1937-38	1	3,747	815	1	626	516	40
1938-39	2	3,457	1,133	d	1,075	288	19
1939-40	6	3,308	3,968	d	429	1,156	35
1940-41	21	4,574	2,575	1	840	2,234	18
1941-42	8	4,904	2,396	3	2,427	2,729	23
1942-43	62	5,570	3,770	15	2,056	3,956	16
1943-44	67	3,440	7,266	52	2,376	5,947	52
1944-45	21	7,830	10,445	54	2,148	6,768	88
1945-46	59	5,573	12,486	60	1,640	10,578	432
1946-47	112	8,949	11,815	87	1,615	12,048	388
1947-48	110	7,055	17,471	77	2,388	19,034	359
1948-49	147	10,489	13,848	84	2,276	18,374	479
1949-50	354	11,571	16,919	231	1,957	24,730	198
1950-51	131	12,578	23,813	84	1,081	25,485	1,230
1951-52	54	8,726	25,138	17	1,831	31,871	0
1952-53	85	9,548	22,876	48	1,643	32,206	240
1953-54	147	4,679	33,080	118	2,192	42,404	30
1954-55	210	8,730	30,376	75	2,071	42,456	270
1955-56	102	8,550	33,821	14	1,623	44,040	300

Table 29.--Continued

1956-57	78	7,060	33,922	21	1,720	47,959	420
1957-58	54	2,880	28,123	19	375	48,488	240
1958-59	30	8,390	38,804	6	2,080	43,411	529
1959-60	180	6,060	39,818	89	1,650	44,266	619
1960-61	90	4,850	34,849	40	510	48,230	1,056
1961-62	213	4,240	56,130	80	700	53,022	1,238
1962-63	554	6,810	30,430	100	3,270	44,264	0
1963-64	294	6,500	29,702	236	2,300	24,100	34
1964-65	592	4,740	39,588	107	1,290	43,639	90
1965-66	559	6,300	51,236	188	4,110	47,797	182

a. Primarily Navels in Arizona and California, plus some tangerines prior to the 1964-65 season in Arizona and prior to the 1961-62 season in California. Florida production includes tangerines while Texas production includes small quantities of tangerines. Florida and Texas are primarily early and midseason fruit.

b. Varietal breakdown not available.

c. Data not available.

d. Less than 500 packed boxes.

Source: United States Department of Agriculture, Statistical Reporting Service, Citrus Fruits by States, 1909-10--1965-66, Production, Use, Value, Washington, D. C., various annual issues.

Table 30. Fresh Orange Production by Variety and State, 1930-1966

Year	Valencia			Navel and Others[a]			All Varieties
	Arizona	California	Florida	Arizona	California	Florida	Texas[b]
	(thousands of packed 75-pound boxes)						
1930-31	c	15,881	c	c	14,863	c	278
1931-32	c	16,227	c	c	18,598	c	593
1932-33	c	15,773	c	c	13,560	c	368
1933-34	c	14,026	c	c	10,622	c	492
1934-35	60	20,750	5,610	85	16,347	12,562	722
1935-36	81	15,521	7,338	131	12,708	11,269	872
1936-37	28	10,653	8,429	133	10,431	13,590	2,324
1937-38	143	22,595	11,641	170	14,549	15,396	1,620
1938-39	214	17,220	14,010	171	13,949	20,069	3,286
1939-40	365	21,918	7,921	173	15,437	17,384	2,730
1940-41	259	23,910	12,185	199	16,618	17,062	3,089
1941-42	313	25,535	11,911	340	19,659	15,392	3,326
1942-43	332	24,854	17,842	328	12,122	18,821	2,976
1943-44	510	27,741	17,064	484	18,700	24,803	4,138
1944-45	587	30,348	14,707	503	19,885	19,116	5,114
1945-46	497	25,219	15,845	522	17,972	23,232	5,528
1947-48	191	20,017	15,199	402	16,371	17,896	5,797
1948-49	113	14,750	17,502	371	9,339	19,756	3,517
1949-50	49	14,943	12,751	362	13,350	15,320	1,830
1950-51	626	18,406	12,547	573	13,498	17,375	1,926
1951-52	325	17,346	16,382	332	10,614	20,389	324
1952-53	418	20,195	12,764	352	15,179	18,254	900
1953-54	479	13,375	15,940	436	12,264	17,476	1,014
1954-55	460	15,000	13,004	425	12,816	19,584	1,476
1955-56	598	14,330	13,279	416	13,070	17,400	1,548
1956-57	702	13,150	12,158	469	13,280	16,781	1,428

