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An Econometric Analysis of Market Control in the California Cling Peach Industry

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CALIFORNIA AGRICULTURAL EXPERIMENT STATION

Volume control provisions of marketing orders have been among the most controversial aspects of the attempts at *orderly marketing* of agricultural commodities. Conflicts occur within and between producer bargaining groups and processors as to *desired* prices and tonnage. Consumer groups also are increasingly concerned with program provisions that appear to keep prices higher than would exist, at least in the short run, without such provisions. Such problems are particularly complex for perennial crops where long production cycles may occur. Policies or programs aimed at aiding short–run adjustments may have unexpected longer term consequences.

This monograph reports the results of a quantitative analysis of the control provision of the California cling peach marketing order. The study focuses on the period 1956–1972, a period during which various market supply control measures were in effect. The analysis compares simulated time paths of the industry with and without the control provisions. Performance measures, such as farm and wholesale price levels, variability in prices, costs and returns, and quantities surplused, are used in this evaluation.

The findings of this study emphasize the importance of conceiving a control program for a cyclical industry that recognizes the long–term impact of measures used to alleviate short–term excess production. Results of the simulated comparison of outcomes with and without controls suggest that the program increased average net returns to growers and reduced their variability. But in so doing, consumers' surplus was reduced by a greater amount than gains in economic rent to producers. However, such findings must be tempered by the consideration that the inherent cyclical behavior of this industry tends to result in wide fluctuations in prices and quantities. A situation of low producer prices was, in fact, the initial reason for the introduction of the quantity control provisions. It was concluded that market control programs, properly conceived and appropriately applied to deal with clearly understood adjustment needs, may offer some potential aggregate social benefits. But programs inappropriate for the problem and programs designed to maintain prices above competitive levels only serve to compound adjustment problems by giving wrong signals to producers. This appears to have been the case during much of the past history in the cling peach industry.

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AN ECONOMIC ANALYSIS OF MARKET CONTROL IN THE CALIFORNIA CLING PEACH INDUSTRY

1. INTRODUCTION

Volume control provisions of marketing orders have been among the most controversial aspects of the attempts at "orderly marketing" of agricultural commodities. Conflicts occur between producer bargaining groups and processors as to "desired" prices and tonnage. Consumer groups also are increasingly concerned with program provisions that appear to keep prices higher than would exist, at least in the short run, without such provisions. The problems are particularly complex in the case of perennial crops where long production cycles may occur. Policies or programs aimed at aiding short–run adjustments may have unexpected longer term consequences.

The California cling peach industry provides an important case study of market controls for perennial crops. This industry has been under state marketing order control programs of various kinds every year since 1936, with the exceptions of 1938, 1943, and 1944. Prior to World War II, control provisions were used sparingly and sporadically, with quantity restricted by means of grade and minimum–size requirements and off–grade diversion of fruit to noncommercial uses. In the 1950s new provisions were introduced to restrict supply, such as the removal of immature fruit from the trees prior to harvest (green drop) and associated tree–removal incentives, and also removal of harvested fruit from the market (cannery diversion of No. 1 grade peaches). The particular provisions in effect varied from year to year, depending on potential supply and demand conditions perceived by the Cling Peach Advisory Board (CPAB). Authorized control provisions were not implemented in 1973 and 1974, and in 1975 the industry voted to terminate all quantity control provisions in the marketing order. The old order was replaced by a new order which dealt only with grade, maturity, and size regulations. That order, with minor amendments in 1978, is effective until 1981.

This is a quantitative analysis of the control provisions of the California cling peach marketing order. This study focuses on the period 1956–1972, a period during which various supply control measures were in effect such as green drop, tree–removal incentives, and processor disposal provisions for No. 1 grade fruit. The quantity of fruit so diverted from the market is referred to as "surplused," or the difference between potential harvest and that utilized by the canner after deducting off–grade fruit. The analysis develops models of industry behavior, with and without the control provisions used, and compares the historically controlled industry with "what might have been" had there been no control program for the industry. Performance measures, such as prices of the wholesale and farm levels, variability of price, costs and returns, and surplused supply, are used in the evaluation. An objective for future study could be the discovery of an alternative control scheme which better allocates resources in the cling peach industry with minimal social and economic adjustment losses. The development of such an "optimal" control model was not undertaken for this study.

A description of the economic environment of the industry is provided in the following section. An econometric model, designed to represent the industry economic behavior, is given in Section 3. Empirical estimates of supply and demand relationships are given in Section 4. Section 5 summarizes the complete commodity system model and reviews evidence as to its validity. Simulation runs of the model to explore industry outcomes as to prices and the like, with and without output control measures, are provided in Section 6. This section provides a summary of findings and economic implications of control programs in this case study.

2. THE ECONOMIC ENVIRONMENT

This section examines the origins, objectives, provisions, and operations of the marketing order programs applicable to cling peaches. It also describes the bargaining process between growers and processors and other structural aspects of the industry and reviews industry trends during the period of analysis starting in 1956.

Cling Peach Marketing Order Programs

Marketing orders are industry–financed "self help" programs which operate under an established legal framework. The enabling legislation was enacted during the turbulent period of the 1930s as a result of the chaotic marketing conditions and low farm prices of the Great Depression. Statutory authority for marketing orders affecting commodities traded interstate is established under the U. S. Agricultural Marketing Agreement Act of 1937. Most California marketing orders are currently under the 1937 California Agricultural Marketing Act. The purpose of the legislation was to permit farmers to accomplish through binding united action what could not be done voluntarily as individuals or through cooperatives. Included were provisions for programs to control product quality, rate of flow to market, and total quantity control. The legislation also authorizes financing of product promotion, market development and research, and prohibition of unfair trade practices.[1]

Objectives

Marketing orders differ from other major crop control programs in that they do not include provisions for direct government payments and do not control directly the amount a farmer can *produce*. Marketing orders are designed to control the *marketing* of supplies already produced rather than directly regulate what may be produced. Marketing order legislation is enabling legislation. This means that industrywide control is possible only when initiated, developed, adopted, and financed by the industry concerned. The farm price goals for the federal and state programs are similar, although the state objective is more loosely defined. The federal Act reads, "The Secretary of Agriculture is to establish and maintain such orderly marketing conditions (in interstate commerce) as will establish parity prices to farmers" (U. S. Department of Agriculture, Commodity Stabilization

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[1]For a more detailed description of marketing orders, see Garoyan and Youde (1975). For earlier descriptive work on marketing orders, see Foytik (1963), Benedict and Stein (1956), Townsend–Zellner (1961), Hoos (1962), Erdman (1963), Jamison and Brandt (1965), and Jamison (1966). Important quantitative studies of particular commodities include that by Sosnick (1962) on avocados, by Mo (1965) on the walnut industry, by Loyns (1968) on the almond industry, and by Rausser (1971) on the orange industry.

Service, 1957, p. 217). The California Act had as a primary objective ". . . to aid agricultural producers in restoring and maintaining their purchasing power at a more adequate, equitable and reasonable level"[1] (California Agricultural Code, 1975). Both acts include orderly marketing and the better correlation of supply with market demand among their principal objectives.

Provisions

The California marketing order programs for cling peaches have all been formulated under California legislation. The first cling peach marketing programs were authorized under the California Marketing Agreement Act of 1935. The programs, effected in 1936, assessed growers and canners for national advertising and for costs associated with regulating the quality of peaches sold to canners. A new order was established in 1937 under the California Agricultural Marketing Act of that year. The early orders listed quality standards and required mandatory third–party (neither producers nor processors) quality inspection of the fruit. Funds were also allocated for advertising and promotion. The 1945 Order made it mandatory that off–grade fruit be diverted to noncommercial use (*i.e.*, dumped). Prior to this time, growers were allowed a tolerance of 10 percent to 15 percent for below–minimum–grade deliveries to canners. If the random sample inspected was within tolerance, the cannery had to accept delivery. If the random sample showed 5 percent defective fruit, the cannery paid only 95 percent of the market price. So the canner could not utilize "something he did not pay for," the 1945 Marketing Order required that the canner divert the comparable tonnage of all fruit received below minimum–grade standards. The diverted tonnage did not, however, have to be culls.

The 1950 Order and all orders from 1952 to 1972 contained surplus elimination provisions that allowed for the compulsory removal of peaches from the normal marketing channels. The authorized methods included seasonal surplus control through removal of immature fruit (green drop) and tree removal credit, general surplus elimination by tree removal in lieu of green drop, diversion of seasonal surpluses at the processing plant into noncommercial uses, and establishment of stabilization funds.

The CPAB, based upon its perception of the economic conditions, was authorized to issue a "general surplus" or a "seasonal surplus" condition for the forthcoming season. A *general* surplus condition was defined as one "wherein the productive capacity of the acreage planted to cling peaches would normally exceed the market requirements for cling peaches." Market requirements presumably were defined as having in mind some "normal" price. A *seasonal* surplus condition was defined as one "in which the estimated supply of cling peaches likely to be available for harvest is in excess of the estimated market requirements therefor."[2] Whether a general or seasonal surplus condition existed, the methods of surplus elimination were substantially the same.

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[1]The wording here is that of California Agricultural Code 1300.10 which was revised in 1967; however, the general intent remains unchanged.

[2]These definitions of a general and seasonal surplus come from any industry marketing order from 1950 and 1952–1974.

The marketing order required that surplus elimination through green dropping be applied on a uniform basis within each orchard, with the affected trees spaced——insofar as possible——an equal distance apart. The tree removal program allowed growers to remove trees in order to receive "credit" against green–drop requirements. Thus, a grower could avoid having to eliminate fruit by green dropping from bearing trees equal in number to the trees removed.[1] Surplus diversion involved the diversion of No. 1 grade fruit that had already been delivered to the cannery. A stabilization fund, created by grower assessments, was used to compensate the processors for the actual tonnage diverted. This stabilization fund could also be used to purchase fruit from growers who had not found an outlet for their production because of high production conditions.

Applications

Table 1 provides a summary of surplus methods used from 1950 to present. While the provisions remained the same throughout the period, the administration of the programs changed by the initiation of an "open market plan" and by shifts in the timing and credit values of tree–removal incentives.

The open–market plan was used after green–drop and No. 1 grade diversion requirements were set and also after an industry price or price formula had been agreed upon. Under this plan, if growers had unsold fruit after a specific date (usually May 15), the remaining industry growers were assessed to buy this production. This pooled fruit was offered to the processors for a one–week period at the prevailing price in case processors wished to increase their projected seasonal needs. After this week, the unsold amount was surplused.[2]

In the period 1959–1965 and 1969, the green–drop declaration was announced in the spring. Growers normally removed trees immediately after harvest in order to prepare the land for replanting in the winter and early spring months. Trees removed prior to the green–drop declaration were not assured of credit against green–drop obligations since the green drop might not be required. The credits were all on a "one for one" basis; that is, one tree removed received one tree credit. When a grower delayed his removals until the green drop was called in order to be assured of obtaining credits, the timing of the removal prevented him from replanting that land in peach trees or other deciduous crops until the following winter.

In the period 1970–1972, the timing of the green–drop requirement was significantly different. An "early green drop requirement" was issued in the fall. This timing allowed growers to remove trees for certain credit and still have time to replant during the winter months. Also, "two for one" credits were given in 1970 and 1971 which meant that a grower was exempted from green dropping two trees for every one tree removed. The early green–drop requirement did not include the entire green–drop requirements for the 1970 and 1971 crops. In 1970 the early green–drop requirement was 25 percent, with

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[1]A provision also existed whereby growers could be paid directly from funds assessed on all other growers as an incentive to remove trees. This provision was never used.

[2]The unsold fruit under the open–market plan was knocked off the trees and, after being adjusted for the cullage factor, was included in the industry's summary data as part of the green–drop surplus tonnage.

TABLE 1

Marketing Order Programs in Effect, 1950-1975

Crop year	No. 1 grade diversion	Green drop: Requirement	Green drop: Satisfied by tree removal	Notes on program
	tons	percent		
1950	*a*	15.00		A green-drop requirement of 15 percent was called for in the fall; a stabilization fund was established at 5 percent of the market price to reimburse growers who could not sell their crop due to underestimation of the year's production. The stabilization fund was not used, and the monies were returned to the growers.
1951				No volume-control program in effect.
1952		15.00		Same situation as 1950.
1953				Volume-control measures were authorized but not used.
1954		17.00		The 1954 marketing order was the first with tree removal provisions, although tree removal credits were not utilized until 1959. A 17 percent green drop was ordered; the stabilization fund was not used and was refunded.
1955				No surplus elimination procedures were ordered.
1956	45,672			No green drop ordered. A 5 percent diversion of No. 1 fruit ordered in August; increased to 10 percent diversion on August 19 and remained at this level for balance of season.
1957	5,106	16.00		A green drop of 16 percent ordered. Processor diversion levels were set at 7 percent from July 8-August 4; 5 percent from August 5-August 11; none thereafter.
1958				No surplus elimination procedures were ordered.

(Continued on next page.)

TABLE 1--continued.

Crop year	No. 1 grade diversion	Green drop Requirement	Green drop Satisfied by tree removal	Notes on program
	tons	percent		
1959	3,089	12.00	1.73	A green drop of 12 percent was ordered with fall removal credits usable on a tree-for-tree basis; removal credits could not be carried over and were not transferable. A 10 percent processor diversion was in effect from August 24-27 and from August 31-September 1; most of the diverted production was returned to regular marketing channels.
1960	17,038	15.00	5.04	Similar green-drop provisions as in 1959. A 10 percent diversion was in effect from July 11-17, but diverted tonnage was returned to regular channels; a 10 percent diversion was in effect July 25-August 14, and this tonnage remained diverted; and diversion continued at the 10 percent level until the end of season, but the remainder of this diverted tonnage was returned to regular channels.
1961	30,946	12.00	6.23	Similar green-drop provisions as in 1959. A 10 percent diversion was in effect from August 6 to end of season; from August 6-September 5, about half of the diverted tons were returned to regular channels; and from September 6 to end of season, all of the diverted tonnage was removed from regular channels.
1962	39,415	12.00	4.57	Similar green-drop provisions as in 1959. A 10 percent diversion was in effect from August 13-26; a 7 percent diversion was in effect from August 27-September 7; a 10 percent diversion was in effect from September 8 to end of season; and all of the diverted production was removed from regular channels.
1963		14.00	4.85	Similar green-drop provisions as in 1959. No processor diversion.
1964		10.00	2.65	Similar programs as in 1963.
1965	9,432	6.00	1.89	Tree credits for trees removed before May 1 usable on a tree-for tree basis, no carry-over, not transferable; tree credit for trees removed May 10-July 13 on a tree-for-tree basis, transferable; if unused can be carried over until 1966 crop, if applicable.

(Continued on next page.)

TABLE 1--continued.

Crop year	No. 1 grade diversion	Green drop: Requirement	Green drop: Satisfied by tree removal	Notes on program
	tons	percent		
1966				Surplus provisions not used.
1967				Surplus provisions not used.
1968				Surplus provisions not used.
1969	18,295	8.00	5.69	Tree credits usable on a tree-for-tree basis, transferable, no carry-over. First year that open-market provisions used; 4,675 tons unsold under open-market provisions.
1970	33,041	33.75	23.88	Early green-drop requirement of 25 percent satisfied by a 12.5 percent tree removal (two-for-one basis); transferable, no carry-over. Later, 10 percent green-drop requirement on balance with no tree credits available.
1971		42.61	21.43	Early green-drop requirement of 26 percent satisfied by 13 percent tree removal; transferable, no carry-over. Later, 13 percent green-drop requirement on balance with tree removal option; still later, 7 percent green-drop requirement with tree removal option. Under open-market provision, 58,837 tons unsold.
1972		25.00	21.06	Early green-drop requirement of 25 percent with tree credit option on a one-for-one basis; transferable, no carry-over.
1973				Surplus provisions not used.
1974				Surplus provisions not used.
1975-present				Surplus program not in effect.

[a]Blanks indicate no entry.

Source: Compiled from California Canning Peach Association (annual issues) and Cling Peach Advisory Board (annual issues).

an additional 10 percent green drop called later. In 1971 a 26 percent green drop was called for, with an additional requirement of 13 percent and then a later requirement of 7 percent.[1] In 1972 the early green drop of 25 percent included the entire green–drop requirement for that year. During the period 1950–1972, there was a trend toward greater deviation between actual and potential production with greater use of volume control provisions (Table 1).

Decision Points

Surplusing controls imposed by the decision group varied from year to year. While it is difficult to define a "typical" year, below is an example of the general timing of decision points.

Early winter:	Expected supply and demand data were compiled and analyzed by the Advisory Board. Minimum grades and sizes were set; these standards rarely changed from year to year. Early green–drop requirement was announced.
Winter:	Surplusing plans were initiated; the open–market plan was initiated if declared to be used. Reevaluation was made of supply and demand conditions.
Spring:	Green–drop requirement was announced. No. 1 grade diversion requirement was announced.
	Bargaining process occurred.
Late spring:	Note was made of tree removals; green–drop requirement was adjusted in response to tree–removal credits. Changes could be made in No. 1 grade diversion requirement. Open–market purchases were made.
Summer:	During the harvest season, the No. 1 grade diversion could be adjusted, allowing some of the set–aside fruit to flow back into regular marketing channels.

Factors Influencing Program Effectiveness

To accomplish the marketing order program objectives most effectively, it is desirable that the industry conform to some rather restricted economic and sociological conditions. Farrell (1966, pp. 349–351) lists these as follows:

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[1]The resultant green drops for 1970 and 1971 were 33.75 percent and 42.61 percent, respectively. The 1970 resultant green drop was calculated as .25 + .10 (1 – .125). The amount .125 was subtracted since 12.5 percent of the trees were removed in response to the early green–drop requirement. The 1971 resultant green drop was calculated as .26 + .13 (1 – .13) + .7 (1 – .13) – .13 (1 – .13).

1. A strong community of interest exists among the participants.

2. Informed, effective leadership prevails in the industry.

3. The structure of markets for the regulated commodity is such that effective enforcement of terms of the order is possible, *i.e.*, few first–handler outlets.

4. A high proportion of the relevant total supply of the commodity is under authority of the order.

5. Appropriate demand relationships prevail for the commodity, *i.e.*, the commodity is marketed in a single market, and the demand for the commodity is inelastic in the relevant range.

6. Producer supply response is relatively inelastic.

A strong community of interests among participants requires basic similarity among participants in terms of technical and economic conditions in production and marketing. A great deal of similarity exists among cling peach growers with respect to production practices, a common canning processor market, and a uniform industry price.[1] Absolute homogeneity, however, does not exist. Dean and Carter (1963) showed there is wide variation among orchards in returns per acre, largely due to differences in yield. They computed a difference of $224 per acre in the net returns of high– and low–yielding orchards. A more recent survey by the Cling Peach Advisory Board (1976) shows the wide range in orchard yields for blocks of trees six years old and older, ranging from 0.2 to 33.9 tons per acre. Returns net of estimated cash costs (as calculated by the authors) ranged from $1,015 per acre for the decile of orchards, with the highest yields to –$382 per acre for the decile of orchards with the lowest yields (Table 2). This indication of the lack of homogeneity in the industry may explain the many varied and sometimes conflicting proposals offered by industry members.[2]

The greatest source of informed, effective leadership comes from the grower bargaining association. The leadership exerted by the bargaining association is well documented (California Canning Peach Association, 1961; Hoos, 1962, p. 19). "This association has provided the unifying force among growers which has long been considered a necessity for the success of a marketing order. Throughout the history of the use of these orders in California, a strong producers' cooperative has often been a major factor in their establishment and continuance" (Jamison and Brandt, 1965, p. 188). Many of the same individuals are members of the Marketing Order Advisory Board and the Bargaining Association's Board of Directors (Jamison, 1966, p. 125).

[1]The aspect of a uniform industry price is discussed in connection with the bargaining process in the following section.

[2]See, for example, U. S. Department of Agriculture (1972).

TABLE 2

Distribution of California Cling Peach Orchards by Yield Category for Blocks of Trees Six Years and Older, 1975-76

Group	Orchards		Acreage		Yield		Production		Gross revenue per acre[a]	Estimated cash costs per acre[b]	Returns per acre, net of cash costs
	Actual	Percent of total	Actual	Percent of total	Average	Range	Actual	Percent of total			
	1	2	3	4	5	6	7	8	9	10	11
	number	percent	1,000 acres	percent	tons per acre		1,000 tons	percent	dollars		
1	206	10	3.97	9.0	22.1	(19.9-33.9)	87.6	14.2	2,542	1,527	1,015
2	205	10	4.05	9.1	18.8	(17.7-19.9)	76.0	12.3	2,162	1,432	730
3	206	10	4.05	9.1	17.0	(16.5-17.7)	68.9	11.1	1,955	1,380	575
4	205	10	4.44	10.0	15.8	(15.3-16.5)	70.2	11.4	1,817	1,346	471
5	206	10	4.40	9.9	14.7	(14.1-15.3)	64.9	10.5	1,690	1,314	376
6	205	10	4.52	10.2	13.5	(12.9-14.1)	61.2	9.9	1,552	1,279	273
7	206	10	5.34	12.0	12.2	(11.7-12.9)	65.0	10.5	1,403	1,242	161
8	205	10	5.58	12.6	11.1	(10.4-11.7)	62.1	10.0	1,276	1,210	66
9	206	10	4.64	10.5	9.2	(8.2-10.4)	42.7	6.9	1,058	1,156	- 98
10	205	10	3.34	7.6	5.9	(0.2- 8.2)	19.9	3.2	678	1,060	- 382
Total	2,055	100	44.30[c]	100.0	13.9[c]	(0.2-33.9)	618.5	100.0	1,598	1,291	307

[a]Base price of $115 per ton applicable for the 1976 crop multiplied by average yield.

[b]Based on the reported cost of $890.56 per acre (for a 16-ton yield) for certain items plus a cost of $24.30 per ton associated with harvesting (allowing for culls) and $4.50 per ton for marketing and promotion. Not included are fixed costs per acre which amounted to an additional $572 per acre for the budgeted 16-ton-yield orchard.

[c]Computed from unrounded data. Figure differs slightly from the value obtained using the rounded data in the column.

Sources:

Cols. 1-8: Cling Peach Advisory Board (1975-76, p. 28).

Col. 9: Computed.

Col. 10: California Canning Peach Association (1977).

Col. 11: Computed.

There were 17 canners of California cling peaches in 1971. This small number of first-handler outlets greatly facilitates enforcement control as almost all cling peach production is used for canning purposes. Because of the great yield advantage California has over other growing regions, California's position with over 90 percent of the national production practically eliminates the possibility of out-of-state growers significantly benefiting from any "umbrella" provided by the marketing order of the California cling peach industry.

A study of selected deciduous tree fruits by Kip and King (1970, p. 57) indicated a price elasticity of demand of −1.39 for canned cling peaches at the f.o.b. level. This compares with their estimated farm-level price elasticity of demand of −0.51, calculated for the 1961–1965 period. These results meet the Farrell requirement (condition 5) of an inelastic farm-level demand.

Due to the long period that exists between planting and economic production and the associated high fixed investment, a significant lag exists between entry and production. Thus, short-run supply response is very inelastic. However, the marketing order does not provide statutory blockades to entry. If the marketing program enhances high grower returns and its existence provides continued expectations of high returns, then new entry into the industry is expected to occur. As is the case with free entry in a cartel, "if entry cannot be restricted . . . the cartel will be able to maintain prices that are profitable at the onset, but excess capacity and total cost will steadily increase until profits are eliminated; the cartel will either collapse or continue a precarious existence" (Machlup, 1952, p. 522). In the case of agricultural industries, "alternately larger and larger quantities of the commodity must be isolated from the market to maintain the enhanced price and total income. At some point, excessively large set-asides or diversions become intolerable and the order will collapse" (Farrell, 1966, p. 35).

One of the purposes of this study is to analyze the effect of the industry's marketing order on total industry entry and exit and the associated production response.

The Bargaining Process

An important structural element in the cling peach industry is the growers' bargaining association, the California Canning Peach Association (CCPA). Like the marketing order, the bargaining association is a voluntary institution organized by agricultural producers to aid themselves in improving their economic position. Its statutory authority stems from the Capper-Volstead Act of 1922 which assures farmers that the elimination of competition among themselves by the cooperative organization is not in itself a violation of the antitrust law.

Negotiations with processors normally start a few months prior to the harvest season. The CCPA, as well as most other fruit bargaining associations, uses a "term" contract which lists the rights and duties of grower and processor. These terms describe grades and grading methods, delivery conditions, processor service charges, and so forth. Further, the grower promises to deliver his estimated crop, and the processor agrees to pay a "reasonable" price. The term contracts are made well before the price negotiation process starts; the term contracts often extend over many years. The next phase of negotiation occurs prior to harvest. Bargaining committees are chosen from the membership of the association to meet with the individual processors. The price that the association had previously agreed upon is presented simultaneously (but individually and separately) to the processors.[1] If a minimum number of processors (one–third in the CCPA contracts) agrees to the price proposal, the offered price becomes effective to all processors. The CCPA also specifies that at least one of the three largest processors must accept the offered price for it to become effective.

One important clause in the term contract between the CCPA members and the processors is the "most favored customer" provision. If a processor pays a higher price to any non–Association member, that higher price must be paid to all Association members. Further, the CCPA agrees that the price terms to any given processor are at least as favorable as those granted to any other processor. The *most–favored–customer* provision, in effect, establishes the uniformity of price throughout the industry.

While many farmer cooperatives finance their operations with membership dues or revolving funding, stronger bargaining associations, such as the CCPA, obtain their financing from a processor service charge. This service charge is for relieving the processor from the uncertainty and trouble of soliciting and obtaining separate contracts with individual producers. The CCPA also assists the processor in making crop estimates, scheduling deliveries, and keeping records. The processor service charge, which eliminates the producer costs associated with membership in the CCPA in conjunction with the *most–favored–customer* clause, is instrumental in eliminating incentives for any CCPA member to leave the Association. This is of great strategic importance in maintaining the bargaining strength of the CCPA.

The original offer may be rejected, and it may require several additional offers before a mutually agreeable price is found. If a stalemate continues and the harvest season approaches, the obligations of the term contract are nevertheless fulfilled, *i.e.*, deliveries are made to the processors. The *reasonable* price may then be determined in a court of law. The California Agricultural Code (1975) states that the buyer must pay a reasonable price and, further, that a reasonable price is a question of fact depending on the circumstances of each particular case. The delays and litigation costs, as well as potential Association–canner ill will, have been sufficient deterrents to utilizing the courts for determining a fair price.

Table 3 shows the membership and production tonnage of the CCPA. In 1971 the Association accounted for slightly less than one–half of the industry tonnage and a little less than two–thirds of the industry growers. An additional bargaining association, the Independent Growers Association, was organized in 1972 and is believed to control about 5 percent of the industry's production. Prior to 1972, the CCPA was the only grower bargaining association in the industry. At this writing, it is premature to predict the future structural impacts of the second bargaining association.

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[1]While the Capper–Volstead Act gives cooperatives a great deal of immunity from antitrust laws, there exist strict limitations of that power: (1) prices cannot be unduly enhanced; (2) the Association cannot restrict or control production; (3) the Association cannot force the processor to deal exclusively with them; (4) the Association cannot cooperatively combine with those who are not agricultural producers (Helmberger and Hoos, 1965, p. 24).

TABLE 3

Membership and Share of Industry Production of the California Canning Peach Association, 1950-1972

Crop year	Number of members	Membership and share of industry production	Crop year	Number of members	Membership and share of industry production
		percent			percent
1950	1,110	27.6	1962	1,294	38.4
1951	1,205	32.5	1963	1,238	35.8
1952	1,238	30.2	1964	1,197	35.5
1953	1,279	36.8	1965	1,121	33.7
1954	1,309	31.7	1966	1,066	33.0
1955	1,241	37.7	1967	1,189	46.2
1956	1,320	37.1	1968	1,309	46.4
1957	1,356	30.2	1969	1,343	47.5
1958	1,426	45.1	1970	1,388	54.4
1959	1,475	32.9	1971	1,168	47.3
1960	1,423	32.1	1972	[a]	
1961	1,383	33.5			

[a]Data for 1972 and subsequent years are not directly comparable with previous years.

Source: California Canning Peach Association (annual issues).

Other Structural Aspects of the Industry

Additional background information pertinent to the analysis is presented below. Included are summary data on the number of producers and processors, product differentiation, and entry and exist conditions.

Number of Producers and Processors

The number of cling peach producers has declined from 2,800 in 1960 to 1,800 in 1972. This decline parallels the trend characterizing all of agriculture, and there is no clear evidence that the relative decrease in the number of producers is associated with the fact that the industry has products under supply control (U. S. Department of Agriculture, 1972, p. 5).

The processor sector of the cling peach industry is highly concentrated relative to the producer sector. There were 51 processors of cling peaches in 1938, 36 processors in 1962 (Jamison and Brandt, 1965, p. 198), 17 in 1971, and 14 processors in 1976 (California Cling Peach Association, 1977).

Changes in the number of processors in these years largely reflect consolidation of plants and firms due to acquisitions and mergers. Vertical integration by producers into the processing sector also has occurred. There are now three cooperative processing associations. The largest organization, California Canners and Growers, acquired five previously independent canning firms in the middle 1950s. The California Bureau of Marketing estimates that the three largest private canners plus the three cooperative canners account for about 75 percent of the industry volume.

Processors also have integrated backward into production. Processors seem reluctant to allocate substantial capital to the growing of peaches; however, some canner–owned acreage exists. It has been suggested that canners grow their own peaches mainly to have some representation at marketing order meetings and to acquire primary cost–of–production data useful in price negotiation conferences. A more common form of processor backward integration is long–term contracting between individual growers and processors. These contracts guarantee the processor access to the raw product from an independent producer to augment the supplies from the bargaining association. Price advantages are not given to non–Association long–term contracts because of the *most–favored–customer* clause; however, the processor may provide useful services to the producer in relation to capital financing. These long–term contracts are quantity contracts with price specified as "the going market price."

Product Differentiation

Unlike the relatively homogeneous commodity at the producer level, the processing sector markets a differentiated product in the sense that national brand identification is used (and, also, private label). None of the processors handle cling peaches exclusively. Their production includes many kinds of processed fruits and vegetables from specialty crops to tomato products.

Barriers to Entry

Bain (1959, p. 975) lists three factors leading to significant barriers to entry: (1) possession of patents, (2) product differentiation advantage, and (3) control over an essential input factor.

Patent rights are not important entry barriers in the canning sector as production methods are similar among firms and are not technologically sophisticated relative to, for example, manufacturing industries.

Product differentiation as a barrier to entry is more important than patents. Recently, however, the rise of private chain labels may have weakened this barrier. Private chain label supplies are often contracted from many firms.

The most important barrier to entry in the processing sector of the industry is control over the input factor—–cling peaches. With approximately 90 percent of the supply owned or under contract to processors or bargaining associations prior to the start of the procurement phase of the season, new firms may find available fruit supplies limited. With a uniform price structure in the industry, competition for the uncommitted supplies would be difficult for an aspiring entrant. When the California Canners and Growers Cooperative organized in 1957, "its founders felt that the only feasible way of entering the canning industry was to purchase existing independent canning firms, whose procurement, production, and marketing organizations and facilities were well established" (Jamison and Brandt, 1965, p. 196).

The producer sector of the industry has low barriers to entry. While the marketing order quantity provisions allow for control of quantities marketed, entry (acreage) cannot be controlled. In 1971 a grower group actively supported the passage of Senate Bill 522 that would substantially limit cling peach acreage and create an entry barrier. The Bill was passed in the state Legislature but was vetoed by the Governor.

The marketing order lowered the exit barrier in the producer sector. Any producer removing trees in years when a tree–removal credit program was in effect (1959–1965 and 1969–1972) received salable credits for acreage removed. These credits have been estimated to be worth \$200–\$500 per acre.[1] The tree credit, in effect, allowed one who exited from the industry to "get out cheaper," as a substantial "salvage" value from the present operation existed.

Industry, Acreage, Production, and Price Trends

During the period from 1956 through 1976, the California cling peach industry went through four stages of adjustment. Acreage expanded during 1956–1959 followed by a slow growth period from 1960 to 1968; acreage was reduced sharply during 1969–1972, followed by a more gradual decline in 1973–1976 (Table 4). During the expansion period, the ratio of nonbearing to bearing acreage increased as a result of new plantings. The early part of the 1960s showed bearing acreage increasing relative to nonbearing acreage as a result of maturing trees from the plantings in the late 1950s. During the period of severe contraction, the average age of the tree population was lowered due to the high removal rate for older trees. In 1969 the group of trees 17 years and older was reduced to one–half its former acreage; this age group was halved again in 1971. The result was a very young distribution of the bearing–age population which would seem to imply higher than normal yields for the industry in the following years.

The planting and removal data in Table 4 show the magnitude of adjustment occurring in the industry during the 1956–1976 period. In several years, acreage adjustments were close to 10 percent. In perennial crops such as clings, the economic adjustment costs to growers are great. Cling peach production requires a high level of initial investment and a lengthy lag before investment returns. A 1969 study estimated that the development costs of establishing an orchard to the end of the fourth year were approximately \$1,400 per acre plus a fixed investment of approximately \$2,000 (California Agricultural Extension Service, 1969). These costs would, of course, be much higher in current inflated dollars. Cling peach trees do not reach peak yield levels until somewhere between the 6th and 15th year; the associated risks of investing in this crop are considerable.

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[1] A discussion of this program and its effect is found in Section 3, *supra*, p. 20.

TABLE 4

Acreage Trends in the California Cling Peach Industry, 1956-1976

Crop year	Acreage, May 1			New plantings (N_t)	Tree removals (E_t)	Net change	
	Nonbearing[a]	Bearing	Total			Actual[b]	Percent of total
	acres					acres	percent
1956	19,894	44,746	64,640	7,468	[c]		
1957	25,211	46,936	72,147	10,295	2,788	7,507	11.61
1958	28,505	46,529	75,034	6,402	3,515	2,887	4.00
1959	33,089	48,948	82,037	9,057	2,054	7,003	9.33
1960	30,432	50,964	81,396	4,872	5,513	- 641	- 0.78
1961	23,562	54,068	77,630	3,364	7,130	-3,766	- 4.63
1962	21,197	55,760	76,957	4,018	4,691	- 673	- 0.87
1963	16,823	59,634	76,457	4,691	5,191	- 500	- 0.65
1964	15,887	60,844	76,731	3,918	3,644	274	0.36
1965	18,368	60,873	79,241	5,796	3,286	2,510	3.27
1966	19,758	61,085	80,843	5,435	3,833	1,602	2.02
1967	21,490	62,087	83,577	6,674	3,940	2,734	3.38
1968	22,492	63,142	85,634	5,045	2,988	2,057	2.46
1969	21,467	63,809	85,276	4,928	5,286	- 358	- 0.42
1970	20,473	58,979	79,452	4,363	10,187	-5,824	- 6.83
1971	17,629	52,285	69,914	4,050	13,588	-9,538	-12.00
1972	16,008	47,075	63,083	3,611	10,442	-6,831	- 9.77
1973	13,612	49,411	63,023	1,822	1,882	- 60	- 0.10
1974	10,584	51,607	62,191	1,242	2,074	- 832	- 1.32
1975	8,909	51,828	60,737	2,400	3,854	-1,454	- 2.34
1976	8,742	51,127	59,869	3,354	4,222	- 868	- 1.43

[a]Trees under four years of age; includes new plantings of previous crop year.

[b]The change of acreage of -9 538 for the June-May crop year of 1971, for example, refers to the May 1, 1970, acreage (79,452) *plus* new plantings (4,050) in the 1970 crop year (Fall, 1970, and Spring, 1971) *less* tree removals (13,588) during the 1970 crop year (June, 1970-May, 1971), giving a May 1, 1971, acreage of 69,914.

[c]Blanks indicate no data available because tabulations begin in 1956.

Source: Cling Peach Advisory Board (1977); basic data adjusted for consistency of age categories. For an explanation, see Appendix Table A.1, *infra*, p. 96.

The resulting production of cling peaches from the aforementioned acreage is shown in Table 5. While the series of gross tonnage before green drop closely follows the bearing acreage series, this tonnage is not necessarily the amount delivered to the processors. In most of the years, this tonnage has been reduced by green drop.

Green–drop surplusing existed where column (5) is nonzero. Green drop occurred without removal incentives in those years where column (3) equals column (5). Green drop occurred with tree–removal incentives when column (3) exceeds column (5). Cannery diversion surplus existed when column (9) is nonzero.

In Table 5, column (1) reports the gross tons as the *potential* amount of production based upon the standing acreage resulting from past plantings and after a *normal* level of removals at the end of the previous harvest period. If a tree–removal incentive program was in effect, some of this potential production was reduced further by additional removals. The green–drop requirement, column (3), is the amount of surplusing required from the combined tree–removal and green–drop programs. The green–drop result, column (5), is only that percentage of surplusing through the green–drop program.

