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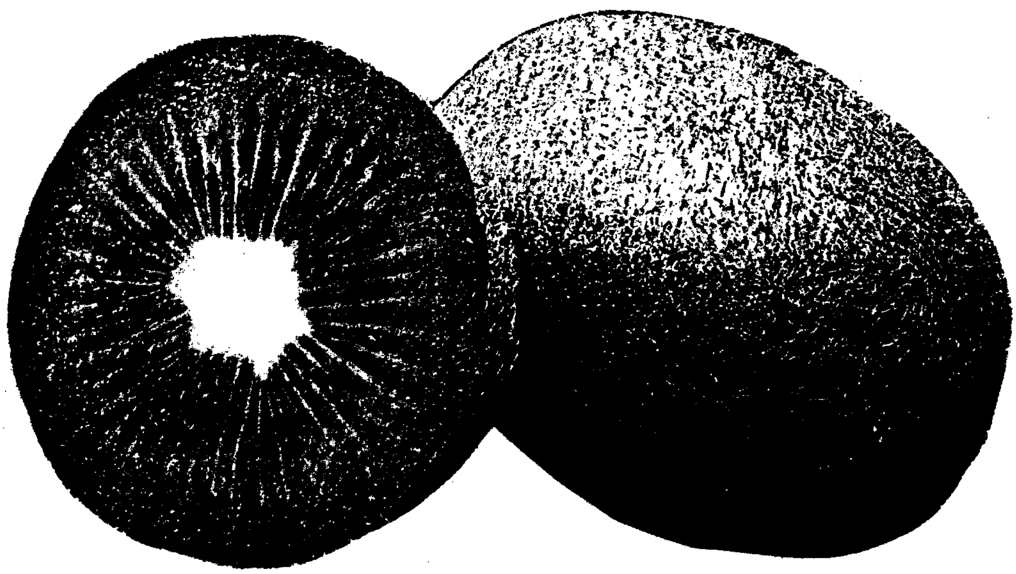

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Executive Summary

Kiwifruit is a perennial vine crop. Its production requires a high initial capital investment in vines, trellises, and high quality agricultural land, and substantial annual production and harvesting costs. It was first commercially produced by the New Zealanders at the beginning of this century, but international marketing success after World War II encouraged plantings in other temperate-zone countries. Kiwifruit made its entry to the U.S. market in 1962, and the first commercial production took place in northern California in 1971. Triggered by high prices of imported kiwifruit, a production boom was maintained in a speculative fashion during the 1970's and the early 1980's. Since the late 1980's, however, increased kiwifruit supply in both Northern and Southern Hemispheres have lowered prices.

The majority of the fruit is consumed fresh worldwide, and it can be stored for more than six months after harvest. In California, the major producing area of the U.S., kiwifruit is harvested in the fall and marketed typically through May. This production is sold both for domestic and export use. The U.S. also imports kiwifruit mainly during the summer months.

The California Kiwifruit Commission has represented kiwifruit growers as an advertising and lobbying agent since 1980. In 1985, the growers voted to establish a federal marketing order to create minimum quality standards, and since 1990, the federal marketing order has been applicable to imports of fresh kiwifruit. As a result of a USITC case filed by the Commission, anti-dumping tariffs were imposed on New Zealand kiwifruit in 1992. Thus, the context of this study is one of rapid growth, followed by declining prices and vigorous foreign competition.

The main objective of our study is to identify factors that affect industry growth and the feasibility of enhancing returns to growers. Specifically, we (1) analyze the determinants of supply, demand, and the level and seasonal pattern of prices received by growers in the U.S. kiwifruit industry, with special attention to the effects of advertising, and (2) project the levels of these variables over the near future. In order to achieve the objectives, a dynamic model of the U.S. kiwifruit industry was conceptualized, estimated, and used for simulation. The analyses use industry data with monthly and annual periodicities. Hence, the model attempts to explain monthly fluctuations as well as the annual growth of the industry. We believe this to be the first complete dynamic analysis of the U.S. kiwifruit industry.

The U.S. kiwifruit industry is conceptualized as consisting of a recursive system with two blocks of equations. A production sector determines annual production through bearing acreage and yield relationships. This production feeds into a marketing-demand block, which resolves price through monthly allocation of the crop among domestic use, exports, and storage.

Empirically, in the production sector, an equation for the net acreage change, which determines bearing acreage and ultimately the crop size, is estimated with data from 1980/81 through 1993/94. In the demand sector, the conceptual framework is directly applied to the latter half of the sample period, when monthly data are available. The monthly price for domestic shipment is determined jointly with domestic shipments and change in inventory, while exports are defined residually. The system of monthly equations was estimated using monthly data from October, 1986 through April, 1995. In the earlier period of the study, price is determined by an annual demand equation, which is estimated using data from 1980/81 through 1994/95. Subsequently, static and dynamic simulations are used to validate the model over the sample period. Furthermore, model predictions for two crop years beyond the sample period were compared to recent available data.

The factors impacting the net change in acreage are specified as past revenues, urbanization, land cost, and institutional changes. We found that while holding other variables constant, bearing acreage expanded if average per-acre revenue from an acre of kiwifruit vineyard increased. On the contrary, kiwifruit acreage would be diverted from production if average per-acre revenue from an acre of an alternative crop operation, e.g., clingstone peaches, was enhanced, or if urban opportunities extended. The results support the notion that it is difficult to expand kiwifruit operation when land costs increases. Furthermore, our analysis suggests that the extension of the marketing order to imports in 1990 and the imposition of anti-dumping tariffs in 1992 jointly retained 640 acres in production, which constitute nearly 10 percent of current bearing acreage.

The monthly equation system explains the prevalent seasonal marketing pattern and corresponding price pattern. The prevalent domestic shipment pattern is such that shipment is withheld during months immediately following harvest, and is concentrated in months February through April. Prices, to the contrary, are high in the beginning of a marketing season, decrease thereafter, and generally recover towards the end of the season but not necessarily beyond the initial level. This pattern seems to contradict price flows when storage costs, which proportionally increase over time, are present. A theoretical monthly price and shipment pattern, following Bressler and King's (1970) framework, was calculated and yielded a higher annual revenue than the actual data average.

The results show that domestic shipments are affected by the trade-offs between current and future returns and between domestic and export markets. Yet, export size and quality requirements appear to inhibit the bulk of shipments from being diverted from domestic use. In addition, storage period appears to dominate the impact of the total volume of available supply. The change in inventory, i.e., total monthly shipments, appears to reflect more the perishability of the commodity than it does the trade-off between current and future returns. In particular, the inventory response to the changes in the current and future returns is not statistically different from zero. Thus, the inconsistency with theory of shipment and price patterns may possibly be explained by the negligible response to prices

Results from the monthly demand equation indicate that the monthly demand for kiwifruit is price elastic. The monthly f.o.b. price decreases by 0.3 cents when there are 1,000 tray equivalents more U.S. kiwifruit on the market. The results suggest that kiwifruit price is nearly adjusted within a month. Imports that arrived during the current month and the three previous months were proved to be substitutes for domestic fruit, but their influence on the f.o.b. price is minimal. Advertising expenditures per tray equivalent were found to be neutral.