Table 30.--Continued

1957-58	696	10,978	7,337	461	8,485	14,392	2,088
1958-59	300	14,600	7,516	256	14,530	12,689	2,159
1959-60	750	10,822	10,822	461	11,550	14,096	2,537
1960-61	620	10,880	7,631	390	8,250	12,493	3,060
1961-62	577	8,630	11,250	550	6,460	13,848	1,480
1962-63	456	9,190	4,070	530	8,800	9,946	30
1963-64	966	9,800	6,538	684	12,350	8,852	240
1964-65	1,148	10,960	7,752	553	13,510	11,573	952
1965-66	891	10,600	7,024	762	14,090	13,463	1,336

a. Primarily Navels in Arizona and California, plus some tangerines prior to the 1964-65 season in Arizona and prior to the 1961-62 season in California. Florida production excludes tangerines while Texas production includes small quantities of tangerines. Florida and Texas are primarily early and midseason fruit.

b. Varietal breakdown unavailable.

c. Data not available.

Source: United States Department of Agriculture, Statistical Reporting Service, Citrus Fruits by States, 1909-10--1965-66, Production, Use, Value, Washington, D. C., various annual issues.

Table 31. Orange Production, Continental United States and Selected Foreign Countries, 1940-1965[a]

Year	United States	Mexico	Israel	Italy	Spain	Japan	Brazil	World Total[b]
				(in thousand boxes)				
1940	67,034	4,761	8,652	11,701	25,824	15,895	34,466	209,790
1941	85,163	7,212	9,870	12,922	27,334	20,766	34,962	247,645
1942	89,349	7,561	5,000	11,495	24,921	17,088	35,465	245,059
1943	106,651	8,317	8,400	11,621	27,166	17,500	32,713	262,195
1944	113,210	8,943	6,000	8,489	30,578	15,669	27,000	255,959
1945	104,350	9,280	8,000	9,715	22,046	11,912	28,000	238,827
1946	117,620	9,291	8,750	9,574	15,747	12,000	30,000	249,476
1947	114,510	10,866	3,000	12,095	23,733	6,496	34,825	275,606
1948	104,120	12,605	6,300	12,858	22,818	9,126	35,138	269,770
1949	108,465	12,950	5,020	10,773	21,585	9,800	35,674	270,764
1950	117,650	11,000	4,600	18,198	30,559	13,575	31,600	297,600
1951	122,590	15,818	6,708	18,408	32,776	11,108	34,752	312,882
1952	125,080	16,814	6,373	20,178	43,157	18,263	35,099	341,180
1953	130,870	17,545	9,549	21,636	44,124	13,205	31,921	343,788
1954	135,725	18,838	7,820	20,799	37,793	21,632	32,508	351,933
1955	137,015	18,741	10,737	22,908	24,723	18,749	33,433	347,366
1956	136,725	19,054	10,368	25,573	17,637	23,778	34,500	355,064
1957	111,200	20,700	10,170	23,351	36,376	25,050	20,600	334,284
1958	127,800	19,526	14,200	26,770	44,722	26,789	22,500	372,020
1959	129,560	20,818	13,857	26,084	49,251	29,697	24,000	383,568
1960	124,475	19,526	15,600	24,880	43,856	31,263	25,000	378,828
1961	142,095	21,623	12,108	28,159	52,088	35,005	25,000	415,889
1962	104,895	17,322	14,550	24,030	51,529	35,000	33,600	387,047
1963	96,355	25,207	19,099	33,790	58,286	38,788	24,000	419,307

Table 31.--Continued

1964	125,008	27,100	21,300	37,600	54,900	48,365	45,500	477,830
1965	138,120	27,200	24,200	36,700	58,900	51,000	43,800	500,978

a. Includes tangerine production.

b. Total does not sum due to exclusion of some production areas.