Gross actual delivery, column (6), is that amount that goes over scale at the processing plant. The producer has some of this tonnage deducted based on the average of culls determined by a random sample of each load. The off–grade tons, column (7), or the off–grade percentage, column (8), is the resultant average of all growers from these random samples. Note that the off–grade percentage increased remarkably during the 1960s. Industry sources state that this was because of changes in the methods and strictness of the inspection process rather than changes in the quality of the product. The diversion percentage, column (9), or diversion tonnage, column (10), is based on No. 1 grade (*i.e.*, after cullage).

After dividing columns (5), (8), and (10) by 100 to express these terms in proportions rather than percentages, the marketable quantity in column (11) is:

$$Q_t^m = Q_t^p\ (1 - G)\ (1 - K)\ (1 - D)$$

where

Q_t^m = marketable quantity, column (11)

Q_t^p = potential quantity, column (2)

G = actual green–drop proportion, column (5) divided by 100

K = cullage proportion, column (8) divided by 100

and

D = diversion result, column (10) divided by 100.

Changes in farm level and f.o.b. processor prices from 1956 to 1977 are graphed in Figure 1. They reflect the final impact of the control program and other economic factors. An economic model of these complex forces is developed in the following section.

TABLE 5

Farm Production of California Cling Peaches and Quantities Surplused and Marketed, 1952-1976

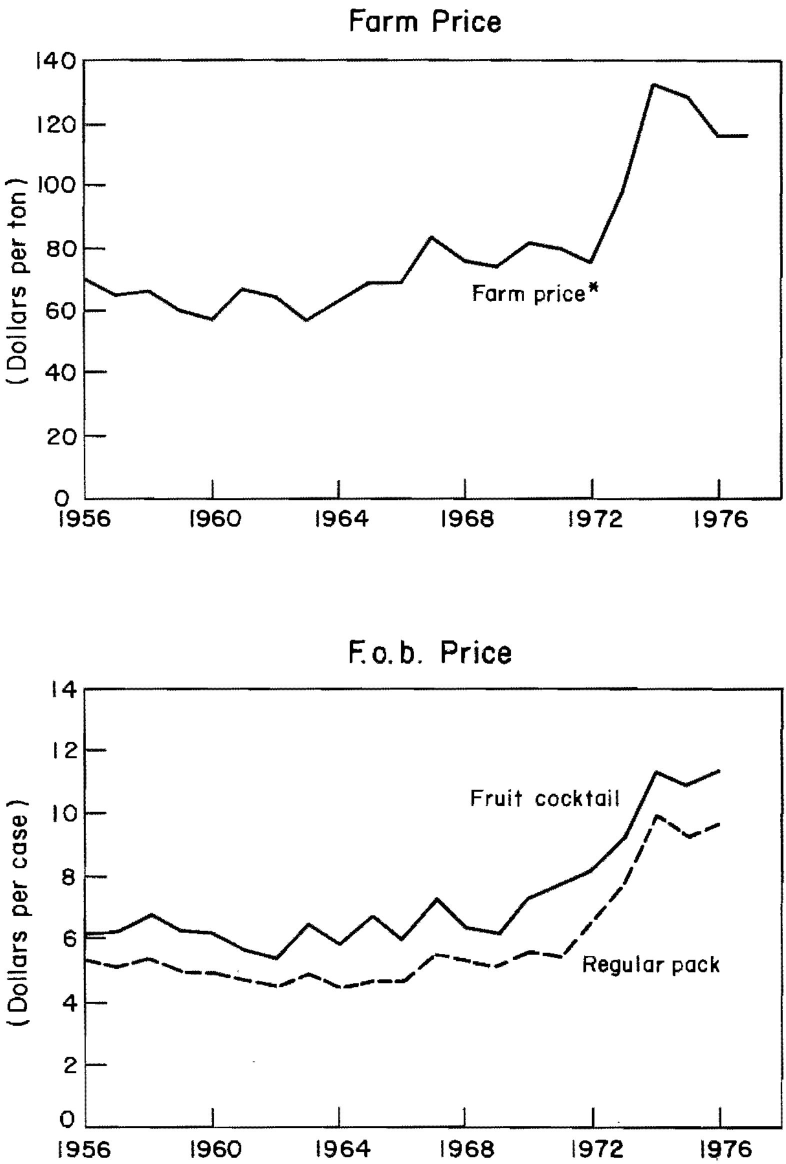
Crop year	Potential harvest before:[a] Green drop and tree removals	Potential harvest before:[a] Green drop	Green drop: Requirement	Green drop: Result	Green drop: Result	Gross actual delivery	Off grade	Off grade	No. 1 grade cling peaches: Cannery diversion	No. 1 grade cling peaches: Cannery diversion	No. 1 grade cling peaches: Cannery utilization
	1	2	3	4	5	6	7	8	9	10	11
	tons	tons	percent	tons	percent	tons	tons	percent	tons	percent	tons
1952	525,908	525,908	15.00	78,886	15.00	447,022	21,328	4.77	0	0	425,694
1953	526,396	526,396	0	0	0	526,396	25,144	4.78	0	0	501,252
1954	533,646	533,646	17.00	90,720	17.00	442,926	19,756	4.46	0	0	423,161
1955	522,412	522,412	0	0	0	522,412	23,485	4.50	0	0	498,927
1956	634,774	634,774	0	0	0	634,774	29,663	4.67	45,672	7.54	559,437
1957	621,298	621,298	16.00	99,408	16.00	521,890	31,100	5.96	5,106	1.04	485,684
1958	492,163	492,163	0	0	0	492,163	30,131	6.12	0	0	462,032
1959	649,333	636,791	12.00	65,378	10.27	571,413	29,303	5.13	3,089	0.56	539,021
1960	697,320	658,242	15.00	65,520	9.95	592,722	30,206	5.10	17,038	3.02	545,478
1961	741,040	692,023	12.00	39,908	5.77	652,115	38,730	5.94	30,946	5.04	582,439
1962	815,990	775,689	12.00	57,608	7.43	718,071	40,298	5.61	39,415	5.81	638,358
1963	839,156	794,457	14.00	72,783	9.16	721,674	45,705	6.33	0	0	675,969
1964	948,898	921,726	10.00	67,718	7.35	854,008	75,261	8.81	0	0	778,747
1965	757,120	742,221	6.00	30,528	4.11	711,693	78,234	10.99	9,432	1.48	624,027
1966	822,949	822,949	0	0	0	822,949	83,578	10.16	0	0	739,371
1967	678,485	678,485	0	0	0	678,485	77,917	11.48	0	0	600,568
1968	840,229	840,229	0	0	0	840,229	84,947	10.11	0	0	755,352
1969	963,878	907,750	8.00	20,982	2.31	886,768	93,510	10.55	18,295	2.50	774,963
1970	907,067	792,464	33.75[b]	78,149	9.87	714,315	64,581	9.04	33,041	5.10	616,693
1971	895,234	799,504	42.61[b]	169,349	21.18	630,155	60,260	9.66	0	0	569,895
1972	800,960	625,385	25.00	24,665	3.94	600,720	58,886	9.80	0	0	541,834
1973	[c]	640,393				640,393	80,093	12.50			560,300
1974		791,817				791,817	74,922	9.47			716,895
1975		718,086				712,071	80,358	11.31			631,713
1976		667,795				667,795	76,341	11.43			591,454

[a] Adjusted for tonnage associated with tree-removal incentives.

[b] In 1970 and 1971 a "2 for 1" tree removal was in effect. The "effective" green-drop requirements are 21.25 percent (1970) and 29.61 percent (1971).

[c] Blanks indicate market control not in effect.

Sources:
Col. 1: Calculated.
Cols. 2-11: California Canning Peach Association (1977).



*Base price, 1973-1977.

Source: Appendix Table A.8, *infra*, p. 107.

FIGURE 1. Farm Level and Processor Prices of California Cling Peaches, 1956-1977 (Years Beginning June 1)

3. AN ECONOMETRIC MODEL OF THE INDUSTRY

This section presents a theoretical framework suggesting how individuals and groups of individuals react to economic signals emanating from other groups within the industry as well as to those signals considered exogenous to the system. The model provides a basis for explaining production adjustment and price determination in response to marketing board decisions.

Model Construction

An econometric model appropriate for explaining industry adjustments should incorporate sufficient detail to explain how performance variables, such as prices and production, react to changes of controlled variables (*e.g.*, percentage green drop) and exogenous variables (*e.g.*, consumer income). Clearly, the real system is much more complex than any possible model. However, the constructed model should be capable of illustrating causal relations among critical variables while stripping away irrelevant complexities.

The choice of variables to include in the model's equations is based on industry observation, interviews with decision–makers, and economic theory. In quantifying the model, modifications were necessary due to the quality of the data or to their availability. Also, variables may be deleted because, in the sample time period, the statistical analysis may not be sensitive enough to sort out the interrelationships among them.

While industry observations and economic theory provide clues as to which variables should be incorporated into the model as well as *a priori* expectations as to the algebraic sign or magnitude of their influence, typically the investigator has no prior information as to the exact nature (functional form) of the relationships. As a practical matter, this study is limited primarily to the use of linear approximations or to curved forms such as log functions which may be transformed to the linear equations for estimation purposes. The final selection of the functional forms (as well as the included variables) is based on statistical criteria such as standard errors, coefficients of determination, and Durbin–Watson statistics. Further modifications involve aggregating over individual, time, place, and form units because of data availability and degrees of freedom considerations.

The investigator's perception of the industry also greatly influences the estimation techniques to be used. The appropriateness of using ordinary least squares (OLS) or alternative estimation techniques reflects the model builder's assumption as to the behavior of the error term. While OLS parameter estimates are biased in a simultaneous structural setting, biasness is not the only nor necessarily the most important property of an estimator. Other factors, such as signs and magnitude of coefficients compared to *a priori* considerations and goodness–of–fit criteria, are additional considerations used in evaluating estimation methods. Further, several studies have found that OLS and two–stage least squares (TSLS) results frequently produce similar coefficients, *e.g.*, Houck (1964), Loyns (1968), and Matthews (1966).

The forms of the relationships, the variables considered to be of consequence, the assumptions regarding the joint dependency on the error terms, the level of aggregation, *etc.*, all are part of the model's specification. Since several plausible model specifications may exist, the final choice of the structural model depends on the evaluation of several criteria and the subjectivity of the investigator. Therefore, the processes of the model construction are reported in this section, as well as the modifications made in Sections 4 and 5, to allow the reader the opportunity to evaluate the adequacy of the model's representativeness.

The econometric model closely follows the schematic diagram of Figure 2 in which the structure is separated into five blocks. The industry system is viewed as consisting of both recursive and simultaneous relationships. Potential production, Block I, is influenced by certain random elements and the past decisions that determined the present acreage characteristics. This potential production may be decreased by the marketing order programs depicted in Block II. The resultant marketable production is transformed to final products and allocated to markets or inventories in Blocks III and IV. The production quantities interact with demand conditions, costs, and other factors in the determination of farm and f.o.b. prices and the quantities allocated by form and market. In Block V, prices, costs, and other variables influence the next period's acreage characteristics through removals and new plantings. Blocks I and V pertain to the producer supply subsystem while Blocks III and IV reflect the processor demand subsystem The producer supply subsystem considers production and the determinants of production. The processor demand subsystem considers the demand conditions that influence price corresponding to levels of marketable production. Block II reflects the decision rules of the control board subsystem.

The Producer Supply Subsystem

In this section the functional relationships required to describe the aggregate industry production and acreage adjustments are developed. The model is similar in its final form to perennial crop supply response models developed previously by French and Bressler (1962) and French and Matthews (1971).[1] It is somewhat unique, however, in its detail with respect to tree age and yield distributions and the inclusion of marketing order control decisions in the supply response functions.

The Neoclassical Production Model

Although concern is primarily with the aggregate behavior of cling peach producers, theoretical concepts at the individual firm level provide implications for aggregate behavior and the relevant variables to be included in the analysis. The neoclassical model of individual firm profit–maximizing behavior yields a set of input demand and output supply functions for each firm which express outputs and inputs as functions of product and factor prices (Henderson and Quandt, 1971). In the multiproduct, multitime period framework appropriate to most cling peach growers, a set of time–dated functions is obtained which relates planned output and input use in each future time period to expected prices over all future periods and to a set of predetermined variables which define the state of the production system in the decision period. The state variables consist mainly of quantities of existing trees of various age groups.

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[1]For examples of other variants of perennial crops supply response models, see Hamilton (1966), Rausser (1971), and Baritelle and Price (1974).

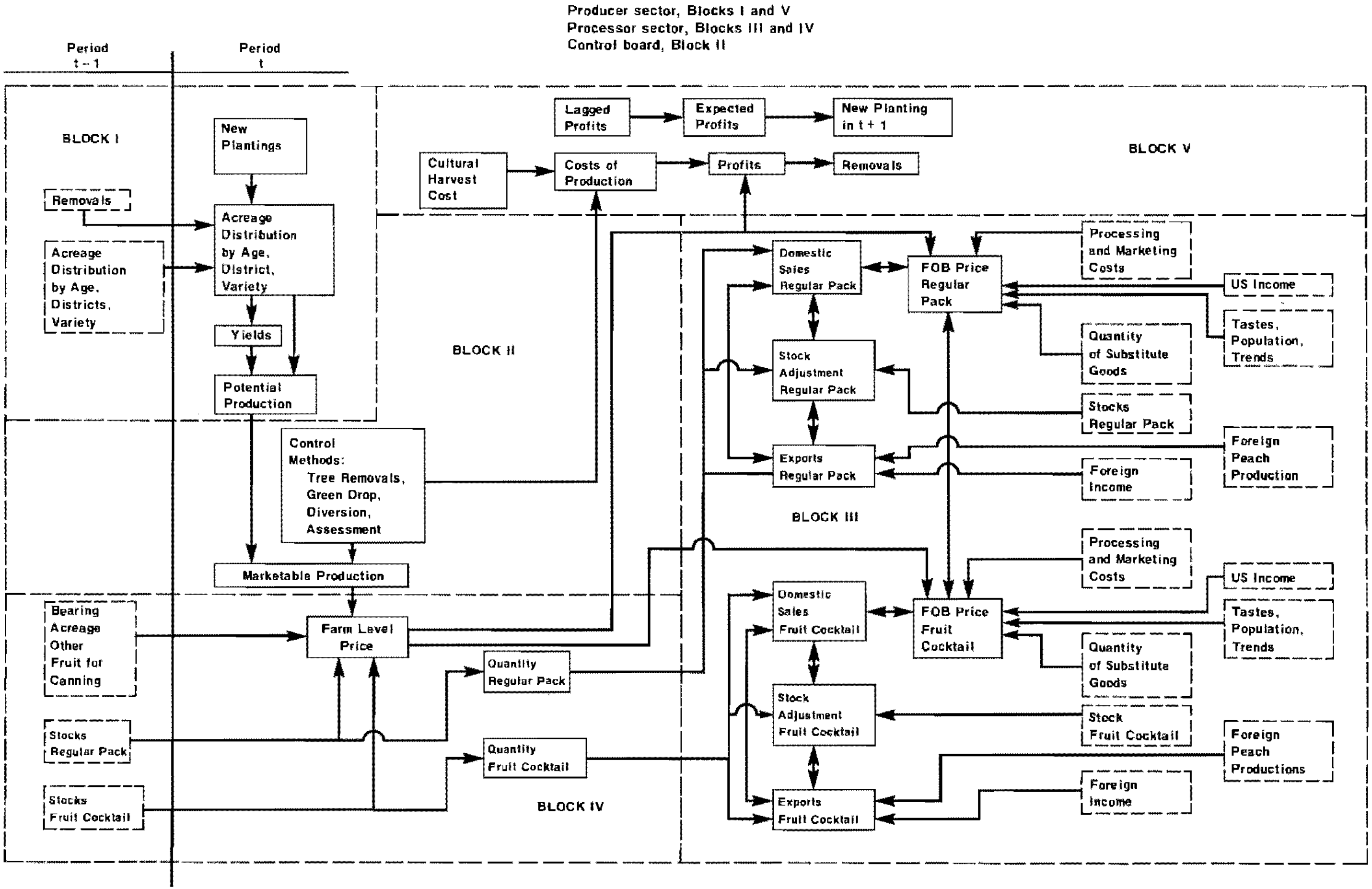

FIGURE 2. Structure of the California Cling Peach Industry

Since yields vary with tree ages, total production (q_t) in period t is given by:

$$q_t = \sum_{i=1}^{n} Y_{it} A_{it}, \qquad i = 1, \ldots, n \tag{3.1}$$

where Y_{it} is average yield per acre for trees i years old in time t, and A_{it} is acres of trees i years old in time period t. The acres of trees available for harvest in each age class in each period are determined by the historical sequence of planting and removal decisions. The acreage in age class i is defined according to

$$A_{it} = n_{t-(i-1)} - \sum_{j=1}^{i} e_{t-(i-j)} \tag{3.2}$$

where n is acres planted and e is acres removed. Decisions to change production are implemented primarily through decisions to plant new trees or remove old trees.[1] Planting and removal functions may be derived from the input demand set by noting that a particular subset of inputs associated with the planting of trees and another subset of inputs associated with the removal of trees can be identified. Since the inputs are functions of expected prices and state variables, so also are planting and removal decisions. Planting, n, and removal, e, relationships may be specified as:

$$n_t = n_t \left(\underset{\sim}{p}_{it}^{*\tau}, \underset{\sim}{c}_{jt}^{*\tau}, \underset{\sim}{Z}_t \right), \tag{3.3}$$

and

$$e_t = e_t \left(\underset{\sim}{p}_{it}^{*\tau}, \underset{\sim}{c}_{jt}^{*\tau}, \underset{\sim}{Z}_t \right), \tag{3.4}$$

where $\underset{\sim}{p}_{it}^{*\tau}$ and $\underset{\sim}{c}_{jt}^{*\tau}$ are vectors of expectations of future prices of s outputs (i = 1 . . . s) and h inputs (j = 1 . . . h), as perceived in time t over the planning horizon τ, and $\underset{\sim}{Z}_t$ is a vector of exogenous or predetermined variables. Equations (3.3) and (3.4) define the firm's acreage response function in terms of planting and removal relationships.

Summing (3.3) and (3.4) over all actual and potential cling peach producers provides expressions for aggregate industry planting and removal response. If all producers were faced with the same expected prices and state variables,. the aggregate functions could be expressed similarly to the firm equations, *i.e.*,

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[1]Conceptually, production could also be altered by intensification of cultural practices associated with fertilizing, spraying, irrigating, and pruning. As a practical matter, these practices seem highly standardized and not likely to respond significantly to changes in economic conditions.

$$N_t = N_t\left(\underset{\sim}{p}_{it}^{*\tau},\ \underset{\sim}{c}_{jt}^{*\tau},\ \underset{\sim}{Z}_t\right), \tag{3.5}$$

and

$$E_t = E_t\left(\underset{\sim}{p}_{it}^{*\tau},\ \underset{\sim}{c}_{jt}^{*\tau},\ \underset{\sim}{Z}_t\right), \tag{3.6}$$

where N_t and E_t refer to acres of new plantings and removals, respectively, for the industry in time t.

In practice, individual producers may form different price expectations and may be faced by different values of the state variables which constrain the firm's operations in each time period. Furthermore, many are faced with different factor endowments and production alternatives and, therefore, may be subject to different production and cost functions. The summation of individual firm functions thus may yield aggregate functions which are exceedingly complex and involve many individual firm variables. It is unlikely that such functions could be estimated even if their general form could be specified. The practical alternative is to use average industry values or average regional values of the explanatory variables in (3.5) and (3.6) and to choose a manageable algebraic form to represent the more complex function. That procedure is followed here.

From the development of the general production model above, it is evident that the following relationships must be specified and estimated in the formulation of a total supply adjustment model: (1) equations to explain removals, (2) equations to explain plantings, (3) equations which relate unobservable expectations to actual values, (4) equations which relate yields to age of trees (and producing district and variety), (5) identities such as (3.1) which relate production to acreage and yield, (6) trend equations which describe secular shifts in the variety and district composition of industry acreage, and (7) equations which show how grower costs and returns are affected by alternative control programs.

Removal Behavior

The basic removal relationship is obtained as an elaboration of equation (3.6). Note that, without loss of generality equations, (3.6) and (3.5) may be expressed in terms of expected profits (returns) rather than prices and costs. This transformation reduces the number of coefficients to be estimated.

Expected profits are not observable. However, observations are available for variables believed to be closely associated with profit expectations. As an indicator of general changes in profitability, average industry revenue per ton less a measure of industry cost per ton is used, all deflated by a farm input price index.[1] Studies of supply response for other perennial crops have explored several alternative formulations of the relation of unobserved expectations to measurable variables.[2] Most commonly, expected profits have been

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[1]The relation of grower returns to market control actions is explained at the end of the discussion of the producer supply subsystem. Grower price and cost data are given in Appendix Sections A and B, *infra*, pp. 95 and 117.

[2]See, for example, Rausser (1971, pp. 414–425), French and Bressler (1962), and Nerlove (1972).

expressed as functions of moving averages of past profitability measures or some weighted average such as a geometric lag distribution. In the removal relationship, expected profit pertains primarily to the short run since acres not removed this year may be evaluated again the next year. Such short–run expectations reasonably may be related most closely to very recent experience. Thus, expected profit is expressed as a function only of the current year profitability indicator rather than an average of several years. Statistical explorations of alternative formulations suggested that this, in fact, was the better choice.

Attempts to include measures of returns to alternative crops as variables proved futile because of the many possible choices open to growers in the various cling peach districts. The data and numbers of observations possible were not sufficient to obtain statistically significant estimators of the coefficients of the various competitive crop variables. Consequently, the influence of such variables is absorbed in the unexplained error term of the removal equation.

The vector $\underset{\sim}{Z}_t$ in (3.6) consists of variables pertaining to acres of existing trees in various age classes, variables to account for influence of tree–removal incentives, and an unexplained disturbance. Since yields decline as trees reach "old age," the removal rate may be expected to increase as the proportion of older trees increases.[1] To account for this influence, a variable, OLD_t, was included which consists of acres of trees over 16 years and older in year t. It was hypothesized that the level of acreage of very young trees (defined in this study as acres 0 to 4 years old in year t) might also be a significant factor affecting removals since it would suggest changes in acreage in the near future. If high, near–future prices might be lower, or higher controls might be indicated which might lead growers to increase removal rates.

It may be recalled from the discussion in Section 2 that two kinds of tree–removal incentive programs were used. The main differences were in the timing of announced green–drop requirements and the amount of credit against green drop given for trees removed. In the period 1959–1965 and in 1969, the green–drop requirement was announced in the spring, with growers given credit for one green–dropped tree for one equivalent tree removed. While the green–drop requirement for year t was thus known in t – 1, growers who delayed removals until spring in order to be certain of green–drop credit were precluded from replacement with other tree crops, although growing of an annual crop was still possible. The direct impact on removal decisions was thus somewhat limited. Nevertheless, it had some effect and enters the removal equation for crop year t – 1 as TRI_t, defined as the green–drop requirement (in the percent of trees) for year t announced in the spring of t – 1.

In 1970–1972 an early green–drop requirement for year t was announced in the fall of crop year t – 1. This permitted growers who wanted to replace trees removed with other trees to be certain of their removal credit. Moreover, in 1970 and 1971 they were given credit for two green–dropped trees for each tree removed. The early green–drop percentage (ETRI) was zero for all years except 1970–1972. Values for these years were 1970 = 12.5, 1971 = 24.3, and 1972 = 25.0. The TRI values for 1959–1965 and 1969 are given in column 3 of Table 5. They were 0 for 1970 and 1972 and 5.3 for 1971.

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[1]For a discussion of the optimal age to replace cling peach trees, see Faris (1960).

Two equation forms were considered: (1) linear in terms of total acres removed and in each age group and (2) linear but with all acreage values expressed as proportions of total acres. The proportional equation, which proved to be the better estimator, has the form

$$PE_{t-1} = a_{10} + a_{11} AR_{t-1} + a_{12} POLD_{t-1} + a_{13} TRI_t + a_{14} ETRI_t + a_{15} PYNG_{t-1} + u_1 \quad (3.7)$$

where

$PE_t = E_t/TA_t$

E_t = acres removed in year t

TA_t = total acres in year t

$AR_t = R_t/CI_t$

R_t = returns per ton indicator (dollars per ton calculated in $TR - TC/Q^p$) in year t

CI_t = index of farm input prices in year t

$PYNG_t = YNG_t/TA_t$

YNG_t = acres in year t (0–4 years old)

$POLD_t = OLD_t/TA_t$

OLD_t = acres of trees over 16 years old in year t

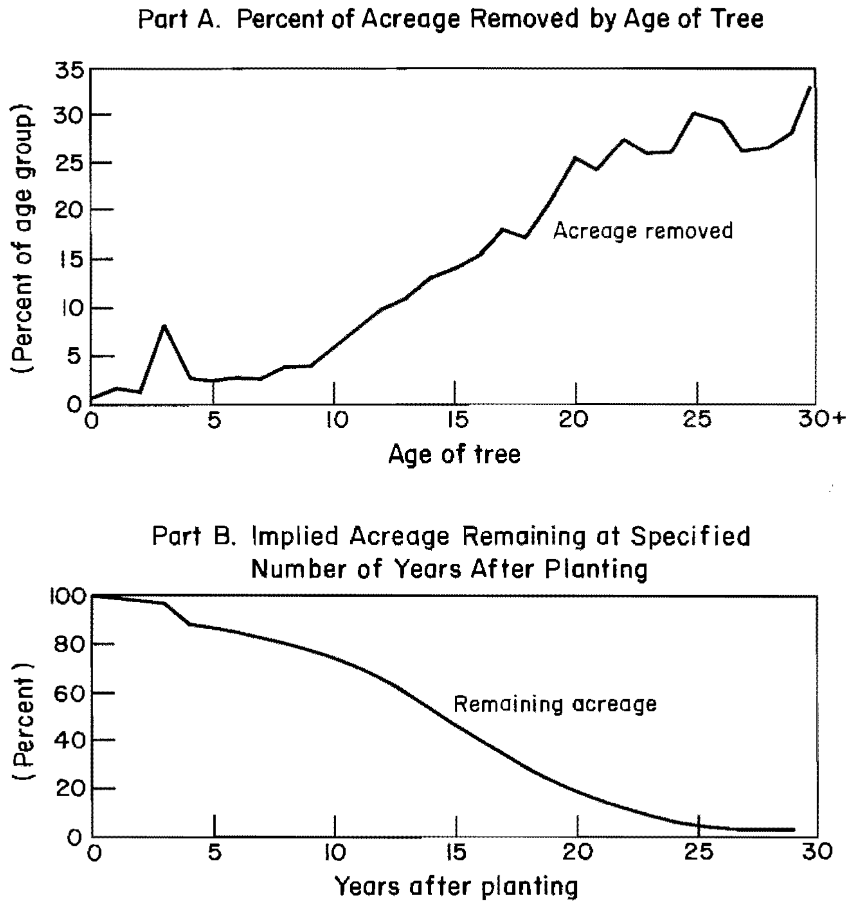
TRI_t = spring green–drop requirement when tree–removal incentives are in effect (percent)

$ETRI_t$ = early green–drop requirement when tree–removal incentives are in effect (percent) [$ETRI_t > 0$ in 1970, 1971, and 1972; ETRI = 0 all other years]

and

u_1 = random disturbance term.

In order to predict the age distribution of trees in each year, the total removals measured by equation (3.7) must be allocated by age of tree. Figure 3 (Part A) summarizes the weighted average rate of removals by age cohort for the 1956–1972 period. The acreage–removal rate increased with age of tree from about 2.5 percent for 5–year



Source: Appendix Table A.1 *infra*, p. 96.

FIGURE 3. California Cling Peach Acreage: Percentage (Weighted Average) Acreage Removed by Age of Tree, 1956-1972, and Implied Percentage of Acreage Remaining at Specified Number of Years After Planting

trees to about 25 percent for 20–year–old trees.[1] Another view of removals is the accumulative effect over the years after initial planting (Figure 3, Part B). For this period, the aggregate acreage remaining after 5 years is 87 percent of the original plantings, 46 percent after 15 years, and 18 percent after 20 years. The level and shape of these curves would be expected to vary with such factors as economic conditions in the industry, regional pressures for urbanization, varietal developments, and the like. Also, the tree–removal–incentive program would tend to result in higher removals than in a growth phase of the industry.

Figure 3 (Part A) is in general agreement with the Faris (1960) study for trees 16 years and older where he concludes that there exists a higher propensity to remove trees as yields decline. A possible explanation for the increasing removal rates between 6 and 15 years is that removal of young trees results from misconceptions at the time of planting. A grower may plant a new variety that does not respond well to existing soil conditions or farm practices, and it takes several years of harvest for the grower to realize the inadequacy of that particular type of tree. Also, alternative uses of land with high returns, such as subdivisions, highway right–of–ways, farm buildings, *etc.*, are more likely to occur as the tree gets older. That is, the older the tree, the more likely the grower did not anticipate the high–return alternative at the time of planting.

Removals by age of tree are a function of the age of tree and the level of total industry removals. Two equations, one for trees of nonbearing age and one for trees of bearing age, are estimated:

$$PE_{it-1} = a_{20} + a_{21}(i) + a_{22} PE_{t-1} + u_2 \qquad (i = 0, \ldots, 3) \qquad (3.8)$$

$$PE_{it-1} = a_{30} + a_{31}(i) + a_{32} PE_{t-1} + u_3 \qquad (i = 4, \ldots, 32+) \qquad (3.9)$$

where

i = age of tree

E_{it} = acres of trees removed i years old in year t

A_{it} = acres of trees i years old in year t

and

$PE_{it} = E_{it}/A_{it}$.

---

[1]The removal rate for three–year old trees showed a marked peak thought to be associated with (1) an age at which the orchardist has a fairly clear idea as to the quality of the trees and (2) a statistical aspect in that acreages and removals are more reliable at this age than for earlier years. As noted, some estimates of plantings and removals were required (Appendix Table A.1), *infra*, p. 96.

New Planting Behavior

The new planting relationship is obtained as an elaboration of equation (3.5). As in the case of the removal equation, price and cost variables were transformed into a single measure of profitability (AR); for reasons described previously, the impact of returns to alternative enterprise is reflected in the unexplained error term rather than as a separate variable or variables.

Profit expectations relevant to planting decisions involve a long–term horizon of 20 years or more. Such expectations seem likely to be related to average experience over a period of past years rather than a single year. Both moving average and geometrically declining lag functions of AR and various lag lengths were explored. A four–year moving average of past profit indicators proved to be the best predictor of new plantings.[1]

The $\underset{\sim}{Z}$ vector of equation (3.5) includes acres of young trees and old trees, defined as in the discussion of the removal relationship, plus an unexplained disturbance term. The acreage of young trees was hypothesized to have a negative effect on plantings in the same manner as it was expected to have a positive effect on removals. Increases in old age acreage might be expected to suggest higher replacement needs and, therefore, increased plantings.

As in the case of the removal relationship, equation forms were explored in which new plantings were expressed alternatively in total terms and as proportions of total acreage. In this case better statistical results were obtained with total plantings as the dependent variable. That is,

$$N_t = a_{40} + a_{41}\ \overline{AR}_{t-1} + a_{42}\ YNG_t + a_{43}\ OLD_t + u_2 \qquad (3.10)$$

where

N_t = acres of new planting in year t

$\overline{AR}_{t-1} = (AR_{t-1} + AR_{t-2} + AR_{t-3} + AR_{t-4})/4$

YNG_t = acres of trees 4 years and younger in time t

and

OLD_t = acres of trees 16 years and older in time t

District and Variety Shifts in Cling Peach Acreage

Along with total acreage adjustments, there have been adjustments with respect to varieties and districts.[2] Cling peach varieties are separated into four variety groups that

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[1]The inclusion of lagged values for returns may also result from adjustment lags where the producer cannot equate his actual plantings with desired plantings in time period t due to capital restraints or the lack of open ground. While the producer may want to plant in period t, the actual new plantings occur in some future time period, *e.g.*, French and Matthews (1971) and Nerlove (1972).

[2]Acreage data by variety and district groupings are found in Appendix Table A.3, *infra.*, p. 102.

relate to the time of harvesting. These varieties are referred to as extra early, early, late, and extra late. The approximate harvest periods of these four variety groups are:

Extra early:	July 15–31
Early:	August 1–15
Late:	August 16–31
Extra late:	September 1–20.

Growers raise several varieties to prolong the harvest season and are encouraged to do so by processors since it allows more complete utilization of processing capacity. In 1954 the respective shares of the total acreage of each variety group was extra early (10.4 percent), early (33 percent), late (43 percent), and extra late (13.6 percent); in 1972 the respective shares were 26.4 percent, 20.3 percent, 39.0 percent, and 14.4 percent. Thus, the trend has been to spread the harvesting more evenly through the season.

The California industry has four main growing areas centered around Marysville–Yuba City, Stockton, Modesto, and Visalia. Their shares of total industry acreage in 1954 were 38.7 percent, 8.6 percent, 42.3 percent, and 8.0 percent, respectively. The balance, or 2.4 percent, was grown outside of the four districts. In 1972 the shares were 40.5 percent, 3.5 percent, 45.2 percent, and 10.8 percent, respectively; only two acres were grown outside of the four districts (*vs.* 1,316 acres in 1954). There was an increasing share of acreage in three of the four districts, whereas the Stockton district share of acreage decreased by more than half over the 18 years of observation.

Since the variety group and district composition of the tree population (along with age of tree) are used to explain yield levels, trends are fitted for these shifts over the period of observation to aid in the yield estimates (developed in Section 3). The trend which most closely approximated the district shares of acreage and the variety shares of acreage within each district was the following hyperbolic function:

$$DS_{jt} = \frac{1}{\left(a_{j40} + a_{j41}\,T + a_{j42}\,T^2 + u_{j4}\right)} \tag{3.11}$$

$$VS_{jkt} = \frac{1}{\left(a_{jk50} + a_{jk51}\,T + a_{jk52}\,T^2 + u_{jk5}\right)} \tag{3.12}$$

where

DS_{jt} = share of the *j*th district's acreage in time t

VS_{jkt} = share of the *k*th variety group, acreage in district j, in time t

and

T = time trend (T = 1 in 1955).

It is necessary, of course, that $\Sigma_j \, DS_{jt} = 1$ and $\Sigma_k \, VS_{jkt} = 1$. The method of adjusting the share allocations to assure that they sum to 1.0 for each year is described with the presentation of empirical results. It should be stressed that these allocations are descriptive measures intended to apply only to the 1956–1972 period, and the equations are not valid for projections beyond that period. Alternatively, actual historical shares could have been used in the analysis rather than these smoothed or estimated values.

Yield Level Determination

Total potential production from a given population of cling peach trees is often obtained by multiplying bearing acreage, B, and expected yield, Y. Actual yield, however, is dependent upon several factors. Faris (1960, p. 8) lists these factors as "age and variety of tree, climate, soil, spacing of trees, fertilizer, water, cultivation practices, thinning, pruning, and disease and pest control" (authors' underscore). Faris' expression of yield, analogous to a production surface, is thus

$$Y = f\,(a, v, c, s, st, f, w, cp, t, p, d).$$

The factors in the above expression are classified as either the resource base (a, v, c, s, st) or as anual inputs[1] (f, w, cp, t, p, d). However, these inputs do vary with respect to age of tree and possibly over time as technological changes occur. As shown in Table 6, Faris' study provides a hypothetical yield function with respect to age of tree that was derived from survey data. Although these yield levels are higher than industry averages, they are indicative of how yields might vary with age of tree. The variables classified as annual inputs were dropped due to lack of meaningful cross–sectional data from the above expression. Their influence is included as part of the error term. The time variable, T, might be included to indicate technological change such as improvements in root stock, chemicals, *etc.*

Two of the factors classified as belonging to the resource base, soil and climate,[2] are deleted from the final estimating equation due to lack of information. Soil and climate maps lack the precision required to index the various peach orchards or the variation of soils within the orchards. Faris (1960, p. 12) found little variation in soil types among growers which decreases *a priori* the value of soil as an explanatory factor in yield variation. The spacing of trees, from 90 to 109 trees per acre, was found to be of little use in explaining yields (Faris, 1960, p. 9).

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[1]Annual inputs are practically synonymous with those activities listed as preharvest costs. These activities are not to be confused with harvesting activities. Annual inputs affect yield, while yield affects the level of harvesting activity.

[2]Climate (the average course or condition of the weather in a specific region) and weather (a seasonal or instant state of temperature, moisture, wind velocity, and visibility) are, of course, differentiated. Climate is considered as part of the resource base, while weather is part of the error term.

TABLE 6

Hypothetical Yields of California Cling Peaches by Age of Tree

i	$\bar{Y}_t$	i	$\bar{Y}_t$
years	tons per acre	years	tons per acre
0	0.0	14	18.6
1	0.0	15	18.2
2	0.0	16	17.7
3	1.0	17	17.3
4	5.5	18	16.8
5	8.5	19	16.2
6	14.0	20	15.6
7	16.2	21	15.3
8	17.8	22	14.8
9	18.7	23	14.5
10	19.2	24	14.4
11	19.4	25	14.1
12	19.3	26	13.9
13	19.0	27	13.6

Source: Synthesized from 1953-1956 data; see Faris (1960, p. 58).