The annual demand relationship is consistent with the monthly results. 1,000 tray equivalents more shipment would reduce the price per tray equivalent by 0.04 cents. In terms of percentage changes, this is a 0.52 percent decline in price due to a one percent increase in domestic supply. Imports during the crop year preceding California's harvest are substitutes for California kiwifruit; the domestic price declines 0.15 percent in response to a one percent increase in imported kiwifruit. Since annual volume of domestic shipments and imports are comparable, the results imply that U.S. kiwifruit demand for imported kiwifruit is more elastic than demand for domestic kiwifruit is with respect to prices. The annual results suggest that advertising expenditures per tray equivalent seem to have had limited impact on the price of kiwifruit.

This study found that per-acre average revenue contributes to the expansion of acreage and production, while alternative land usage and increasing land values are likely to weaken the industry. Imported kiwifruit are not differentiated from the domestic supply in the market, but their impact on the domestic price appears to be limited. Advertising expenditures do not affect the price level received by the growers. Furthermore, our analysis indicates a potential discrepancy in incentives between kiwifruit growers and handlers, i.e., a principal-agent issue in the marketing system of the U.S. kiwifruit industry. Barring unforeseen circumstances, the U.S. kiwifruit industry appears to be in a stable state with slight increase in production perhaps offset by small increases in demand. However, given competition from imported fruit, larger production could result in lower prices.

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Section I. Introduction

Kiwifruit, *Actinidia deliciosa*, is an indigenous crop to southeast Asia, originally called *Chinese gooseberry*. In the beginning of this century, the kiwifruit plant was brought to New Zealand from China, where the first commercial plantings of kiwifruit were established. Early international marketing success, following World War II, encouraged further plantings within New Zealand and export of the vines which initiated plantings in other temperate-zone countries. Consequently, Australia, Chile, France, Greece, Italy, Japan, Portugal, South Africa, Spain, and the U.S. became the major commercial producers of kiwifruit.

Kiwifruit made its entry to the U.S. market in 1962, and the first commercial production took place in northern California in 1971. Attracted by high prices of imported kiwifruit, production boomed mostly in California during the 1970's and the early 1980's. The California Kiwifruit Commission (CKC) was established in 1980 under state law to promote kiwifruit sales on behalf of all growers.

Today, 94 percent of U.S. retail stores carry kiwifruit (CKC), and annual consumption is more than a half-pound per person (USDA/ERS). The market expansion of this novel commodity is noted within the produce industry as a major illustration of promotional success. However, as a consequence of a worldwide increase in supply, kiwifruit is no longer a lucrative commodity. U.S. growers have been suffering from low returns, as have growers in every other producing region (USDA/FAS, 1994). Not only has no significant increase in domestic acreage occurred since the early 1980's, but some acres have actually been removed.

A. Objectives and Organization of the Study

The focus of this study is to determine what factors influence industry growth, i.e., production and acreage expansion, and how California kiwifruit growers could enhance their returns. Specifically, the objectives of this study are to:

1) Analyze the factors influencing annual supply and demand in the U.S. kiwifruit market,
2) Identify the factors determining the monthly prices growers receive for their fruit,
3) Evaluate the impact(s) of advertising expenditures on the price level received by the growers, and
4) Project key industry supply and demand factors in the near future.

To achieve the objectives, a dynamic model of the U.S. kiwifruit industry is conceptualized, estimated, and used for simulation. The remainder of this section describes the characteristics of kiwifruit as a commodity and the industry. An industry model is conceptualized and the empirical specification is discussed in section II, with reference to appropriate literature. Section III presents the estimation results. In section IV, the empirical model is evaluated as a dynamic system using static and dynamic simulation. Subsequently, the model is used to forecast beyond the sample period. The report's implications from the industry viewpoint are presented in section V, together with a discussion on limitations of this study.

B. Commodity Characteristics

Kiwifruit is a perennial vine crop, requiring four years before the first crop and another four years to reach full yield. A high initial capital investment in vines, trellises, and high quality agricultural land with a permanent irrigation system, is necessary.[1] In addition, production costs accumulate from acquiring specially designed equipment and hiring labor for extensive pruning. Once a vineyard is established, the vines remain productive for more than twenty years.

The harvest begins in October in the Northern Hemisphere and takes place mainly from March through May in the Southern Hemisphere. Kiwifruit is picked in a mature state, i.e., with sufficient sugar content but firm and unripe. With improved storage facilities and technology, e.g., controlled atmosphere storage, kiwifruit can be stored for more than six months. Thus, marketing seasons of the crop in the two hemispheres overlap. The Hayward variety is the single dominant commercial variety today.

Fruit size is determined by the count in a single-layer tray. In the U.S., fruit ranges from the smallest size of 45 kiwifruit per tray to one of the largest sizes, 25s[2]. The minimum weight of a tray has been seven pounds, which is the conversion factor used in the industry today to calculate the volume of kiwifruit in tray equivalents (TE). Common shipping containers are single-layer flats or trays, 22-pound volume-fill or count-fill cartons, three-layer cartons, cartons with twenty one-pound film bags, and bulk bins (125, 350, and 500 pounds). The minimum grade is determined as USDA No.1 or KAC No.1.[3] Most California shipments meet the two higher grades, U.S. Fancy and U.S. No.1.

Kiwifruit is known for its desirable nutritional content. The majority of the fruit is consumed fresh worldwide in salads, desserts, garnish, or as a breakfast/snack item. Only a small fraction of the crop is diverted to further processing.

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[1] In California, it takes longer than ten years to recover establishment cost, even with favorable prices (Beutel, 1990).

[2] This notation is used to indicate size in the kiwifruit industry.

[3] The fruit must be at least the minimum size 49s, which was raised to 45s beginning in the 1994/95 season, minimum maturity of 6.5 percent soluble solids (sugar content), and meeting certain container and packing criteria.

C. The U.S. Kiwifruit Industry

The U.S. kiwifruit industry began in a rather speculative fashion. Many of the initial growers were non-traditional farmers with limited knowledge of crop production. Nonetheless, the market eagerly accepted "anything with fuzz" for a good price (LaRue, 1994). Plantings were supported by investors who sought tax shelters or by groups who were motivated by the high prices to become early producers.

There are roughly 600 kiwifruit growers in California today, accounting for 99 percent of U.S. kiwifruit production. Within California, the production area is concentrated in the northern Sacramento Valley and in the central San Joaquin Valley.[4] Both regions account for a large share of the state's production of other fruit and nuts such as almonds, grapes, olives, walnuts, citrus, and tree fruits (peaches, plums, and nectarines). The majority of the growers are diversified.[5]

All California kiwifruit growers are represented by the CKC under state legislation since 1980. It is a non-profit entity, administered by kiwifruit growers and handlers elected from kiwifruit producing districts, to promote kiwifruit sales domestically and abroad. As for export promotion activities, the CKC has been receiving Market Promotion Program (MPP[6]) funds since 1987.