Source: United States Department of Agriculture, Agricultural Statistics, Washington, D. C., various annual issues.

Table 32. On-Tree Prices for All Oranges by States and for United States, 1940-41 through 1965-66

Year	Arizona	California	Florida	Texas	United States[a]
	(in thousands of 75-pound packed boxes)				
1940-41	105	130	66	72	105
1941-42	99	149	92	86	127
1942-43	230	263	145	162	195
1943-44	237	280	151	185	218
1944-45	263	245	184	191	218
1945-46	298	284	197	182	235
1946-47	242	141	79	138	112
1947-48	119	141	52	112	92
1948-49	233	154	116	102	130
1949-50	85	163	178	177	170
1950-51	235	166	137	90	148
1951-52	284	171	67	275	103
1952-53	186	138	107	123	120
1953-54	220	231	105	116	138
1954-55	188	201	114	116	141
1955-56	297	243	154	131	180
1956-57	258	246	117	112	153
1957-58	501	425	178	123	233
1958-59	377	266	239	193	247
1959-60	301	330	163	149	204
1960-61	438	378	245	182	273
1961-62	441	348	138	136	172
1962-63	331	364	226	329	265
1963-64	331	351	370	299	362
1964-65	244	284	204	255	226
1965-66	188	187	163	197	169

a. Weighted average of prices received by Arizona, California, Florida, and Texas growers, weighted by quantity.

Source: United States Department of Agriculture, Statistical Reporting Service, Prices Received by Farmers, Citrus Fruits, Noncitrus Fruits, Tree Nuts, and Agricultural Prices, Washington, D. C., various annual issues.

Table 33. Free-on-Board Prices for Fresh Oranges by States, 1940-1966

Season	Arizona	California	Florida	Texas	United States[a]
	(in thousands of 75-pound packed boxes)				
1940-41	218	235	133	b	191
1941-42	207	257	168	b	218
1942-43	358	379	252	b	293
1943-44	381	402	253	b	320
1944-45	394	381	290	287	340
1945-46	445	440	297	283	360
1946-47	416	310	218	237	263
1947-48	312	326	171	218	238
1948-49	538	379	233	206	288
1949-50	286	360	292	298	318
1950-51	421	374	262	232	306
1951-52	470	399	193	502	262
1952-53	382	322	232	310	268
1953-54	443	461	241	245	299
1954-55	417	418	241	275	296
1955-56	506	476	282	275	340
1956-57	448	470	272	267	327
1957-58	692	678	331	282	407
1958-59	588	491	376	347	410
1959-60	552	603	320	311	391
1960-61	700	652	421	402	472
1961-62	733	668	327	344	382
1962-63	680	678	473	500	532
1963-64	582	606	543	483	565
1964-65	531	559	404	425	447
1965-66	466	520	342	333	384

a. Weighted average by quantity, of major producing States.

b. Data not available.

Source: United States Department of Agriculture, Statistical Reporting Service, Prices Received by Farmers, Citrus Fruits, Noncitrus Fruits, Tree Nuts, and Agricultural Prices, Washington, D. C., various annual issues.

APPENDIX D

DATA USED IN THE ANALYSIS

Table 34. Arizona-California Fresh Orange Shipments (Intrastate and Interstate) by Months, 1954 through 1966