The data from the cling peach industry, although not differentiated by soil and climate, do give yield values disaggregated by the four main production areas. This district designation, DIST, will be used to explain yield variation among regions. The variety variable, VAR, will also be used to explain yield variability. Dummy variables are incorporated to designate the qualitative variables of age group, district, and varietal group. The stochastic yield equation specified is:

$$Y_{ijkt} = a_{60} + \sum_{i=2}^{7} a_{61i}\, AG_i + \sum_{j=2}^{4} a_{62j}\, DIST_j + \sum_{k=2}^{4} a_{63k}\, VAR_k + a_{64}\, T + u_6 \quad (3.13)$$

where

Y_{ijkt} = yield per acre for trees i years old in district j of variety k in year t

AG_2 = 1 when age is 3, 0 otherwise

AG_3 = 1 when age is 4, 0 otherwise

AG_4 = 1 when age is 5, 0 otherwise

AG_5 = 1 when age is 6–15, 0 otherwise

AG_6 = 1 when age is 16–20, 0 otherwise

AG_7 = 1 when age is 21 or older, 0 otherwise

$DIST_2$ = 1 when district is Stockton–Linden, 0 otherwise

$DIST_3$ = 1 when district is Modesto, 0 otherwise

$DIST_4$ = 1 when district is Kingsburg–Visalia, 0 otherwise

VAR_2 = 1 when variety group is early, 0 otherwise

VAR_3 = 1 when variety group is late, 0 otherwise

VAR_4 = 1 when variety group is extra late, 0 otherwise

and

T = time trend (1955 = 1).

The yields associated with age = 2, district = Marysville–Yuba City, and variety = extra early are included in the constant term, a_{60}. Note that yield levels for trees as young as two years old are incorporated in the yield equation in spite of the fact that bearing age is normally defined as over four years old. This information was included as a result of the positive yields (though small) that occur for two– and three–year–old trees.

Average yields for the state are computed from the expression

$$\overline{Y}_t = \sum_i \sum_j \sum_k \frac{(\hat{Y}_{ijkt} \quad A_{ijkt})}{\left(\sum_{i=2}^{31+} A_{it}\right)} \tag{3.14}$$

where

A_{ijkt} = acres of trees i years old in district j of variety k in year t

$\hat{Y}_{ijkt}$ = estimated yield (equation 3.13)

and

$A_{it} = \Sigma_j \Sigma_k A_{ijkt}$ = acres of trees i years old.

Potential Production

The producer subsystem's potential production, Q_t^p, is found by multiplying average yield by the acreage of trees two years and older.

$$Q_t^p = \bar{Y}_t \left(\sum_{i=2}^{31+} A_{it} \right). \qquad (3.15)$$

Relation of Grower Returns to Market Control Actions

Grower returns, TR – TC, are affected in the short run by surplusing actions under the marketing order program.[1] These effects must be taken into account in computing the values of the average return variables, AR, in the removal and planting equations, (3.7) and (3.10).

Surplusing reduces quantity and increases total revenue (TR) when the demand curve facing the producers is in the inelastic range. Revenue per unit of *potential* tonnage is decreased since costs are incurred for production which is not marketed. Grower returns per potential tons are derived for four cases: (1) no surplusing program in effect, (2) diversion program in effect, (3) green–drop program in effect, and (4) both diversion and green–drop programs in effect.

The various control programs are described in Section 2.[2] Here, how the controls reduce supply will be reviewed using the notation in Table 7. For comparison purposes, let the farm price, P, be the same in all four cases; and let the surplus requirement, S, be the same for cases (2), (3), and (4). A season starts with a potential quantity of tonnage, Q^p. A green–drop requirement may be declared.[3] The available supply at this point is $Q^p (1 - G) = Q^p G'$. A diversion requirement may be declared. Deliveries are made to the processor, and culls are eliminated. The available supply at this time is $Q^p G' K'$ where $K' = (1 - K)$. The diversion requirement is diverted from the marketing channel. The marketable quantity at this point, Q^m, is equal to $Q^p G' K' D'$. The surplus requirement is $S = 1 - (Q^m/Q^p K') = 1 - [Q^p K' G' D'/(Q^p K')] = 1 - G' D' = G + D - GD$. Note that, when only one control is in effect, $S = G$ or $S = D$; but when both types of control are in effect, $S \neq G + D$. Consider the following four cases:

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[1]The long–run effects are discussed in Section 6, *infra,* p. 81.

[2]*Supra,* p. 2.

[3]It is assumed here that there is no tree–removal–incentive program. Thus, the actual green–drop proportion is equal to the green–drop requirement (see Table 5, columns 3 and 5, *supra,* p. 18) for the difference in these green–drop percentages.

TABLE 7

Variable Designation: Grower-Return Equations

P = farm price (dollars per ton)

Q^m = marketable quantity (tons)

Q^d = quantity diverted (tons)

Q^g = quantity green dropped (tons)

Q^p = potential quantity (tons)

C_1 = cultivated cost prior to thinning costs (dollars per ton of potential production)

C_2 = harvest and thinning costs (dollars per ton of potential production)

C_3 = knock-off (green drop) cost (dollars per ton, green dropped)

D = diversion requirement (percent x 0.01)

G = actual green-drop proportion

S = surplus requirement (percent x 0.01)

K = cullage proportion

TR = total revenue (dollars)

TC = total cost (dollars)

R = returns (per ton)

$D' = 1 - D$

$G' = 1 - G$

$S' = 1 - S$

$K' = 1 - K$

Case 1. No control program in effect.

$$TR = P Q^p (1 - K); \quad Q^m = Q^p K'$$

$$TC = Q^p (C_1 + C_2) \tag{3.16}$$

$$R_1 = \frac{TR - TC}{Q^p} = PK' - (C_1 + C_2)$$

Case 2. Cannery No. 1 diversion in effect.

The grower harvests and delivers the entire crop, grower gets paid for entire delivery after adjusting for K, and grower buys back D proportion of the crop from the processor. In essence, the grower gets paid for D' of his delivery.

$$TR = P Q^p (1 - K)(1 - D); \quad Q^m = Q^p K' D'$$

$$TC = Q^p (C_1 + C_2)$$

$$TR - TC = P Q^p K' D' - Q^p (C_1 + C_2) \tag{3.17}$$

$$R_2 = \frac{TR - TC}{Q^p} = P D' K' - C_1 - C_2.$$

Case 3. Green–drop program in effect.

The grower knocks off G proportion of his crop and harvests G'. The grower gets paid for all that he harvests after adjusting for K.

$$TR = P\ Q^p K' G'; \quad Q^m = Q^p K' G'$$

$$TC = Q^p C_1 + C_2 Q^p G' + C_3 Q^p G \tag{3.18}$$

$$R_3 = \frac{TR - TC}{Q^p} = P G' K' - C_1 - C_2 G' - C_3 G.$$

Case 4. Both green–drop and diversion programs in effect.

The grower knocks off G of his crop and harvests G'. The grower gets paid for G' of his crop after adjusting for K and buys back D of the delivered quantity from the processor.

$$TR = P\ Q^p\ G'\ K' - P\ Q^p\ G'\ K'\ D; \quad Q^m = Q^p\ K'\ G'\ D'$$

$$TC = Q^p\ C_1 + C_2\ Q^p\ G' + C_3\ Q^p\ G \tag{3.19}$$

$$R_4 = \frac{TR - TC}{Q^p} = P\ G'\ K' - P\ G'\ K'\ D - C_1 - C_2\ G' - C_3\ G.$$

Note that R_4 simplifies to R_3 when $D = 0$, to R_2 when $G = 0$, and to R_1 when $D = G = 0$.

The Processor Demand Subsystem

Marketable supply of cling peaches is determined by the control board, subject to potential production and institutional constraints. The processor demand subsystem model is developed to explain the demand–supply interrelationships that determine price levels for alternative levels of quantity supplied to processors subject to the levels of variables exogenous to the subsystem.

Blocks III and IV in Figure 2 and the discussion of the processor subsystem in Section 2 form the framework of analysis for the construction of the subsystem model. The processor subsystem takes the predetermined marketable supply and allocates this supply to regular pack, fruit cocktail, and other miscellaneous final product forms. Because the miscellaneous products are a small proportion of total production and reliable data are not available, their level of allocation is treated as predetermined.

Derived Demand Concepts

The consumer behavior at the retail level is transmitted through intermediaries (*e.g.*, jobbers, brokers, retailers, *etc.*) in the marketing channel back to the processors. The prices at the processor level and retail level are separated by marketing margins. The magnitudes of these margins reflect the nature of the product, the marketing structure, and other related factors. A complete theory of demand then would have to explain the factors that influence retail prices and price spreads between processors and consumers (Waugh, 1964, p. 20). Although there are few shipping points, there are many consuming regions for processed cling peach products. The price and quantity determinations at each retail outlet are a result of simultaneously solving an almost infinite number of demand and supply equations. Data are insufficient for the estimation of regional retail demand functions and the marketing costs to each region. It is, therefore, necessary to abstract from a complete model and to use the derived demand relations facing the processor to indicate consumer behavior included with the behavior of intermediaries.

Hildreth and Jarrett (1955, pp. 107 and 108) consider a simplified situation where there is one intermediary and where the quantity sold to the consumer is equal to the quantity sold by the processor in any given time period. The relevant equations are:

$$f_1\ (x,\ p,\ r) = 0 \quad \text{(processor supply relation)} \tag{3.20}$$

$$f_2 \quad (x, \quad p, \quad q, \quad w) \quad = \quad 0 \qquad \text{(intermediary behavior relation)} \qquad (3.21)$$

$$f_3 \quad (x, \quad q, \quad y, \quad z) \quad = \quad 0 \qquad \text{(consumer demand relation)} \qquad (3.22)$$

where

x = quantity exchanged

p = price received by processor

q = price received by intermediary

r = other factors affecting processor supply

w = other factors affecting behavior of processors

y = consumer income

and

z = other factors affecting consumer behavior.

The intermediary behavior relation shows the quantities intermediaries are willing to handle at various combinations of processor and consumer price. Suppose equations (3.21) and (3.22) are such that it is possible to eliminate q [*e.g.*, solve for q in equation (3.21) and substitute into equation (3.22), thus obtaining a relation among x, p, y, w, and z]. This is called the price–quantity relationship at the processor level when both consumer and intermediary behavior are taken into account:

$$f_4 \quad (x, \quad p, \quad y, \quad w, \quad z) \quad = \quad 0 \qquad \text{(derived demand relation).} \qquad (3.23)$$

Equation (3.23) is a partially reduced–form equation.[1] The processors collectively face a set of derived demand functions. There is no rigorous method of aggregating the many derived functions because of the nonhomogeneity of the costs incurred by intermediaries (*e.g.*, transportation costs). Hildreth and Jarrett's development does provide, however, some clues regarding the arguments to be used in the aggregate demand functions facing the processing subsystem.

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[1]Hildreth and Jarrett (1955, p. 108) explain the concept of partially reduced–form equations. "Equations obtained by simultaneously eliminating one or more equations and one or more endogenous variables from a model have been called partially reduced form equations in various discussions. In a certain fundamental sense, all equations we are likely to deal with may be regarded as partially reduced form relations. It is always possible to imagine a more fundamental explanation of the phenomena that we observe, involving more equations and more endogenous variables. If the model we use is a reasonable one, it should, in principle, be possible to derive it, either exactly or approximately, from the more fundamental model by successive elimination of variables."

The derived demand concept can be carried one further step by including the processor behavior relation to derive the demand equation facing the producers. The initial estimation of the demand relationships will be at the California f.o.b. processor level rather than at the farm level. This market level estimation allows a closer analysis of the impacts of changes in the level of exports on f.o.b. price or processor margins on farm price.

The demand facing producers is determined by subtracting the processor margins for processing and handling costs and for profit (after transferring to a common quantity unit) from the processor demands for final product. In a system with perfect knowledge, the farm–level demand equation can be derived from the f.o.b. demand relationships. Recall from Section 2 that the farm–level price is established prior to the establishment of f.o.b. prices. In the model development it is assumed that the processor demand facing the producers is based on processor expectations of the f.o.b. level demands. Further, the processor expectations are equivalent to the f.o.b. level prices subsequently predicted by the estimated f.o.b. demand functions.[1]

Mathematical Model for the Processor Demand Subsystem

Five sets of relationships are required for the analysis of processor behavior in the demand subsystem of the model: (1) equations describing the form allocation of the raw product and the transformation ratios between raw product and final–form quantities, (2) equations allocating each final form to sales outlets and stocks, (3) equations describing demand for final forms, (4) equations describing margin levels, and (5) equations to determine the farm level price.

Form Allocation.—–Since the raw product of cling peaches yields more than one processed form, the quantities of the processed forms are technically interdependent. Because processing occurs prior to the sale of the final product, theoretically the supplies of each final form are determined simultaneously with expected prices and costs for those forms. A rationally behaving industry will allocate supplies in such a manner that expected marginal net returns are equated in all final forms. Marginal net returns are the difference between marginal revenues and marginal transformation costs.[2] When the firm is acting as a perfect competitor, marginal revenue equals price. Our statistical investigation failed to show systematic changes in the proportionate allocation of form in response to economic variables. The procedure below shows first a solution for the allocation of the raw product going to "other" uses and then the solution for allocation of the remainder to the two more important forms, regular pack and fruit cocktail.

The quantity of cling peaches allocated to other uses, Q^o, is believed to be related to the marketable quantity, Q^m; the amount of Q^o allocated last year; and a time trend.

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[1]The approach is similar to Mills' (1962, p. 38) implicit expectations approach. The implicit expectation of P is the estimate of its value (P*) "such that if it were the true expectation it would lead to the behavior actually observed." The argument is that expectation formulation takes into account more factors in a more sophisticated way than other proposed expectations formulas. Therefore, Mills suggests that one neglect the expectation formula initially and fit the behavioral equation without first obtaining an estimate of the expectation function.

[2]Let TR = total revenue from the sale of a particular product form and TTC = total cost of transforming raw product into that form. Net revenue = NR = TR – TTC and dNR/(dq) = MNR = dTR/(dq) – dTTC/(dq). To maximize profits, the firm would purchase an amount of raw product such that MNR = marginal raw product cost for all final products.

The market for Q^o is a specialized market and, therefore, relatively stable. Using the proportion $Q^o/Q^m = Q^{op}$ as the dependent variable, the *a priori* expectation is that Q^{op} would be negatively associated with Q^m. It is expected that Q^o would increase with increases in Q^m; however, Q^{op} will decrease as Q^m increases. Much of the contracting for Q^o is undertaken prior to the processing season, and the market in time t is very much related to the market in time t – 1. A time trend is included to account for the secular downward trend in the relative importance of processed cling peaches for other uses. The relationship expressing the allocation to other uses is

$$Q^{op} = Q^{op}\left(Q^m, Q^{op}_{t-1}, T\right) + v_1 \tag{3.24}$$

where

$Q^{op} = Q^o/Q^m$

Q^o = tons of raw product allocated to other uses

Q^m = tons of marketable quantity

T = time trend

and

v_1 = random disturbance term.

The remainder of the raw product, $Q^n = Q^m - Q^o$, is allocated between regular pack and fruit cocktail. The allocation between regular pack and fruit cocktail shows fairly stable proportions over the period of observations (Appendix Table A.4); the 1956–1972 average allocations to regular pack and fruit cocktail have been 78.42 and 21.58 percent, respectively. It appears that the industry found what was considered to be a good approximation to the best allocation between regular pack and fruit cocktail prior to or early in the period of observations and that demand and cost conditions have not led to significant deviations from this allocation. The allocation equations may be expressed as:

$$\begin{aligned} Q^1 &= .7842\ Q_n + v_2 \\ Q^2 &= .2158\ Q_n - v_2 \end{aligned} \tag{3.25}$$

where

Q^1 = raw tonnage allocated to regular pack

Q^2 = raw tonnage allocated to fruit cocktail

and

v_2 = random disturbance to indicate deviations from the average allocations.

The ratio of raw tonnage to packed cases also shows relative stability after 1956. Prior to this time, packed cases per ton were increasing and approaching the average pack ratios of 1956–1972. It was during the mid–1950s that the processors were incorporating a torque pitter that increased recoverable meat from the raw product. It is believed that the industry fully incorporated this new technology by 1956. On the average, 1 ton of raw product yields 53.11 cases of regular pack or 103.98 cases of fruit cocktail. To determine the packed amount from the raw allocation, the following technical coefficients, based on the average yields of raw product to final products, are used:

$$
\begin{aligned}
Q^{p1} &= .05311 \ (Q^1) + v_3 \\
Q^{p2} &= .10398 \ (Q^2) - v_3
\end{aligned}
\tag{3.26}
$$

where

Q^{p1} = thousands of cases of regular pack

Q^{p2} = thousands of cases of fruit cocktail

and

v_3 = random disturbance to indicate deviation from average pack–out ratios.

Final Form Allocation.—The available supplies of the two final forms, regular pack and fruit cocktail, for the current marketing year are equal to last year's ending stock levels plus current quantities packed. These available supplies are distributed to three outlets, namely, domestic market, export market, and the current year–ending stocks. The following market–clearing identities for regular pack and fruit cocktail must hold:

$$
\begin{aligned}
Q_t^{p1} + S_{t-1}^1 &= Q_t^{d1} + Q_t^{x1} + S_t^1 \\
Q_t^{p2} + S_{t-1}^2 &= Q_t^{d2} + Q_t^{x2} + S_t^2
\end{aligned}
\tag{3.27}
$$

where

$S_t^{1(2)}$ = ending stocks of regular pack (fruit cocktail) in year t (thousand cases)

$Q^{d1(2)}$ = domestic sales of regular pack (fruit cocktail; thousand cases)

and

$Q^{x1(2)}$ = export sales of regular pack (fruit cocktail; thousand cases).

Figure 2 specified that, for each form, the quantities allocated to the three outlet levels are jointly related with f.o.b. price. Given this specification, four simultaneous relationships are indicated for each form: domestic demand, export demand, ending stock demand, and market–clearing identity (equation 3.27). As a result of data limitations and preliminary statistical trials, the simultaneous system specified in Figure 2 was modified prior to final estimation.

The foreign demand for cling peach products is influenced by such factors as foreign prices, foreign supplies (foreign production and imports of substitute products), foreign income levels, exchange rates and tariffs, and the level of foreign advertising and promotion effort. The development of a system of equations for each major importing country is beyond the scope of this analysis. Furthermore, some of the data, *e.g.*, foreign prices and supplies, were unavailable or difficult to acquire. In view of the anticipated difficulties in estimating a set of export equations, export relationships were formulated using selected variables such as West German income, domestic price, European peach production, *etc.*, to formulate an expression for each final form. The results of statistical trials in finding equations predicting exports were inconclusive.[1] Consequently, the levels of exports for regular pack and fruit cocktail are treated as exogenous in this model.[2]

With the subtraction of the predetermined levels of exports, the remainder of available supplies, $Q^{pi} + S^i_{t-1} - Q^{xi}$ (i = 1, 2), is divided between domestic sales and ending stocks. Since $Q^{pi} + S^i_{t-1} - Q^{xi}$ (i = 1, 2) is treated as predetermined, the solution of Q^{di} determines the level of S^i and vice versa. The allocation of stocks (sales) results from the processors' evaluation of current and expected economic conditions. In a system of perfect competition, processors would allocate supplies so that discounted expected returns equaled current prices. As the expected future prices are unobservable and no systematic relationship was discovered to relate the unobservable to past or current observable price variables, this term was dropped.[3] Statistical trials under a simultaneous specification and later with single equations failed to yield a satisfactory relationship between stock (sales) allocations and current price. Because of these estimation difficulties, an alternative approach was used in predicting the industry allocation of available supplies between domestic sales and ending stocks.

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[1]One major difficulty in finding an equation to predict export levels is the widely fluctuating shares of exports received by the top three countries: West Germany, Canada, and Japan. To incorporate the diverse characteristics of these markets into one equation would easily create degrees of freedom complications in statistical analysis.

[2]An alternative approach would be to combine domestic sales and export sales as a new variable, "shipments." The model would then be used to explain the allocation levels of shipments and ending stocks. However, exports are expressed separately due to the recent industry interest in significantly expanding cling peach exports. The model then maintains the flexibility to later make conditional predictions of the effect of exports on domestic prices if a surge of exports occurs.

[3]French and Matsumoto (1970, p. 56) suggest that processor expectations of future prices are possibly based on average or normal past prices and would, therefore, show up as a constant or trend factor. The subsequent modifications in the cling peach stock (sales) allocation section closely follows the French–Matsumoto development for their frozen brussels sprouts allocation.

The alternative approach specifies that the sales (stock) allocations can be reasonably predicted on the basis of available supplies and a time trend. With domestic sales as the dependent variable, this specification can be expressed as

$$Q^{d1} = b_{10} + b_{11} \left(Q^{p1} + S^1_{t-1} - Q^{x1}\right) + b_{12} T + v_6$$
$$Q^{d2} = b_{20} + b_{21} \left(Q^{p2} + S^2_{t-1} - Q^{x2}\right) + b_{22} T + v_7. \qquad (3.28)$$

The expectations are that domestic sales will increase with the availability of supplies, but the proportion of sales will decrease as the availability of supply increases. This equation form reflects the processors' desire to maintain orderly supplies to major markets in above– or below–normal supply periods. The independent variables in equation (3.28) are treated as predetermined, suggesting OLS estimation. The behavioral equations for ending stock allocation are found by substituting equation (3.28) into equation (3.27).

F.O.B. Price Determination.—The concept of the derived demands facing the processors was discussed at the beginning of the processor demand section. Because the quantity allocated to domestic sales is treated as predetermined in the demand equations, the price–dependent form is used. The f.o.b. prices for regular pack and fruit cocktail are specified as functions of quantity of sales, quantity of substitutes, income, and a time trend.

$$P^1 = P^1 (Q^{d1}, Q^{s1}, Y, T) + v_8$$
$$P^2 = P^2 (Q^{d2}, Q^{s2}, Y, T) + v_9 \qquad (3.29)$$

where

$P^{1(2)}$ = f.o.b. price of regular pack (fruit cocktail; dollars per case, 24 No. 2–1/2 cans)

$Q^{s1(2)}$ = supply of canned fruits competing with regular pack (fruit cocktail; 1,000 cases)

and

Y = index of U. S. disposable income (1947–1950 = 100).

F.O.B. Farm Price Spread.—The demand for cling peaches facing the producers is derived from the f.o.b. prices and farm prices, with the data converted from a farm–level measure (raw tons) to a final–form measure (cases). Recall that, on the average, 1 ton of raw product yields 53.11 cases of regular pack or 103.98 cases of fruit cocktail. The value of the raw product in a case of regular pack or a case of fruit cocktail is $p^f/53.11$ and $p^f/103.98$, respectively. Margins are derived from the historical data by the expressions

$$M^1 = P^1 - \frac{P^f}{53.11}$$

$$M^2 = P^2 - \frac{P^f}{103.98} \tag{3.30}$$

where

$M^{1(2)}$ = margin or value added by the processors in a case of regular pack (fruit cocktail), dollars

$P^{1(2)}$ = f.o.b. price of regular pack (fruit cocktail), dollars per case

and

P^f = farm price (dollars per ton).

The shift variables explaining systematic variations in M^i are the costs of processing, the quantity packed, and a time trend. Assuming that the firm had a total cost function that approximates $TC = f + vQ^{pi}$ where f designates fixed costs and v the level of variable cost per unit packed, the average cost function takes the form $AC = TC/Q^{pi} = v + f\,(1/Q^{pi})$, i = 1, 2. With respect to the quantity packed, the average cost function is hyperbolic in shape, with the costs of production declining as production increases. The stochastic margin equations are

$$M^1 = b_{30} + \frac{b_{31}}{Q^{p1}} + b_{32}\,F + b_{33}\,T + v_{10}$$

$$M^2 = b_{40} + \frac{b_{41}}{Q^{p2}} + b_{42}\,F + b_{43}\,T + v_{11} \tag{3.31}$$

where F is an index of processing costs, 1957–1959 = 100 (Appendix Table A.9).

Farm–Level Price.—The estimate of the farm price from the price and margin estimates of regular pack is

$$P^{f1} = (P^1 - M^1)\;\;53.11, \tag{3.32}$$

and the estimate of the farm price from the fruit cocktail values is

$$P^{f2} = (P^2 - M^2)\;\;103.98. \tag{3.33}$$

Under competitive conditions, it is expected that the raw product would be allocated by form such that $P^{f1} = P^{f2}$. That is, either equation (3.32) or equation (3.33) alone would suffice as an estimate for farm price. However, the allocation proportions shown in equation (3.29) do not show sufficient variation to indicate attempts to equalize P^{f1} and P^{f2}. It is possible that margins differ somewhat from those predicted in equation (3.31) to achieve the equality condition $P^{f1} = P^{f2}$. Given the large fixed elements and uncertainties associated with margins as well as recognizing the lag between the form allocation decision and discovery of actual wholesale demand conditions, the fact that P^{f1} and P^{f2} differ slightly is not surprising.

To reconcile the slight inconsistency between the two estimates of farm price, equations (3.32) and (3.33) were weighted by the raw tonnage allocation equation (3.25) to obtain a single weighted estimate for farm price.

$$\begin{aligned} P^f &= P^{f1}\ (.7842) + P^{f2}\ (.2158) \\ &= (P^1 - M^1)\ 53.11\ (.7842) + (P^2 - M^2)\ 103.98\ (.2158) \qquad (3.34) \\ &= (P^1 - M^1)\ 41.65 + (P^2 - M^2)\ 22.44. \end{aligned}$$

Thus, the demand facing the producers is derived from the two demands facing the processors with their respective margins subtracted. Note that equation (3.34) is an *ex ante* function to be fitted with *ex post* observations. The proposed model employs the Mills (1962) implicit expectations approach where the processors' expectation of the f.o.b. demand functions is based on the estimated f.o.b. demand equations in the model.

The Control Board Subsystem

As indicated previously in the discussion of Table 5, the marketable supply of cling peaches may differ considerably from the quantities potentially produced each year, depending on the surplusing actions taken under the marketing order program. In order to complete the model, equations which represent the decisions of the control board are needed.

The first step is to determine the total quantity to be surplused or, conversely, the quantity to be marketed. Discussions with industry members suggested that the control board decisions reflected a compromise among three objectives: (1) to obtain a *reasonable* grower price, (2) to market an amount sufficient to maintain market share and processor capacity, and (3) to minimize the amount surplused. The third objective remained in effect until 1970 when the industry believed drastic measures were needed to reduce acreage and subsequent potential production.[1] During the period 1970 to 1972, the control board initiated an early green–drop announcement with tree–removal incentives. During this period, there was considerable urging of growers to remove trees and end a chronic surplus situation.

Based on these discussions, it was hypothesized that the control board decisions on quantity to be marketed could be expressed as a function of expected potential production

---

[1]For example, see the discussion in Section 2, *supra*, p. 2.

(Q_t^{p*}),[1] last year's farm price for canning cling peaches (P_{t-1}^f), exports (Q_t^x), carry–over stock levels in equivalent raw tonnage (S_{Bt}), quantity marketed the previous year (Q_{t-1}^m), index of U. S. disposable personal income (Y_t), a dummy variable (DD) to account for the influence of greater tree–removal incentives (1970–1972), and a random error term to account for other factors affecting the Board's decisions; that is,

$$Q_t^m = h\left(Q_t^{p*},\ P_{t-1}^f,\ Q_t^x,\ S_{Bt},\ Q_{t-1}^m,\ Y_t,\ DD,\ U_t\right). \qquad (3.35)$$

It has been assumed that the actual quantity marketed is the desired quantity. Once the value of Q_t^m is determined, the surplus level is computed by

$$S_1 = 1 - \frac{Q_t^m}{Q_t^{P*}\ (1 - K)} \qquad (3.36)$$

where K is the cullage proportion and S_1 is the total surplus proportion. If the initial computed value of $S_1 \leqslant 0$, no surplus is in effect. If $S_1 > 0$, surplusing is in effect. Since grower returns are affected by the type of surplus program, it is necessary to specify rules to determine how the controls are implemented. This will be explained with the presentation and discussion of the empirical estimates.

Review of the Econometric Model

Integrating the producer supply subsystem model with the processor demand subsystem model produces an industry model describing the recursive nature of the aggregate price and quantity determination. The producer supply subsystem describes how current output is related to past returns and present controls. Current prices are related to current output and other predetermined shift variables. Given the lagged supply relationships and the derived price relationships, future price and quantity levels can be projected recursively.

The acreage characteristics in the year t + 1 can be estimated from the characteristics of acreage in year t and the removals, new plantings, and variety and district shifts in equations (3.7)–(3.12). These estimates are then used to estimate yield and potential production in equations (3.13)–(3.15). Control measures, as indicated by (3.35) and (3.36), may reduce the level of *potential* production to *marketable* production for t + 1.

The prices at the f.o.b. and farm level in t + 1 resulting from the marketable production are estimated in equations (3.24)–(3.34). These prices, as well as past prices, are used to estimate the acreage adjustments for period t + 2 which are used to estimate prices in t + 2, *etc.*

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[1] Table 5, column 1, *supra*, p. 18.

To project future prices and quantities, supplementary forecasting is required for the variables treated as exogenous in the system model. Projections can also be made for the historical period corresponding with the data observations, starting with, for example, the first year of known observations. Then, using the resultant values of the exogenous values in the model, the projected prices and quantities are compared with the actual prices and quantities. This historical comparison is a part of the model–testing procedure to be discussed in Section 5.[1] Conditional historical statements also can be made for alternative exogenous values. An example of a conditional historical statement is discussed in Section 6 where the price determination and acreage adjustment levels are estimated under a condition where marketing order supply controls are not used.[2] That is, potential supply less cullage is equal to marketable supply in all periods.

The schematic diagram of the proposed model (Figure 2) specifies several joint relationships in the processor demand subsystem.[3] However, because of the difficulties discussed in this section, alternative recursive or otherwise predetermined specifications are utilized to predict allocation among outlets and products and commodity prices. Although this suggests the possibility of some bias in the coefficient estimates, the values obtained appear acceptable as reasonable approximations to the true structure.

4. STATISTICAL RESULTS

Empirical estimates of the producer supply, the processor demands, and control board subsystems are presented in this section. The producer supply subsystem required estimates of five major aspects: (1) acreage removals; (2) new plantings; (3) acreage shifts by district and variety; (4) yields by age, district, and variety; and (5) potential production.

The processor–demand subsystem includes four sets of relationships: (1) the processor allocation of the raw product to regular pack, fruit cocktail, and other uses; (2) the allocation of available supplies of these final products to domestic sales, exports, and ending stocks; (3) price forecasting equations for regular pack canned peaches and for fruit cocktail; and (4) margin relationships between farm price and processor f.o.b. product prices.

The control board subsystem requires estimates of an equation which determine quantity to be marketed and a set of rules for implementation of specific surplusing provisions.

Estimates for the Producer Supply Subsystem

Acreage, Yield, and Cost Data

Acreage and yield data were obtained from the CPAB[4] and are summarized in Appendix A. These data are collected annually by the industry to (1) estimate the size

[1]*Infra,* p. 70.

[2]*Infra,* p. 81.

[3]*Supra,* p. 22.

[4]Cling Peach Advisory Board (annual issues).

of the forthcoming crop, (2) police the green–drop requirements and the tree–removal programs, and (3) determine the acreage associated with industry voting.

The collection of accurate data is important for several reasons. First, surplusing decisions which were made several months prior to harvest were based on these production estimates. Second, equity requirements of surplusing required that green drop or tree removal in lieu of green drop be proportionately imposed on all industry growers. Age specifications were required since typically 1 acre of tree removal obviates the necessity of an acre of green drop when the removed trees were five years or older. If the trees to be removed were four years old, 2 acres of removal were required for 1 acre of green–drop credit. In a similar manner, if the trees were three years old or two years old, 3 acres or 10 acres were required, respectively, for 1 acre of green–drop credit. Third, recording industry acreage data by grower is still necessitated by the marketing order voting provisions where a requirement for a measure to pass is generally either at least 51 percent of the growers with at least 65 percent of the acreage or at least 65 percent of the growers with at least 51 percent of the acreage being in favor of the measure.

The data collected by the industry are believed to be superior to the California Crop and Livestock Reporting Service (CCLRS) series in accuracy and detail. The industry acreage data are disaggregated not only by age of tree but by district and varietal group as well. The average yield is provided for any subset of acreage specified as to age group, district, and variety.

Because yields of cling peach trees are light until the fourth year, the industry places more emphasis on the accuracy of acreage data by trees bearing and trees coming into bearing within a year (three–year olds) as opposed to those trees coming into bearing in two or more years (two–year olds and younger). Consequently, the data for trees two years old and younger typically show inconsistencies in the reported industry data. For example, the reported acreage of age two trees in year t ($A_{2..t}$) may be less than the reported acreage of age three in year t + 1 ($A_{3..t+1}$), while preliminary removal figures for age two acreage in year t ($E_{2..t}$) are positive. Disregarding topwork (*i.e.*, grafting), which industry sources indicate plays a very minor role, acreage of a given age less removals in the same year must equal acreage one year older in the following year. The level of acreage in earlier years is therefore adjusted, assuming the later age distribution and removal data are more accurate.[1]

Because the reported removals ($E_{i..t}$) are preliminary, these figures are biased downward somewhat; however, most of the removals not reported for trees two years old and younger are subsequently discovered by the time the trees are three years old. Therefore, if the acreage of four–year–old trees is accurate and if the sum of the removals for $E_{i-1..t-1} + E_{i-2..t-2} + E_{i-3..t-3}$ is accurate (although the individual removal rates in a specific year do not necessarily coincide with the reported rates in that year), the

[1]Technically, the adjustment is $A_{i-1..t-1} = E_{i-1..t-1} + A_{i..t}$ where A_i is acreage of age i and E_i is acreage removed of age i.

estimate of $A_{0..t}$ (*i.e.*, new plantings) is accurate.[1] The number of adjustments made in the CPAB data as well as the magnitude of these adjustments declined during the more recent years. The yield data are presented by age of tree, district, and variety group. Yield levels with respect to age of tree are presented for seven age groups: trees of ages 2, 3, 4, 5, 6–15, 16–20, and 21+.

The estimates of cultivation cost prior to harvest (C_1), harvest and thinning costs (C_2) and green–drop costs (C_3) were derived from sample cost–of–production studies for a base year (1970) and then adjusted over the 1956–1972 period by the index of prices for farm inputs, CI.[2] The procedures followed in obtaining these estimates are described in Appendix B. The complete computed cost series is given in Appendix Table B.3.[3] Variables used in the statistical analysis are identified in Table 8.

Estimates of Removal Behavior

Estimates of the removal relationship specified in accordance with equation (3.7) are given in Table 9. The table gives results obtained with removals expressed both in acres and as a proportion of total acres. Equation (4.1) was selected as the estimator to be used in further analysis. Its statistical properties appear slightly superior to those of equation (4.2) which treats removals in total rather than proportionate terms. Inclusion of the proportion of young trees, as in equation (4.3), created intercorrelation problems which resulted in the coefficient for proportion of old trees having a sign contrary to theoretical expectations. In all cases the measurable effect of the age variables is small and of low statistical confidence.

The coefficient for the spring announced tree–removal incentive variable (TRI) is small and has low statistical significance. That result is consistent with our expectations as explained in Section 3.[4] The tree–removal incentives associated with early green–drop programs generate a much greater response. The early tree–removal incentives allow the producer to be assured of receiving credits for his removed trees against the current year's green–drop program. The negative coefficient associated with producer returns agrees with *a priori* expectations.

Results for the estimation of "proportion of removals by age of tree" as a function of age of tree i and the proportion of total acres removed, PE_{t-1}, are reported in Table 10 for bearing and nonbearing age. The dependent variable, PE_{it-1}, is the proportion of

---

[1]The procedure of adjusting acreages was discussed with and found acceptable by an industry statistician. This procedure closely follows the procedure used by Hamilton (1966) on CCLRS data; however, because of the nature of the reported data, Hamilton's adjustments were more numerous, of greater magnitude, and were made for trees of greater age than for the CPAB industry data.

[2]University of California, Agricultural Extension Service (1970).

[3]These figures differ slightly from those reported in Minami (1977). The reason for the difference is that subsequent reexamination of the available sample cost studies suggested that a single study representing the Sacramento and San Joaquin Valley areas would be more representative than the average of three studies used originally (Appendix B). These cost changes also slightly affected the estimates of the coefficients of the plantings and removal equations, but the magnitude is minor. The overall results of the analysis are not significantly altered.

[4]*Supra*, p. 20.