In 1985, the growers voted to establish a federal marketing order to create minimum quality standards. The regulations are executed by the Kiwifruit Administrative Committee (KAC). Both the CKC and KAC are financed through independent assessments on every shipment of California kiwifruit, and are periodically subject to a grower referendum to determine the extension of the program. The federal marketing order became applicable to imports of fresh kiwifruit in 1990. This did not affect imports from New Zealand, whose kiwifruit is comparable in quality to U.S. Fancy, but has significantly restricted the amount of European kiwifruit entering the U.S. market.

Following a season of low prices, the CKC filed an anti-dumping petition against the New Zealand Kiwifruit Marketing Board in April, 1991 to the U.S. Department of Commerce (USDC). The claim was that the U.S. kiwifruit industry had been adversely affected by strategic pricing of the New Zealand Kiwifruit Marketing Board in the U.S. market (USITC,

[4]The regions correspond to Butte, Sutter, Yuba, Tulare, Kern, Kings, and Fresno counties.

[5]Although a few operations over 100 acres are found in San Joaquin Valley, most kiwifruit operations are under 15 acres, many under five acres (CKC).

[6]MPP is one of the generic export promotion programs funded by the federal government, administered by the 1990 farm bill. Prior to 1990, it was called the Target Export Assistance Program.

1992). The case ended in favor of the CKC.[7] During two seasons beginning in May, 1992, every tray of New Zealand kiwifruit imported into the U.S. required a cash or bond deposit of 98.6 percent of shipment value.[8] The New Zealand market share collapsed from over 50 percent to less than five percent within these seasons.

Figures I-1 and I-2 show the trends in bearing acreage and production of U.S. kiwifruit. Bearing acreage has leveled off around 7,200 acres since 1988. This implies some acreage removal in the late 1980's, since the new plantings in the mid-1980's would still be maturing into bearing. Consequently, production peaked in 1992. As depicted in figure I-3, total consumption, defined as the sum of domestic shipments and imports, has more than tripled since the 1985/86 crop year. The decline in domestic supply after 1992/93 has been supplemented by increased imports.

Figure I-1 U.S. Kiwifruit: Bearing Acreage

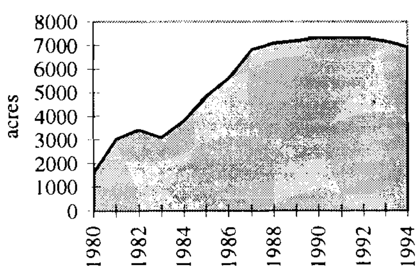
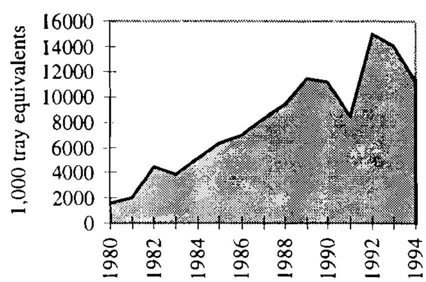


Figure I-2 U.S. Kiwifruit: Production



The U.S. has been a net importer of kiwifruit, although imports during the 1993/94 crop year were less than seven percent of the estimated world trade (USDC; USDA/FAS, 1994). The drop in 1991/92 imports (figure I-3) reflects the imposition of anti-dumping tariffs against New Zealand in May, 1992. Thereafter, Chile has replaced New Zealand as the leading supplier. U.S. production today accounts for approximately five percent of current world production. The trend of California kiwifruit shipments is illustrated in figure I-4. The share of total California shipment exported has dropped from 51.0 percent in 1985/86 to 20.3 percent in 1994/95.[9] Current U.S. export markets of significance are Canada, Taiwan, Korea, Mexico, and Hong Kong. U.S. exports account for less than two percent of the annual world trade volume in the 1990's.

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[7]The critical argument was that the New Zealand Kiwifruit Marketing Board lowered the price of New Zealand kiwifruit *below the cost of production*, after the California harvest in October, to increase their U.S. market share (USITC, 1992).

[8]The deposit rate was reduced to 11 percent in the 1994/95 season.

[9]The decline in exports in the late 1980's is due to the reduction in the European export market which was entirely lost in 1990.

Figure I-3 U.S. Kiwifruit: Consumption

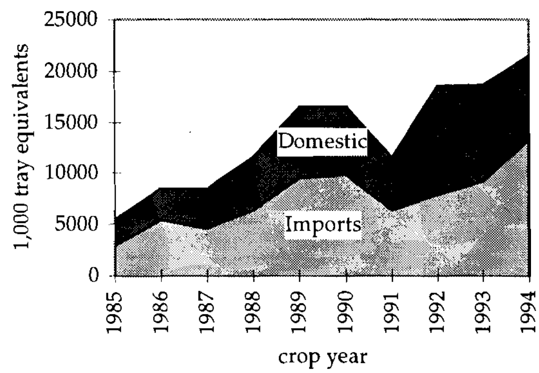
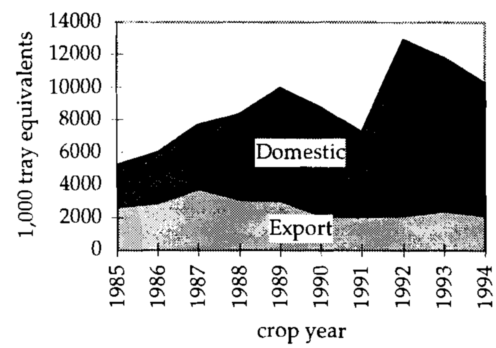


Figure I-4 U.S. Kiwifruit: Shipments



During the California harvest, October/November, picked kiwifruit are delivered to packing facilities in field bins, where they are immediately cooled (*precooling*[10]) and packed in various container-types by size. On average, 20 percent of the crop is culled in the initial packing process.[11] Then, the packed fruit are moved to cold storage facilities.

Kiwifruit is packed and stored by operations who typically handle tree fruits.[12] Approximately 90 packers, 50 cold storage operations, and 75 handlers or marketers are involved with kiwifruit today[13]. Varying degrees of vertical integration exist among growers, packers, cold storage operators, and handlers. Packing and storage costs are charged according to container-types. Storage costs are monthly rates, with additional charges for precooling in the first month and optional ethylene treatment at the time of shipment. The costs vary among individual operations.

Shipment of California kiwifruit is small in October, remains moderate through November and December, and heightens in January and thereafter. Smaller-sized fruit appear in the market earlier in the season while larger fruit are marketed later in the season.[14] The majority of fruit sizing 33s and larger are exported. Generally, higher prices are quoted for export shipment.

California fruit is typically marketed through May. At the time of shipment, fruit is inspected

[10]Kiwifruit should be cooled to 32 to 40 degrees Fahrenheit within 12 to 24 hours after picking to minimize handling loss.

[11]Formerly, cull was wasted, but in the recent years, it has been bought by juice concentrate makers. It contributes to positive yet limited returns to growers.