Year	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total for Season
						(in thousands of packed 75-pound boxes)							
1954-55	1,991	1,979	2,144	2,629	1,981	1,899	2,491	1,773	2 512	1,442	1,874	2,348	25,063
1955-56	1,723	2,001	3,140	2,462	2,368	2,310	1,514	2,063	1,816	1,496	764	1,810	23,467
1956-57	1,485	1,847	2,720	2,401	3,072	2,080	1,235	1,987	1,682	1,321	1,711	1,790	23,340
1957-58	2,073	1,776	1,685	2,102	1,870	1,452	1,360	1,525	1,286	1,080	784	2,088	19,081
1958-59	2,523	2,454	2,846	2,929	3,093	1,731	2,027	1,549	1,879	1,737	1,430	1,819	26,017
1959-60	2,572	2,210	2,175	2,250	1,779	1,206	1,463	1,142	1,525	992	1,404	2,084	20,892
1960-61	1,530	1,593	1,905	1,360	1,426	1,217	1,118	1,120	1,594	969	1,099	2,310	17,241
1961-62	1,289	1,216	1,813	1,186	1,133	1,043	818	1,084	1 037	800	692	1,784	13,895
1962-63	1,800	1,177	1,614	1,171	1,856	1,019	977	1,260	1,004	1,004	1,380	2,252	16,514
1963-64	2,800	2,586	2,422	2,092	2,465	1,150	1,292	919	958	860	1,172	2,470	21,183
1964-65	2,136	2,354	2,934	3,203	1,964	1,674	1,311	1,186	1,244	1,384	1,203	2,422	23,015
1965-66	2,137	2,726	2,799	3,291	2,406	1,530	1,114	1,099	1,548	868	823	2,610	22,051
Average	2,005	1,993	2,350	2,256	2,118	1,526	1,393	1,392	1,507	1,163	1,202	2,150	

Source: Valencia and Navel Orange Administrative Committees, Annual Report, Los Angeles, California, 1954-1966.

Table 35. Data Used in the Orange Demand Analysis

Season	Arizona On-Tree Fresh Price	Arizona F.O.B. Fresh Price	Arizona P.H.D. Fresh Price	U. S. Per Capita Disposable Income	Arizona and California Per Capita Production	U. S. Per Capita Rest-of-U. S. Prod.
	(dollars)	(dollars)	(dollars)	(dollars)	(75-pound boxes)	
1944-47	2.37	3.64	2.63	1,179	0.390	0.492
1947-48	2.09	3.84	2.44	1,290	0.326	0.523
1948-49	3.18	5.15	3.51	1,264	0.259	0.499
1949-50	2.55	4.15	2.80	1,364	0.290	0.480
1950-51	2.18	3.63	2.44	1,468	0.310	0.547
1951-52	3.04	4.59	3.33	1,518	0.256	0.603
1952-53	1.85	3.44	2.16	1,582	0.302	0.551
1953-54	2.29	4.03	2.60	1,585	0.212	0.666
1954-55	2.13	4.14	2.45	1,666	0.246	0.654
1955-56	2.68	4.58	3.00	1,743	0.235	0.662
1956-57	2.23	4.00	2.56	1,801	0.217	0.663
1957-58	5.77	7.49	6.10	1,831	0.140	0.584
1958-59	2.81	4.66	3.23	1,905	0.230	0.600
1959-60	3.18	5.20	3.63	1,937	0.179	0.628
1960-61	4.70	6.90	5.00	1.983	0.142	0.591
1961-62	4.50	6.62	4.95	2,064	0.117	0.745
1962-63	4.69	7.10	5.19	2,136	0.159	0.472
1963-64	3.55	5.65	4.05	2,273	0.176	0.366
1964-65	2.65	4.90	3.20	2,411	0.173	0.537
1965-66	2.50	4.45	2.65	2,570	0.194	0.620

Sources: Columns 1, 2, 3: United States Department of Agriculture, Statistical Reporting Service, Prices Received by Farmers, Citrus Fruits, Noncitrus Fruits, Tree Nuts, Statistical Bulletin No. 322, Washington, D. C., 1962; Column 4: Statistical abstract of the United States.