TABLE 8

Variable Designation: Producer Subsystem

Variable	Definition
A_{ijkt}	acres of California cling peach trees of age i, in district j, of variety group k, in time t; i = 0, ..., 32+; j = 1, ..., 5; k = 1, ..., 4[a]
$A_{it} = A_{i..t} = \sum_j \sum_k A_{ijkt}$	acres of trees i years old in year t
$TA_t = A_{..t} = \sum_i \sum_j \sum_k A_{ijkt}$	total acres in time t
$AA_{5t} = \sum_{i=6}^{15} A_{i..t}$	acres of trees age 6 to 15
$AA_{6t} = \sum_{i=16}^{20} A_{i..t}$	acres of trees age 16 to 20
$AA_{7t} = \sum_{i=21}^{31+} A_{i..t}$	acres of trees age 21 and over
$N_t = A_{0..t} = \sum_j \sum_k A_{0jkt}$	acres of new plantings in time t
$OLD_t = \sum_{i=16}^{31+} A_{i..t}$	acres of trees 16 years and older in time t
$YNG_t = \sum_{i=0}^{4} A_{i..t}$	acres of trees 4 years and younger in time t
TRI_t	spring green-drop requirement when tree removals are in effect (percent)
$ETRI_t$	early green-drop requirement when tree removals are in effect (percent)
Q_t^p	potential quantity in time t
E_{ijkt}	acres of trees removed, i years old, in district j of variety group k in time t
$E_{it} = E_{i..t} = \sum_j \sum_k E_{ijkt}$	acres of trees removed, i years old, in year t
$E_t = E_{..t} = \sum_i \sum_j \sum_k E_{ijkt}$	acres removed in time t
$PE_t = E_t/TA_t$	proportion of total acres removed

(Continued on next page.)

TABLE 8--continued.

$PE_{it} = E_{it}/A_{it}$ =	proportion of acres removed in age group i
$POLD_t = OLD_t/TA_t$ =	proportion of acres removed, 16 years and older
$PYNG_t = YNG_t/TA_t$ =	proportion of trees removed, 4 years and younger
$DS_{jt} = A_{.j.t}/TA_t$ =	share of the *j*th district's acreage in time t
$VS_{jkt} = A_{.jkt}/A_{.j.t}$ =	share of the *k*th variety group acreage in district j in time t
Y_{ijkt} =	yield per acre for trees, i years old, in district j, of variety k in time t
$\overline{Y}_t$ =	average yield for trees two years and older in time t
CI =	index of farm input prices
R_t =	returns per ton indicator in year t = $(TR - TC)/Q^P$[b]
AR_t =	R_t/CI_t
C_1 =	cultivation of costs prior to thinning, dollars per ton of potential production
C_2 =	harvest and thinning costs per ton of potential production
C_3 =	knock-off (green-drop) cost per ton green dropped
AG_i, $DIST_j$, VAR_j =	dummy (1-0) variables to designate age group, district, and variety; subscript i refers to the age groups defined by the AA variables[a]
D =	diversion requirement (percent x 0.01)
G =	actual green-drop proportion
K =	cullage proportion

[a]Subscript i refers to age of tree where a tree planted prior to the harvest season of t and after the harvest season of t - 1 is considered 0 years old in t. District subscript j is defined as j = 1 for Marysville/Yuba City district, j = 2 for Stockton/Linden district, j = 3 for Modesto district; j = 4 for Visalia/Kingsburg district, and j = 5 for district other than those listed above. The variety group subscript k is defined as k = 1 for the extra early variety group, k = 2 for the early variety group, k = 3 for the late variety group, and k = 4 for the extra late variety group.

[b]See equations 3.16 to 3.19, *supra*, pp. 36 and 37.

TABLE 9

Estimates of Removal Relationships for California Cling Peach Trees, 1956-1972

Equation	Dependent variable	Constant term	AR_{t-1}	$POLD_{t-1}$	OLD_{t-1}	TRI_t	$ETRI_t$	$PYNG_{t-1}$	Summary statistics: Durbin-Watson[a]	Summary statistics: R^2
(4.1)	PE_{t-1}	.04176	-.0012405 (.0005652)[c]	.11902 (.09014)	[b]	.0005416 (.0006790)	.003962 (.000554)		1.48 (accept)[d]	.928
(4.2)	E_{t-1}	2,827.2	-110.213 (53.649)		.17594 (.12626)	33.35 (70.04)	294.92 (53.33)		1.30 (accept)[d]	.883
(4.3)	PE_{t-1}	.02787	-.0011940 (.0005424)	-.34342 (.43087)		.000330 (.000792)	.003511 (.000726)	.17986 (.12925)	1.69 (accept)[d]	.933

[a] 17 observations.

[b] Blanks indicate variables not included in equation. For a more complete definition of variables, see Table 8, *supra*, p. 50.

[c] Figures in parentheses indicate standard errors.

[d] Indicates that the hypothesis of no serial correlation cannot be rejected at the 1 percent level of significance.

Sources: Computed from data in Tables 1, 2, 3, and 5, *supra*, pp. 5, 10, 13, and 18; also, Appendix Tables A.1, A.8, A.9, and B.3, *infra*, pp. 96, 107, 108, and 122.

TABLE 10

Estimates of Removal Relationships for California Cling Peaches by Age of tree, 1956-1972[a]

Equation	Dependent variable	Constant term	i	PE_{t-1}	R^2
(4.4)	PE_{it-1} (i = 0, .., 3)	.00552	.000308 (.003241)[b]	.30458 (.10878)	.1150
(4.5)	PE_{it-1} (i = 4, ..., 31+)	-.20680	.013450 (.000050)	2.27110 (.10210)	.7574

[a]16 observations (one year lost due to lag).

[b]Figures in parentheses indicate standard errors.

Source: Computed from data in Appendix Table A.1, *infra*, p. 96.

trees removed from each age cohort. The prediction of the distribution by age is necessary for the yield estimates shown subsequently. The predicted values for the proportion of removals by age are multiplied by the corresponding acreage of trees by age to obtain an estimate of removal acreage by age. That is, $(\hat{PE}_{it-1})(A_{it-1}) = \hat{E}_{it-1}$. The $\hat{E}_{it}$ is later adjusted (Section 5) so that the two conditions, $\hat{E}_{it-1} \geqslant 0$ and $\Sigma_i \hat{E}_{it-1} = \hat{E}_{t-1}$ hold. The later adjustment was achieved by multiplying each estimate $\hat{E}_{it-1}$ by the ratio $\hat{E}_{t-1}/(\Sigma_i \hat{E}_{it-1})$ to get $\hat{E}_{it-1}$. Note that, while the effect of increasing age on the removal proportion is small and statistically not significant for trees under four years of age (equation 4.4), it is quite significant for older, mature trees.

Estimates of New Planting Behavior

Estimates of new planting relationships are given in Table 11. In contrast to the removal estimating equation, better statistical results were obtained when the dependent variable was in terms of acres, N_t, rather than the proportion of existing acres. Lagged returns, as a proxy for returns expectations, and nonbearing acreage are used as independent variables in the new planting equation. Regression trials were attempted using a one–year lag on returns and two–, three–, four–, and five–year moving lagged averages of returns. As was the case in the removal equations, the returns were deflated by a farm cost index (Appendix B). Table 11 shows the results of these regression trials using alternative lag lengths and the effect of including the acreage of old trees as an explanatory variable in new planting levels.

The length of lagged moving averages affects the new planting estimates, at least for the sample period. The statistical results shown in Table 11 suggest that a four–year moving average provided a relatively good fit of the profit expectation variable. The coefficient associated with YNG_{t-1} is negative and large relative to its standard error in equation (4.9). The acreage of young trees is an indicator of the future production and returns when the new plantings reach bearing age. In equation (4.11) the variable OLD_{t-1} added little to the explanation of the variation in N_t.

Estimates of District and Variety Shifts in Acreage Shares

The functional forms of equations (3.11) and (3.12) are used to approximate trends in the district and variety acreage shares. As noted in Section 3, the trend values are smoothed measures of annual shares which are valid only over the period of analysis.[1] Any projection much beyond 1972 would require further modification and specification. Table 12 shows the estimates of the parameters with their associated t–statistics. In most cases the Durbin–Watson statistic shows strong positive serial correlation of the residuals. This is probably the result of the crude specification used in explaining acreage trends.[2]

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[1] *Supra*, p. 20.

[2] The strong positive correlation of residuals necessitated all five district shares being estimated rather than estimating four district shares and obtaining the fifth district share by subtracting the four district share estimates from unity.

TABLE 11

Estimates of New Planting Relationships for California Cling Peach Trees, 1956-1972

Equation	Dependent variable	Constant term	AR^*_{t-1}	YNG_{t-1}	OLD_{t-1}	Summary statistics: Durbin-Watson[a]	Summary statistics: R^2
(4.6)	N_t	5,887.1	171.11[b] (29.27)[d]	-.0654 (.0587)	[c]	1.51 (accept)[e]	.725
(4.7)	N_t	6,113.5	155.77[f] (28.20)	-.0846 (.0621)		2.14 (accept)[e]	.701
(4.8)	N_t	7,117.0	176.65[g] (39.20)	-.1436 (.0763)		2.50 (accept)[e]	.610
(4.9)	N_t	8,505.1	237.72[h] (36.42)	-.2368 (.0650)		2.05 (accept)[e]	.766
(4.10)	N_t	9,859.3	284.10[i] (50.81)	-.3241 (.0842)		2.02 (accept)[e]	.707
(4.11)	N_t	8,520.1	240.32[f] (75.08)	-.2330 (.1172)	-.00111 (.27607)	2.04 (accept)[e]	.766

[a] 16 observations.

[b] $AR^*_{t-1} = AR_{t-1}$.

[c] Blanks indicate variable not included in equation.

[d] Figures in parentheses indicate standard errors.

[e] Indicates that the hypothesis of no serial correlation cannot be rejected at the 1 percent level of significance.

[f] $AR^*_{t-1} = (AR_{t-1} + AR_{t-2})/2$.

[g] $AR^*_{t-1} = (AR_{t-1} + AR_{t-2} + AR_{t-3})/3$.

[h] $AR^*_{t-1} = (AR_{t-1} + AR_{t-2} + AR_{t-3} + AR_{t-4})/4$.

[i] $AR^*_{t-1} = (AR_{t-1} + AR_{t-2} + AR_{t-3} + AR_{t-4} + AR_{t-5})/5$.

Sources: Computed from data in Table 2, *supra*, p. 10; also, Appendix Tables A.1, A.8, A.9, and B.3, *infra*, pp. 96, 107, 108, and 122.

TABLE 12

Estimates of Coefficients for Trend Fit of District and Variety Shares, 1956-1972[a]

Dependent variable	Coefficient associated with: Constant term (10^{-2})	T (10^{-3})	T^2 (10^{-3})	t statistics: t^b	t^c	Summary statistics: Durbin-Watson[d]	R^2
DS_{1t}	2.5403	.6367	.3398	6.21	6.82	1.36	.7565
DS_{2t}	13.3695	- 8.8934	8.6933	5.86	11.79	.89	.9775
DS_{3t}	2.4350	- .4859	.1834	8.45	6.57	1.22	.8820
DS_{4t}	11.7633	- 2.5306	.6187	1.46	.74	.49	.3965
DS_{5t}	2,098.5600	-8,365.8000	6,112.5000	3.29	4.94	1.00	.8034
VS_{11t}	12.3533	- 14.0503	5.2780	11.04	8.54	.36	.9283
VS_{12t}	2.1930	2.8384	-1.0733	10.22	7.96	.38	.9157
VS_{13t}	2.1887	.2467	- .0432	3.04	1.10	.47	.8158
VS_{14t}	10.1541	5.2437	-1.5423	5.81	3.52	.74	.8772
VS_{21t}	123.0560	- 185.1060	68.2617	9.25	7.02	.73	.9061
VS_{22t}	2.1100	3.3668	.4118	2.09	.53	1.44	.8834
VS_{23t}	1.9233	- .1554	.0966	3.66	4.69	1.74	.6939
VS_{24t}	7.6951	- 3.2732	1.0704	5.63	3.79	.75	.8365
VS_{31t}	7.3558	- 5.3308	1.8877	8.54	6.22	.42	.9032
VS_{32t}	2.8391	2.1749	.3737	6.49	2.30	1.33	.9884
VS_{33t}	2.5892	.1345	- .0806	2.67	3.29	1.21	.4965
VS_{34t}	6.4936	- .8525	- .1435	1.50	.52	.31	.8177
VS_{41t}	8.0565	- 7.6702	2.9595	7.70	6.12	.47	.8524
VS_{42t}	3.6934	.9883	- .4101	9.23	5.20	1.77	.8688
VS_{43t}	1.9392	2.2998	- .9991	22.00	19.67	2.43	.9710
VS_{44t}	6.8363	- 3.3570	2.1451	5.52	7.27	1.37	.8556

[a] Equation forms are $DS_{jt} = 1/(a_j + b_jT + c_jT^2)$ and $VS_{jk} = 1/(a_{jk} + b_{jk}T + c_{jk}T^2)$. Parameter estimates were obtained by fitting $1/DS_{it} = a_j + b_jT + c_jT^2$ and $1/VS_{jk} = a_{jk} + b_{jk}T + c_{jk}T^2$; t = 1 in 1955.

[b] Associated with T coefficient.

[c] Associated with T^2 coefficient.

[d] 17 observations.

Sources: Computed from data in Appendix Tables A.2 and A.3, *infra*, pp. 101 and 102.

The adjustments required to assure that district and variety shares each sum to 1.0 is explained in a later table.[1] Alternatively, actual observed shares could have been used in each year as exogenous variables, with little effect on the overall analysis.

The share of the *k*th variety group in district j with respect to the total industry acreage is found by multiplying VS_{jkt} by DS_{jk}.

Yield Estimation

The values of the estimated coefficients for the yield equation (3.14) are shown in Table 13.

Potential Production Estimation

For a given age, district, variety distribution in t – 1 (A_{ijkt-1}), and from the estimates presented in this section, one can construct the estimated acreage distribution for the year t.

Removals by age are derived from equations (4.1), (4.4), and (4.5) and the identity $E_{i..t-1} = (PE_{it-1})(A_{i..t-1})$.

$$\hat{A}_{i..t} = A_{i-1..t-1} - \hat{E}_{i-1..t-1} \qquad \text{for } i - 1, .., 30.$$

Those trees in t – 1 that were 30 years of age become part of the 31+ years of age group in t. Those trees in the 31+ years of age group in t – 1 remain in the 31+ age group in t. Then,

$$\hat{A}_{31..t} = A_{30t-1} + A_{31t-1} - (\hat{E}_{30t-1} + \hat{E}_{31t-1}).$$

The new plantings estimate for t is obtained from equation (4.9).

$$\hat{A}_{0..t} = \hat{N}_t.$$

The above steps are sufficient to define the current age distribution $A_{i..t}$ (i = 0, ..., 31) in t from the age distribution in t – 1 and the new planting and removal equations. The condensed age distribution AA_{it} (i = 1, ..., 7) is derived from $A_{i..t}$.

District– and variety–share estimates are obtained from Table 12. Assuming that the same age distribution exists for all district and variety shares, the portion of total acreage of trees at least two years old, SH_{ijkt}, is derived by:

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[1]For an explanation of the sequence of calculations required to simulate the total industry behavior, see Table 19, footnote *c*, *infra*, p. 72.

TABLE 13

Yield Relationship for California Cling Peach Trees, 1956-1972[a]

Coefficients for dummy variables[b]					
AG_i	COEFF	$DIST_j$	COEFF	VAR_k	COEFF
2	$0.000 = a_{611}$	Marysville-Yuba City	$0.000 = a_{621}$	Extra early	$0.000 = a_{631}$
3	$2.934 = a_{612}$	Stockton	$-2.137 = a_{622}$	Early	$-0.699 = a_{632}$
4	$6.586 = a_{613}$	Modesto	$-0.364 = a_{623}$	Late	$0.695 = a_{633}$
5	$9.318 = a_{614}$	Visalia	$0.022 = a_{624}$	Extra late	$0.337 = a_{634}$
6-15	$11.958 = a_{615}$	[c]			
16-20	$11.078 = a_{616}$				
21+	$9.949 = a_{617}$				

[a]The yield-estimating equation is of the following form; figure in parentheses indicates standard error.

$$\hat{Y}_{ijkt} = 0.662 + \sum_{i=2}^{7} a_{61i}\, AG_i + \sum_{j=2}^{4} a_{62j}\, DIST_j + \sum_{k=2}^{4} a_{63k}\, VAR_k + \underset{(0.0087)}{0.0827T}.$$

To interpret this table, the yield level is equal to the constant term plus the time term plus the indicated adjustment indicated by the coefficients. For example, to compute the estimated yield for trees 5 years old from the Modesto district of the Extra Early variety in 1956, add [0.662 + 9.318 - 0.364 + 0.000 + 0.0827(2)].

[b]R^2 = .8004.

[c]Blanks indicate not applicable.

Source: Compiled from data in Appendix Table A.10, *infra*, p.

$$SH_{ijkt} = (DS_{jt})\ (VS_{jkt}) \left(\frac{AA_{it}}{AA_{.t}} \right) \qquad \text{for all i, j, k.}^{1}$$

The term $\overline{Y}_t = \Sigma_i\ \Sigma_j\ \Sigma_k\ SH_{ijkt}\ (Y_{ijkt})\ i = 1, ..., 7;\ j = 1, ..., 4;\ k = 1, ..., 4$ is equal to the average yield for all trees at least two years old in all districts and varieties in time t. Actual and predicted values of $\overline{Y}_t$ are given in Appendix Table A.1. The product $(\overline{Y}_t)\ (AA_{.t}) = \hat{Q}^p_t$ is the total potential quantity that is predicted for the producer section of the industry in time t.

To recap the statistical results, a set of exogenous signals enters into the producers supply subsystem of the industry model. The growers collectively take these exogenous signals and, through new plantings and removals, create a new acreage distribution. This new acreage distribution affects the level of yields; then the yields and acreages are combined to determine the potential quantity of production.

Estimates for the Processor Demand Subsystem

The processor demand subsystem consists of equations which allocate raw product among types of pack (equations 3.24 and 3.25), equations which allocate canned pack to current sales and carry–over stocks (equations 3.27 and 3.28), the f.o.b. demand equations facing processors (equation 3.29), and the f.o.b. farm–price margin relationships (equations 3.31, 3.32, and 3.33). The data used in this section are summarized in Appendix A. The variables used are defined in Table 14.

Form Allocation

The processors allocate the marketable quantity, Q^m_t, of raw production to three forms: regular pack, fruit cocktail, and miscellaneous other uses. The estimate for the proportion allocated for other uses, Q^{op}_t, is expressed as a function of total raw product, Q^m_t, lagged proportion, Q^{op}_{t-1}, and time trend, T.

The balance of the raw quantity, $Q^m_t - Q^o_t = Q^n_t$, is allocated between regular pack and fruit cocktail by the constant proportions used in equation (3.25). Table 15 shows the OLS estimates of the Q^{op}_t allocation relationship and the average allocation to other prevalent forms.

Equation (4.12) indicates that the coefficients all have the expected signs. The proportion of marketable quantity allocated to other uses has been strongly related to the level of marketable raw product and last year's allocation. The negative time trend corresponds with the general decline in the importance of the miscellaneous market.

Equations (4.13) and (4.14) indicate the average proportions of Q^n allocated to regular pack and fruit cocktail over the historical period of observations. Equations (4.15) and

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[1]At this point in the computations, the yields associated with District 5 are assumed to be approximately equal to the industry average. Since District 5 has a very small amount of acreage, the loss in accuracy by using state averages is slight, while the computations are simplified. Computationally, the DS_{jt} are adjusted upward proportionally such that $\Sigma^4_{j=1}\ DS_{jt} = 1$.

TABLE 14

Variable Designation: Processor Subsystem[a]

Q_t^m	= marketable quantity (tons)
Q_t^o	= raw quantity utilized for "other" uses (tons)
Q_t^1	= raw quantity allocated to regular pack (tons)
Q_t^2	= raw quantity allocated to fruit cocktail (tons)
$Q_t^{op} = Q_t^o / Q_t^m$	= proportion of raw quantity allocated for other uses
$Q_t^n = Q_t^m - Q_t^o$	= raw quantity used for regular pack and fruit cocktail (tons)
Q_t^{p1}	= level of pack for regular pack (1,000 cases)[b]
Q_t^{p2}	= level of pack for fruit cocktail (1,000 cases)
S_t^1	= ending stock level of regular pack (1,000 cases)
S_t^2	= ending stock level of fruit cocktail (1,000 cases)
Q_t^{x1}	= quantity of regular pack allocated to the export market (1,000 cases)
Q_t^{x2}	= quantity of fruit cocktail allocated to the export market (1,000 cases)
Q_t^{d1}	= quantity of regular pack allocated to the domestic market (1,000 cases)

(Continued on next page.)

TABLE 14--continued.

Q_t^{d2} = quantity of fruit cocktail allocated to the domestic market (1,000 cases)

Q_t^{s1} = supply of canned fruit competing with regular pack (1,000 cases)[c]

Q_t^{s2} = supply of canned fruit competing with regular fruit cocktail (1,000 cases)[d]

Y_t = index of U. S. disposable personal income (1947-1950 = 100)

P_t^1 = f.o.b. price for regular pack (dollars per case)

P_t^2 = f.o.b. price for fruit cocktail (dollars per case)

M_t^1 = margin or value added by the processor in a case of regular pack (dollars) $\left[M_t^1 = P_t^1 - P_t^f / 41.65\right]$

M_t^2 = margin or value added by the processor in a case of fruit cocktail (dollars) $\left[M_t^2 = P_t^2 - P_t^f / 22.44\right]$

F_t = index of processing costs (1957-1959 = 100)

P_t^f = farm price for canning cling peaches (dollars per ton)

T = time trend (1950 = 1)

[a]Subscript t refers to the year associated with the variable.

[b]Cases are 24 No. 2-1/2 cans.

[c]Includes the domestic sales of canned pears, apricots, pineapple, freestone peaches, and fruit cocktail.

[d]Includes the domestic sales of canned pears, apricots, pineapple, freestone peaches, and cling peaches.

Sources: Appendix Tables A.4, A.5, A.6, A.7, A.8, and A.9, *infra*, pp. 103-108.

TABLE 15

Marketable Production Form and Pack Allocation Relationships, 1956-1972

Equation	Dependent variable	Constant term	Q_t^{m*} (10^{-6})	Q_{t-1}^{op}	T^* (10^{-3})	Summary statistics	
						Durbin-Watson[a]	R^2
(4.12)	Q_t^{op}	0.06841	− 0.04798 (0.01816)[b]	0.38688 (0.17491)	− 0.3844 (0.3728)	1.73 (accept)[c]	.7598
(4.13)	Q_t^1/Q_t^n	0.7842	[d]				
(4.14)	Q_t^2/Q_t^n	0.2158					
(4.15)	Q^{p1}/Q^1	0.05311					
(4.16)	Q^{p2}/Q^2	0.10398					

[a] 17 observations.

[b] Figures in parentheses indicate standard errors.

[c] Indicates that the hypothesis of no serial correlation of residuals cannot be rejected at the 1 percent level of significance.

[d] Blanks indicate variable not included in equation.

Source: Computed from data in Appendix Table A.4, *infra*, p. 104.

(4.16) give the average number of cases of final product per ton of peaches (1,000 cases, 24 No. 1–1/2 basis). The proportions in equations (4.13) to (4.16) have been generally stable over the period of observations.[1]

Final–Form Market Allocation

The available supplies of regular pack and fruit cocktail, $S^i_{t-1} + Q^{pi}_t$ (i = 1, 2), less the exogenously treated exports are allocated between domestic sales and ending stocks. The OLS estimates of the allocation equations are given in Table 16.

Equation (4.17) shows that domestic sales of regular pack absorbed about 55 percent of the *changes* in available supply, while equation (4.18) shows that fruit cocktail sales absorbed about 76 percent. The sales of regular pack are positively associated with time which indicates a shift toward increased sales and decreased stocks. The sales allocation for fruit cocktail failed to reveal a relationship between sales and time.[2] Equations (4.19) and (4.20) are derived by substituting equations (4.17) and (4.18) into the identities, respectively:

$$Q^{p1}_t + S^1_{t-1} = Q^{d1}_t + Q^{x1}_t + S^1_t$$

and

$$Q^{p2}_t + S^2_{t-1} = Q^{d2}_t + Q^{x2}_t + S^2_t \cdot$$

Equations (4.19) and (4.20) indicate how carry–over stocks have varied in response to available supply.

F.O.B. Price

The domestic demand relationship expresses price as a function of domestic sales, sales of competing canned fruits, income, and time. Several functional forms were explored. In particular, the dependent variable price in its natural and logarithmic forms were regressed against the natural and logarithmic forms of the independent variables. The results of these trials are presented in Table 17.[3]

Equation (4.26) is similar to the form used by Hoos and Kuznets (1974) in the f.o.b. price estimates. The only difference is that Hoos and Kuznets use the logarithm

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[1]See Appendix Table A.4, *infra*, p. 103.

[2]Refer to the discussion in Section 3, *supra*, p. 20, where $Q^{d1(2)}$ is originally specified to be jointly related with export demand, stock demand, and current price. The above endogenous variables were specified to be dependent also on available supplies, expected price, interest rates, and the like. However, the TSLS statistical analysis did not generate meaningful coefficients relating price effects to disappearance in the various outlets. Therefore, market allocation by equations (4.17) and (4.18) have been predicted which are partially reduced–form equations.

[3]The specifications utilizing per capita quantities and/or deflated prices generated results inferior to those shown in Table 17, *infra*, p. 65.

TABLE 16

Final-Form Market Allocation Relationships, 1956-1972

Equation	Dependent variable	Constant term	Available supplies[a]	T	Summary statistics: Durbin-Watson[b]	Summary statistics: R^2
(4.17)	Q_t^{d1}	5,044.62 (511.95)[c]	.55406 (.08500)	128.44 (48.11)	1.73 (accept)[d]	.7669
(4.18)	Q_t^{d2}	577.18 (290.41)	.75854 (.13684)	*e*	2.05 (accept)[d]	.6057
(4.19)	S_t^1	-5,044.62	.44594	-128.44	--[f]	
(4.20)	S_t^2	- 577.18	.24146	*e*	--	

[a] Available supplies $= Q_t^{p1} + S_{t-1}^1 - Q_t^{x1}$ for equations (4.17) and (4.19)

$= Q_t^{p2} + S_{t-1}^2 - Q_t^{x2}$ for equations (4.18) and (4.20).

[b] 17 observations.

[c] Figures in parentheses indicate standard errors.

[d] Indicates that the hypothesis of no serial correlation cannot be rejected at the 1 percent level of significance.

[e] Trend variable not included in equation.

[f] Dashes indicate summary statistics not applicable since equations (4.19) and (4.20) are derived by identity from (4.17) and (4.18).

Sources: Computed from data in Appendix Tables A.4, A.5, and A.6, *infra*, pp. 103-105.

TABLE 17

Estimates of F.O.B. Price Relationships, 1956-1972

Equation	Dependent variable	Constant term	Q^{d1}	Q_t^{s1}	Y_t	T	Summary statistics: Durbin-Watson[a]	Summary statistics: R^2
(4.21)	P_t^1	6.165	-.09390 (.03142)[b]	.018965 (.023495)	.01211 (.00237)	-.10413 (.04573)	1.52 accept[c]	.8094
(4.22)	ln P_t^1	8.242	-.55234[d] (.13601)	-.03279[d] (.18521)	.45587[e] (.07784)	-.06654[e] (.04074)	1.48 accept	.7248
(4.23)	ln P_t^1	10.317	-.51516[d] (.13985)	-.53066[d] (.14333)	.37175[e] (.06086)	[f]	1.52 accept	.6840
(4.24)	ln P_t^1	-4.4653	-.01997 (.00555)	-.00379 (.00415)	1.3960[e] (.2480)	-.07055 (.01651)	1.79 accept	.8299
(4.25)	ln P_t^1	.78585	-.02333 (.00759)	-.01553 (.00429)	.35395[e] (.06202)		1.42 accept	.6574
(4.26)	ln P_t^1	.71012	-.40741[d] (.10884)	-.14130[d] (.14643)	1.3507[e] (.2529)	-.06714 (.01706)	1.83 accept	.8302
(4.27)	P_t^1	.22253	-2.2122[d] (.5748)	-.68956[d] (.77335)	7.135[e] (1.336)	-.35200 (.09009)	1.85 accept	.8318
			Q^{d2}[d]	Q_t^{s2}[d]				
(4.28)	P_t^2	8.815	-.27005 (.10569)	-.03389 (.04647)	.00939 (.00268)	-.00673 (.05336)	1.32 accept	.8500
(4.29)	ln P_t^2	6.978	-.48598[d] (.18381)	-.02563[d] (.36374)	.41181[e] (.05606)	-.03460[e] (.03317)	1.43 accept	.8048
(4.30)	ln P_t^2	8.603	-.45375[d] (.18162)	-.42678[d] (.32574)	.38076[e] (.04761)		1.49 accept	.7930
(4.31)	ln P_t^2	-1.431	-.04255 (.01631)	-.00540 (.00709)	.81168[e] (.23774)	-.02965 (.01617)	1.43 accept	.8395
(4.32)	ln P_t^2	.75668	-.04315 (.01729)	-.01052 (.00691)	.38325[e] (.04646)		1.31 accept	.8095
(4.33)	ln P_t^2	5.231	-.42374[d] (.18100)	.27741[d] (.34410)	-.71006[e] (.27381)	-.02291 (.01877)	1.57 accept	.8088
(4.34)	P_t^2	30.024	-2.724[d] (1.186)	-2.028[d] (2.254)	4.701[e] (1.794)	-.14713 (.12295)	1.50 accept	.8172

[a] 17 observations.

[b] Figures in parentheses indicate standard errors.

[c] Indicates that the hypothesis of no serial correlation cannot be rejected at the 1 percent level of significance.

[d] The variable is in natural logarithmic form; where the variables are in natural form, the coefficient is actually 1/1,000 the size reported.

[e] The variable is in natural logarithmic form.

[f] Blanks indicate trend variable not included in equation.

Sources: Computed from data in Appendix Tables A.4, A.5, A.6, and A.7, *infra*, pp. 103-106.

of price of substitutes as the independent variable rather than the logarithm of the quantity of substitutes used here.[1]

The fruit cocktail equations are similar to the regular pack equations, although the linear equation form (4.28) provides a slightly better fit than the double log forms. The set of equations shown in Table 17 show that a 10 percent increase in the quantity of either final product is associated with a 4–5 percent decrease in f.o.b. price, *ceteris paribus.* Equations (4.24) and (4.26) indicate that a 10 percent increase in the index of disposable income is associated with a 13–14 percent increase in the f.o.b. price of regular pack, *ceteris paribus*; equations (4.31) and (4.33) indicate that a 10 percent increase in the index of disposable income is associated with a 7–8 percent increase in the f.o.b. price of fruit cocktail. There is some question in the interpretation of the income coefficients, however, because of the high degree of collinearity between income and time.

Farm–Price Determination

The estimated parameters of the f.o.b. farm price margin relationship are shown in Table 18. The coefficients in equations (4.35) and (4.36) indicate that margins are inversely related to size of pack and directly related to the processing cost index. Both margins are negatively related to time, with the index of processing cost, F, constant. This suggests that the cling peach processors may have become more efficient relative to processors in general over the period of observation. An alternative interpretation is that the bargaining strength of the producers' association increased relative to the processor sector which resulted in smaller processor margins.

The farm–level demand equation (3.34) relates farm price to f.o.b. prices and processor margins or

$$P^f = (P^1 - M^1)\ 41.65 + (P^2 - M^2)\ 22.44.$$

Substituting equations (4.35) and (4.36) into the above expression gives

$$P^f = \left(P^1 + .9565 - \frac{18864}{Q^{p1}} - .05078F + .1216T\right) 41.65$$

$$+ \left(P^2 + .2898 - \frac{25242}{Q^{p2}} - .03927F + .0189T\right) 22.44.$$

From equations (3.25) and (3.26), the following are obtained:

$$Q^{p1} = .05311\ (.7842\ Q_n) = .04165\ Q_n$$

[1]If this model is to be used for prediction, the future quantity of substitutes can be projected with greater accuracy than future prices. It is felt, therefore, that the slightly better fit obtained by the Hoos and Kuznets estimate is offset by the advantages in forecasting future quantities of substitute canned fruits.

TABLE 18

F.O.B.-Farm Price Margin Relationship, 1956-1972

Equation	Dependent variable	Constant term	$\frac{1}{Q^{p1}}$	$\frac{1}{Q^{p2}}$	F	T	Summary statistics	
							Durbin-Watson[a]	R^2
(4.35)	M^1	-.9565	18,864 (5,984)[c]	[b]	.05078 (.00896)	- .1216 (.0324)	1.81 (accept)[d]	.8192
(4.36)	M^2	-.2898		25,242 (10,947)	.03927 (.01821)	- .0189 (.0107)	2.48 (accept)[d]	.7304

[a]17 observations.

[b]Blanks indicate variable not included in equation.

[c]Figures in parentheses indicate standard errors.

[d]Indicates that the hypothesis of no serial correlation cannot be rejected at the 1 percent level of significance.

Source: Computed from data in Appendix Tables A.5, A.6, and A.8, *infra*, pp. 105, 106, and 108.

$$Q^{p2} = .10398 \quad (.2158\ Q_n) \quad = \quad .02244\ Q_n.$$

Substituting this result and collecting terms yields

$$p^f = 46.2553 + 41.65\ P^1 + 22.44\ P^2 - \frac{4410600}{Q_n} - 2.9916\ F + 5.4778\ T.$$

This result shows the farm price to be related to the two f.o.b. prices, with a downward shift associated with increases in the processing cost index and with upward shifts associated with raw tonnage for the two final forms and time.

Estimates for the Control Board Subsystem

The predicting equation for quantity marketed (3.35) was expressed linearly and estimated as an OLS regression for the period 1956–1972. The result is given below:

$$\begin{aligned} Q_t^{\hat{m}} = & -83765 + \underset{(889.8)}{2306.4}\ P_{t-1}^f + \underset{(0.10299)}{0.19837}\ Q_{t-1}^m - \underset{(0.3247)}{1.3104}\ S_{Bt} \\ & + \underset{(0.06164)}{0.45420}\ Q_t^{p^*} + \underset{(151.47)}{514.02}\ Y_t - \underset{(30180)}{123590}\ DD + 1\ Q_t^x \end{aligned} \qquad (4.37)$$

where

$Q_t^{\hat{m}}$ = estimated quantity marketed in time period t (tons)

Q_t^x = equivalent raw tonnage allocated to exports (tons)

P_{t-1}^f = last year's farm price for canning cling peaches (dollars per ton)

Q_{t-1}^m = quantity marketed previous year (tons)

S_{Bt} = carry–over stock levels in equivalent raw tonnage

$Q_t^{p^*}$ = expected potential production (tons)[1]

Y_t = index of total U. S. disposable income (1947–1950 = 100)

and

DD = dummy variable = 1 in 1970, 1971, and 1972; 0 otherwise (to account for increased tree–removal incentives).

Figures in parentheses indicate standard errors, R^2 = .9565, and d = 2.397.

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[1]Potential production is considered as the tonnage that could be harvested from the existing industry acreage. The existing industry acreage consists of the previous year's acreage plus new plantings less those removals that occur normally without tree–removal incentives; see Table 5, column 1, *supra*, p. 18.

The level of exports is treated exogenously in this model without significant departure from actuality as most of the export contracts for sale are made well in advance of shipping dates.[1] The signs of the coefficients in equation (4.37) are consistent with theoretical expectations and are large relative to their respective standard errors. Note that the coefficient associated with carry-over stocks, S_{Bt}, is larger than 1.0 in absolute value. The implication is that the control board has overcompensated for errors in previous decisions; that is, an increase in 1 ton of carry-over stocks results in a curtailment of 1.3 tons in the following year's quantity marketed.[2]

Once the desired quantity marketed is determined, the control board determines both the level of surplus and the manner in which the surplus is to occur. The surplus level is computed as indicated in equation (3.36), *i.e.*,

$$S_1 = 1 - \frac{\hat{Q}_t^m}{Q_t^{p*}(1 - K)} .$$

As indicated in Table 1, several types of surplus programs existed in the 1956–1972 period. These may be grouped into seven cases:

Case 1. *No surplus in effect (1958, 1966, 1967, and 1968).*

Case 2. *Surplus diversion only in effect (1956).*

Case 3. *Green drop with no tree–removal incentives with diversion were in effect (1957).*

Case 4. *Green drop with tree–removal incentives and diversion were in effect (1959, 1960, 1961, 1962, 1965, and 1969).*

Case 5. *Green drop with tree–removal incentives without diversion were in effect (1963 and 1964).*

Case 6. *Early green drop with tree–removal incentives with diversion were in effect (1970).*

Case 7. *Early green drop with tree–removal incentives without diversion were in effect (1971 and 1972).*

If in the initial computation $S_1 \leqslant 0$, then no surplus is in effect, and a Case 1 situation arises. If $S_1 > 0$, then three different situations may occur. For the year 1956, surplus diversion only was in effect, and D (cannery diversion proportion) is set equal to S_1, that is, Case 2. The period 1957–1969 was consolidated under one type of program for

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[1]The formulation with Q_t on the right–hand side of equation (4.37), with the coefficient forced to equal unity, assumed that the producers know precisely what the levels of exports will be. Also, refer to Section 3, footnote 1, *supra*, p. 20.