[12]Since their operating season is finished by the time of kiwifruit harvest, handling any significant amount of kiwifruit is a bonus to these operations.

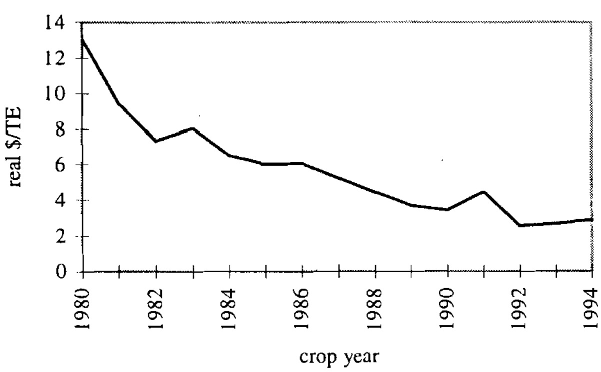
[13]Barbara Toews, KAC (May, 1996).

[14]Larger fruit tend to store longer because of higher sugar content per fruit on an equal maturity basis. In addition, they are likely to be packed in single-layer trays which hold the fruit better.

and any damaged fruit is replaced. The cost of *repacking*, due to loss of fruit and additional labor, accumulates proportionally as the conditions of fruit worsen. *Repack loss* ranges from three and a half to four percent of the initial pack-out volume. It is possible to repack fruit into different container-types, but it is very costly. As a result, the apportionment of kiwifruit among container-types is determined at the time of harvest. Therefore, shipment decisions involve moving the fixed supply of various container-types to meet demand, to attain the highest f.o.b. (free-on-board) price, i.e., the price quoted between handlers and primary buyers.

More than 85 percent of shipment is made directly to retailers and buyers for retail chains; less than 15 percent is moved through the terminal markets. The majority of growers delegate marketing decisions to handlers once the crop has been delivered to packing houses, although the growers retain the ownership of their crop until the actual shipment.[15] Sales commission is negotiated at the beginning of each season, as early as after the previous harvest, and is between eight and ten percent of total f.o.b. sales. At the end of a marketing season, growers receive their total returns which is total f.o.b. sales less sales commission and all costs of packing, storing, and repacking. In figure I-5, the trend of annual f.o.b. price, deflated by the Consumer Price Index for food, is depicted. The real price of kiwifruit per TE has dropped more than four-fold since 1980.

Figure I-5 Annual F.o.b. Price

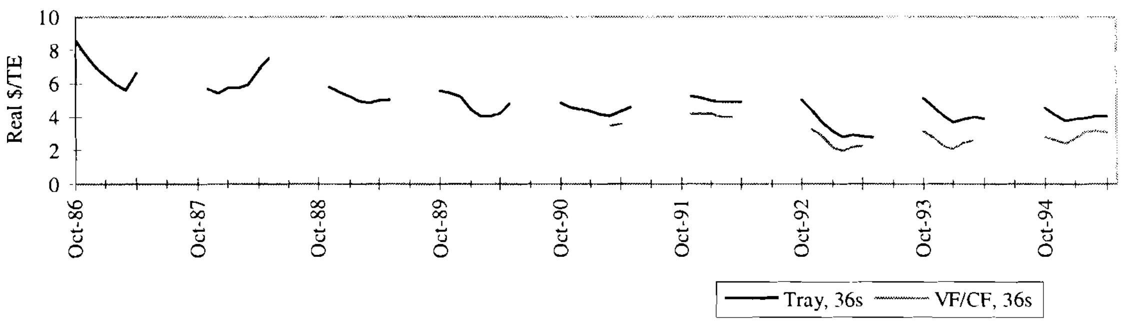


Monthly prices follow a reverse of the monthly marketing pattern. Prices, in the beginning of a marketing season, are high and decrease thereafter. Generally, prices recover towards the end of the season, but do not necessarily exceed the initial level. In fact, a season ending with the highest price of the season is rather exceptional. Figure I-6 illustrates monthly movement of TE prices of 36s-sized fruit in single trays and volume- and count-fill cartons

[15]There are likely to be incidents where handlers, in an effort to meet their customers' demand, readily accept requests of repacking, resulting in lower returns for growers.

in real dollars (VF/CF).[16] These patterns seem to contradict price flows when storage costs, which proportionally increase over time, are present. This observation provides a motivation to investigate the monthly pricing mechanism in the U.S. kiwifruit industry.

Figure I-6 Monthly F.o.b. Price



[16]These size and container-types are representative of California kiwifruit shipment. See table A-5.

Section II. Model Development

A. Introduction

The focus of this study is on growers' returns, and the framework involves relationships at the farm level, i.e., primary supply and derived demand. Kiwifruit has not received much attention from economists, and its features as a commodity and the industry, reviewed above, are unique enough that a framework used for research on other commodities cannot be applied directly. Yet, this study can draw on relevant literature regarding industry models of agricultural commodities, perennial crop supply response models, multiple market commodity allocation, and assessment of commodity promotion programs.

Following the "industry model" literature regarding agricultural commodities (e.g., French and Matsumoto, 1970; French and King, 1988; Nuckton, French, and King, 1988; Willett, 1992), the U.S. kiwifruit industry may be viewed as a recursive system of two economic activity blocks: production and marketing, as illustrated in figure II-1.

The production block models the annual growers' supply response, incorporating the features of perennial crops. Perennial crops are distinct from annual crops in two respects; first, it takes several years after investment before an initial crop, and second, yields vary over the life of plants, typically following increasing and decreasing phases with age. Consequently, current production is an outcome of decisions made in the past, based on growers' expectations. The dominant literature regarding the formation of expectations are adaptive expectations (Nerlove, 1956) and rational expectations (Muth, 1961) models.[17] These hypotheses have been applied to research on perennial crops. The general theoretical framework for perennial crop supply models is provided by such literature as French and Bressler (1962) and French and Matthews (1971).

The marketing block explains the monthly allocation of harvested kiwifruit among domestic and export markets and storage, and simultaneously determines the domestic f.o.b. price. To analyze commodity distribution among markets, total demand is decomposed to provide a demand function for each market. Commodity allocation literature, such as French and King (1986) and aforementioned industry models with allocation sectors, are referred to in modeling the marketing sector. Promotional activities by the California Kiwifruit Commission (CKC) are incorporated following the studies on generic advertising effect (e.g., Nerlove and Waugh, 1961; Carman and Green, 1993).

[17]The adaptive expectations model assumes price expectations to be a proportional adjustment processes and specifies expected price as a weighted average of past prices with the weights declining geometrically over time. The rational expectations model assumes that growers know the economic system in which they operate and fully utilize their information to formulate their expectations. Thus, expected prices are regarded as the predictions based on an underlying structural model.