Table 36. Data Used in Arizona and California Supply Analysis

Season	Production in Four-Year Moving Averages (1,000 75-Pound Boxes)	Bearing Acreage (1,000 acres)	Trend Variable	Estimated Revenue in Four-Year Moving Averages Unweighted	Estimated Revenue in Four-Year Moving Averages Weighted
				--------(dollars per acre)--------	
1941-42	50,712	237.7		250	275
1942-43	54,563	239.5		299	316
1943-44	52,614	241.6		324	330
1944-45	67,060	241.9		301	290
1945-46	53,441	242.5		244	228
1946-47	47,299	241.3		183	164
1947-48	46,689	236.4		135	125
1948-49	44,605	231.0		125	122
1949-50	42,688	223.5		137	122
1950-51	45,052	220.1		140	127
1951-52	42,671	216.0		154	134
1952-53	40,845	208.3	1	156	144
1953-54	40,679	199.3	2	174	166
1954-55	37,931	190.1	3	195	190
1955-56	35,428	186.8	4	225	215
1956-57	35,492	158.7	5	267	241
1957-58	33,688	155.3	6	276	258
1958-59	30,930	151.6	7	288	267
1959-60	30,302	146.1	8	276	254
1960-61	27,640	144.2	9	267	258
1961-62	28,040	140.3	10	277	268
1962-63	29,905	137.6	11	266	265
1963-64	33,950	129.4	12	252	257

Table 36.--Continued

1964-65	139.4	13
1965-66	142.8	14

Sources: Column 1 taken from United States Department of Agriculture, Statistical Reporting Service, Citrus Fruits by States, 1909-10--1965-66, Production, Use, Value, Statistical Bulletin No. 380, Washington, D. C., 1967; Column 2 taken from Florida State Department of Agriculture, Florida Citrus Summary, Tallahassee, various annual issues; Columns 4 and 5 computed from United States Department of Agriculture, Statistical Reporting Service, Prices Received by Farmers, Citrus Fruits, Noncitrus Fruits, Tree Nuts, and Citrus Fruits by States, 1909-10--1965-66, Production, Use, Value, Washington, D. C., various annual issues, and Florida Citrus Summary, Tallahassee, various annual issues.

Table 37. Data Used in Florida Supply Analysis

Season	Bearing Acreage	Estimated Revenue in Four-Year Moving Acreage	On-Tree Price for Oranges in Four-Year Moving Acreages
	(1,000 acres)	(dollars per acre)	(dollars per 75-pound box)
1941-42	236.0	129	.00722
1942-43	246.3	162	.00856
1943-44	251.3	199	.00958
1944-45	256.3	180	.00826
1945-46	264.9	144	.00659
1946-47	270.0	122	.00520
1947-48	280.5	106	.00443
1948-49	289.9	117	.00480
1949-50	300.9	122	.00489
1950-51	309.5	120	.00473
1951-52	324.8	110	.00396
1952-53	337.4	111	.00385
1953-54	348.3	137	.00478
1954-55	368.7	142	.00486
1955-56	382.3	154	.00551
1956-57	393.6	184	.00666
1957-58	374.7	183	.00666
1958-59	373.9	211	.00782
1959-60	391.6	207	.00742
1960-61	397.8	194	.00719
1961-62	429.8	219	.00908
1962-63	370.7	204	.00862
1963-64	351.8	193	.00854
1964-65	424.6		
1965-66	485.1		

Table 38. Data Used in Texas Supply Analysis

Season	Production in Four-Year Moving Averages	Zero-One Variable	Estimated Revenue in Four-Year Moving Averages
	(1,000 75-lb boxes)		($ per acre)
1941-42	3,480	0	108
1942-43	4,005	0	140
1943-44	4,590	0	166
1944-45	5,325	0	166
1945-46	5,820	0	144
1946-47	5,520	0	104
1947-48	4,608	0	72
1948-49	3,918	0	54
1949-50	2,448	0	39
1950-51	1,728	0	37
1951-52	1,470	0	30
1952-53	1,110	0	30
1953-54	1,500	0	34
1954-55	1,680	0	34
1955-56	2,010	0	36
1956-57	2,250	0	44
1957-58	2,580	1	49
1958-59	3,150	1	59
1959-60	3,240	1	60
1960-61	2,562	1	57
1961-62	1,824	1	69
1962-63	1,038	0	70
1963-64	738	0	68

Sources: Columns 1 and 3 computed from data in: United States Department of Agriculture, Statistical Reporting Service, Prices Received by Farmers, Citrus Fruits, Noncitrus Fruits, Tree Nuts, and Citrus Fruits by States, 1909-19--1965-66, Production, Use, Value, Washington, D. C., various annual issues.

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