[2]The coefficient associated with S_B might also imply that producers have in mind a normal level of stocks and are aware that processors normally do not use their stocks to completely absorb yearly variations in the amount marketed (equations 4.19 and 4.20).

model purposes, that is, Case 4. During this period, the initial green–drop level with tree–removal incentives was set at 81 percent of S_1 which was the historical average. Growers responded to this program by removing additional trees.[1] Potential production is recomputed (Q^p).[2] An actual green–drop level is then declared where growers must knock immature fruit off a proportion of their trees. This actual green–drop level is set at 68.9 percent of S_1 as was the historical average.[3] After the effects of the tree–removal program and actual green drop are calculated, the surplus is again computed as

$$S_2 = 1 - \frac{Q_t^m}{Q^p (1 - K)(1 - G)} \tag{4.38}$$

where Q^p is the level of potential quantity after the effects of the tree–removal program are observed.

If $S_2 > 0$, the additional surplus requirements are satisfied by diversion at the cannery, and D is set equal to S_2; for $S_2 \leqslant 0$, $D = 0$.[4]

The period 1970–1972 is consolidated as Case 7. The initial early green–drop level with tree–removal incentives was set equal to S_1. Growers respond to this program by removing additional trees, and an actual green–drop level is then declared at 34.42 percent of the initial green–drop level as was the historical average for the 1970–1972 period. Diversion at the cannery is not in effect.

5. THE COMPLETE COMMODITY SYSTEM MODEL

In this section the econometric results obtained in previous sections are formulated as a complete system which simulates the price, production, and acreage behavior of the cling peach industry. How the model works is described first. Then its validity as a tool for analyzing the effects of the market control program is examined. In the next section the model is used to generate comparative results with and without controls in effect.

Controlled–Model Description

The basic model of the system is referred to as the "controlled model" since it is intended to represent industry behavior during the period within which controls were in effect. A later variation will be referred to as the "free market model." The model is made operational by specifying initial starting values of the endogenous variables and values for all years for the exogenous variables. It then generates a sequence of predicted values of prices, quantities, and acreage for all subsequent periods.

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[1]Table 9, equation (4.3), *supra*, p. 52.

[2]Table 5, column 2, *supra*, p. 18.

[3]The actual green drop is declared as growers did not take a sufficient amount of tree–removal credits to satisfy the initial green–drop level.

[4]Recall that the marketable quantity is computed as $Q^m = Q^p (1 - K)(1 - G)(1 - D)$.

The complete commodity system is described in Table 19 in terms of the sequence of calculations required to generate its output. The period of analysis is 1956 to 1972. The initial year, 1956, was chosen because it is the first period for which accurate acreage data exist. The last period, 1972, is the period in which market controls were last used. The model sets as initial values the age distribution of acreage in 1956 and, from this distribution, estimates yields and quantities. After these quantities are adjusted downward for cullage and surplusing, the remaining quantity enters into the processor demand subsystem for estimates of allocation quantities and prices at the f.o.b. and farm levels. These prices are used to estimate the next year's new plantings and this year's removals. The planting and removal estimates generate a new acreage distribution for 1957 which is used to estimate quantities that are used to estimate allocation, price, and so on.

Validity of the Model

The extent to which the model outlined in Table 19 is a valid representation of the system under study may be judged in terms of (1) the logic of the basic equation specifications, (2) the statistical tests applied to the estimates of the equation parameters, and (3) the stability properties of the model which may derive from (1) above. Both (1) and (2) have been discussed in Sections 3 and 4.[1] All of the equation specifications appear consistent with accepted theoretical concepts of firm and market behavior, and the coefficients of all equations are of the theoretically expected sign. The standard errors of the coefficients are generally smaller than the values of the coefficients, and most coefficients are significantly different from zero at the 5 percent level of significance.

An indication of how closely the model tracks actual industry behavior may be obtained by comparing the historical sequence of model predictions with actual values of acreage, production, and prices.[2] Table 20 compares the historical sequence of predictions obtained by the deterministic control model with actual values of the major endogenous variables for the period 1956–1972. This model sets all stochastic elements at zero, including random yield deviations around predicted yield values.

Note first that the overall movement of predicted values is generally consistent with actual values. This is to be expected since the various equations were estimated from the same data. Note, also, that actual annual values do not, in general, fluctuate randomly around the predicted values. Rather, the predictions may remain above or below actual values for several periods, thus producing a serially correlated set of actual and predicted differences. This, too, is to be expected since the model predictions are in terms of expected

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[1]*Supra*, pp. 20 and 47.

[2]Howrey and Kelejian (1971) have shown that, for linear systems, this historical comparison of predicted and actual values provides no *additional* information concerning the validity of the model as an interrelated system over and above that noted in (1) and (2) above. However, the comparison provides a visual check which may help uncover programming errors and may reveal peculiarities in predicted variable sequences which could lead to a reexamination and improvement of the model.

TABLE 19

Sequence of Calculations Required to Simulate the California Cling Peach Industry, 1956-1972

(1) READ

Initial values

(a) Acreage age distribution for 1956

(b) Lagged endogenous variables for 1952-1955

Exogenous variables for 1952-1972

(a) Cullage rate (K)

(b) Cost indices for producers and processors (CI, C_1, C_2, C_3, F)

(c) Administration and advertising assessment

(d) Index of consumer disposable income (Y)

(e) Export quantities (Q^{x1}, Q^{x2})

(f) Quantities of competing canned fruits (Q^{s1}, Q^{s2})

(g) Weather influence on yield[a]

(2) READ

Coefficients for district and variety share equations (Ref. Table 12)

Coefficients for yield equations (Ref. Table 13)

(3) COMPUTE lagged producer returns (R)

Producer returns are a function of farm prices, marketing order assessment, control levels, cullage rate, producer cost index (Ref. equation 3.19)

Adjusted returns = returns ÷ producer cost index = AR

(4) COMPUTE new plantings and removals with no current marketing order provisions in effect (N, E)

New plantings a function of lagged four-year moving average of adjusted returns, lagged acreage of nonbearing trees (Ref. equation 4.9)

Lagged total removals a function of lagged adjusted returns, lagged old trees, lagged total acreage, and current tree removal credits (Ref. equation 4.1)[b]

Lagged removals by age of tree, a function of age of trees, lagged total removals, and lagged age distribution of trees (Ref. equations 4.4 and 4.5)[b]

(Continued on next page.)

TABLE 19--continued.

(5) COMPUTE new age distribution of acreage (A_i)

Zero-year-old trees (A_{ot}) = new planting acreage

For trees aged 1 to 31

Acreage by age = last year's acreage when trees were one year younger less their associated removal levels

(6) CONDENSE the previous 32 age groupings to 7 age groupings, AA_{it}, $i = 1, \ldots, 7$ (Ref. section 4)

COMPUTE shares for district, variety, age groups, SH_{ijkt} (Ref. section 4)[c]

(7) COMPUTE yield level (Y_{ijk})

Yield level, a function of district, variety, and age group (Ref. Table 13)

Average yield is a weighted average of yield levels by groups

COMPUTE potential production (Q^P)

Potential production = average yield × acreage at least two years old (Ref. equation 3.15)

(8) COMPUTE desired quantity marketed ($\hat{Q}^m$)

Desired quantity marketed is a function of lagged farm price, lagged quantity marketed, beginning stocks, expected potential quantity, exports (Ref. equation 4.37)

(9) COMPUTE surplus level (S_J)

Surplus level = 1.0 - desired quantity marketed/potential production × (1.0 - cullage factor)

TEST value of surplus level

If surplus level $\leq$ 0.0, then surplus level = green-drop level = diversion level = 0.0; go to step (15) (Ref. equation 4.38)

(Continued on next page.)

TABLE 19--continued.

(10) DECLARE type of surplus program in effect

For year 1956: Diversion only in effect; go to step (14)

For years 1957-1969: Green drop with tree removal incentives in effect; diversion to be in effect later if necessary; go to step (11)

For years 1970-1972: early green drop with tree removal incentive in effect; go to step (11) (Ref. section 4, last part)

(11) DECLARE initial green-drop level for years 1957-1969

Initial green-drop level with tree removal incentives = (0.81) × surplus level (historical proportion)

DECLARE initial early green-drop level for years 1970-1972

Initial early-green drop level with tree removal incentives = surplus level (Ref. section 4, last part)

(12) COMPUTE removals with current marketing order provisions in effect (Ref. equation 4.1)

COMPUTE new age distribution of acreage

CONDENSE age groupings

COMPUTE yield level

COMPUTE potential production (Q^P) [Ref. steps (4), (5), (6), and (7)]

(13) DECLARE actual green-drop levels for years 1957-1969 (G)

Actual green-drop level = 0.689 × initial green-drop level for that year (historical average)

DECLARE actual green-drop levels for years 1970-1972 (G)

Actual green-drop levels = 0.3442 × initial green-drop level for that year (Ref. section 4, last part)

(14) COMPUTE diversion level (D)

S_1 = 1.0 - [desired quantity marketed/potential production × (1.0 - cullage level) (1.0 - actual green-drop level)]

If $S_1 \leq 0.0$, then diversion level = 0.0 (Ref. equation 4.39)

(Continued on next page.)

TABLE 19--continued.

(15) COMPUTE marketable quantity from potential production (Q^m)

Marketable quantity = potential quantity × (1.0 - cullage level) × (1.0 - green drop) × (1.0 - diversion level) (Ref. equation 4.40)

(16) COMPUTE the allocation of marketable quantity to alternate forms

Quantity allocated to other uses is a function of quantity marketed, lagged allocation to other uses, and a time trend

Quantity allocated to regular pack is a constant proportion

Quantity allocated to fruit cocktail is a constant proportion (Ref. equations 4.12, 4.13, and 4.14)

COMPUTE packed quantities from raw quantity allocation

Regular pack = constant × raw allocation

Fruit cocktail pack = constant × raw allocation (Ref. equations 4.16 and 4.17)

(17) COMPUTE domestic sales and ending stock allocation for both main final forms (Q^{d1}, Q^{d2})

Export quantity is treated as exogenous

Available quantity = pack + lagged ending stocks - exports

Domestic sales allocation a function of available quantity and time trend

Ending stocks = available quantity - domestic sales (Ref. Table 16)

(18) COMPUTE estimated f.o.b. prices for both main final forms (P^1, P^2) f.o.b. price a function of domestic sales quantity, quantity of competing canned fruits, income index, and time trend (Ref. equations 4.26 and 4.33)

(19) COMPUTE processor margins for both main final forms (M^1, M^2)

Margins a function of quantity packed, processor cost index, and time trend (Ref. equations 4.35 and 4.36)

(20) COMPUTE farm price (P^f)

Farm price a function of f.o.b. prices and processor margins (Ref. section 4)

(Continued on next page.)

TABLE 19--continued.

(21) COMPUTE producer returns

Producer returns are a function of farm price, marketing order assessment, control levels, cullage rate, producer cost index (Ref. equation 3.19)

Adjusted returns = returns ÷ producer cost index

(22) ADVANCE TIME, ONE YEAR

If time ≤ 1972, go to step (4)

If time > 1972, continue

(23) PRINT RESULTS for 1956-1972 period

Acreage

Quantities

Prices

[a] Random deviates with zero mean based on the residuals of the yield-predicting equation in Table 13, *supra*, p. 58. The values are zero for deterministic runs which suppress all disturbances.

[b] Lagged removal values are historical for the initial time period, 1956. At this step of the calculations, for all time periods, current tree removal credits are equal to zero in the tree removal equation.

[c] After the model calculated the five district acreage shares, the share of the fifth district (the balance of the state not included in the four major producing areas) was set to zero as indicated in section 4. The fifth district's share was allocated among the other four districts in proportion to their original shares. (A consistent yield series for the fifth district was unavailable. This procedure implicitly assumes that the fifth district's yield is a weighted average of the other four districts. This assumption has a minimal effect on the computation of industry average yields as the fifth district's share was no more than 2.4 percent.) These four district shares again were adjusted proportionately upward or downward to assure their summation to unity. The four variety shares are also proportionately adjusted to assure their sum to unity. Each district share is multiplied by each variety share by each age group share to compute the 112 combinations (4 x 4 x 7) of district, variety, and age groups. Each of these 112 shares become the weights used in computing the average yield in Step (7). The computed removals by age were summed and compared against the total removal estimate. The individual age removals were adjusted proportionately to assure correspondence between the sum of age-identified removals in Steps (4) and (12). Also, removals by age were constrained such that removals could not exceed existing acreage.

values with all individual equation disturbances set at zero. The model predictions thus may be out of phase with actual values which include the effects of the omitted disturbances. The comparison must be in terms of the overall closeness and movement rather than specific year–to–year variations. In this sense the model performs reasonably well.[1]

The third factor in considering the validity of the model is its stability properties. If all the exogenous variables remain constant, the sequence of calculations of endogenous variables should converge to stationary values. Otherwise, the model might explode in the sense of prices or quantities increasing or decreasing indefinitely to unreasonable levels—–a condition which is not expected to be observed in the real world. If the model were not convergent, it would suggest a need to reexamine the specifications and estimates of variable coefficients.

Conceptually, the dynamic properties of the model may be ascertained analytically.[2] However, the complexity of the model makes this very difficult. Therefore, a simulation procedure to determine if the model eventually stabilizes when all the exogenous variables are held constant has been followed. In this procedure all exogenous variables are set at 1972 levels. Two sets of initial endogenous variables were used. Although both converge to the same values, this permits the manner in which convergence occurs to be compared. One set starts with the 1972 predicted values of the controlled model as initial values, and the other set starts with 1972 values predicted by a free–market model not yet discussed. These initial values are given in Table 20 for the controlled–market model. The initial free–market values, not shown, are very close to the values given in Table 22 in the next section.

With exogenous variables fixed at 1972 values, the model twice generates endogenous values for 100 years. The data indicating the time path of the convergence of selected variables are shown as Appendix Table C.1. The model's endogenous values cycled about those values shown in Table 21 as the model's equilibrium values. These results are reported with the actual 1972 data for comparisons. The model's generated endogenous values approached those shown in Table 21 but oscillated around them with progressively smaller amplitudes. As the initial endogenous values from the free–market simulation model differed from the model equilibrium value by a greater amount than those of the controlled simulation model, the amplitudes of their oscillations were consistently larger. In both cases the length of the endogenous variables cycle was about 21 years.

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[1]An examination of the pattern of simulation results compared to the actual values shows the predicted level of total acreage and potential production consistently below the actual values during most of the earlier years. However, this pattern is not reflected in the price series. The reason is that the simulation model, with less potential production, eliminates less fruit by green–drop or cannery diversion, leaving predicted and actual marketable quantities more similar. This difference in surplus level affects grower returns, and eventually the actual and predicted acreages are brought more closely in line; but there is a considerable lag in the adjustment. Again, this reflects the fact that the simulation results are not subject to the unexplained disturbances which affect actual values.

[2]See, for example, Howrey and Kelejian (1971) and Labys (1973).

TABLE 20

Comparisons of Historical Predictions of the Deterministic Controlled Model With Actual Values of Major Endogenous Variables, 1956-1972[a]

Year	TA_t		N_t		E_t		Q_t^p		Q_t^m	
	Actual values	Controlled model	Actual values	Controlled model	Actual values	Controlled model	Actual values	Controlled model	Actual values	Controlled model
	acres						1,000 tons			
1956	64,640	64,640	7,468	7,468	2,788	1,584	634.8	555.4	559.4	529.5
1957	72,147	73,380	10,295	10,325	3,515	5,923	621.3	587.6	485.7	523.4
1958	75,034	75,361	6,402	7,904	2,054	4,545	492.2	579.4	462.0	485.9
1959	82,037	77,887	9,057	7,070	5,513	5,421	636.8	602.0	539.1	528.0
1960	81,396	76,106	4,872	3,641	7,130	5,512	658.2	629.4	545.5	545.5
1961	77,630	72,564	3,364	1,971	4,691	4,166	692.0	667.3	582.4	577.2
1962	76,957	72,675	4,018	4,276	5,191	4,524	775.7	718.9	638.4	639.2
1963	76,457	72,630	4,691	4,479	3,644	4,175	794.5	751.8	676.0	676.9
1964	76,731	73,585	3,918	5,132	3,286	3,659	921.7	766.5	778.8	675.1
1965	79,241	75,355	5,796	5,428	3,833	2,356	742.2	779.6	624.0	665.2
1966	80,843	78,549	5,435	5,549	3,940	3,104	822.9	808.0	739.4	725.9
1967	83,577	81,577	6,674	6,133	2,988	3,462	678.5	833.2	600.6	690.5
1968	85,634	84,537	5,045	6,421	5,286	4,608	840.2	861.4	755.4	710.5
1969	85,276	85,836	4,928	5,906	10,187	12,900	907.8	878.4	775.0	720.4
1970	79,452	77,726	4,363	4,790	13,588	9,430	792.5	788.8	616.7	622.9
1971	69,914	72,322	4,050	4,026	10,452	9,503	799.5	744.8	569.9	635.0
1972	63,175	65,610	3,713	2,791	1,974	4,871	625.4	697.2	541.8	598.2

(Continued on next page.)

TABLE 20--continued.

Year	P_t Actual values	P_t Controlled model	P^1 Actual values	P^1 Controlled model	R_t^2 Actual values	R_t^2 Controlled model	R_t[b] Actual values	R_t[b] Controlled model	$\bar{Y}_t$[a] Actual values	$\bar{Y}_t$[a] Controlled model
	dollars per ton		dollars per case				dollars per ton		tons per acre	
1956	70.00	74.50	5.35	5.18	6.22	6.36	19.54	28.73	12.03	10.52
1957	65.00	51.38	5.10	4.98	6.28	6.15	8.16	- 2.50	11.42	10.56
1958	66.00	56.35	5.36	5.07	6.83	6.58	16.60	7.53	8.44	10.10
1959	59.67	54.14	4.89	4.94	6.27	6.25	4.23	- 0.36	9.56	9.54
1960	56.76	52.92	4.86	4.82	6.17	6.26	- 1.44	- 4.45	9.75	9.60
1961	67.00	62.95	4.70	4.85	5.75	6.31	5.92	2.74	9.97	9.95
1962	65.00	59.85	4.50	4.70	5.40	6.12	3.57	- 0.46	11.15	10.81
1963	57.00	61.09	4.87	4.66	6.50	6.05	- 2.22	1.08	11.72	11.74
1964	62.00	66.75	4.51	4.68	5.78	6.17	1.13	5.03	13.53	11.96
1965	69.00	82.50	4.65	4.94	6.75	6.44	5.62	16.75	10.67	12.01
1966	68.50	75.98	4.63	4.85	6.00	6.26	7.13	13.85	11.82	11.94
1967	83.00	77.98	5.50	4.96	7.20	6.51	16.91	12.46	9.49	11.90
1968	76.00	68.26	5.30	4.95	6.35	6.44	8.99	2.03	11.34	11.94
1969	74.00	77.67	5.05	5.25	6.10	6.70	- 1.69	1.25	12.05	11.93
1970	81.00	86.22	5.60	5.73	7.30	7.35	- 6.47	- 2.92	11.29	11.73
1971	79.00	68.31	5.90	5.81	7.70	7.41	-14.07	-20.87	12.99	11.70
1972	75.00	74.49	6.50	6.17	8.20	8.03	-12.10	-17.74	11.28	11.83

[a] All disturbance terms set equal to their expected values.

[b] These are computed indicators of return levels rather than representative values of actual returns; see equations (3.16) to (3.19), *supra*, pp. 36 and 37.

[c] Average yields for trees two years and older. These figures are less than the average yields reported by the California Crop Reporting Service due to the inclusion of younger age trees.

Source: Computed as indicated in Table 19, *supra*, p. 72.

TABLE 21

Comparison Between Actual and Approximate Stationary Equilibrium Values, 1972

Variable	Actual 1972 value	Model stationary equilibrium value
Quantity marketed (tons)	541,834	610,000
F.o.b. prices, regular pack (dollars per case)	6.50	6.23
F.o.b. prices, fruit cocktail (dollars per case)	8.20	8.05
Farm price (dollars per ton)	75.00	78.00
Total acres, t - 1	69,914	66,000
New plantings (acres)	3,713	4,192
Tree removals, t - 1 (acres)	10,452	4,192
Average yields (tons per acre)[a]	11.28	11.75

[a]Trees two years and older; figures are less than the average yields reported by the California Crop Reporting Service due to the inclusion of younger age trees.

Source: Computed.

The results shown in Table 21 suggest that in 1972 a farm price of approximately $78.60 per ton would have produced returns to the growers that, on the average, would be equal to the average of the opportunity costs associated with their land. That is, there would be no net land entry nor exit from the industry. Since the actual price ($75) was below that figure in 1972, the long–run equilibrium acreage is below the acreage level of 1972.

6. ANALYSIS OF MARKET–CONTROL EFFECTS

To evaluate the economic impacts of a market–control program, such as existed for cling peaches, one needs to be able to predict how prices, returns, production, acreage, and other economic variables would behave with and without controls. Since controls have been in effect for many years, there are no meaningful observations on comparative behavior without controls. With appropriate adjustments and assumptions, however, our model of the commodity subsystem can be modified so that it reflects the operation of an uncontrolled system, or at least how it is thought the uncontrolled system would work. The model predictions under the two alternative specifications may then be compared.

The *controlled–market model* described in Table 19 is converted to a *free–market model* by setting all volume controls at zero. In this case, $Q^m = Q^p (1 - K)$.[1] This assumes all potential production would be delivered to canners, with no unsold production, but normal cullage at the cannery occurs. Whether or not this would, in fact, occur in periods of very large supply and associated very low prices might be questioned. In most cases, however, the levels of production predicted by the free–market model are not so extreme as to suggest the need for any limits or modifications of the model. The one instance where this might be a consideration is discussed and evaluated with the presentation of results.

The free–market model also assumes that the supply and derived demand equations which were estimated for a period during which controls were operational in most years are applicable in an uncontrolled situation. It is possible, however, that the coefficients might differ in an uncontrolled environment because of differences in risk perception or other attitude factors. On the supply side, such differences are believed to be minimized by the manner in which the effects of control provisions are incorporated into grower returns. On the demand side, little impact is seen except for the bargaining environment, but that exists even without the marketing order program. Overall, if there is any bias in transferring these behavioral equations to the uncontrolled–model analysis, it is believed to be small.

Economic results of the two models might be compared for a variety of situations with respect to the values of the exogenous variables. The set of exogenous conditions which existed during the 1956–1972 period was selected as most appropriate for the results to be presented here. Thus, a comparison is made as to what happened during

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[1]Recall that under the controlled model, quantity marketed (Q^m) is equal to potential quantity produced multiplied by three factors: green drop $(1 - G)$, cullage $(1 - K)$, and cannery diversion $(1 - D)$.

that period, as measured by our controlled–model predictions, with what would have been expected without controls as measured by our free–market–model predictions.[1]

The exogenous variables of the model include the unexplained stochastic disturbances which cause the actual values of the endogenous variables to fluctuate around their expected values. These random deviations are the result of variations in omitted individually minor and/or unmeasurable variables. In the previous historical simulation and the stability test run, these stochastic elements were held at their expected values which are assumed zero under the methods of estimating the structural equations of the model. An alternative simulation procedure is to specify probability distributions based on the variances of the residuals of the model's equations and to introduce these stochastic elements into the simulation process as factors affecting the values of the endogenous variables. This procedure requires repeated simulation runs since the stochastic terms are generated randomly for each year. Expected values and variances of the predicted endogenous variables may be computed from the values obtained by the repeated runs.

Because of the high computer cost of the repeated runs, the simulation procedure was modified to take account only of the stochastic elements believed to have potentially different effects under controlled and free–market conditions. The major factor here is weather and biological conditions which affect yield and, therefore, also affect total production and levels of surplusing. To account for this influence, the previously measured deviations between actual and predicted yields (as computed from Table 13) have simply been added into each year's yield prediction. These deviations are given in Appendix Table A.1, Part B. Alternatively, the variance of the yield deviations could have been computed and, assuming a normal distribution, could have generated random yield deviations under repeated runs. However, using the actual deviations as exogenous variables in a single run provides an indication of both "what was" and "what might have been" in a historical modeling sense and is much more economical in computer time.

The simulation results are given in Table 22. The columns of the table present the model predictions of the major endogenous variables of the system with and without marketing order controls for the 17–year period of analysis during which marketing order programs were authorized. The average value of each variable over the 17 years and its standard deviation and coefficient of variation are given at the bottom of each column. The findings may be evaluated in terms of their production effects, price effects, revenue effects, and selected measures of social welfare. From this, an attempt is made to formulate an overall evaluation.

Production Effects

Table 22 indicates that total acres of land devoted to cling peach production would have been slightly higher but more variable without marketing controls. The differences in acreage are very small until 1970 when the early green drop with the tree–removal–incentive program resulted in much larger removals than would have been expected under free–market conditions. The acreage changes are further dissected in the removal and planting comparisons. Over the 17 years compared, both removals and

[1] Note that it would not be appropriate to compare free–market–model *predictions* with *actual* values since the former eliminates the disturbance elements which are included in the actual outcomes.

TABLE 22

Comparison of Simulation Model Predictions With and Without Marketing Controls, 1956-1972[a]

A. Production Effects

Year	TA			E			N			$\bar{Y}_t$		
	Controlled market	Free market	Difference[b]	Controlled market	Free market	Difference[b]	Controlled market	Free market	Difference[b]	Controlled market	Free market	Difference[b]
	acres									tons per acre		
1956	64,640	64,640	0	2,390	1,797	-593	7,468	7,468	0	12.03	12.03	.00
1957	72,101	72,848	747	6,020	5,401	-619	9,851	10,005	154	11.42	11.43	.01
1958	73,435	75,022	1,587	4,626	4,968	342	7,354	7,575	221	8.41	8.45	.04
1959	75,255	76,323	1,068	4,536	4,709	173	6,446	6,272	-174	9.53	9.54	.01
1960	74,200	74,825	625	5,190	5,109	-81	3,481	3,208	-273	9.61	9.59	-.02
1961	71,402	71,763	361	4,174	4,179	5	2,392	2,047	-345	10.21	10.24	.03
1962	71,905	71,915	10	4,660	4,573	-87	4,676	4,331	-345	11.52	11.58	.06
1963	72,023	72,146	123	4,397	4,260	-137	4,778	4,804	26	12.08	12.18	.10
1964	72,476	72,741	265	3,884	4,179	295	4,850	4,855	5	13.60	13.73	.13
1965	73,458	73,140	-318	2,197	2,425	228	4,866	4,579	-287	10.61	10.67	.06
1966	76,563	75,597	-966	2,140	2,461	321	5,302	4,882	-420	11.01	10.63	-.38
1967	80,870	79,084	-1,786	2,194	2,165	-29	6,446	5,948	-498	9.46	9.49	.03
1968	85,962	83,890	-2,072	4,039	3,780	-259	7,286	6,970	-316	11.40	11.46	.06
1969	88,951	87,077	-1,874	13,312	4,482	-8,830	7,029	6,967	-62	12.10	12.20	.10
1970	81,053	88,138	7,085	10,652	4,942	-5,710	5,413	5,543	130	10.95	11.25	.30
1971	74,556	87,560	13,004	10,004	8,036	-1,968	4,154	4,363	209	12.38	12.83	.45
1972	66,946	81,371	14,425	4,976	7,797	2,821	2,393	1,847	-546	10.73	11.18	.45
Mean ($\bar{X}$)	75,047	76,946	1,899	5,258	4,427	-831	5,101	4,953	-148	11.00	11.09	.09
Standard deviation (σ)	6,187	6,609	422	3,166	1,712	-1,453	2,298	2,374	76	1.30	1.35	
Coefficient of variation [$\sigma/(\bar{X})$ 100]	8.24	8.59		60.2	38.7		45.1	47.9		11.79	12.11	

(Continued on next page.)

TABLE 22--continued.

Year	Q^p Controlled market	Q^p Free market	Q^p Difference[b]	Q^m Controlled market	Q^m Free market	Q^m Difference[b]	Quantity surplused in the controlled market[c]: Actual	Quantity surplused in the controlled market[c]: Percentage of Q^p (1 – K)
	1,000 tons							percent
1956	634.8	634.8	0	570.6	605.1	34.5	34.6	5.7
1957	626.6	633.8	7.2	539.1	596.0	56.9	53.1	9.0
1958	474.8	486.9	12.1	404.3	457.1	52.8	44.2	9.9
1959	587.1	597.7	10.6	524.2	567.0	42.8	34.3	6.2
1960	618.8	628.2	9.4	554.2	596.2	42.0	33.8	5.8
1961	670.0	681.6	11.6	583.5	641.2	57.7	47.7	7.6
1962	747.5	759.6	12.1	657.1	717.0	59.9	48.7	6.9
1963	757.0	768.8	11.8	675.1	720.2	45.1	36.3	5.1
1964	856.3	867.7	11.4	730.1	791.3	61.2	55.7	7.1
1965	677.3	681.0	3.7	584.5	606.2	21.7	19.7	3.3
1966	772.3	770.5	– 1.8	693.8	692.2	– 1.6	0	0
1967	654.8	648.7	– 6.1	579.6	574.2	– 5.4	0	0
1968	824.7	814.8	– 9.9	727.0	732.4	5.4	15.7	2.1
1969	905.1	893.9	– 11.2	758.9	799.6	40.7	54.7	6.8
1970	753.7	852.6	98.9	596.4	775.5	219.8	94.7	13.8
1971	807.0	997.6	190.6	681.9	901.2	219.3	52.5	7.2
1972	649.3	841.6	192.3	556.8	759.1	202.3	31.8	5.4
Mean ($\bar{X}$)	706.9	738.8	31.9	612.8	678.3	65.5	38.7	6.0
Standard deviation (σ)	109.6	130.2	20.6	91.3	111.0	19.7		
Coefficient of variation [$\sigma/(\bar{X})$ 100]	15.5	17.6		14.9	16.4			

(Continued on next page.)

TABLE 22--continued.

B. Price Effects

Year	P			P^1			P^2		
	Controlled market	Free market	Difference[b]	Controlled market	Free market	Difference[b]	Controlled market	Free market	Difference[b]
	dollars per ton			dollars per case					
1956	72.32	70.33	- 2.01	5.07	4.98	-.09	6.17	6.02	- .15
1957	48.00	43.88	- 4.12	4.90	4.73	-.17	6.04	5.78	- .26
1958	53.47	48.71	- 4.76	5.26	5.02	-.24	7.01	6.61	- .40
1959	59.51	51.71	- 7.80	5.03	4.82	-.21	6.36	6.08	- .28
1960	54.65	47.58	- 7.07	4.84	4.65	-.19	6.25	6.01	- .24
1961	62.78	54.44	- 8.34	4.84	4.62	-.22	6.29	5.99	- .30
1962	58.21	48.90	- 9.31	4.66	4.44	-.22	6.04	5.74	- .30
1963	60.04	52.02	- 8.02	4.65	4.47	-.18	6.04	5.81	- .23
1964	62.64	54.46	- 8.18	4.57	4.39	-.18	5.96	5.70	- .26
1965	83.98	76.67	- 7.31	5.06	4.91	-.15	6.73	6.54	- .19
1966	81.95	78.45	- 3.50	4.97	4.91	-.06	6.45	6.41	- .04
1967	87.90	86.70	- 1.20	5.25	5.23	-.02	7.02	7.04	.02
1968	74.41	73.79	- 0.62	5.03	5.02	-.01	6.50	6.48	- .02
1969	76.73	73.20	- 3.53	5.21	5.13	-.08	6.57	6.43	- .14
1970	86.44	70.93	-15.51	5.78	5.35	-.38	7.43	6.70	- .73
1971	65.73	38.78	-26.95	5.72	5.13	-.59	7.23	6.34	- .89
1972	74.94	40.39	-34.55	6.24	5.48	-.76	8.19	7.02	-1.17
Mean ($\bar{X}$)	68.45	59.47	- 8.98	5.12	4.90	-.22	6.60	6.28	- .32
Standard deviation (σ)	12.37	15.02		.44	.32		.60	.43	
Coefficient of variation [$\sigma/(\bar{X})$ 100]	18.07	25.26		8.55	6.51		9.15	6.81	

(Continued on next page.)

TABLE 22--continued.

C. Revenue Effects

Year	Total gross farm revenue ($P \cdot Q^m$)			Net returns per ton indicator (R)			Deflated return per ton indicator (AR)		
	Controlled market	Free market	Difference[b]	Controlled market	Free market	Difference[b]	Controlled market	Free market	Difference[b]
	million dollars			dollars					
1956	41.27	42.56	1.29	22.83	24.75	1.92	30.85	33.45	2.60
1957	25.88	26.15	0.27	- 5.14	- 3.65	1.49	- 6.59	- 4.68	1.91
1958	21.62	22.27	0.65	4.84	0.36	- 4.48	6.12	0.46	- 5.66
1959	31.19	29.32	- 1.87	4.10	2.03	- 2.07	5.00	2.48	- 2.52
1960	30.29	28.37	- 1.92	- 3.09	- 2.97	0.12	- 3.68	3.53	0.15
1961	36.63	34.91	- 1.72	2.60	2.57	- 0.03	3.06	3.02	- 0.04
1962	38.25	35.06	- 3.19	- 1.74	- 3.04	- 1.30	- 2.02	- 3.54	- 1.52
1963	40.54	37.46	- 3.08	0.23	- 1.55	- 1.78	0.27	- 1.76	- 2.03
1964	45.74	43.09	- 2.65	1.66	- 1.64	3.30	1.84	- 1.83	- 3.67
1965	49.09	46.47	- 2.62	17.97	16.03	1.94	19.53	17.43	- 2.10
1966	56.86	54.30	- 2.56	19.21	16.07	- 3.14	20.01	16.74	- 3.27
1967	50.95	49.78	- 1.17	21.25	20.18	- 1.07	21.25	20.18	- 1.07
1968	54.10	54.04	- 0.06	7.57	7.01	- 0.56	7.21	6.67	- 0.54
1969	58.23	58.53	0.30	0.52	2.89	2.37	0.45	2.60	2.15
1970	51.55	55.01	3.46	- 2.77	- 1.16	1.61	- 2.37	- 0.99	1.38
1971	44.82	34.95	- 9.87	-22.51	-35.57	-13.06	-18.15	-28.69	-10.54
1972	41.72	30.66	-11.06	-17.43	-37.18	-19.75	-13.41	-28.60	-15.19
Mean ($\bar{X}$)	42.28	40.17	- 2.11	2.95	0.30	- 2.65	4.08	1.73	- 2.35
Standard deviation (σ)	10.75	11.32		12.45	16.37		12.76	15.45	
Coefficient of variation [$\sigma/(\bar{X})$ 100]	25.41	28.17		422	5,418		313	893	

(Continued on next page.)

TABLE 22--continued

Year	Total net revenue indicator ($Q^p \cdot R$)			Deflated total net revenue indicator ($Q^p \cdot AR$)		
	Controlled market	Free market	Difference[b]	Controlled market	Free market	Difference[b]
	million dollars					
1956	14.49	15.71	1.22	19.58	21.23	1.65
1957	- 3.22	- 2.32	0.90	- 4.13	- 2.97	1.16
1958	2.30	0.18	- 2.12	2.91	0.22	- 2.69
1959	2.41	1.21	- 1.20	2.93	1.48	- 1.45
1960	- 1.91	- 1.86	0.05	- 2.28	- 2.22	0.06
1961	1.74	1.75	0.01	2.05	2.06	0.01
1962	- 1.30	- 2.31	- 1.01	- 1.51	- 2.69	- 1.18
1963	0.18	- 1.19	- 1.37	0.20	- 1.35	- 1.55
1964	1.42	- 1.43	- 2.85	1.58	- 1.59	- 3.17
1965	12.17	10.92	- 1.25	13.23	11.87	- 1.36
1966	14.83	12.38	- 2.45	15.45	12.89	- 2.56
1967	13.91	13.09	- 0.82	13.91	13.09	- 0.82
1968	6.24	5.71	- 0.53	5.94	5.44	- 0.50
1969	0.45	2.58	2.13	0.41	2.33	1.92
1970	- 2.09	- 0.98	1.11	- 1.79	- 0.84	0.95
1971	-18.16	-35.48	-17.32	-14.65	-28.62	-13.97
1972	-11.32	-31.29	-19.97	- 8.71	-24.07	-15.36
Mean ($\bar{X}$)	1.89	- 0.78	- 2.67	2.66	0.37	- 2.29
Standard deviation (σ)	8.82	13.65		8.83	12.23	
Coefficient of variation [$\sigma/(\bar{X})$ 100]	467	1,741		333	3,312	

[a]All equation disturbance terms held at their expected values except yield ($\bar{Y}_t$). Yield predictions are adjusted to reflect observed random deviations from predicted values.

[b]Free-market minus controlled-market values.

[c]Recall $Q^m = Q^p (1 - G)(1 - K)(1 - D)$. The quantity surplused in the control model is the sum of green-drop tree removal and cannery diversion.

Source: Computed; see Table 19, *supra*, p. 72.

plantings are higher under the controlled market, suggesting a possible misallocation of resources in the production sector. However, the major differences were due to the high level of removals during the crop years beginning June 1, 1969, 1970, and 1971, associated with the tree–removal incentives (Table 22). These acreages and production effects are shown for the 1966–1972 crop years in Figure 4. The free–market simulation suggests that large acreage removals would have been delayed until economic forces would have encouraged high–level removals in 1971.