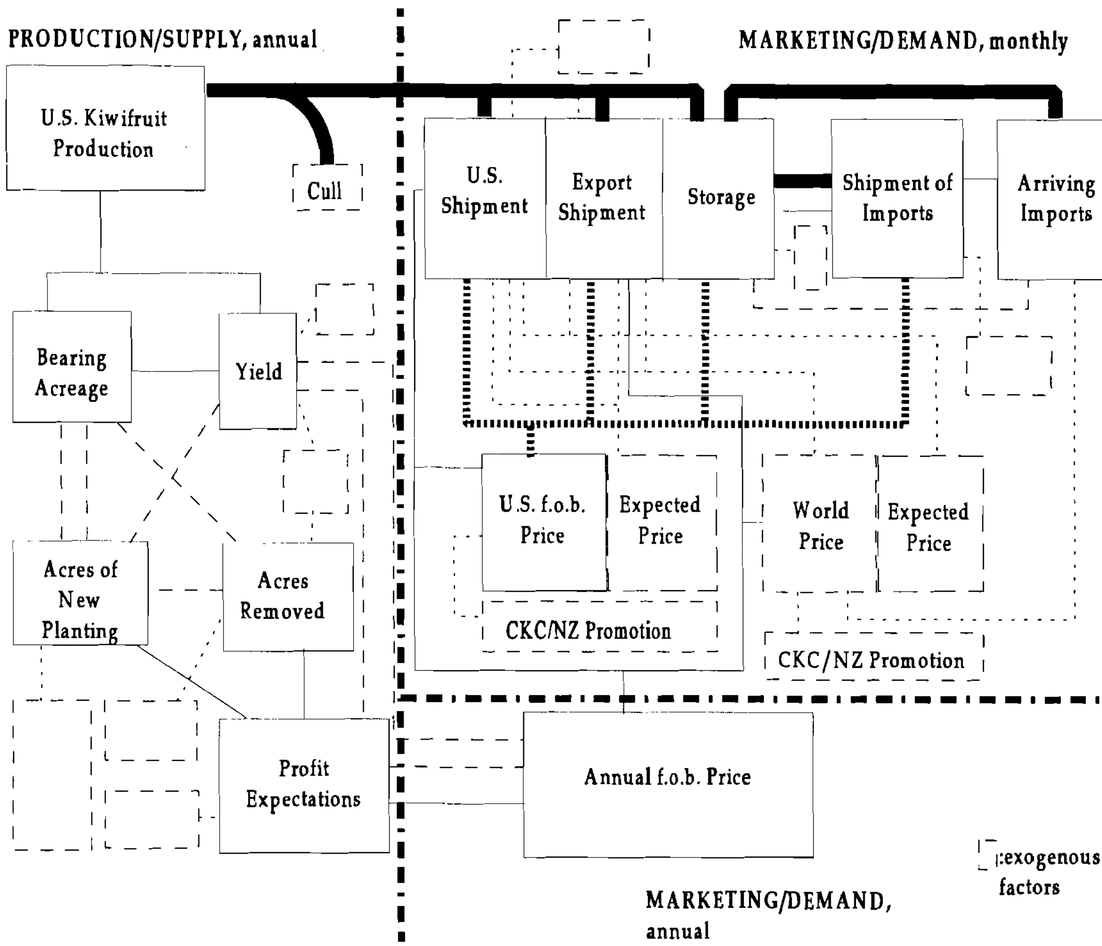


Figure II-1 Structural Relationships in the U.S. Kiwifruit Industry

In the following development of the industry model, a crop year is defined from October 1 through September 30. The complete conceptual model is found in table II-1, and table II-2 lists the definitions of variables in alphabetical order. Current endogenous variables are in bold face, while exogenous variables are underlined. The other variables in regular face are lagged endogenous variables. Empirical specification is developed following the conceptual discussion on the respective component of the model. The period of analysis begins with the establishment of the CKC in 1980/81 through the 1993/94 crop year (14 years). The complete empirical model is presented with estimated coefficients in table IV-1 at the beginning of section IV; variables are defined in table IV-2.[18] Linear relations are assumed between dependent and explanatory variables. Equations are numbered consistently throughout the conceptual framework and the empirical model.[19]

B. Production

Total production is determined as the product of bearing acreage and yield. Bearing acreage is determined by two components: new plantings and removals. There exists a lag between the current outcome and the time when these decisions were made based on expectations, because kiwifruit is a perennial crop. Since expected price and yield are unobservable, they need to be related to observable variables. Empirically, the net outcome of plantings and removals is specified as the determinant of bearing acreage, and the relationship between annual production and total utilized volume is defined within the production block.

1. Bearing acreage

The current number of bearing acres (BA) is determined by an identity (French and Bressler, 1962):

$$BA_t = BA_{t-1} + N_{t-k} - R_{t-1} \qquad \text{[C-1]}$$

where N_{t-k} is acreage planted k years ago with respect to crop year t, and R_{t-1} is acreage removed at the end of year $t-1$. In the case of kiwifruit, k is four years.[20]

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[18] All quantity variables regarding kiwifruit are measured in 1,000 TE (tray equivalents), while all kiwifruit price variables are normalized to real dollars per TE, using the Consumer Price Index (CPI) for food as the deflator. Data source is presented in Appendix B.

[19] Each equation is labeled by a capital letter *C* or *E* followed by a number. These capital letters, denoting conceptual and empirical equations respectively, indicate the model to which the equation belongs. Equations are numbered separately for the production and marketing blocks, while the same numbers are used to represent similar relationships across the two models. For example, the labels C-1 and E-1 correspond to the bearing acreage equation in the respective models. Allocation and demand equations in the marketing block are additionally marked by subscripts m and a, identifying monthly and annual relationships. Furthermore, empirical allocation and demand equations are denoted with superscripts *1* and *2*, corresponding to periods 1980/81-1985/86 and 1986/87-1993/94 respectively.

[20] According to French and Matthews (1971), N_{t-k} is multiplied by a constant between zero and one, accounting for acreage removed before bearing. However, this constant is assumed to be one here, since removals of non-bearing acreage are not important in the case of kiwifruit.

Plantings

As in French and Matthews (1971), growers are assumed to base their planting decisions on expected profitability of kiwifruit production and of alternative land uses. An alternative land use may be production of another crop or non-farm opportunities, e.g., entry to a housing real estate market. Profitability variables for farm enterprises in this model are specified in per-acre terms; non-farm opportunities are measured by the urbanization rate (*URB*). In addition, individual growers' planting decisions are affected in part by *total net acres* at the beginning of year *t* (TNA_{t-1}) which represents the overall industry planting response (French, King, and Minami, 1985).[21]

Thus, the function for new plantings (*N*), i.e., the number of acres planted in crop year *t*, is

$$N_t = f(\ PROFIT^e_t,\ PROFITA^e_t,\ URB_t,\ TNA_{t-1},\ \varepsilon_{N,t}\ ). \qquad \text{[C-1.1]}$$

$PROFIT^e_t$ and $PROFITA^e_t$ are expected future profit per acre of kiwifruit vineyard and of an alternative crop operation, respectively, at the beginning of crop year *t*. The random disturbance associated with the new planting equation is ε_N.

Long-run profit expectations

A profitability variable encompasses revenue and cost. Revenue is expressed on a per-acre basis by multiplying price per unit-of-output by yield, but since prices and yield at harvest are unknown at the time of planting, proxies for expected values need to be developed. The initial investment or establishment cost is specified separately from production costs, because both are substantial. The former is likely to be known at the time of the planting decision, while the latter is not. Again, a proxy for expectation must be developed.

Despite the two expectations hypotheses mentioned above, a rational assumption in the context of the kiwifruit industry is to treat recent averages of prices and yields as the expected values, which is consistent with the discussion by French and Bressler (1962). Analogously, expected production costs would be represented by an average of historical levels.

In addition, it seems reasonable to assume that the establishment of the marketing order and the anti-dumping ruling against New Zealand affected growers' future expectations in a positive way. French and Matthews (1971) discuss the inclusion of such institutional variables in profit equations.

Hence, the expected profitability equation is defined as

$$PROFIT^e_t = f(\ FOB^E_t \times YIELD^E_t,\ EST_t,\ C^E_t,\ MO_t,\ AD_t,\ \varepsilon_{P,t}\ ) \qquad \text{[C-1.1c]}$$

where FOB^E_t is a proxy for expected real price and $YIELD^E_t$ is a proxy of expected level of

[21] Total net acres at the *end* of year *t* is defined as

$$TNA_t = BA_t + NBA_t - R_t \qquad \text{[C-1.1a]}$$

where NBA_t is the number of non-bearing acres in year *t*, corresponding to the sum of new plantings between years *t-3* and *t*, inclusive. Since it is reasonable to assume that all new plantings are maintained for bearing in the kiwifruit industry, non-bearing acreage can be expressed as

$$NBA_t = N_{t-3} + N_{t-2} + N_{t-1} + N_t. \qquad \text{[C-1.1b]}$$

yield, both represented by historical averages. The superscript E denotes that specific forms of these variables are left to be empirically determined in terms of observable variables. EST_t is the real cost of establishing an acre of kiwifruit vineyard. C^E_t is a proxy for expected production costs per acre, defined in terms of previous production costs, deflated by an appropriate price index. Its specific form is left to be determined empirically as well. MO_t and AD_t are institutional variables, the former for the establishment of the federal marketing order in 1985 and the latter for the imposition of anti-dumping tariffs against New Zealand imports in 1992. ε_P is the random error associated with the long-run expected profit equation.

The expected profitability of an alternative crop is specified in a similar fashion as

$$PROFITA^e_t = f(\ FOBA^E_t \times YIELDA^E_t,\ ESTA_t,\ CA^E_t,\ \varepsilon_{PA,t}\ ) \qquad \text{[C-1.1d]}$$

where the corresponding variables are denoted with an A at the end of the variable names.

<u>Removals</u>

Growers' removal decisions respond to *short-run* profit expectations in contrast to planting decisions. French and Matthews (1971) suggest that short-run expectations be formed similarly to the long-run expectations affecting planting decisions, or that they be approximated by the most recent, i.e., the current season's, profit. Following the former suggestion, the short-run expected profit equations include institutional variables in addition to the expected profit proxies.

A non-farm opportunities variable, measured by the urban expansion rate, is incorporated analogous to the planting equation (French and Bressler, 1962)[22]. Severe weather would also induce removals of damaged vineyards.[23] When the industry is mature, the decline in productivity of plants is a concern, although it is not yet pertinent in the case of kiwifruit.

The number of acres removed (R) is specified as

$$R_t = f(\ SPROFIT^e_t,\ SPROFITA^e_t,\ URB_t,\ W_t,\ \varepsilon_{R,t}\ ) \qquad \text{[C-1.2]}$$

where $SPROFIT^e_t$ and $SPROFITA^e_t$ are short-run profit from kiwifruit and from an alternative crop expected at year t measured in real dollars per acre, and W_t is a weather variable. The short-run profit expectations are further be defined as

$$SPROFIT^e_t = f(\ SPROFIT^E_t,\ MO_t,\ AD_t,\ \varepsilon_{SP,t}\ ) \qquad \text{[C-1.2a]}$$

and

$$SPROFITA^e_t = f(\ SPROFITA^E_t,\ \varepsilon_{SPA,t}\ ) \qquad \text{[C-1.2b]}$$

where specific forms of short-run expected profit proxies $SPROFIT^E_t$ and $SPROFITA^E_t$ are left to be empirically investigated as indicators of recent gross or net revenues.

2. Net acreage change - an empirical specification

Empirically, no historical data are available for plantings and removals. As a combined

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[22] They included the urban expansion variable in their removal function but not in their planting function.

[23] It should be noted that the weather factor enters the planting decision through total net acreage at the beginning of crop year t (TNA_{t-1}).

outcome of the two decisions, annual difference in bearing acreage was calculated from the acreage figures, which was determined as the empirical dependent variable (*NET*). Then, the current number of bearing acres is

$BA_t = BA_{t-1} + NET_{t-1}$. [E-1]

According to this definition of the dependent variable, the explanatory variables in the planting and removal equations need to be merged.[24]

A proxy variable for expected revenue is obtained in a series of steps. First, annual revenue is computed by multiplying the real annual f.o.b. price (*FOB*) by total volume of utilized production, i.e., total shipment volume (*QSHIP*). Dividing the product by bearing acreage, per-acre revenue in year *t* (*REV*) is defined as

$REV_t = FOB_t \times QSHIP_t \times 1000/BA_t$ [E-1.1e]

noting that shipment is quantified in 1,000 TE.[25] Second, expected revenue is assumed to be an average of revenues in past years.[26] The fact that generally, one- to two-year-old seedlings are planted, which are ordered from a nursery a year or two in advance, suggests that planting decisions take place during years *t-4* and *t-2* with respect to the harvest in year *t*. On the other hand, removal decisions are resolved at the end of year *t-1*. Thus, the average revenue during years *t-4* to *t-1* accounts for both factors. Given the relationship that harvest in year *t* is determined by net acreage change in the preceding year, the expected revenue from kiwifruit production (*KIWI*) affecting net acreage change in year *t* is

$KIWI_t = (REV_t + REV_{t-1} + REV_{t-2} + REV_{t-3})/4$. [E-1.1f]

Its expected influence on the net acreage change is positive.

Clingstone peaches are selected as the most important alternative to kiwifruit production.[27] A similar calculation of per-acre revenue was applied, and a parallel four-year average of revenue is obtained (*PEACH*). A measure of non-farm opportunities is specified as the rate of population growth in eight counties in California, Tulare, Butte, Kern, Kings, Yuba, Sutter, Fresno, and Stanislaus, which account for over 90 percent of U.S. kiwifruit production (*URB*). Since these variables are proxies for expected revenue of alternative operations, it is predicted to have a negative impact on the net change in kiwifruit bearing acreage.

Data regarding production costs are limited. However, farm real estate values per acre in California are considered a suitable proxy for establishment cost, since a significant portion of establishment cost is attributable to land acquisition. The Prices Paid by Farmers index is

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[24]Total net acreage is excluded due to lack of planting data.