The simulation of both controlled and free markets are continued over a 100–year period but with controls removed as of 1972 (Appendix Table C.1 for the controlled market and Appendix Table C.2 for the free market). Figure 4, giving 15 years of the 100–year–convergence trial results, indicates the wider swings in total acreage, plantings, and removals in the free–market model.

In accordance with the acreage predictions, *potential production* is also higher and more variable under free–market conditions than for the controlled–market case. The difference reflects both higher acreage and slightly higher yield under the free–market conditions. Yields of trees three years of age and older are higher because of the differences in planting and removal patterns and the resulting differences in age distributions. As noted above, however, this type of comparison needs to be carried out over a longer period in order for all lagged adjustments to be felt. With allowance for this, the average yield differences appear very small.[1]

Quantities actually marketed with and without marketing order control programs differ more than total production because of the surplusing activities. With marketing controls in effect, the model predicts on the average about 38,700 tons surplused per year which is about 6 percent of total production less cullage.[2] However, with the added long–run impact of the tree–removal–incentive programs, the average free–market production is about 10.7 percent higher than for the controlled–market model (678.3 thousand tons versus 612.8 thousand tons marketed).

Price Effects

A comparison of the simulated free–market and controlled–market farm price predictions suggests that the control programs significantly increased the price received by growers, averaging nearly $9.00 per ton more over the period of study. Farm prices are less variable under the controlled conditions as indicated by the lower standard deviation and coefficient of variation.

The model also predicts f.o.b. prices received by canners for regular pack and fruit cocktail to be significantly higher under market controls. However, the prices are slightly more variable than under free–market conditions, and the relative magnitude of the price increase is less than for the farm price. The increase averages about 5 percent for f.o.b.

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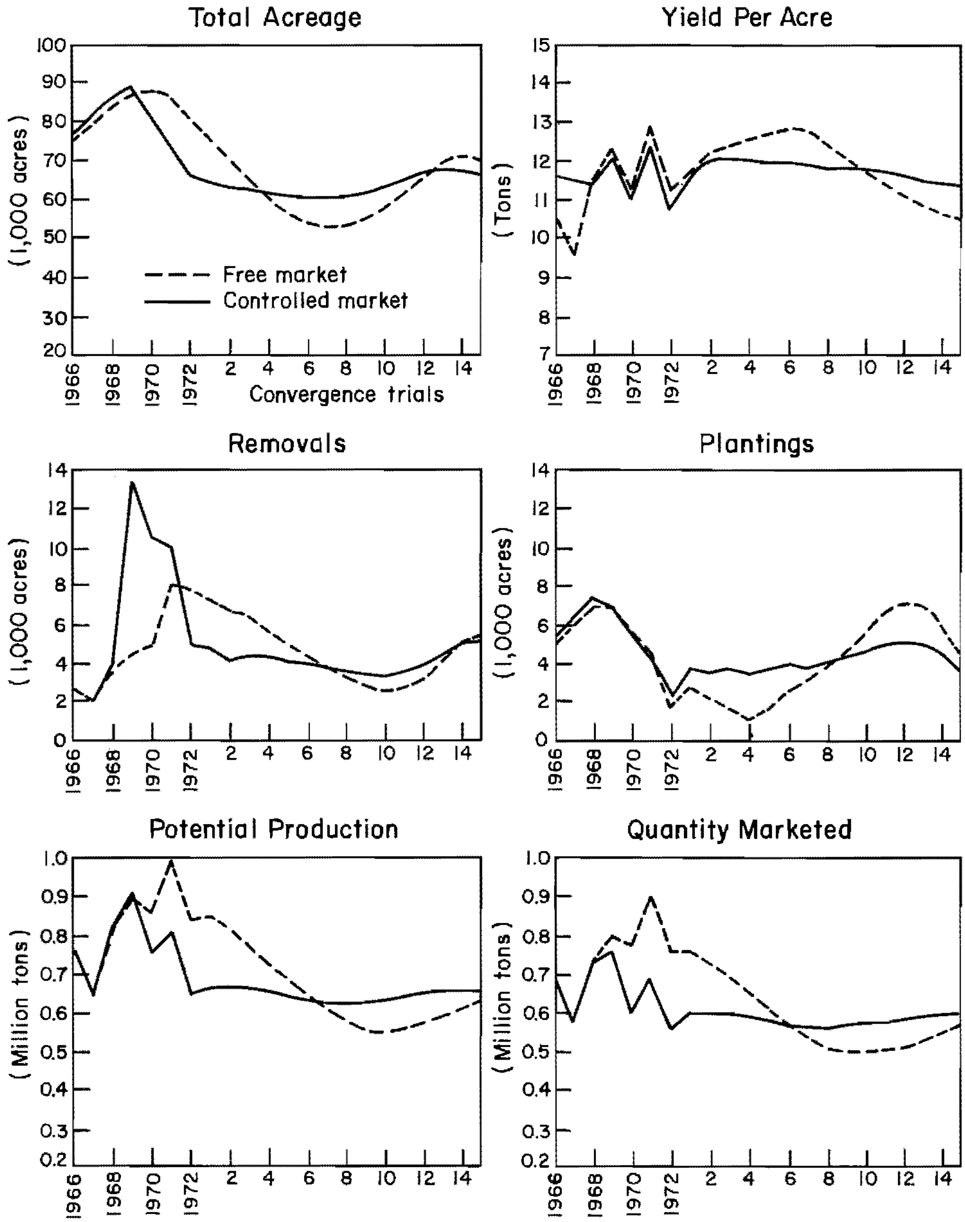
[1]For production under alternative model simulations, see Figure 4, *supra,* p. 89.

[2]The actual quantity surplused averaged about 6.4 percent of total production, less cullage, so the model predictions are reasonably close to actual conditions (Table 5), *infra,* p. 18.



Source: Table 22 for 1966-1972 data and Appendix Tables C.1 and C.2, *infra*, pp. 124 and 128, for the convergence trial data.

FIGURE 4. Simulation Model Acreage and Production Predictions With and Without Controls for Period Prior to 1972, and Implied Carry-Over Effects Subsequent to 1972, Assuming II Controls Are Removed as of 1972 (Years Beginning June 1)

prices compared to 15 percent at the farm level. But if the f.o.b. processed product prices are expressed in farm–weight equivalents, the increases are $11.7 per ton for regular pack and $33.3 per ton for fruit cocktail. In these terms processor spread for regular pack averaged about $2.70 per raw product ton higher under controlled–market conditions. The fruit cocktail spread averaged about $26.30 per ton higher. Percentagewise, the increases in spread are 1.35 percent for regular pack and 4.4 percent for fruit cocktail.[1]

Revenue Effects

Table 22, Part C, compares several types of farm–revenue measures with and without market controls. Total (gross) farm revenue averaged $2.11 million per year higher with the marketing order program in effect and was slightly less variable. Since the control program also increased unit costs of production, the "bottom line" is the impact on *net revenue*. Based on the *typical* cost series used in this study, net returns per ton averaged $2.65 higher under controlled–market conditions.[2] When deflated by the consumer price index, as in the next set of comparisons, the gain to producers from market controls averages $2.35 per ton. In both cases the net revenue variability is somewhat lower under controlled–market conditions. Aggregate net revenue under market controls (last six columns of Table 22) averaged about $2.67 million higher in current dollars and $2.29 million higher in deflated terms. As shown above, the variability of net revenue is reduced under the marketing order program.

Figure 5 illustrates the sharp changes in net returns (undeflated), particularly under free–market conditions. Also, with perennial crops, a number of years are required to recover from overproduction, assuming that a significant number of producers are not forced out of business. The aggregate effect on the state economy also would be severe as reflected in net and gross income data.

Social Welfare Measures

It has become rather common practice to attempt to evaluate the social benefits and costs of various public policies and programs by measures of changes in consumers and producers' surplus associated with the program.[3] Consumer surplus is usually computed as the area under the price–dependent demand curve above the point of intersection with the supply curve. Producers' surplus is measured from the same intersection point as the area above the supply curve but below the price line. The theoretical validity of these and related measures of economic surplus have been widely discussed and debated in the economics literature.[4] Without entering this debate, an estimate of the change in consumer surplus resulting from the marketing control program for cling peaches is computed. This change is then compared with the change in net returns to producers.

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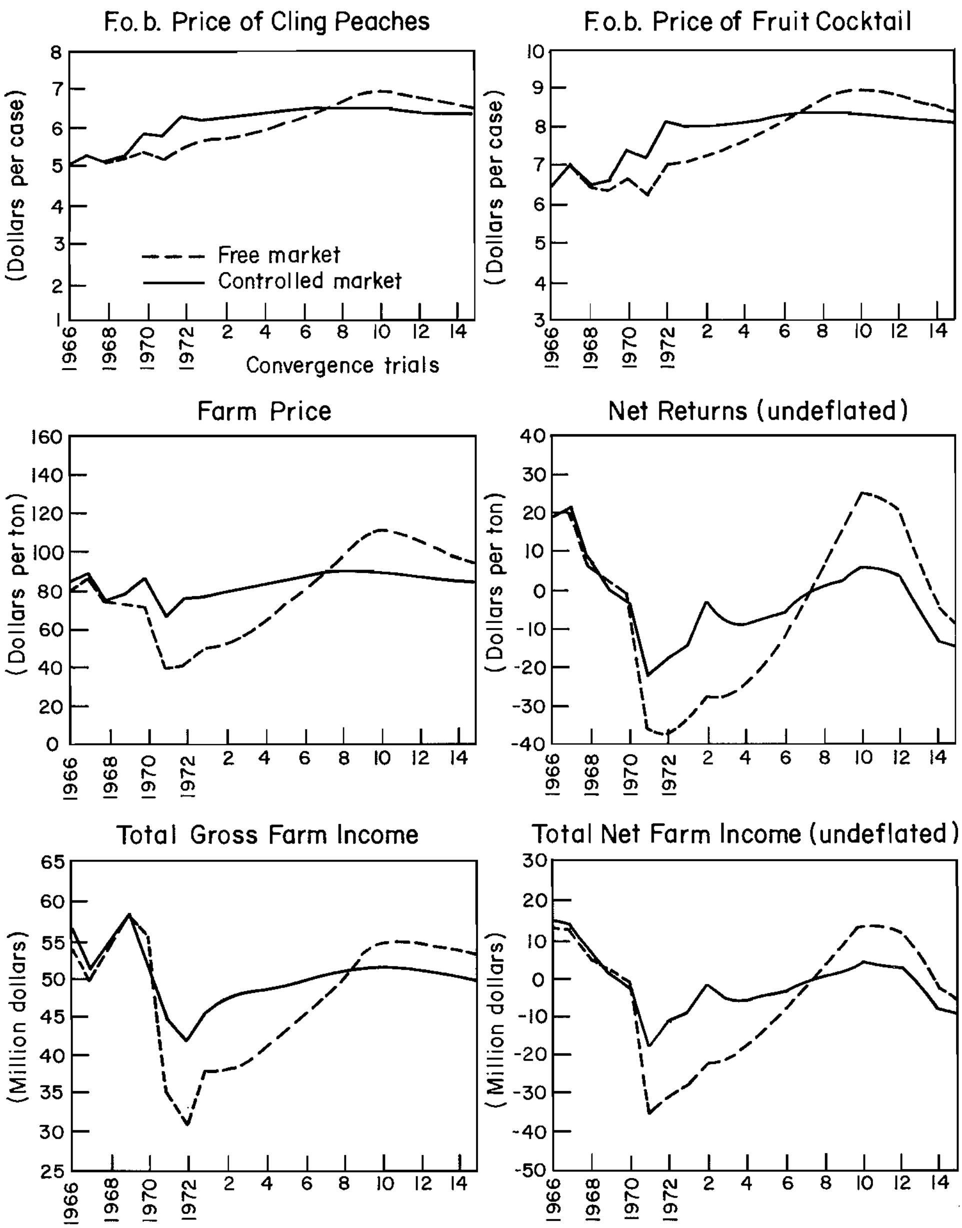
[1]Figure 5, *infra*, p. 91, illustrates the price effects associated with the production effects shown in Figure 4, *supra*, p. 89.

[2]These figures are net of all control–program assessments.

[3]For a recent survey of applications of economic surplus measures, see Mann (1977).

[4]For reviews of this literature, see, especially, Mann (1977) and Currie, Murphy, and Schmitz (1971).



Source: Table 22 for 1966-1972 data and Appendix Tables C.1 and C.2, *infra*, pp. 124 and 128, for the convergence trial data.

FIGURE 5. Simulation Model Price and Income Predictions With and Without Controls and Implied Carry-Over Effects Subsequent to 1972 Assuming All Controls Are Removed as of 1972 (Years Beginning June 1)

Our cling peach industry model does not include demand equations at the consumer level, so consumer surplus cannot be measured directly. However, surplus areas under the f.o.b. demand curves can be computed and may be expected to be roughly the same as the consumer surplus areas if f.o.b. and retail demands are parallel and a bit less with constant percentage markups at retail.

Since the f.o.b. demand equations are the same each year regardless of whether or not controls are in effect, the gain or loss of consumer surplus due to control restrictions may be expressed approximately as

$$\Delta CS = \frac{1}{2} (P_f - P_c)(Q_f + Q_c)$$

where P_c and Q_c are controlled–market prices and quantities and P_f and Q_f are free–market prices and quantities. This relationship holds as long as the nonlinear (logarithmic) f.o.b. demand slopes can be viewed as approximately linear over the range P_c to P_f. This seems a reasonable expectation.

Applying this estimator of the gain and loss in consumer surplus to the regular pack and fruit cocktail price and pack values gives average annual surplus losses for the 17–year period as follows:

$$\Delta CS^1 = \frac{1}{17} \sum_t \frac{1}{2} \left(P^1_{ft} - P^1_{ct}\right)\left(Q^{d1}_{ft} + Q^{d1}_{ct}\right) = -\$5.0 \text{ million}$$

$$\Delta CS^2 = \frac{1}{17} \sum_t \frac{1}{2} \left(P^2_{ft} - P^2_{ct}\right)\left(Q^{d2}_{ft} + Q^{d2}_{ct}\right) = -\$3.9 \text{ million}$$

$$\Delta CS^1 + \Delta CS^2 = -\$8.9 \text{ million.}$$

This change in consumers' surplus represents 8.1 percent of average yearly expenditures for canned cling peaches and fruit cocktail at the f.o.b. level. It represents 4.6 cents per person in the United States. The free–market simulation indicates lower prices and higher consumption in each of the 17 years (with the exception of one year of a higher price and lower consumption of fruit cocktail) as compared with the control market. However, the most drastic differences were for the three years, 1970–1972, which account for 55 percent of the change in consumer surplus. The average annual change in consumer surplus for the 14–year period, 1956–1969, is –\$4.9 million as compared with –\$8.9 million for the entire period.

For the 1970–1972 period, the free–market model predicted sharp increases in sales of canned peaches and fruit cocktail. For example, average free–market sales of cling peaches were 29.2 percent above simulated control–market prices during 1970–1972 as compared with 7.3 percent higher during 1956–1969. There is some question whether processors would have accepted the higher level marketing during 1970–1972 and would have lowered product prices to the extent needed to increase sales accordingly. Processing capacity and potential inventory accumulations might have been factors limiting this increased sales level. Therefore, for purposes of this analysis, a change in consumers' surplus ranging between −\$4.9 million (1956–1969 average) and −\$8.9 million (for 1956–1972 average) seems a reasonable measure.

The measure of net loss in consumer surplus may be compared with the gains achieved by producers. Since supply is predetermined in each year and the long–run supply curve is perfectly elastic over a considerable range of quantity with C_1 and C_2 constant, it is not possible to compute a measure of producer surplus in the usual sense. However, our model does produce a measure of change in net returns which may be viewed in the context of economic rent and which is viewed by many as a more satisfactory concept in any case. Table 22 indicates that by this measure the gain in economic rent to producers averaged \$2.67 million per year. Even if our estimates of producer gains are off by a factor of two or three, these figures suggest that, in economic surplus terms, the aggregate benefits to producers fell well short of the aggregate loss in consumer surplus.

Although these measures are suggestive of potential welfare benefits, such computations have many limitations; there are other factors which may also be important in evaluating the impact of the market–control program. These other criteria are examined in the next section which gives an overall evaluation of our simulation results.

Overall Evaluation

The results of the simulation analysis suggest that the marketing order program for cling peaches was generally successful in terms of the objectives for which it was established. That is, it increased average net returns to growers and reduced their variability. It also reduced total quantities canned, increased processor–grower price spreads, raised prices to consumers, and reduced consumer surplus by an amount greater than the gains in economic rent to producers. By these measures, the marketing order program was an expensive means of providing improved returns and greater stability in the cling peach industry. The economic surplus computations suggest that society as a whole might have been better off with a direct government subsidy and no market controls, although there are difficult questions as to who should pay for such subsidies.

The simulation analysis produced some other results which are suggestive of more positive social benefits from the marketing order program. In particular, the convergence test results given in Appendix C show that there is an inherent cyclical tendency within the uncontrolled system which may produce periods of excess supply and low prices followed by periods of improved returns. This is reflected in the historical free–market simulation by the buildup of potential production and associated low returns to producers in the early 1970's.[1] Whether or not all this potential production (less culls) would have been placed on the market, in view of the predicted low prices, might be questioned even under the free–market conditions. However, the returns clearly would have been very low. The marketing order program, through the early tree–removal incentives, provided a means of achieving a more rapid adjustment in acreage, thereby avoiding some

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[1]Note that the age distribution of trees and the random yield deviation gives a high average yield in 1971 which, coupled with large acreage, produces very high potential production.

potentially disastrous periods for producers. The consumer surplus and average producer returns comparisons do not take account of the individual disutilities that may occur under extreme conditions.

As noted earlier, the method of achieving market controls has varied somewhat over time. The green–drop and diversion programs were aimed mainly at dealing with short–run excesses, whereas the tree–removal–incentive programs were aimed at achieving both short–run and longer run adjustments. The results of the analysis suggest that, in the early years of the marketing order program, production excesses which were viewed as short–run were, in fact, associated with longer run cyclical behavior. The green–drop and cannery diversions which were intended to alleviate a temporary problem became almost permanent fixtures and, since they helped to maintain prices, tended to delay needed adjustments. This tended to perpetuate a system whereby a significant portion of the resource input was wasted, although returns were above what they might have been in the free market. With investments capitalized in terms of controlled–market price expectations, producers became increasingly reluctant to accept more normal competitive rates of return.

The point of the above is that it is extremely important for program managers to understand the basic economic factors influencing the returns to producers. Where uncontrollable weather conditions create a temporary excess that would drive returns to levels well below competitive equilibrium, the disutility to producers may equal or exceed the gain in economic surplus to consumers, and some type of temporary control may be desirable. However, if the excess is due to overinvestment in the industry, a different type of program seems called for.

It is concluded from the above that market–control programs properly conceived and appropriately applied to deal with clearly understood adjustment needs may offer some potential aggregate social benefits. However, in a world of uncertainty and incomplete information, programs are easily misdirected with one misdirection often leading to others. In such cases and in cases where an attempt is made to maintain returns above competitive equilibrium values, the social benefits may be negative. The cling peach marketing order program, although apparently having provided positive benefits to producers, appears to be a case in point.

APPENDIX A

CALIFORNIA CLING PEACH DATA

APPENDIX TABLE A.1

Acreage, Removal, and Yield Data, 1956-1972

A. Tree Acreage and Removals by Age of Tree (i) as of May 1 Each Harvest Year[a]

Year	i							
	0	1	2	3	4	5	6	7
	acres							
1956	7,468[b] (15)	4,390[b] (19)	3,124 (32)	4,912 (236)	4,354 (229)	2,286 (77)	1,777 (28)	3,503 (50)
1957	10,295[b] (0)	7,453[b] (15)	4,371[b] (1)	3,092 (55)	4,676[b] (39)	4,125 (23)	2,209 (22)	1,749[b] (0)
1958	6,402[b] (31)	10,295[b] (35)	7,438[b] (37)	4,037 (155)	3,037[b] (34)	4,637[b] (25)	4,102[b] (0)	2,187 (2)
1959	9,057[b] (12)	6,371[b] (35)	10,260[b] (81)	7,401 (609)	4,215[b] (32)	3,003 (36)	4,612 (37)	4,102 (76)
1960	4,872[b] (0)	9,045[b] (14)	6,336[b] (41)	10,179 (692)	6,792 (176)	4,183 (57)	2,967 (62)	4,575 (198)
1961	3,364[b] (24)	4,872[b] (53)	9,031[b] (11)	6,295 (495)	9,487[b] (163)	6,616[b] (74)	4,126 (135)	2,905 (18)
1962	4,018[b] (23)	3,340[b] (9)	4,819 (13)	9,020 (756)	5,800 (253)	9,324 (200)	6,542 (230)	3,991 (121)
1963	4,691[b] (12)	3,995[b] (15)	3,331 (21)	4,806 (610)	8,264[b] (150)	5,547 (44)	9,124 (128)	6,312 (103)
1964	3,918[b] (3)	4,679[b] (2)	3,980[b] (0)	3,310 (251)	4,196 (63)	8,114 (223)	5,503 (47)	8,996 (120)
1965	3,796[b] (15)	3,915 (30)	4,677[b] (20)	3,980 (266)	3,059[b] (19)	4,133 (22)	7,891 (419)	5,456 (30)
1966	5,435[b] (2)	5,781 (216)	3,885 (67)	4,657 (265)	3,714 (31)	3,040[b] (22)	4,111 (51)	7,472 (253)
1967	6,674[b] (173)	5,433[b] (38)	5,565 (14)	3,818 (223)	4,392[b] (23)	3,683[b] (5)	3,018[b] (0)	4,060 (9)
1968	5,045 (19)	6,501 (133)	5,395 (250)	5,551 (428)	3,595[b] (19)	4,369 (215)	3,678 (60)	3,018 (71)
1969	4,928[b] (7)	5,026 (116)	6,368 (89)	5,145 (534)	5,123 (125)	3,576 (156)	4,154 (156)	3,618 (113)
1970	4,363[b] (25)	4,921 (503)	4,910 (87)	6,279 (909)	4,611 (427)	4,998 (303)	3,420 (284)	3,998 (341)
1971	4,050[b] (13)	4,338 (150)	4,418 (246)	4,823 (521)	5,370 (347)	4,184 (362)	4,695 (235)	3,136 (326)
1972	3,713[b]	4,037	4,188	4,172	4,302	5,023	3,822	4,460

(Continued on next page.)

APPENDIX TABLE A.1--continued.

Year	i							
	8	9	10	11	12	13	14	15
	acres							
1956	2,295 (44)	1,773 (125)	1,421 (40)	1,713 (96)	2,731 (92)	2,374 (87)	2,846 (151)	2,725 (83)
1957	3,453 (15)	2,251 (7)	1,648 (74)	1,381 (60)	1,617 (86)	2,639 (103)	2,287 (137)	2,695 (222)
1958	1,749 (9)	3,438[b] (0)	2,244 (22)	1,574 (36)	1,321 (44)	1,531 (43)	2,536 (158)	2,150 (79)
1959	2,185 (37)	1,740 (46)	3,438 (73)	2,222 (88)	1,538 (132)	1,277 (125)	1,488 (228)	2,378 (291)
1960	4,026 (107)	2,148 (146)	1,694 (71)	3,365 (178)	2,134 (165)	1,406 (219)	1,152 (183)	1,260 (195)
1961	4,377 (178)	3,919 (73)	2,002 (42)	1,623 (60)	3,187 (166)	1,969 (91)	1,187 (152)	969 (123)
1962	2,887 (122)	4,199 (175)	3,846 (219)	1,960 (70)	1,563 (67)	3,021 (141)	1,878 (148)	1,035 (155)
1963	3,870 (103)	2,765 (119)	4,024 (115)	3,627 (126)	1,890 (101)	1,496 (72)	2,880 (203)	1,730 (148)
1964	6,209 (162)	3,767 (73)	2,646 (124)	3,909 (154)	3,501 (246)	1,789 (97)	1,424 (87)	2,677 (166)
1965	8,876 (284)	6,047 (246)	3,694 (142)	2,522 (163)	3,755 (175)	3,255 (229)	1,692 (146)	1,337 (58)
1966	5,426 (272)	8,592 (336)	5,801 (211)	3,552 (128)	2,359 (110)	3,580 (174)	3,026 (169)	1,546 (119)
1967	7,219 (213)	5,154 (58)	8,256 (188)	5,590 (134)	3,424 (114)	2,249 (139)	3,406 (269)	2,857 (221)
1968	4,051 (110)	7,006 (255)	5,096 (301)	8,068 (449)	5,456 (310)	3,310 (245)	2,110 (186)	3,137 (532)
1969	2,947 (177)	3,941 (252)	6,751 (993)	4,795 (573)	7,619 (1,072)	5,146 (714)	3,065 (360)	1,924 (541)
1970	3,505 (169)	2,770 (214)	3,689 (339)	5,758 (1,424)	4,222 (907)	6,547 (1,572)	4,432 (1,245)	2,705 (803)
1971	3,657 (502)	3,363 (284)	2,556 (465)	3,350 (317)	4,334 (1,094)	3,315 (699)	4,975 (1,369)	3,187 (995)
1972	2,810	3,155	3,052	2,091	3,033	3,240	2,616	3,606

(Continued on next page.)

APPENDIX TABLE A.1--continued.

Year	i							
	16	17	18	19	20	21	22	23
	acres							
1956	2,366 (154)	1,620 (66)	2,218 (117)	2,185 (142)	2,331 (299)	1,096 (90)	651 (72)	324 (33)
1957	2,642 (248)	2,212 (268)	1,554 (179)	2,101 (243)	2,043 (424)	2,032 (402)	1,006 (191)	579 (115)
1958	2,473 (138)	2,394 (163)	1,944 (111)	1,375 (106)	1,858 (257)	1,619 (144)	1,630 (130)	815 (66)
1959	2,071 (207)	2,335 (385)	2,231 (295)	1,833 (398)	1,269 (333)	1,601 (432)	1,475 (417)	1,500 (385)
1960	2,087 (499)	1,864 (328)	1,950 (439)	1,936 (572)	1,435 (548)	936 (319)	1,169 (444)	1,058 (344)
1961	1,065 (131)	1,588 (288)	1,536 (292)	1,511 (390)	1,364 (435)	887 (286)	617 (203)	725 (193)
1962	846 (104)	934 (138)	1,300 (234)	1,244 (320)	1,121 (346)	929 (304)	601 (227)	414 (150)
1963	880 (114)	742 (125)	796 (75)	1,066 (227)	924 (148)	775 (154)	625 (229)	374 (108)
1964	1,582 (170)	766 (86)	617 (89)	721 (111)	839 (168)	776 (153)	621 (136)	396 (96)
1965	2,511 (247)	1,412 (164)	680 (125)	528 (92)	610 (125)	671 (78)	623 (132)	485 (160)
1966	1,279 (236)	2,264 (233)	1,248 (182)	555 (117)	436 (83)	485 (91)	593 (156)	491 (110)
1967	1,427 (145)	1,043 (105)	2,031 (207)	1,066 (163)	438 (84)	353 (37)	394 (35)	437 (113)
1968	2,636 (246)	1,282 (179)	938 (172)	1,824 (289)	903 (168)	354 (91)	316 (95)	359 (63)
1969	2,605 (872)	2,390 (796)	1,103 (336)	766 (282)	1,535 (710)	735 (318)	263 (131)	221 (86)
1970	1,383 (550)	1,733 (902)	1,594 (628)	767 (347)	484 (271)	825 (407)	417 (283)	132 (79)
1971	1,902 (473)	833 (330)	831 (381)	966 (452)	420 (152)	213 (133)	418 (219)	134 (84)
1972	2,192	1,429	503	450	514	268	80	199

(Continued on next page.)

APPENDIX TABLE A.1--continued.

Year	i							
	24	25	26	27	28	29	30	31+
	acres							
1956	240	232	298	1,387+[c]				
	(35)	(48)	(35)	(293)				
1957	291	205	184	263	1,094+			
	(34)	(42)	(57)	(50)	(403)			
1958	464	257	163	127	213	691+		
	(28)	(25)	(32)	(11)	(16)	(117)		
1959	749	436	232	131	116	197	574+	
	(213)	(176)	(60)	(30)	(20)	(39)	(185)	
1960	1,115	536	260	172	101	96	158	389
	(411)	(264)	(79)	(73)	(44)	(20)	(242)	
1961	714	704	272	181	99	57	76	305
	(161)	(150)	(44)	(76)	(80)	(18)	(86)	
1962	532	553	554	228	105	19	39	295
	(126)	(142)	(226)	(41)	(22)	(6)	(103)	
1963	264	406	411	328	187	83	13	231
	(74)	(82)	(65)	(41)	(14)	(38)	(80)	
1964	266	190	324	346	287	173	45	164
	(96)	(61)	(84)	(63)	(67)	(48)	(40)	
1965	300	170	129	240	283	220	125	169
	(88)	(61)	(40)	(57)	(63)	(57)	(80)	
1966	325	212	109	89	183	220	163	214
	(65)	(65)	(21)	(8)	(42)	(55)	(50)	
1967	381	260	147	88	81	141	165	327
	(69)	(42)	(32)	(17)	(12)	(37)	(69)	
1968	324	312	218	115	71	69	104	423
	(68)	(57)	(73)	(39)	(4)	(10)	(149)	
1969	296	256	255	145	76	67	59	378
	(90)	(112)	(131)	(71)	(29)	(22)	(223)	
1970	135	206	144	124	74	47	45	214
	(85)	(114)	(51)	(70)	(53)	(28)	(168)	
1971	53	50	92	93	54	21	19	91
	(28)	(27)	(74)	(39)	(40)	(13)	(82)	
1972	50	25	23	18	54	14	8	28

(Continued on next page.)

APPENDIX TABLE A.1—continued.

B. Acreage and Yield Summaries

Year	Tree acreage		Average yields of trees, two years and older		
	Acreage under two years of age	Two years and older	Actual	Predicted[d]	Deviation
	acres		tons		
1956	11,858	52,782	12.03	10.52	1.51
1957	17,748	54,399	11.42	10.55	.87
1958	16,697	58,337	8.44	10.10	-1.66
1959	15,428	66,609	9.56	9.60	- .04
1960	13,917	67,479	9.75	9.85	- .10
1961	8,236	69,394	9.97	9.85	.12
1962	7,358	69,599	11.15	10.54	.66
1963	8,686	67,771	11.72	11.36	.36
1964	8,597	68,134	13.53	11.77	1.76
1965	9,711	69,530	10.67	11.92	-1.25
1966	11,216	69,627	11.82	12.07	- .25
1967	12,107	71,470	9.49	11.98	-2.49
1968	11,546	74,088	11.34	11.98	- .64
1969	9,954	75,322	12.05	11.91	.14
1970	9,284	70,168	11.29	11.97	- .68
1971	8,388	61,526	12.99	12.05	.94
1972	7,750	55,425	11.28	12.12	- .84

[a]With the exception of footnoted figures, figures in upper row indicate reported standing acreage at beginning of year; figures in parentheses indicate calculated removal acreage.

[b]Calculated; revised from the original figures; for an explanation, see *supra*, pp. 47-49. Yearly totals aggregated for all ages of trees, see Table 4, *supra*, p. 16.

[c]Pluses indicate years of specified age and older.

[d]Weighted average of values predicted by equation 3.14, Table 13, *supra*, pp. 33 and 58.

Source: Cling Peach Advisory Board (annual issues).

APPENDIX TABLE A.2

Cling Peach Percentage Shares by Variety and District, 1956-1972

Year	Variety				District				
	Extra early (V_1)	Early (V_2)	Late (V_3)	Extra late (V_4)	Marysville-Yuba City (D_1)	Stockton (D_2)	Modesto (D_3)	Visalia (D_4)	Other (D_5)
	percent								
1956	13.26	30.84	42.49	13.41	36.49	9.02	43.99	8.88	1.62
1957	16.26	29.29	41.46	13.00	35.67	8.77	43.88	10.52	1.16
1958	18.76	27.58	40.64	13.02	34.53	8.64	44.43	11.46	0.94
1959	21.24	25.96	40.13	12.66	35.69	8.64	43.80	11.05	0.82
1960	22.62	24.66	39.75	12.98	35.72	8.28	44.96	10.29	0.75
1961	23.24	23.41	39.73	13.62	35.78	7.82	45.99	9.92	0.49
1962	23.69	22.34	39.93	14.03	35.67	7.45	46.92	9.65	0.31
1963	24.25	21.47	39.83	14.45	35.22	7.29	47.67	9.61	0.20
1964	24.64	20.51	39.79	15.05	34.90	7.26	48.28	9.37	0.18
1965	25.00	20.03	39.56	15.41	36.09	7.42	46.86	9.46	0.16
1966	25.37	19.42	39.72	15.49	36.65	6.75	46.84	9.62	0.14
1967	26.13	18.68	39.66	15.53	36.46	5.54	47.92	10.00	0.09
1968	26.53	18.63	39.53	15.31	36.73	5.25	47.23	10.71	0.07
1969	26.98	18.60	39.40	14.96	36.50	4.69	47.67	11.10	0.04
1970	27.34	18.47	39.13	15.06	36.95	4.21	46.92	11.89	0.03
1971	26.38	19.44	39.63	14.54	38.30	3.94	46.32	11.43	0.01
1972	26.37	20.29	38.97	14.38	40.48	3.46	45.24	10.82	0.01

Source: Cling Peach Advisory Board (annual issues).

APPENDIX TABLE A.3

Cling Peach Variety Percentage Within Districts, 1956-1972

Crop year	Shares by district and variety: Marysville-Yuba City (D_1)				Stockton (D_2)				Modesto (D_3)				Visalia (D_4)			
	Extra early (V_1)	Early (V_2)	Late (V_3)	Extra late (V_4)	Extra early (V_1)	Early (V_2)	Late (V_3)	Extra late (V_4)	Extra early (V_1)	Early (V_2)	Late (V_3)	Extra late (V_4)	Extra early (V_1)	Early (V_2)	Late (V_3)	Extra late (V_4)
	percent															
1956	12.08	34.31	44.98	8.63	1.40	30.35	53.20	15.05	15.78	29.06	38.68	16.48	17.71	25.90	40.23	16.16
1957	14.76	33.44	43.55	8.25	2.04	30.08	53.25	14.63	18.78	26.85	38.49	15.89	22.67	24.76	39.93	15.64
1958	17.28	31.67	42.92	8.13	2.84	29.14	53.40	14.63	21.57	24.90	38.00	15.52	24.29	24.49	34.41	16.81
1959	21.12	29.36	42.12	7.41	5.82	26.27	52.68	15.23	23.59	23.73	37.47	15.21	24.42	23.62	34.43	17.54
1960	22.57	28.39	41.85	7.19	6.33	24.48	53.41	15.78	24.94	21.90	37.16	16.00	25.78	23.88	32.72	17.63
1961	23.70	27.23	41.79	7.27	7.49	22.44	52.78	17.29	24.78	20.61	37.67	16.94	26.82	23.37	31.54	18.27
1962	25.05	26.16	41.49	7.30	8.58	19.58	54.08	17.76	24.23	19.65	38.44	17.67	27.74	23.46	30.50	18.29
1963	25.82	25.41	41.59	7.18	10.25	17.54	53.79	18.43	24.36	18.78	38.15	18.71	28.52	23.36	31.18	16.94
1964	26.67	24.71	41.50	7.13	11.38	15.41	54.26	18.95	24.52	17.73	38.00	19.75	28.03	23.16	31.48	17.33
1965	27.07	24.17	41.35	7.41	12.46	14.97	52.49	20.08	24.86	17.02	38.01	20.12	27.58	23.12	30.30	19.00
1966	26.78	23.54	42.31	7.36	13.05	13.32	53.38	20.25	25.50	16.16	37.64	20.70	27.99	23.90	30.33	17.78
1967	27.24	23.26	42.26	7.24	14.45	11.63	53.25	20.67	26.08	14.92	37.80	21.19	28.75	23.85	31.57	15.82
1968	27.65	23.77	41.49	7.09	15.31	11.77	53.38	19.54	26.29	14.24	38.13	21.34	29.28	23.72	32.21	14.79
1969	27.97	24.36	40.99	6.67	17.17	11.42	52.67	18.73	26.72	13.61	38.52	21.16	29.01	24.09	32.91	13.99
1970	27.58	25.80	39.94	6.69	19.14	8.73	51.50	20.63	27.41	12.33	38.96	21.30	29.26	23.40	32.91	14.40
1971	26.39	27.28	39.75	6.58	20.23	11.81	49.80	18.16	26.70	12.42	39.49	21.38	27.18	24.21	36.33	12.28
1972	25.81	28.37	38.91	6.91	19.87	12.10	50.69	17.34	27.08	12.77	38.75	21.39	27.51	24.09	36.36	12.05

Source: Cling Peach Advisory Board (annual issues).

APPENDIX TABLE A.4

California Cling Peach Utilization, 1956–1972

Marketing year[a]	Q^1	Q^2	Q^o	Total	$\frac{Q^1}{Q^1 + Q^2}$
			tons		
1956	415,870	102,377	41,190	559,437	.803
1957	352,007	97,586	36,091	485,684	.783
1958	331,746	97,160	33,126	462,032	.774
1959	393,567	108,797	36,657	539,021	.783
1960	394,827	118,727	31,924	545,478	.769
1961	429,290	120,321	32,828	582,439	.781
1962	476,763	124,427	37,168	638,358	.793
1963	508,661	128,171	39,137	675,969	.799
1964	583,516	156,320	38,911	778,747	.789
1965	444,483	143,126	36,418	624,027	.756
1966	559,803	149,411	30,157	739,371	.789
1967	432,002	136,264	32,302	600,568	.760
1968	559,339	165,347	30,666	755,352	.772
1969	580,438	162,774	31,751	774,963	.781
1970	462,634	126,739	27,320	616,963	.785
1971	411,310	129,012	29,573	569,895	.761
1972	405,753	111,469	24,612	541,834	.785

[a]Beginning June 1.

Sources: Cling Peach Advisory Board (annual issues); also, unpublished reports presented at annual meetings.

APPENDIX TABLE A.5

California Cling Peach Regular Pack (Q^1), Carry-Over, and Shipment Data, 1956-1975

Marketing year[a]	Q^1	Beginning stocks	Total f.o.b. movement	Domestic movement[b]	Export movement
	1,000 cases, 24 No. 2-1/2 basis				
1956	21,322	1,556	18,300	15,979	2,321
1957	18,484	4,579	20,581	17,960	2,621
1958	17,545	2,482	16,988	14,749	2,239
1959	21,485	3,039	21,874	18,368	3,506
1960	21,587	2,650	20,793	16,660	4,133
1961	22,940	3,443	23,001	17,685	5,316
1962	25,574	3,382	25,765	19,322	6,443
1963	25,089	3,191	25,722	21,000	4,722
1964	30,640	2,558	28,007	22,832	5,175
1965	23,233	5,191	25,604	21,007	4,597
1966	30,348	2,820	29,052	23,985	5,067
1967	22,566	4,116	23,631	21,578	2,053
1968	29,867	3,051	27,282	24,787	2,495
1969	31,479	5,636	28,787	23,791	4,996
1970	24,878	7,458[c]	25,573	21,875	3,698
1971	21,839	6,763	24,712	22,067	2,645
1972	21,233	3,890	23,532	20,885	2,647
1973	21,615	1,591	21,819	19,000	2,819
1974	28,983	1,387	26,009	23,862	2,147
1975[d]	25,691	4,361	23,794	21,794	2,000

[a] Beginning June 1.

[b] Includes U. S. government direct f.o.b. purchases.

[c] Excludes cyclamate packs.

[d] Preliminary; subject to revision.

Source: Hoos and Kuznets (1976).

APPENDIX TABLE A.6

Fruit Cocktail Pack (Q^2), Carry-Over, and Shipment Data, 1956-1975

Marketing year[a]	Q^2	Beginning stocks	Total f.o.b. movement	Domestic movement[b]	Export movement
	1,000 cases, 24 No. 2-1/2 basis				
1956	11,033	1,548	10,430	9,036	1,394
1957	10,638	2,151	10,567	9,114	1,453
1958	10,734	2,222	10,649	9,245	1,404
1959	10,274	2,307	12,189	10,533	1,656
1960	12,848	2,192	11,913	10,045	1,868
1961	13,660	3,127	13,389	10,764	2,625
1962	13,771	3,398	14,936	11,841	3,095
1963	12,565	2,233	12,706	9,966	2,740
1964	16,176	2,092	15,875	12,355	3,520
1965	14,504	2,393	13,457	10,727	2,730
1966	15,781	3,440	16,545	13,212	3,333
1967	13,399	2,676	13,239	11,219	2,020
1968	16,570	2,836	16,090	13,725	2,365
1969	16,686	3,316	15,935	13,269	2,666
1970	13,081	3,113[c]	12,741	10,899	1,842
1971	13,334	3,453	12,451	10,818	1,633
1972	11,855	4,336	13,856	11,737	2,119
1973	13,384	2,335	14,479	11,979	2,500
1974	14,907	1,240	13,082	11,403	1,679
1975[d]	13,677	3,065	13,502	11,602	1,800

[a]Beginning June 1.

[b]Includes U. S. government direct f.o.b. purchases.

[c]Excludes cyclamate packs.

[d]Preliminary; subject to revision.

Source: Hoos and Kuznets (1976).

APPENDIX TABLE A.7

Domestic Movement and F.O.B. Prices of Canned Fruits, 1956-1975

Marketing year[a]	Domestic movement				F.o.b. prices			
	Pacific Coast Bartlett pears	California apricots	Pacific Coast Freestone peaches	Hawaiian pineapples	Pacific Coast Bartlett pears	California apricots	Pacific Coast Freestone peaches	Hawaiian pineapples
	1	2	3	4	5	6	7	8
	1,000 cases, 24 No. 2-1/2 basis				dollars per case			
1956	6,789	3,852	4,688	12,101	6.89	5.60	6.29	7.40
1957	7,746	3,871	4,753	12,457	6.25	5.48	6.10	7.45
1958	7,077	2,052	5,161	12,779	6.88	6.75	6.16	7.75
1959	8,009	4,026	5,449	12,951	6.15	5.38	5.79	8.05
1960	7,016	4,073	5,755	12,928	6.50	5.24	5.52	8.05
1961	7,220	4,448	5,559	13,030	6.53	4.95	5.37	8.15
1962	8,644	3,747	5,502	13,062	5.64	5.65	5.20	8.20
1963	6,001	3,914	5,092	12,808	7.60	5.30	6.00	8.50
1964	8,240	3,823	4,841	13,468	6.29	5.26	5.68	8.50
1965	5,995	4,748	4,600	13,578	7.55	4.90	5.80	8.50
1966	8,916	4,425	4,256	14,054	6.14	5.15	6.00	8.50
1967	5,820	3,784	3,743	14,724	9.00	6.55	7.15	8.50
1968	7,860	3,433	3,659	15,527	7.25	6.70	7.10	8.50
1969	8,978	3,510	4,109	14,556	6.50	5.95	6.20	8.65
1970	7,734	3,503	2,601[b]	14,700	8.05[b]	6.00	7.10[b]	8.85
1971	8,775	3,460	2,735[b]	15,061	7.80[b]	6.15	7.50[b]	9.00
1972	9,616	3,103	2,474[b]	15,900	8.35[b]	7.90	8.20[b]	9.00
1973	9,738	3,757	2,299[b]	[c]	9.30[b]	9.00	9.90[b]	
1974	8,388	2,174	2,062[b]		11.70[b]	13.15	13.00[b]	
1975	9,082	2,916	1,961[b]		10.30[b]	10.95	11.35[b]	

[a]Beginning June 1.

[b]California only.

[c]Blanks indicate data not reported subsequent to 1972-73; recall that the estimated equations include data for 1956-1972 only.

Sources:

Cols. 1-3 and 5-7: Hoos and Kuznets (1976).

Cols. 4 and 8: *Ibid.* (1972).

APPENDIX TABLE A.8

Prices of California Cling Peaches, 1956-1977

Marketing year[a]	P	P^1	P^2
	dollars per ton	dollars per case	
1956	70.00	5.35	6.22
1957	65.00	5.10	6.28
1958	66.00	5.36	6.83
1959	59.67	4.89	6.27
1960	56.76	4.86	6.17
1961	67.00	4.70	5.75
1962	65.00	4.50	5.40
1963	57.00	4.87	6.50
1964	62.00	4.51	5.78
1965	69.00	4.65	6.75
1966	68.50	4.63	6.00
1967	83.00	5.50	7.20
1968	76.00	5.30	6.35
1969	74.00	5.05	6.10
1970	81.00	5.60	7.30
1971	79.00	5.90	7.70
1972	75.00	6.50	8.20
1973	97.00[b]	7.75	9.20
1974	132.50[b]	9.90	11.15
1975	128.50[b]	9.25	10.90
1976	115.00[b]	9.60	11.35
1977	115.00[b]	9.55	11.70

[a] Beginning June 1.

[b] Base price. Average value may differ depending on percentage offgrade.

Sources: Hoos and Kuznets (1978); also, California Canning Peach Association (annual issues).

APPENDIX TABLE A.9

Selected Variables Influencing Cling Peaches, 1956-1975

Year	Index of: Prices paid by farmers,[a] United States (1967 = 100)	Processing cost[b] (1957-1959 = 100)	U. S. disposable personal income (1947-1949 = 100)
	1	2	3
1956	74	93.2	160.0
1957	78	98.2	165.8
1958	79	100.5	174.7
1959	82	101.4	182.6
1960	84	103.0	188.2
1961	85	104.0	199.5
1962	86	106.1	208.9
1963	88	107.9	222.9
1964	90	109.0	240.5
1965	92	111.8	262.4
1966	96	114.3	280.8
1967	100	117.8	301.6
1968	105	122.8	323.5
1969	111	127.9	352.4
1970	117	135.1	382.6
1971	124	144.8	410.3
1972	130	152.6	454.7
1973	141	162.1	503.6
1974	171	189.4	551.6
1975	199	217.4	605.7

[a] Input items included in the index are motor supplies, motor vehicles, farm machinery, building and fencing materials, fertilizer, interest, taxes, and wage rates.

[b] Canning: weighted average of BLS index of average hourly earnings of production or nonsupervisory workers in canned food industries (SIC 1030) and general-purpose machinery and equipment (SIC 1140). The paperboard and metal containers indexes were weighted .16 and .84 to derive a packaging cost index. The total index weights used were labor .29, packaging .58, and equipment .13.

Sources:

Col. 1: U. S. Statistical Reporting Service (annual issues).

Col. 2: French (1961) and unpublished supplements.

Col. 3: Hoos and Kuznets (1976).

APPENDIX TABLE A.10

Yield by Age of Tree, 1956-1972

Year	District 1: Marysville-Yuba City						
	Age of tree						
	2	3	4	5	6-15	16-20	21+
	tons per acre						
Extra early							
1956	0.73	4.60	7.29	13.37	51.21	13.31	0.00
1957	0.79	3.85	8.01	9.48	11.56	10.06	0.00
1958	0.52	3.48	6.57	10.87	13.47	13.04	0.00
1959	1.37	5.73	8.23	9.79	12.51	11.79	0.00
1960	0.91	4.62	9.62	10.60	13.09	10.28	0.00
1961	0.55	3.64	7.96	12.39	14.92	12.46	0.00
1962	0.77	4.87	8.81	12.16	15.76	13.49	11.16
1963	0.57	2.56	7.78	10.88	13.85	11.83	12.44
1964	1.27	4.67	8.76	14.32	17.07	14.47	14.87
1965	1.54	5.15	9.46	12.44	15.28	11.50	11.09
1966	1.56	5.09	8.29	9.81	13.25	10.29	10.18
1967	0.90	4.51	8.34	10.84	13.69	10.09	10.05
1968	1.05	5.35	7.83	11.84	13.13	9.01	9.93
1969	2.16	5.46	10.82	12.62	14.67	10.68	15.37
1970	1.54	4.95	8.90	11.61	13.73	9.80	6.53
1971	1.76	5.98	9.79	13.97	15.31	13.95	0.00
1972	1.52	4.71	9.15	10.13	13.43	12.23	0.00
Early							
1956	0.35	3.10	6.73	12.06	15.73	14.67	13.42
1957	0.16	2.53	5.92	8.88	11.00	9.56	7.78
1958	0.14	1.49	5.52	7.24	11.08	11.78	11.42
1959	0.89	4.94	8.74	12.10	12.78	10.64	9.59
1960	0.95	4.11	8.78	10.74	13.60	10.67	9.06
1961	0.25	2.44	6.83	11.12	14.10	11.32	9.88
1962	0.35	3.41	7.52	10.39	14.12	11.32	12.12
1963	0.11	1.53	6.23	8.38	12.62	12.00	11.22
1964	0.59	3.40	7.08	12.68	16.34	14.88	12.82
1965	0.75	2.50	6.50	8.58	12.81	10.81	7.17
1966	1.74	3.55	7.89	9.48	11.50	9.62	6.75
1967	0.82	4.33	5.22	8.35	10.35	8.96	6.28
1968	1.64	5.33	9.80	10.47	12.69	11.26	9.70
1969	2.11	6.69	10.18	12.19	13.26	11.62	10.31
1970	1.75	5.60	10.91	12.20	12.95	11.94	9.83
1971	1.73	7.36	11.60	14.80	14.74	13.84	7.49
1972	2.57	7.31	12.70	15.23	14.96	12.75	8.67

(Continued on next page.)

APPENDIX TABLE A.10--continued.

	District 1: Marysville-Yuba City						
	Age of tree						
Year	2	3	4	5	6-15	16-20	21+
	tons per acre						
Late							
1956	0.67	4.43	8.78	15.02	18.37	16.03	15.58
1957	0.51	3.55	7.57	10.95	14.35	11.88	9.78
1958	0.34	2.86	6.63	9.20	13.52	12.64	11.63
1959	1.25	6.45	11.53	14.19	16.03	12.66	11.80
1960	0.86	5.39	10.44	13.88	16.07	12.27	10.43
1961	0.46	3.86	8.50	13.10	17.64	13.63	12.35
1962	0.35	4.72	11.02	13.80	17.60	13.28	12.80
1963	0.48	2.10	8.42	13.11	15.90	14.14	12.60
1964	0.65	3.90	8.39	15.75	20.21	17.45	15.86
1965	0.66	2.50	4.89	6.65	8.23	6.11	5.80
1966	1.50	4.63	7.94	11.39	15.06	12.56	9.49
1967	0.48	4.04	7.03	8.70	11.97	10.26	7.95
1968	0.81	4.83	8.53	13.08	15.13	13.54	11.41
1969	1.65	5.14	10.92	13.56	17.40	13.70	14.44
1970	1.92	4.57	8.73	12.42	16.04	14.10	13.45
1971	1.14	6.36	10.99	15.38	18.04	17.18	13.88
1972	2.44	5.74	12.59	14.43	17.00	15.12	12.64
Extra late							
1956	0.40	4.89	7.36	17.65	18.79	18.54	12.70
1957	0.92	3.11	7.34	8.77	14.96	7.81	1.58
1958	0.49	2.44	5.74	5.53	12.38	12.98	4.15
1959	1.17	8.50	13.01	14.22	16.40	12.07	3.84
1960	1.02	4.74	14.27	16.52	16.40	12.31	4.62
1961	0.35	4.00	6.75	16.97	15.82	12.67	0.00
1962	0.03	4.70	11.48	14.77	17.70	14.83	0.00
1963	0.12	2.79	7.67	12.61	16.60	16.07	16.41
1964	0.46	2.74	7.66	14.83	19.35	16.95	12.38
1965	1.07	2.87	6.67	8.20	13.06	8.33	8.92
1966	1.84	5.47	10.20	12.71	16.61	14.04	13.53
1967	0.50	4.81	8.15	6.49	11.30	7.74	6.46
1968	0.53	4.38	10.42	14.65	12.84	11.56	9.18
1969	0.74	6.31	11.36	16.48	18.26	15.28	15.97
1970	1.37	3.73	12.19	11.52	16.54	14.08	12.33
1971	0.37	5.47	12.23	15.84	18.48	17.35	15.45
1972	2.75	3.65	11.38	14.71	17.20	15.36	16.26

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APPENDIX TABLE A.10--continued.

Year	District 2: Stockton						
	Age of tree						
	2	3	4	5	6-15	16-20	21+
	tons per acre						
Extra early							
1956	1.39	0.00	0.00	0.00	15.81	0.00	0.00
1957	0.13	2.35	0.00	0.00	6.78	12.10	0.00
1958	0.00	2.44	3.59	0.00	12.89	9.80	0.00
1959	0.89	2.20	5.19	15.25	13.72	7.50	0.00
1960	0.89	3.67	4.68	6.40	12.72	6.50	0.00
1961	0.58	2.35	5.85	6.58	9.65	13.33	4.00
1962	1.10	4.03	5.58	8.92	10.00	12.28	5.33
1963	0.00	2.56	5.85	5.60	9.48	13.28	4.00
1964	1.79	6.12	5.94	11.68	10.39	16.80	0.00
1965	1.03	7.04	9.21	8.14	11.80	15.38	0.00
1966	0.93	2.32	11.72	9.68	10.60	0.00	12.86
1967	0.99	1.98	5.59	11.18	9.31	0.00	11.43
1968	0.04	1.92	4.62	7.77	10.95	0.00	7.93
1969	0.82	4.09	8.73	11.10	11.93	0.00	12.92
1970	0.45	3.02	4.56	6.33	9.33	0.00	9.97
1971	0.80	6.45	6.56	9.77	11.49	13.21	8.66
1972	0.09	4.90	7.10	7.20	9.24	0.00	0.00
Early							
1956	0.57	0.88	5.60	7.69	11.28	11.28	10.26
1957	0.15	2.00	2.84	6.55	8.46	8.17	6.13
1958	0.05	0.86	3.21	3.41	7.62	8.74	6.56
1959	1.36	3.11	4.73	8.63	8.74	8.73	6.20
1960	0.25	2.81	3.93	5.02	8.37	9.08	6.96
1961	0.38	1.28	4.49	4.68	8.61	9.76	8.58
1962	0.29	2.57	4.45	5.61	9.56	9.91	9.02
1963	1.19	2.82	5.23	5.50	8.64	9.95	9.84
1964	0.42	5.78	7.98	7.26	10.73	13.32	15.58
1965	0.00	0.21	7.76	4.10	4.35	3.28	5.05
1966	1.13	4.09	7.22	8.57	6.36	8.78	6.60
1967	1.48	2.29	4.48	4.50	6.62	7.79	6.14
1968	0.00	4.25	5.48	7.33	8.19	8.83	9.80
1969	1.04	4.54	12.65	8.67	9.78	9.17	11.38
1970	0.16	6.77	5.92	11.56	8.97	8.02	10.04
1971	1.07	4.82	9.23	9.29	11.02	8.75	10.75
1972	0.00	7.11	8.45	12.15	11.20	10.76	6.32

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APPENDIX TABLE A.10--continued.

Year	District 2: Stockton						
	Age of tree						
	2	3	4	5	6-15	16-20	21+
	tons per acre						
Late							
1956	1.07	2.29	7.84	7.24	13.57	13.14	11.69
1957	0.53	3.90	5.81	10.60	11.22	9.71	9.14
1958	0.26	1.99	5.08	6.39	10.12	11.70	9.60
1959	2.23	3.61	7.69	10.45	10.76	11.05	10.11
1960	0.71	4.85	5.10	9.45	11.49	11.51	9.51
1961	0.51	2.90	6.28	6.66	11.18	10.84	10.37
1962	1.23	4.11	6.83	9.21	12.61	13.55	12.74
1963	0.60	3.18	6.02	8.98	12.34	13.07	13.94
1964	0.39	1.95	7.57	8.86	12.92	16.26	13.14
1965	0.18	1.66	5.25	5.69	6.57	7.27	6.28
1966	0.71	2.44	8.88	11.13	10.06	11.07	9.93
1967	0.55	1.64	3.23	7.97	7.73	6.42	7.71
1968	0.22	0.54	2.52	3.03	7.51	8.59	8.24
1969	0.23	5.12	7.57	10.56	12.59	11.87	12.29
1970	0.45	1.58	4.17	4.39	9.63	7.64	10.04
1971	1.65	6.10	4.73	10.17	13.09	13.65	11.25
1972	0.00	6.79	7.65	8.08	11.92	10.73	12.21
Extra late							
1956	1.00	2.92	8.90	12.39	14.38	12.76	9.03
1957	0.43	6.29	6.98	11.69	9.70	8.32	7.53
1958	0.21	1.47	8.46	5.95	10.31	12.48	7.01
1959	0.97	4.72	7.31	11.98	11.67	11.01	8.25
1960	0.77	4.13	6.35	8.88	12.83	9.89	9.64
1961	0.31	3.99	5.72	7.39	11.30	10.80	9.82
1962	0.35	3.72	9.43	10.88	14.28	13.38	14.74
1963	0.96	1.99	7.02	14.20	13.93	12.88	11.60
1964	0.57	4.67	5.39	8.39	12.33	12.67	13.28
1965	0.52	3.97	8.22	6.32	8.79	9.46	7.09
1966	0.55	3.46	11.10	14.02	11.40	12.19	10.34
1967	0.13	1.47	2.69	6.59	8.84	6.80	5.68
1968	0.00	0.60	2.19	5.23	7.26	6.53	6.20
1969	0.23	3.98	6.64	9.33	12.69	10.61	10.83
1970	0.03	1.52	4.67	6.31	8.06	10.59	9.68
1971	0.00	2.08	5.56	10.26	11.63	7.22	12.34
1972	0.00	0.00	6.57	9.10	11.66	3.08	0.00

(Continued on next page.)

APPENDIX TABLE A.10--continued.

Year	District 3: Modesto						
	Age of tree						
	2	3	4	5	6-15	16-20	21+
	tons per acre						
Extra early							
1956	1.00	3.79	7.29	10.12	15.42	13.05	8.33
1957	0.73	3.91	5.72	10.82	10.46	10.08	1.58
1958	0.88	2.38	6.02	7.12	10.29	10.38	0.00
1959	1.90	4.50	7.27	9.36	10.40	10.15	4.95
1960	1.11	4.18	7.33	9.68	11.64	10.55	6.38
1961	1.05	3.43	7.63	10.13	12.10	12.12	8.15
1962	1.55	3.67	7.46	10.85	13.09	13.09	11.30
1963	1.01	4.16	6.46	9.55	13.39	13.61	12.07
1964	1.67	4.83	9.29	10.21	15.12	14.91	16.27
1965	2.14	5.18	9.01	13.42	14.96	13.24	15.10
1966	2.32	5.49	8.50	10.27	13.20	10.91	12.90
1967	1.39	4.55	7.12	8.96	11.78	12.05	11.13
1968	1.49	4.74	7.56	9.70	14.07	10.48	12.32
1969	2.07	4.56	9.19	12.67	14.19	11.84	12.01
1970	1.45	4.42	7.37	10.28	12.87	11.46	10.70
1971	1.88	4.70	8.20	9.66	14.55	13.05	12.15
1972	1.77	2.52	5.85	8.21	11.48	12.20	10.71
Early							
1956	0.37	2.96	5.99	9.55	13.26	12.04	11.12
1957	0.27	2.74	6.34	7.98	11.48	9.93	9.52
1958	0.20	1.19	3.61	6.44	9.19	9.47	8.01
1959	1.79	4.72	7.42	8.16	11.54	11.00	9.71
1960	1.42	4.05	7.03	8.72	11.74	11.15	9.88
1961	0.54	4.11	7.09	9.63	12.43	12.65	10.75
1962	1.21	1.89	6.50	9.55	12.21	12.09	11.63
1963	0.82	3.30	3.56	9.27	12.68	12.97	12.36
1964	0.70	2.78	7.15	6.80	14.07	14.93	14.67
1965	0.70	3.86	5.14	7.85	9.94	9.34	7.33
1966	1.15	3.66	7.00	8.21	10.39	9.33	9.25
1967	1.35	2.23	4.33	7.33	8.25	8.69	8.93
1968	1.64	5.24	6.49	6.58	10.48	11.74	12.08
1969	1.29	5.55		11.06	11.48	10.40	11.36
1970	1.89	3.04	6.87	12.84	10.74	10.95	10.64
1971	1.63	5.88	6.50	10.72	11.94	11.13	11.81
1972	2.66	1.61	7.00	7.54	8.61	7.48	10.37

(Continued on next page.)

APPENDIX TABLE A.10--continued.

Year	District 3: Modesto						
	Age of tree						
	2	3	4	5	6-15	16-20	21+
	tons per acre						
Late							
1956	0.89	3.73	7.83	12.75	15.06	13.96	13.50
1957	0.62	4.56	8.00	10.95	14.16	12.66	11.66
1958	0.48	2.42	6.42	9.04	12.92	10.77	10.56
1959	2.18	5.03	9.33	12.28	14.87	11.67	11.90
1960	1.07	4.55	7.80	11.36	15.05	12.42	12.49
1961	1.12	3.69	8.13	11.03	15.87	14.41	13.37
1962	1.55	3.87	7.84	11.71	15.37	13.97	13.33
1963	0.98	4.22	7.61	11.06	16.28	15.52	14.73
1964	0.88	3.57	8.32	10.28	16.02	14.19	14.15
1965	1.25	4.63	8.06	11.97	13.35	11.89	9.63
1966	1.42	5.34	9.64	12.20	15.22	14.37	12.48
1967	0.52	2.39	5.46	8.10	10.68	11.74	10.22
1968	1.18	4.42	8.15	9.61	14.02	15.47	13.66
1969	1.31	5.17	9.28	12.52	15.00	15.04	13.23
1970	1.08	3.39	7.74	11.18	13.71	15.58	14.17
1971	1.05	4.56	8.50	12.60	16.19	16.37	15.42
1972	2.24	2.06	5.73	10.44	13.30	14.04	14.37
Extra late							
1956	0.71	4.31	5.74	12.09	15.20	13.20	10.28
1957	0.59	3.30	8.27	10.77	13.63	12.31	6.12
1958	0.30	1.94	4.82	8.58	10.13	7.89	6.75
1959	2.48	6.28	10.58	11.09	13.77	12.99	11.63
1960	0.97	4.93	9.43	13.02	14.07	12.69	12.07
1961	0.74	3.73	8.41	11.87	14.72	14.17	11.29
1962	1.57	3.91	9.11	13.27	15.92	15.90	14.98
1963	0.81	5.05	7.51	10.09	16.75	16.09	15.20
1964	0.64	3.40	9.29	10.47	15.68	14.98	14.06
1965	1.44	5.02	9.03	14.05	15.61	14.73	12.66
1966	1.38	5.59	10.07	12.90	15.88	15.86	13.87
1967	0.54	2.67	5.23	8.37	10.74	11.36	9.66
1968	1.00	4.19	8.31	9.72	14.33	12.05	13.39
1969	0.95	4.41	8.38	9.88	12.87	12.10	9.09
1970	0.97	2.97	7.37	9.82	13.68	12.66	14.84
1971	1.00	4.81	9.35	13.11	16.30	14.69	13.80
1972	1.69	3.11	5.40	9.69	13.68	13.20	14.05

(Continued on next page.)

APPENDIX TABLE A.10--continued.

	District 4: Visalia						
	Age of tree						
Year	2	3	4	5	6-15	16-20	21+
	tons per acre						
Extra early							
1956	0.70	4.93	11.70	11.33	13.73	0.00	0.00
1957	1.34	3.11	7.79	10.27	11.06	0.00	0.00
1958	0.72	3.17	7.25	10.64	12.32	0.00	0.00
1959	1.44	3.67	7.26	10.92	11.42	12.50	0.00
1960	0.72	4.48	7.47	9.63	12.60	15.44	0.00
1961	1.06	3.69	9.43	9.62	12.76	10.85	0.00
1962	0.91	4.63	7.40	12.49	13.23	12.36	0.00
1963	0.24	4.67	8.38	11.02	14.66	11.14	0.00
1964	0.97	5.45	10.54	12.38	15.67	14.69	0.00
1965	2.13	5.54	8.32	12.89	16.00	11.98	17.24
1966	2.05	4.19	7.80	9.06	15.52	11.55	13.30
1967	2.19	3.11	7.99	11.31	15.13	12.08	11.44
1968	2.10	5.83	5.99	9.08	15.74	13.84	11.63
1969	1.44	6.95	9.27	8.07	14.72	13.46	14.17
1970	1.54	4.48	10.49	9.47	13.12	17.46	12.71
1971	1.80	5.51	9.05	13.61	15.69	18.58	14.97
1972	1.05	4.47	4.75	9.01	12.64	11.25	0.00
Early							
1956	0.72	2.12	5.63	14.06	13.52	12.58	11.34
1957	0.48	2.45	5.02	9.91	11.09	9.72	9.58
1958	0.29	2.35	6.11	8.32	11.54	11.51	10.49
1959	1.24	3.96	7.65	10.92	12.68	10.34	11.15
1960	0.77	3.62	7.40	10.26	12.58	10.76	12.14
1961	0.78	2.67	6.71	9.51	12.90	11.77	12.83
1962	0.35	3.99	5.70	11.13	12.89	12.54	13.40
1963	0.99	2.11	9.50	8.94	14.16	14.23	13.22
1964	1.26	6.98	7.61	13.47	14.99	15.84	15.46
1965	0.83	3.85	8.36	8.87	13.74	13.63	12.80
1966	1.05	3.64	6.67	8.59	14.34	12.12	13.20
1967	0.43	2.03	6.02	7.81	12.72	10.50	12.47
1968	1.19	3.62	5.96	10.13	13.50	13.06	13.66
1969	1.50	4.64	7.00	10.27	12.64	12.02	11.11
1970	1.69	4.45	7.23	11.03	12.27	13.93	14.31
1971	1.03	5.89	8.45	10.90	12.58	13.80	14.29
1972	1.16	1.92	5.57	9.65	11.94	13.09	8.55

(Continued on next page.)

APPENDIX TABLE A.10--continued.

Year	District 4: Visalia						
	Age of tree						
	2	3	4	5	6-15	16-20	21+
	tons per acre						
Late							
1956	0.69	4.36	8.22	15.99	15.44	13.99	9.70
1957	0.12	2.75	8.53	11.85	12.51	11.21	9.37
1958	0.34	3.30	7.52	10.28	13.59	12.16	10.84
1959	1.04	3.62	7.43	11.01	14.98	12.55	11.35
1960	0.96	4.21	7.43	9.88	15.57	12.16	11.86
1961	0.56	4.00	8.85	11.35	16.65	13.30	12.74
1962	1.42	3.88	8.62	11.86	14.31	13.76	12.69
1963	0.32	3.56	8.74	13.35	17.03	17.29	14.54
1964	0.45	5.79	10.85	12.64	16.97	16.08	15.72
1965	0.98	4.00	10.24	14.36	16.65	17.41	14.76
1966	1.50	5.12	9.80	14.58	15.13	14.29	13.00
1967	1.47	4.27	5.98	13.22	14.93	15.63	12.06
1968	0.92	4.81	10.10	11.79	16.02	16.26	12.61
1969	1.47	4.30	12.01	15.17	15.29	15.83	11.49
1970	1.28	5.26	9.35	15.21	15.11	16.07	13.14
1971	1.39	5.11	10.47	10.17	14.39	16.64	14.09
1972	1.20	3.78	4.26	9.77	11.82	14.29	14.41
Extra late							
1956	0.35	1.67	8.94	14.68	14.57	15.69	12.70
1957	0.75	3.86	5.63	9.70	11.63	10.58	10.39
1958	0.25	2.96	8.16	5.71	11.07	9.99	9.42
1959	0.51	3.20	9.31	12.25	12.47	12.65	10.48
1960	0.69	3.08	7.34	11.95	13.13	13.63	13.70
1961	0.34	2.70	6.71	10.31	14.46	13.51	13.97
1962	0.56	4.46	7.16	9.72	13.00	11.87	13.07
1963	0.77	2.79	7.96	12.41	14.10	14.46	14.16
1964	0.00	9.79	10.37	9.50	14.85	12.91	12.34
1965	0.83	0.15	15.38	12.26	13.83	12.44	13.20
1966	1.42	4.92	8.53	20.83	13.47	12.10	12.40
1967	0.70	5.01	4.25	9.49	11.02	16.25	10.24
1968	0.80	3.08	9.00	9.50	13.09	18.66	9.86
1969	0.52	3.54	9.25	10.95	10.73	10.09	11.60
1970	1.45	3.82	6.77	12.89	12.53	9.91	10.49
1971	0.90	4.76	6.01	9.97	13.51	11.39	12.76
1972	1.13	1.47	1.57	3.86	9.77	9.19	0.00

Source: Cling Peach Advisory Board (annual issues).

APPENDIX B

ESTIMATION OF PRODUCTION COSTS

APPENDIX B

Estimation of Production Costs

For purposes of this analysis, it would have been desirable to have had available a continuous series of annual cling peach production costs which would represent the average experience of the industry. Unfortunately, such a series does not exist. What is available are periodic Agricultural Extension Service sample cost–of–production studies for particular counties or subregions, some Bank of America studies, and a few other special studies (Appendix Table B.1). None of these studies is representative of the entire industry nor are any of them based on random samples, even for the limited areas they represent. For the most part, the information was obtained from typical successful growers who were willing to participate. The individual studies vary both in time and across counties in accordance with varying specifications as to wage rates, input prices, and physical requirements and yields.

In view of the considerable variation among studies, it was concluded that the best way to develop consistent cost series for our industry model was to choose what appeared to be the most widely representative study for a particular year and then adjust these costs for other years in accordance with the index of prices paid by farmers for farm inputs, CI. The 1970 study for Sacramento County and the San Joaquin Valley was chosen for this purpose. The cost components of the study are given in Appendix Table B.2.

The cultivation cost per ton prior to harvest, C_1, is defined to include direct cultural costs excluding thinning, overhead costs excluding the marketing order cost, annual investment costs, and management cost. The value of C_1 was computed by dividing the sum of per acre costs of these components by the gross yield (which includes losses from eventual cullage) of 17.67 tons per acre.

In estimating the management component of C_1, the value of $60.00 per acre given in Appendix Table B.2 was not used. The latter value was calculated as 5 percent of gross product value. This has been common practice in many Cooperative Extension cost studies. In the absence of any other data, it may provide a crude approximation of general experience; but it has little foundation in actual measurement and fluctuates with assumed product price and yield. Dean and Carter––in their 1963 study of economies of scale in cling peach production––estimated that, for operations up to 100 acres, the owner–operator would provide all supervisory inputs; then a foreman would be added for each additional 100 acres. The costs in Appendix Table B.2 reflect approximately a 100–acre operation. With 1970 supervisory wages of $550–$600 per month and top management somewhat higher, a combined management cost of about $7,400 per year seems reasonable which amounts to $74 per acre. This is close to the Appendix Table B.2 figure and is, itself, very crude but seems a conceptually better estimating procedure.

The sum of the component costs per acre is $706.50 which, when divided by 17.67, gives a 1970 value for C_1 of $39.98 per ton.

APPENDIX TABLE B.1

Sources of Cost Data

Date of study	Author (s)	Area of study
1958-59	Faris	Yuba City-Marysville
1959	Carter-Dean	Yuba City-Marysville
1960	Agricultural Extension Service	Stanislaus County
1965	Agricultural Extension Service	Fresno County
1967	Agricultural Extension Service	Tulare County
1967	Agricultural Extension Service	Peach Bowl
1967	Agricultural Extension Service	Stanislaus County
1968	Bank of America	Sutter and Yuba counties
1968-69	Agricultural Extension	Merced, San Joaquin, and Stanislaus counties
1969	Bank of America	Visalia area
1969	Bank of America	Linden and Modesto area
1969	Bank of America	Merced area
1970	Agricultural Extension Service	Sacramento County and San Joaquin Valley
1970	Agricultural Extension Service	Kings County
1970	Agricultural Extension Service	Fresno County
1970	Johnson-Grise	Stanislaus County
1971	Bank of America	Fresno-Merced area
1972	Bank of America	Fresno area
1973	Bank of America	Fresno area
1973	Agricultural Extension Service	San Joaquin Valley
1973	Agricultural Extension Service	Sacramento and San Joaquin Valleys

APPENDIX TABLE B.2

Costs to Produce Cling Peaches, One-Acre Basis (109 trees per acre; 16 tons, No. 1 fruit)
Sacramento and San Joaquin Valley Areas, 1970

Type of operation and cost	Time (hours per acre)	Cost per acre: Labor	Fuel and repairs	Material	Total		Percent of cost
Cultural cost							
Prune ($0.90 per tree)	--[a]	$ 98.10	$ 1.40	$ --	$ 99.50		12
Brush removal	2.0	3.80	3.40	--	7.20		
Wire and prop	4.0	7.60	.25	2.00	9.85		
Spray (5X; 2 men)	5.0	10.38	9.63	65.00	85.01		10
Fertilizer (approximately @ 1.50 + 150 N. @ $0.12)	--	--	--	19.50	19.50		
Thin ($1.60 per tree)	--	174.40	--	--	174.40		21
Cultivate (4X; 2 ways)	4.0	9.00	6.00	--	15.00		
Ridge (4X)	0.8	1.80	1.16	--	2.96		
Knock ridge	0.4	.90	.58	--	1.48		
Irrigate (6X)	12.0	22.80	--	9.75	32.55		4
Miscellaneous	3.0	5.70	1.50	--	7.20		
Total cultural costs		$334.48	$23.92	$96.25		$454.65	47
Harvest cost							
Pick and haul (17-2/3 tons @ $14)						$247.33	30
Cash overhead							
Miscellaneous, office, etc.					$42.11		
Taxes							
Land ($1,200 x 25 percent x 7 percent rate)		$21.00					
Trees ($1,200 x 25 percent x 7 percent rate)		21.00					
Equipment ($288 + 2 x 25 percent x 7 percent rate)		2.52					
Total taxes					44.52		
Marketing order ($2.25 per ton)					36.00		
Total cash overhead and taxes						$122.63	
TOTAL CASH COST						$824.61	
Management (5 percent of 16 tons @ $75)					$60.00		7

Investment	Per acre	Annual cost: Depreciation	Interest @ 7 percent	Total	Percent of cost
Land	$1,200	--	$ 84.00		
Trees	1,200	$ 85.71	42.00		
Irrigation system	110	5.50	3.85		
Buildings	75	3.00	2.63		
Equipment	288	28.81	10.12		
	$2,873	$123.02	$142.60		
Total annual cost				$ 265.62	32
TOTAL COST PER ACRE				$1,150.23	
Cost per ton @ 16-ton yield				$ 71.89	

[a]Dashes indicate not applicable.