[25]Footnote 18.

[26]The initial specification of two variables, each corresponding to the time of planting and removal decisions, led to a multicollinearity problem, and hence, a single measure of expected revenue is considered.

[27]Mr. Mark Houston at the CKC stated that a period of low returns for clingstone peach growers occurred in the early stage of the kiwifruit industry. Moreover, the peach production area overlaps more with that of kiwifruit than do other tree fruits and nuts, and clingstone peach orchards are relatively easy to pull out and re-establish.

used to deflate the farm real estate values, and the variable is specified as a three-year average from *t-5* to *t-3* (*EST*). Referring to the age of seedlings and the timing of planting decisions, this specification reasonably presumes that land acquisition decisions are made a year or two before the actual planting. It is expected that the higher the establishment cost, the less incentive there is to plant; it would have a negative impact on the net change in bearing acreage.

Two major institutional changes, the establishment of the marketing order in 1985 and the anti-dumping ruling in 1992, have been discussed. With respect to the former, the impact on growers' expectations was presumably larger when the marketing order was extended to all imports in October, 1990, than in 1985. Furthermore, the 1990 change, together with the imposition of anti-dumping tariffs, occurred during a period of consecutive low returns to encourage the growers to remain in production, and the events would have, if any effect, discouraged acreage removals. In crop year terms, the two changes occurred in 1990/91 and 1991/92.[28] Due to the constraint in degrees of freedom, a single dummy variable was specified taking the value of one in 1990 and 1991, and zero otherwise (*DU*). The expected impact on the net acreage change is positive, although coincidentally, the 1991 crop year was noted for unfavorable weather.

In sum, the net acreage equation to be estimated is

$$NET_t = \alpha_{N,1} + \alpha_{N,2}KIWI_t + \alpha_{N,3}PEACH_t + \alpha_{N,4}URB_t + \alpha_{N,5}EST_t + \alpha_{N,6}DU_t + \varepsilon_{N,t}. \quad \text{[E-1.1]}$$

3. Yield

According to French and Matthews (1971), per-acre yield of a perennial crop operation depends on the age distribution of bearing plants, weather and biological factors, and cultural practices. The age distribution of plants are not available for kiwifruit, but it may be possible to distinguish bearing acreage by whether or not full yield has been reached, which is typically an additional four years after initial bearing. The bearing acres below full yield at year *t* are the new plantings four to seven years in the past. Consequently, these acres correspond to the non-bearing acres in year *t-4*, if it is assumed that all kiwifruit plantings are maintained before reaching full yield. The ratio of the number of non-bearing acres in year *t-4* to the current number of bearing acres, NBA_{t-4}/BA_t, identifies the portion of bearing acreage whose yield is lower than full yield in year *t*, which should be an adequate indicator of the yield level.

The impact of a severe weather year is accounted for by a zero-one variable (*W*). With respect to cultural practices, the effect of knowledge accumulation through experience is measured by a trend variable (*TR*). Additionally, expenditures on cultural practices may be constrained by the previous year's return, represented by the average f.o.b. price (*FOB*). The random variable, ε_Y, accounts for other unexpected shocks. The yield equation is conceptualized as

$$YIELD_t = f(\, NBA_{t-4}/BA_t,\ W_t,\ TR_t,\ FOB_{t-1},\ \varepsilon_{Y,t}\,). \quad \text{[C-2]}$$

[28]The anti-dumping tariffs went into effect in May, 1992.

However, since data on new plantings are not available, per-acre yield is considered to be exogenous in the empirical model.

4. Annual production and shipment

Annual production of kiwifruit (*QP*) is determined by the current number of bearing acres and yield, namely

$$QP_t = BA_t \times YIELD_t. \qquad \text{[C-3]}$$

Many factors are involved in determining the relationship between production and shipment. First, all production may not be harvested. Second, there is cull from initial pack-out, and third, for shipments later in the marketing season, repack loss is unavoidable. In the conceptual model, these monthly factors are accounted for by the inventory relation (equation C_m-4). Empirically, however, data regarding these factors are not sufficient and causality is difficult to model. Thus, total shipment volume (*QSHIP*) is assumed to be a linear function of production, treating any handling loss as random. Theoretically, when production is zero, shipment is zero, and no intercept is necessary. Nonetheless, given the crudeness of the production data, an intercept is included.[29] The relationship to be estimated is

$$QSHIP_t = \alpha_{Q,1} + \alpha_{Q,2}QP_t + \varepsilon_{Q,t}. \qquad \text{[E-3a]}$$

C. Marketing / Demand

The marketing process of kiwifruit, from harvest in October through May, may be regarded as monthly allocation decisions across three outlets: domestic shipments, exports, and inventory. Considering the percentage of U.S. trade volume of kiwifruit relative to that of the world, a *small country* assumption is used to model the U.S. kiwifruit industry. This implies that prices quoted for exports and arriving imports are exogenously determined at the international level, and export demand may be considered exogenous. Therefore, the complete system of five equations — two allocation equations (one for the U.S. and the other for overseas markets), an import demand equation, an inventory identity accounting for physical flows of kiwifruit, and a demand equation at the U.S. farm level — simultaneously resolves (1) domestic shipments of domestic production, (2) exports of domestic production, (3) imported quantity, (4) the inventory level, and (5) the domestic farm-level price.

Since monthly price data are only available from 1986/87, this sector is specified separately for two time periods according to the data availability. It is to the second period, 1986/87 through 1993/94, that the monthly conceptual model is applied. The annual price is defined as an average of monthly prices, which are determined within the system of equations depicting the crop allocation process between shipment and storage. During the prior period, which extends from 1980/81 through 1985/86, annual specification is used to determine the

[29]The production figures reported by the California Agricultural Statistics Service are estimates based on information provided by the CKC, reported in *100 short tons*. The relation should be interpreted as relevant only within the range of *QP*.

annual price. The overall demand for U.S. kiwifruit is the sum of the domestic and export demand schedules, but due to the lack of international trade figures for kiwifruit during this first period of analysis, a single price-dependent demand equation for the total volume of U.S. kiwifruit is specified. Below, the conceptual and empirical monthly crop allocation models are developed; the annual component of the empirical model is discussed subsequently.

1. Monthly crop allocation - conceptual framework

Domestic shipment

As summarized by French and King (1986), market allocation decisions are modeled by specifying the quantity allocated to each outlet as a function of relevant current prices, expected future prices, and available total supply.[30] The dependent variable is the quantity allocated to domestic shipment (*QDOM*), and relevant prices here are current and expected prices in domestic and export markets. The option of storage is accounted for by the difference in the returns relative to storage cost during a certain time period. As in the production process, price expectations need to be associated with observable variables. Since prices during a marketing season generally follow a seasonal pattern reflecting the available supply and storage costs, the expected price proxies incorporate this seasonality. Specific forms of expected price proxies are considered in the empirical section.