Source: The investment costs in this study were based on 1969 values, but the current input prices were in 1970 dollars; see University of California, Agricultural Extension Service (1970).

The 1970 value for C_2 (harvesting and thinning costs) was obtained by combining the thinning cost of \$174.40 and the harvest cost of \$247.33 and, again, dividing by 17.67 tons per acre. This gave a value of \$23.87 per ton.

The study reported in Appendix Table B.2 did not include costs of green drop, C_3. However, two other 1970 studies (Kings and Fresno counties) were found which indicated that green–drop costs were about one–half of thinning costs, roughly 80 cents per tree or \$87.20 per acre in 1970. To convert to an average–cost–per–ton basis, the per acre cost was divided by the 1956–1972 statewide average yield of 13.36 tons per acre. This was used as a more representative industry figure than the 17.67 figure assumed in the Appendix Table B.2 study.[1] The 1970 value obtained for C_3 was \$6.56 per ton.

The complete historical series for C_1, C_2, and C_3, obtained by adjusting the 1970 values by the index of prices paid by farmers (given in Appendix Table A.9), is presented in Appendix Table B.3. A comparison of these values with costs reported in the studies listed in Appendix Table B.1 suggested that the overall movement was roughly comparable. Although the C_1, C_2, and C_3 estimates cannot be viewed as representing average industry costs, they are consistent in their specifications over time and thus provide indicators of the general level and movement of costs for a typical set of producers.

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[1]Note that it would not be appropriate to use the statewide average yield in converting the Appendix Table B.2 acreage costs to a per ton basis since the higher yield specified for this study likely is associated with somewhat higher cultural costs. This is not the case for the green–drop component.

APPENDIX TABLE B.3

Historical Production Cost Series Used in the Grower Supply Model, 1956-1972

Year	C_1	C_2	C_3
	1	2	3
	dollars per ton		
1956	25.29	15.10	4.15
1957	26.65	15.91	4.38
1958	26.99	16.12	4.43
1959	28.02	16.73	4.60
1960	28.70	17.14	4.71
1961	29.04	17.34	4.77
1962	29.39	17.54	4.82
1963	30.07	17.95	4.94
1964	30.75	18.36	5.05
1965	31.44	18.77	5.16
1966	32.80	19.58	5.39
1967	34.17	20.40	5.61
1968	35.88	21.42	5.89
1969	37.92	22.64	6.23
1970	39.98	23.87	6.56
1971	42.37	25.30	6.96
1972	44.42	26.52	7.29

Sources:

Cols. 1 and 2: Computed from Appendix Table A.2, *supra*, p. 101.

Col. 3: Computed from data, *supra*, p. 49.

APPENDIX C

RESULTS FROM THE CONTROLLED–MARKET SIMULATION MODEL AND FREE–MARKET SIMULATION MODEL

APPENDIX TABLE C.1

Convergence Trial Data With Initial Endogenous Variables as Predicted for 1972 Using the Controlled-Market Model With Stochastic Yield Model, 1956-1972

										Total farm income			Net returns per ton produced	
											Net			
										Gross	Actual	Deflated	Actual	Deflated
Year	TA	E	N	Y	Q^P	Q^m	P	P^1	P^2	$(P \cdot Q^m)$	$(R \cdot Q^P)$	$(AR \cdot Q^P)$	(R)	(AR)
	acres			tons			dollars per ton	dollars per case		1,000 dollars			dollars	
Initial	65,610	4,919	0	11.17	658,290	594,699	65.84	6.02	7.95	39,157	-12,176	-9,366	-18.50	-14.23
1	64,440	4,830	3,749	11.56	669,981	604,323	75.10	6.15	8.06	45,383	- 9,330	-7,177	-13.93	-10.71
2	63,165	4,180	3,554	11.92	666,762	601,420	78.56	6.22	8.10	47,250	- 1,826	-1,405	- 2.74	- 2.11
3	62,668	4,495	3,683	11.98	665,249	600,055	80.25	6.26	8.12	48,156	- 5,173	-3,979	- 7.78	- 5.98
4	61,561	4,421	3,388	11.99	654,567	590,420	82.02	6.30	8.18	48,423	- 6,169	-4,745	- 9.42	- 7.25
5	60,814	4,107	3,674	11.94	642,932	579,924	84.26	6.35	8.25	48,862	- 4,795	-3,688	- 7.46	- 5.74
6	60,690	3,971	3,982	11.92	633,160	571,110	86.57	6.40	8.32	49,441	- 3,953	-3,041	- 6.24	- 4.80
7	60,438	3,676	3,719	11.89	627,978	566,436	88.41	6.44	8.37	50,080	- 1,326	-1,020	- 2.11	- 1.62
8	60,729	3,492	3,967	11.81	627,142	565,682	89.45	6.46	8.38	50,600	682	525	1.09	0.84
9	61,550	3,452	4,314	11.81	630,257	568,492	89.59	6.46	8.37	50,930	1,575	1,212	2.50	1.92
10	62,716	3,289	4,617	11.78	634,840	572,625	89.06	6.44	8.34	50,998	4,270	3,284	6.73	5.17
11	64,484	3,515	5,058	11.71	642,958	579,948	87.86	6.42	8.29	50,953	3,628	2,791	5.64	4.34
12	66,070	3,791	5,101	11.61	650,564	586,809	86.32	6.38	8.24	50,652	2,767	2,128	4.25	3.27
13	67,265	4,415	4,987	11.48	657,745	593,286	84.73	6.35	8.19	50,267	- 2,189	-1,684	- 3.33	- 2.56
14	67,422	5,044	4,572	11.40	660,961	596,187	83.53	6.33	8.16	49,797	- 8,444	-6,496	-12.78	- 9.83
15	66,082	5,047	3,704	11.38	658,939	594,363	83.13	6.32	8.17	49,410	- 9,666	-7,435	-14.67	-11.28
16	64,137	3,847	3,102	11.45	657,364	592,942	83.20	6.32	8.18	49,331	945	727	1.44	1.11
17	63,730	3,865	3,441	11.67	668,428	602,922	82.21	6.30	8.12	49,567	367	282	0.55	0.42
18	63,827	3,915	3,961	11.93	674,210	608,137	80.87	6.27	8.08	49,179	- 445	- 342	- 0.66	- 0.51
19	64,550	3,967	4,639	12.03	674,276	608,197	80.14	6.26	8.07	48,741	- 888	- 683	- 1.32	- 1.01
20	65,607	3,976	5,024	11.97	671,025	605,265	80.16	6.26	8.08	48,515	- 875	- 673	- 1.30	- 1.00
21	66,089	3,960	4,458	11.79	668,502	602,989	80.51	6.27	8.10	48,546	- 659	- 507	- 0.99	- 0.76
22	66,292	3,966	4,163	11.59	669,665	604,038	80.63	6.27	8.10	48,700	- 590	- 454	- 0.88	- 0.68
23	66,442	3,992	4,116	11.59	675,167	609,000	80.11	6.25	8.07	48,786	- 909	- 699	- 1.35	- 1.04
24	66,685	4,069	4,235	11.68	682,107	615,261	79.06	6.23	8.03	48,644	- 1,561	-1,201	- 2.29	- 1.76
25	66,981	4,173	4,365	11.76	687,612	620,226	77.91	6.21	7.99	48,320	- 2,291	-1,762	- 3.33	- 2.56

(Continued on next page.)

APPENDIX TABLE C.1--continued.

Year	TA	E	N	Y	Q^p	Q^m	P	P^1	P^2	Total farm income			Net returns per ton produced	
										Gross	Net			
											Actual	Deflated	Actual	Deflated
										$(P \cdot Q^m)$	$(R \cdot Q^P)$	$(AR \cdot Q^P)$	(R)	(AR)
	acres			tons			dollars per ton	dollars per case		1,000 dollars			dollars	
26	67,083	4,267	4,275	11.79	690,155	622,520	77.04	6.19	7.97	47,957	-2,841	-2,185	-4.12	-3.17
27	66,919	4,342	4,103	11.76	689,503	621,931	76.67	6.18	7.97	47,683	-3,067	-2,359	-4.45	-3.42
28	66,544	4,380	3,968	11.74	687,611	620,225	76.71	6.19	7.98	47,580	-3,031	-2,331	-4.41	-3.39
29	66,099	4,384	3,935	11.76	685,181	618,033	77.01	6.19	7.99	47,596	-2,836	-2,181	-4.14	-3.18
30	65,710	4,352	3,996	11.79	682,294	615,429	77.47	6.20	8.01	47,679	-2,540	-1,954	-3.72	-2.86
31	65,434	4,269	4,076	11.82	679,175	612,616	78.04	6.21	8.03	47,808	-2,182	-1,678	-3.21	-2.47
32	65,302	4,163	4,136	11.83	676,242	609,970	78.64	6.23	8.05	47,969	-1,805	-1,388	-2.67	-2.05
33	65,314	4,094	4,176	11.81	674,092	608,031	79.18	6.24	8.06	48,146	-1,469	-1,130	-2.18	-1.68
34	65,430	4,071	4,209	11.78	672,909	606,964	79.59	6.25	8.07	48,306	-1,223	- 941	-1.82	-1.40
35	65,605	4,097	4,247	11.75	672,541	606,632	79.82	6.25	8.08	48,423	-1,078	- 829	-1.60	-1.23
36	65,788	4,148	4,280	11.73	672,686	606,763	79.92	6.25	8.08	48,492	-1,021	- 785	-1.52	-1.17
37	65,940	4,167	4,300	11.72	673,216	607,241	79.90	6.25	8.07	48,521	-1,031	- 793	-1.53	-1.18
38	66,075	4,172	4,301	11.71	674,070	608,011	79.80	6.25	8.07	48,520	-1,095	- 842	-1.62	-1.25
39	66,193	4,178	4,290	11.70	675,188	609,020	79.63	6.25	8.06	48,494	-1,202	- 925	-1.78	-1.37
40	66,287	4,193	4,272	11.70	676,367	610,083	79.41	6.24	8.06	48,446	-1,337	-1,028	-1.98	-1.52
41	66,348	4,215	4,254	11.70	677,443	611,053	79.18	6.24	8.05	48,384	-1,478	-1,137	-2.18	-1.68
42	66,368	4,229	4,235	11.70	678,481	611,990	78.96	6.23	8.04	48,322	-1,617	-1,244	-2.38	-1.83
43	66,355	4,232	4,216	11.71	679,376	612,797	78.75	6.23	8.04	48,258	-1,746	-1,343	-2.57	-1.98
44	66,320	4,225	4,197	11.73	680,097	613,448	78.57	6.22	8.03	48,199	-1,859	-1,430	-2.73	-2.10
45	66,276	4,215	4,180	11.74	680,630	613,928	78.43	6.22	8.03	48,147	-1,950	-1,500	-2.87	-2.20
46	66,227	4,208	4,166	11.75	680,957	614,224	78.32	6.22	8.03	48,105	-2,017	-1,551	-2.96	-2.28
47	66,174	4,205	4,155	11.75	681,095	614,347	78.25	6.22	8.02	48,073	-2,058	-1,583	-3.02	-2.32
48	66,118	4,203	4,149	11.76	681,037	614,295	78.23	6.22	8.02	48,053	-2,074	-1,595	-3.05	-2.34
49	66,060	4,201	4,145	11.77	680,782	614,066	78.24	6.22	8.03	48,044	-2,064	-1,588	-3.03	-2.33
50	66,005	4,199	4,145	11.77	680,342	613,669	78.29	6.22	8.03	48,046	-2,030	-1,561	-2.98	-2.30

(Continued on next page.)

APPENDIX TABLE C.1--continued.

Year	TA	E	N	Y	Q^p	Q^m	P	P^1	P^2	Total farm income: Gross $(P \cdot Q^m)$	Total farm income: Net: Actual $(R \cdot Q^p)$	Total farm income: Net: Deflated $(AR \cdot Q^p)$	Net returns per ton produced: Actual (R)	Net returns per ton produced: Deflated (AR)
	acres			tons			dollars per ton	dollars per case		1,000 dollars			dollars	
51	65,954	4,198	4,149	11.77	679,746	613,131	78.39	6.22	8.03	48,060	-1,972	-1,517	-2.90	-2.23
52	65,912	4,196	4,156	11.77	679,045	612,499	78.51	6.22	8.04	48,085	-1,895	-1,458	-2.79	-2.15
53	65,882	4,194	4,165	11.77	678,303	611,829	78.65	6.23	8.04	48,119	-1,807	-1,390	-2.66	-2.05
54	65,865	4,192	4,177	11.76	677,585	611,181	78.80	6.23	8.04	48,158	-1,715	-1,319	-2.53	-1.95
55	65,864	4,190	4,191	11.76	676,952	610,610	78.94	6.23	8.05	48,200	-1,626	-1,251	-2.40	-1.85
56	65,877	4,187	4,204	11.75	676,454	610,161	79.06	6.23	8.05	48,241	-1,549	-1,191	-2.29	-1.76
57	65,906	4,186	4,215	11.74	676,129	609,868	79.16	6.24	8.05	48,277	-1,488	-1,145	-2.20	-1.69
58	65,945	4,185	4,225	11.74	675,998	609,750	79.22	6.24	8.06	48,306	-1,450	-1,115	-2.15	-1.65
59	65,992	4,185	4,232	11.73	676,065	609,810	79.25	6.24	8.06	48,325	-1,436	-1,104	-2.12	-1.63
60	66,042	4,187	4,235	11.73	676,313	610,034	79.23	6.24	8.05	48,333	-1,446	-1,112	-2.14	-1.65
61	66,090	4,189	4,235	11.73	676,710	610,392	79.18	6.24	8.05	48,330	-1,478	-1,137	-2.18	-1.68
62	66,132	4,192	4,231	11.73	677,210	610,844	79.10	6.23	8.05	48,317	-1,528	-1,175	-2.26	-1.74
63	66,165	4,196	4,225	11.73	677,763	611,342	79.00	6.23	8.05	48,295	-1,591	-1,224	-2.35	-1.81
64	66,185	4,199	4,217	11.73	678,316	611,841	78.89	6.23	8.04	48,267	-1,660	-1,276	-2.45	-1.88
65	66,193	4,202	4,207	11.73	678,821	612,297	78.78	6.23	8.04	48,236	-1,728	-1,329	-2.55	-1.96
66	66,188	4,204	4,197	11.74	679,239	612,673	78.68	6.23	8.04	48,205	-1,790	-1,377	-2.64	-2.03
67	66,172	4,206	4,188	11.74	679,538	612,943	78.60	6.22	8.03	48,176	-1,841	-1,416	-2.71	-2.08
68	66,146	4,206	4,180	11.75	679,703	613,092	78.54	6.22	8.03	48,152	-1,877	-1,444	-2.76	-2.12
69	66,114	4,205	4,174	11.75	679,730	613,116	78.51	6.22	8.03	48,134	-1,897	-1,459	-2.79	-2.15
70	66,079	4,204	4,170	11.75	679,626	613,023	78.50	6.22	8.03	48,124	-1,899	-1,461	-2.79	-2.15
71	66,044	4,202	4,169	11.76	679,411	612,829	78.53	6.22	8.03	48,122	-1,885	-1,450	-2.78	-2.13
72	66,013	4,200	4,170	11.76	679,110	612,557	78.57	6.22	8.04	48,128	-1,858	-1,429	-2.74	-2.10
73	65,986	4,197	4,174	11.76	678,755	612,237	78.63	6.23	8.04	48,139	-1,820	-1,400	-2.68	-2.06
74	65,968	4,195	4,178	11.76	678,379	611,898	78.70	6.23	8.04	48,156	-1,775	-1,365	-2.62	-2.01
75	65,957	4,193	4,185	11.75	678,014	611,569	78.78	6.23	8.04	48,176	-1,729	-1,330	-2.55	-1.96

(Continued on next page.)

APPENDIX TABLE C.1--continued.

										Total farm income			Net returns per ton produced	
											Net			
										Gross	Actual	Deflated	Actual	Deflated
Year	TA	E	N	Y	Q^p	Q^m	P	P^1	P^2	$(P \cdot Q^m)$	$(R \cdot Q^p)$	$(AR \cdot Q^p)$	(R)	(AR)
	acres			tons			dollars per ton	dollars per case		1,000 dollars			dollars	
76	65,955	4,192	4,191	11.75	677,690	611,277	78.85	6.23	8.04	48,197	-1,683	-1,295	-2.48	-1.91
77	65,961	4,191	4,198	11.75	677,430	611,042	78.91	6.23	8.05	48,218	-1,644	-1,264	-2.43	-1.87
78	65,974	4,190	4,204	11.75	677,251	610,881	78.96	6.23	8.05	48,236	-1,612	-1,240	-2.38	-1.83
79	65,993	4,190	4,209	11.74	677,163	610,801	79.00	6.23	8.05	48,251	-1,590	-1,223	-2.35	-1.81
80	66,015	4,191	4,212	11.74	677,166	610,804	79.01	6.23	8.05	48,262	-1,580	-1,215	-2.33	-1.80
81	66,039	4,192	4,214	11.74	677,254	610,883	79.01	6.23	8.05	48,267	-1,581	-1,216	-2.34	-1.80
82	66,062	4,193	4,215	11.74	677,414	611,028	79.00	6.23	8.05	48,268	-1,593	-1,225	-2.35	-1.81
83	66,082	4,194	4,214	11.74	677,629	611,221	78.96	6.23	8.05	48,263	-1,613	-1,241	-2.38	-1.83
84	66,099	4,196	4,211	11.74	677,877	611,445	78.92	6.23	8.04	48,254	-1,640	-1,261	-2.42	-1.86
85	66,111	4,197	4,208	11.74	678,135	611,677	78.87	6.23	8.04	48,242	-1,671	-1,285	-2.46	-1.90
86	66,117	4,199	4,203	11.74	678,381	611,899	78.82	6.23	8.04	48,228	-1,703	-1,310	-2.51	-1.93
87	66,117	4,200	4,199	11.74	678,596	612,093	78.77	6.23	8.04	48,214	-1,734	-1,333	-2.56	-1.97
88	66,111	4,200	4,194	11.74	678,763	612,244	78.73	6.23	8.04	48,200	-1,760	-1,354	-2.59	-2.00
89	66,102	4,200	4,190	11.74	678,873	612,343	78.69	6.23	8.04	48,187	-1,780	-1,369	-2.62	-2.02
90	66,088	4,200	4,187	11.75	678,919	612,385	78.67	6.23	8.04	48,178	-1,793	-1,379	-2.64	-2.03
91	66,072	4,200	4,185	11.75	678,902	612,370	78.66	6.23	8.04	48,171	-1,799	-1,383	-2.65	-2.04
92	66,056	4,199	4,184	11.75	678,828	612,303	78.67	6.23	8.04	48,168	-1,796	-1,381	-2.65	-2.04
93	66,040	4,198	4,184	11.75	678,707	612,194	78.68	6.23	8.04	48,169	-1,786	-1,374	-2.63	-2.03
94	66,027	4,197	4,185	11.75	678,551	612,053	78.71	6.23	8.04	48,173	-1,771	-1,362	-2.61	-2.01
95	66,016	4,196	4,187	11.75	678,377	611,896	78.74	6.23	8.04	48,180	-1,751	-1,347	-2.58	-1.99
96	66,009	4,195	4,189	11.75	678,199	611,736	78.77	6.23	8.04	48,188	-1,730	-1,330	-2.55	-1.96
97	66,006	4,194	4,192	11.75	678,033	611,586	78.81	6.23	8.04	48,198	-1,708	-1,313	-2.52	-1.94
98	66,007	4,194	4,195	11.75	677,892	611,459	78.84	6.23	8.04	48,208	-1,687	-1,298	-2.49	-1.92
99	66,011	4,193	4,198	11.75	677,786	611,363	78.87	6.23	8.04	48,218	-1,670	-1,284	-2.46	-1.90

Source: Computed.

APPENDIX TABLE C.2

Convergence Trial Data With Initial Endogenous Variables as Predicted for 1972 Using the Free-Market Model With Stochastic Yield Model, 1956-1972

Year	TA	E	N	Y	Q^p	Q^m	P	P^1	P^2	Total farm income: Gross $(P \cdot Q^m)$	Total farm income: Net: Actual $(R \cdot Q^p)$	Total farm income: Net: Deflated $(AR \cdot Q^p)$	Net returns per ton produced: Actual (R)	Net returns per ton produced: Deflated (AR)
	acres			tons			dollars per ton	dollars per case		1,000 dollars			dollars	
Initial	81,524	7,294	0	11.35	855,177	772,566	51.31	5.64	7.19	39,643	-26,179	-20,138	-30.61	-23.55
1	77,069	7,510	2,839	11.69	846,349	763,407	49.50	5.62	7.17	37,786	-28,039	-21,568	-33.13	-25.48
2	71,820	6,827	2,261	12.17	812,630	732,992	51.35	5.67	7.27	37,639	-22,174	-17,057	-27.29	-20.99
3	66,751	6,477	1,758	12.36	775,911	699,872	55.54	5.76	7.43	38,874	-21,161	-16,277	-27.27	-20.98
4	61,373	5,779	1,099	12.49	731,361	659,688	61.60	5.89	7.64	40,637	-17,997	-13,843	-24.61	-18.93
5	57,162	4,992	1,568	12.60	687,025	619,697	69.02	6.05	7.89	42,772	-13,016	-10,013	-18.95	-14.57
6	54,667	4,479	2,497	12.72	643,974	580,864	77.36	6.22	8.17	44,937	- 8,455	- 6,503	-13.13	-10.10
7	53,260	3,911	3,073	12.71	606,949	547,468	86.01	6.41	8.44	47,090	- 2,410	- 1,854	- 3.97	- 3.06
8	53,172	3,438	3,823	12.45	576,730	520,210	94.34	6.58	8.69	49,078	2,919	2,245	5.06	3.89
9	54,283	2,938	4,549	12.11	556,780	502,216	104.92	6.81	8.89	52,694	8,523	6,556	15.31	11.78
10	56,769	2,499	5,424	11.74	549,981	496,083	109.41	6.90	8.99	54,277	13,795	10,612	25.08	19.30
11	60,758	2,712	6,487	11.40	557,434	502,805	108.51	6.86	8.96	54,561	13,531	10,408	24.27	18.67
12	65,022	3,134	6,977	11.08	572,344	516,254	105.09	6.77	8.86	54,252	12,124	9,326	21.18	16.30
13	68,869	4,148	6,980	10.78	592,962	534,852	100.07	6.66	8.70	53,525	5,388	4,145	9.09	6.99
14	70,863	5,115	6,143	10.59	612,822	552,766	96.31	6.58	8.55	53,236	- 2,549	- 1,961	- 4.16	- 3.20
15	70,422	5,280	4,674	10.54	629,941	568,206	92.85	6.51	8.41	52,757	- 5,354	- 4,119	- 8.50	- 6.54
16	68,779	3,966	3,638	10.72	649,631	585,967	88.84	6.43	8.28	52,055	4,239	3,261	6.53	5.02
17	68,578	4,155	3,765	11.15	682,928	616,001	83.24	6.31	8.08	51,277	1,010	777	1.48	1.14
18	68,569	4,314	4,147	11.62	705,641	636,488	77.83	6.20	7.92	49,536	- 2,402	- 1,847	- 3.40	- 2.62
19	68,878	4,381	4,623	11.90	716,487	646,272	74.07	6.12	7.84	47,867	- 4,869	- 3,746	- 6.80	- 5.23
20	69,201	4,336	4,703	11.98	718,614	648,190	72.09	6.09	7.81	46,725	- 6,168	- 4,744	- 8.58	- 6.60
21	68,638	4,235	3,774	11.91	717,775	647,433	71.30	6.07	7.80	46,164	- 6,667	- 5,129	- 9.29	- 7.15
22	67,697	4,159	3,293	11.82	717,699	647,364	71.01	6.07	7.80	45,969	- 6,857	- 5,274	- 9.55	- 7.35
23	66,755	4,125	3,217	11.92	719,110	648,638	70.76	6.06	7.80	45,898	- 7,031	- 5,408	- 9.78	- 7.52
24	66,028	4,142	3,398	12.09	719,057	648,590	70.62	6.06	7.79	45,801	- 7,124	- 5,480	- 9.91	- 7.62
25	65,507	4,183	3,621	12.21	715,026	644,954	70.91	6.06	7.81	45,732	- 6,897	- 5,305	- 9.65	- 7.42

(Continued on next page.)

APPENDIX TABLE C.2--continued.

										Total farm income			Net returns per ton produced	
											Net			
Year	TA	E	N	Y	Q^p	Q^m	P	P^1	P^2	Gross ($P \cdot Q^m$)	Actual ($R \cdot Q^p$)	Deflated ($AR \cdot Q^p$)	Actual (R)	Deflated (AR)
	acres			tons			dollars per ton	dollars per case		1,000 dollars			dollars	
26	64,954	4,226	3,630	12.22	706,361	637,138	71.90	6.09	7.85	45,808	-6,183	-4,756	-8.75	-6.73
27	64,314	4,269	3,586	12.14	693,872	625,873	73.66	6.13	7.92	46,101	-4,971	-3,824	-7.16	-5.51
28	63,666	4,293	3,621	12.04	680,571	613,875	75.96	6.18	8.00	46,631	-3,462	-2,663	-5.09	-3.91
29	63,162	4,291	3,789	11.97	667,976	602,514	78.49	6.23	8.08	47,292	-1,874	-1,441	-2.81	-2.16
30	62,930	4,240	4,060	11.91	656,820	592,452	81.00	6.28	8.16	47,989	- 355	- 273	-0.54	-0.42
31	63,023	4,125	4,333	11.84	647,873	584,382	83.28	6.33	8.22	48,668	981	755	1.52	1.17
32	63,453	3,990	4,555	11.75	642,008	579,092	85.12	6.37	8.27	49,289	2,034	1,565	3.17	2.44
33	64,180	3,913	4,716	11.64	639,967	577,250	86.29	6.39	8.29	49,809	2,704	2,080	4.23	3.25
34	65,090	3,910	4,824	11.53	641,786	578,891	86.66	6.39	8.29	50,167	2,928	2,252	4.56	3.51
35	66,062	3,978	4,882	11.46	646,941	583,540	86.24	6.38	8.26	50,322	2,704	2,080	4.18	3.22
36	66,963	4,082	4,879	11.42	654,537	590,392	85.13	6.36	8.21	50,260	2,082	1,602	3.18	2.45
37	67,689	4,152	4,808	11.42	663,716	598,672	83.52	6.32	8.16	50,003	1,150	884	1.73	1.33
38	68,214	4,207	4,677	11.45	673,580	607,570	81.62	6.28	8.09	49,589	10	7	0.02	0.01
39	68,515	4,262	4,508	11.50	683,221	616,266	79.62	6.24	8.03	49,067	-1,221	- 939	-1.79	-1.38
40	68,579	4,318	4,326	11.56	691,677	623,893	77.73	6.20	7.98	48,492	-2,418	-1,860	-3.50	-2.69
41	68,412	4,368	4,151	11.63	698,210	629,785	76.11	6.17	7.93	47,929	-3,462	-2,663	-4.96	-3.81
42	68,042	4,392	3,998	11.71	702,539	633,690	74.86	6.14	7.90	47,440	-4,270	-3,285	-6.08	-4.68
43	67,527	4,387	3,877	11.79	704,417	635,384	74.06	6.13	7.89	47,058	-4,790	-3,684	-6.80	-5.23
44	66,932	4,358	3,793	11.86	703,918	634,934	73.73	6.12	7.88	46,811	-5,000	-3,846	-7.10	-5.46
45	66,324	4,316	3,749	11.91	701,330	632,600	73.83	6.13	7.89	46,707	-4,914	-3,780	-7.01	-5.39
46	65,753	4,272	3,746	11.95	697,074	628,761	74.33	6.14	7.92	46,737	-4,570	-3,515	-6.56	-5.04
47	65,260	4,231	3,779	11.96	691,670	623,887	75.15	6.15	7.95	46,885	-4,025	-3,096	-5.82	-4.48
48	64,874	4,193	3,844	11.96	685,642	618,449	76.20	6.18	7.98	47,123	-3,343	-2,572	-4.88	-3.75
49	64,613	4,160	3,931	11.94	679,497	612,906	77.38	6.20	8.02	47,423	-2,590	-1,993	-3.81	-2.93
50	64,486	4,133	4,033	11.90	673,705	607,681	78.59	6.23	8.06	47,758	-1,830	-1,407	-2.72	-2.09

(Continued on next page.)

APPENDIX TABLE C.2--continued.

Year	TA	E	N	Y	Q^p	Q^m	P	P^1	P^2	Total farm income: Gross ($P \cdot Q^m$)	Total farm income: Net, Actual ($R \cdot Q^p$)	Total farm income: Net, Deflated ($AR \cdot Q^p$)	Net returns per ton produced: Actual (R)	Net returns per ton produced: Deflated (AR)
	acres			tons			dollars per ton	dollars per case		1,000 dollars			dollars	
51	64,494	4,114	4,141	11.86	668,672	603,143	79.75	6.25	8.09	48,099	-1,118	- 860	-1.67	-1.29
52	64,626	4,103	4,246	11.80	664,737	599,593	80.76	6.27	8.12	48,424	- 503	- 387	-0.76	-0.58
53	64,864	4,100	4,341	11.75	662,138	597,249	81.56	6.29	8.14	48,709	- 27	- 20	-0.04	-0.03
54	65,183	4,103	4,419	11.70	661,006	596,228	82.08	6.30	8.15	48,937	284	218	0.43	0.33
55	65,554	4,113	4,474	11.65	661,350	596,537	82.30	6.30	8.15	49,094	415	319	0.63	0.48
56	65,944	4,129	4,503	11.62	663,060	598,081	82.21	6.30	8.14	49,170	365	281	0.55	0.42
57	66,320	4,149	4,505	11.60	665,925	600,664	81.85	6.29	8.13	49,163	147	113	0.22	0.17
58	66,652	4,172	4,481	11.59	669,645	604,019	81.25	6.28	8.10	49,076	- 213	- 164	-0.32	-0.24
59	66,914	4,196	4,434	11.60	673,860	607,822	80.48	6.26	8.08	48,920	- 679	- 522	-1.01	-0.78
60	67,088	4,219	4,370	11.62	678,186	611,724	79.63	6.24	8.05	48,711	-1,206	- 927	-1.78	-1.37
61	67,164	4,240	4,296	11.64	682,245	615,385	78.77	6.23	8.03	48,471	-1,745	-1,342	-2.56	-1.97
62	67,143	4,255	4,218	11.68	685,704	618,505	77.97	6.21	8.00	48,222	-2,248	-1,729	-3.28	-2.52
63	67,032	4,265	4,145	11.71	688,304	620,850	77.29	6.20	7.98	47,988	-2,674	-2,057	-3.89	-2.99
64	66,847	4,268	4,080	11.75	689,881	622,272	76.80	6.19	7.97	47,788	-2,990	-2,300	-4.34	-3.33
65	66,609	4,265	4,030	11.78	690,371	622,715	76.50	6.18	7.97	47,637	-3,177	-2,444	-4.60	-3.54
66	66,341	4,257	3,998	11.81	689,811	622,210	76.41	6.18	7.97	47,545	-3,227	-2,483	-4.68	-3.60
67	66,068	4,243	3,984	11.83	688,325	620,869	76.53	6.18	7.98	47,516	-3,148	-2,421	-4.57	-3.52
68	65,813	4,227	3,988	11.84	686,104	618,866	76.83	6.19	7.99	47,546	-2,954	-2,272	-4.31	-3.31
69	65,595	4,210	4,010	11.85	683,385	616,413	77.27	6.20	8.00	47,628	-2,671	-2,055	-3.91	-3.01
70	65,430	4,193	4,045	11.84	680,428	613,746	77.80	6.21	8.02	47,752	-2,330	-1,792	-3.43	-2.63
71	65,328	4,177	4,090	11.83	677,492	611,098	78.39	6.22	8.04	47,904	-1,962	-1,509	-2.90	-2.23
72	65,292	4,164	4,141	11.81	674,816	608,684	78.97	6.23	8.06	48,069	-1,600	-1,231	-2.37	-1.82
73	65,322	4,155	4,194	11.78	672,599	606,684	79.51	6.24	8.07	48,234	-1,272	- 978	-1.89	-1.46
74	65,410	4,149	4,243	11.76	670,993	605,236	79.95	6.25	8.08	48,386	-1,002	- 771	-1.49	-1.15
75	65,546	4,148	4,285	11.73	670,089	604,420	80.26	6.26	8.09	48,513	- 808	- 622	-1.21	-0.93

(Continued on next page.)

APPENDIX TABLE C.2--continued.

Year	TA	E	N	Y	Q^P	Q^m	P	P^1	P^2	Total farm income: Gross $(P \cdot Q^m)$	Total farm income: Net: Actual $(R \cdot Q^P)$	Total farm income: Net: Deflated $(AR \cdot Q^P)$	Net returns per ton produced: Actual (R)	Net returns per ton produced: Deflated (AR)
	acres			tons			dollars per ton	dollars per case		1,000 dollars			dollars	
76	65,716	4,151	4,318	11.71	669,917	604,265	80.44	6.26	8.09	48,607	- 701	- 539	-1.05	-0.81
77	65,902	4,157	4,338	11.69	670,445	604,742	80.47	6.26	8.09	48,662	- 685	- 527	-1.02	-0.79
78	66,090	4,167	4,345	11.68	671,585	605,770	80.36	6.26	8.09	48,677	- 755	- 580	-1.12	-0.86
79	66,262	4,178	4,339	11.67	673,204	607,230	80.12	6.26	8.08	48,651	- 900	- 692	-1.34	-1.03
80	66,405	4,190	4,321	11.67	675,136	608,972	79.79	6.25	8.07	48,589	-1,103	- 848	-1.63	-1.26
81	66,510	4,202	4,295	11.68	677,198	610,832	79.40	6.24	8.05	48,500	-1,345	-1,034	-1.99	-1.53
82	66,569	4,213	4,261	11.69	679,208	612,646	78.99	6.23	8.04	48,391	-1,601	-1,232	-2.36	-1.81
83	66,580	4,222	4,225	11.70	681,001	614,263	78.59	6.22	8.03	48,274	-1,851	-1,423	-2.72	-2.09
84	66,547	4,227	4,189	11.72	682,440	615,561	78.24	6.22	8.02	48,159	-2,072	-1,593	-3.04	-2.34
85	66,475	4,230	4,155	11.74	683,427	616,451	77.96	6.21	8.01	48,055	-2,247	-1,729	-3.29	-2.53
86	66,373	4,230	4,128	11.76	683,912	616,888	77.77	6.21	8.01	47,972	-2,366	-1,820	-3.46	-2.66
87	66,251	4,227	4,108	11.77	683,888	616,867	77.67	6.20	8.01	47,915	-2,422	-1,863	-3.54	-2.73
88	66,121	4,222	4,097	11.78	683,393	616,421	77.68	6.21	8.01	47,886	-2,415	-1,857	-3.53	-2.72
89	65,994	4,215	4,095	11.79	682,502	615,617	77.79	6.21	8.01	47,885	-2,349	-1,807	-3.44	-2.65
90	65,881	4,207	4,101	11.79	681,316	614,547	77.96	6.21	8.02	47,912	-2,235	-1,719	-3.28	-2.52
91	65,790	4,198	4,115	11.79	679,953	613,318	78.20	6.22	8.03	47,961	-2,086	-1,604	-3.07	-2.36
92	65,726	4,190	4,135	11.79	678,539	612,042	78.47	6.22	8.04	48,027	-1,916	-1,474	-2.82	-2.17
93	65,694	4,184	4,158	11.78	677,192	610,827	78.75	6.23	8.05	48,104	-1,740	-1,339	-2.57	-1.98
94	65,693	4,178	4,183	11.77	676,019	609,769	79.02	6.23	8.05	48,183	-1,574	-1,211	-2.33	-1.79
95	65,722	4,175	4,207	11.76	675,104	608,944	79.25	6.24	8.06	48,260	-1,431	-1,100	-2.12	-1.63
96	65,777	4,173	4,229	11.74	674,507	608,405	79.43	6.24	8.06	48,327	-1,319	-1,015	-1.96	-1.51
97	65,850	4,174	4,247	11.73	674,255	608,178	79.55	6.24	8.07	48,380	-1,248	- 960	-1.85	-1.42
98	65,936	4,176	4,259	11.72	674,348	608,262	79.60	6.25	8.07	48,415	-1,219	- 938	-1.81	-1.39
99	66,026	4,180	4,266	11.72	674,754	608,628	79.58	6.24	8.06	48,431	-1,233	- 949	-1.83	-1.41

Source: Computed.

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