As a measure of available total supply, previous levels of U.S. kiwifruit inventory (INV_{i-1}) is used.[31] Furthermore, kiwifruit is a semi-perishable commodity, and ultimately, the fruit will spoil. The number of months fruit has been in storage (*MIS*) is critical in shipment decisions.

Accordingly, the monthly domestic shipment equation is

$$QDOM_i = f(\ FOBDOM_i,\ FOBEX_i,\ FOBDOM^E_i,\ FOBEX^E_i,\ INV_{i-1},\ MIS_i,\ \varepsilon_{D,i}\ ) \qquad [C_m\text{-}1]^{32}$$

where $FOBDOM_i$ is the real monthly average f.o.b. price per TE for domestic shipment, and $FOBEX_i$ is the corresponding price for export shipment. Expected price proxies with the superscript *E* indicate that their specific forms are empirically defined in terms of observed variables. ε_D is the random component associated with the monthly domestic shipment equation.

Export shipment

The quantity of export shipment (*QEX*) is determined analogously to that of domestic shipment with additional variables which account for the factors affecting export demand,

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[30]In practice, individual shipment is specified by fruit size and container-type, for which prices vary. Therefore conceptually, there are as many shipment functions as the number of combinations of size and container-type. Such details cannot be modeled easily, and the model is developed at an aggregated level, i.e., quantities in various container-types are converted to TE and summed across all sizes.

[31]All handlers have access to the biweekly inventory report known as "KISS Summary Report" published by the CKC since 1989/90. The report covers California kiwifruit inventory only.

[32]The notation is explained in footnote 19.

since export demand is considered exogenous in this study. First, it should be noted that production in the Northern Hemisphere (*QPNH*) competes directly with U.S. kiwifruit in the overseas market due to the concurrent marketing season. Second, the CKC has been expending resources on export promotion as part of their function since the late 1980's. In addition to the California growers' effort, growers in other exporting countries, primarily the New Zealanders, have practiced promotional efforts in U.S. export markets, by which U.S. export demand has been affected since kiwifruit is generic. Advertising expenditures are used as proxies for advertising activity levels by the two organizations (*ADEX* for the CKC and *ADOTHER* for growers in the other kiwifruit growing regions). Because of monthly specification, both current and lagged effects of the two advertising activities will be considered in the empirical analysis.[33]

Hence, the quantity allocated for export shipment is specified as

$$QEX_i = f(\ FOBEX_i,\ FOBDOM_i,\ FOBEX^E_i,\ FOBDOM^E_i,\ INV_{i-1},\ MIS_i,\ QPNH_i,\ ADEX_i,\ ADOTHER_i,\ \varepsilon_{X,i}\ ). \qquad [C_m\text{-}2]$$

Imports

The import demand equation is specified as quantity of arriving imports (*QIM*) dependent on the price for imported kiwifruit at the port of entry, which is the world price using the small country assumption (*FOBIM*) and the level of U.S. kiwifruit inventory (*INV*). Since it takes approximately two weeks for a load leaving an exporting country to arrive at a U.S. port, the relevant variables are the current prevailing price and beginning inventory in a monthly specification. Accordingly, the monthly import demand equation is defined as

$$QIM_i = f(\ FOBIM_i,\ INV_{i-1},\ \varepsilon_{IM,i}\ ). \qquad [C_m\text{-}3]$$

Imported kiwifruit is known to be held in domestic storage facilities before the actual shipment for consumption. Thus, the quantity of monthly shipment of imported fruit (*QMIM*) are determined in a similar way to those of California kiwifruit. The prices pertinent to these decisions are no longer the f.o.b. prices at port of entry but prices at a higher market level, such as the wholesale market, which are treated as exogenous.[34] Expectations are involved in import shipment decisions as well, since storage remains an option.

The total quantity of imported kiwifruit available for actual shipment is constrained by previous and current imports, where previous imports are included in the inventory. Thus, total available supply of imports reflects the volume of currently arriving imports and beginning inventory. Correlation between the two variables may be problematic in empirical analyses.

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[33] Liu and Forker (1988) identify two sources of the dynamics involved in advertising; one is a lag required for consumers to perceive and process information, while the other is the carryover effect of advertising.

[34] Although more than 85 percent of the fruit is marketed directly to retailers (section I), the wholesale price was judged appropriate as suitable price reference for prices at a higher market level.

The resulting equation for the shipment of imported kiwifruit is

$$QMIM_i = f(\ WIM_i,\ WIM^E_i,\ QIM_i,\ INV_{i-1},\ \varepsilon_{M,i}\ ) \qquad [C_m\text{-3a}]$$

where WIM_i is the real average wholesale price for imported kiwifruit during month i, and WIM^E_i is an expected price proxy for later shipment of imported kiwifruit, the specific form of which is left to be examined empirically.

Inventory

Storage is treated as the residual of shipment decisions. The level of inventory at the end of a month (*INV*) is the sum of beginning inventory, production, and monthly arriving imports, minus total quantity of shipments during that month. This identity relationship, mentioned by French and King (1986), can be expressed as

$$INV_i = INV_{i-1} + QP_t + QIM_i - (1-r^D_i)QDOM_i\ - (1-r^X_i)QEX_i - (1-r^M_i)QMIM_i \qquad [C_m\text{-4}]$$

The subscript t on the production variable implies that this variable takes on a positive value only during the month of harvest. The r coefficients, which range between zero and one, are specified to account for any quantity produced but not harvested, culled at initial packing, and lost during the repacking process. The coefficients allow for monthly variation and distinction among the three types of shipment, mainly to account for the difference in repack loss.[35]

Domestic derived demand

The demand for kiwifruit faced by growers is derived from consumer demand at the retail level. According to demand theory, the demand function resulting from utility maximization behavior of an individual consumer is such that the quantity demanded is dependent on all relevant prices and total income. In this application, however, quantities are determined by allocation equations, and the demand specification should focus on the factors determining prices (Waugh, 1964). The demand equation for domestic shipment of California kiwifruit is specified as the real f.o.b. price (*FOBDOM*) dependent on domestic shipment volume, shipment volume of imported kiwifruit, shipment volume of other fruit (*QOTHER*), and real per capita income in the U.S. (*INC*).

Two organizations, the California Kiwifruit Commission and the New Zealand Kiwifruit Marketing Board, have promoted kiwifruit in the U.S. market. As before, advertising expenditures by the respective organizations would be regarded as proxies for advertising levels (*ADDOM*, *ADNZ*). An explicit form of advertising proxies incorporating lagged effects of advertising needs to be explored in the empirical specification.

[35] The difference in repack loss is based on the variation in storage potential across size and container-type. Repack loss for exports is likely to be the least, since export shipment is comprised of a high proportion of large fruit packed in trays, which maintain the quality of fruit longer. Repack loss associated with shipments of imported kiwifruit is the largest, because they have been transported from afar.

The marketing margin (*SPR*) is included to account for the difference between primary and derived demand schedules. In addition, the consumption level, or domestic disappearance (*QUS*), in the previous month is incorporated to investigate consumption behavior in the long-run, where domestic disappearance is defined as the sum of shipments of domestic and imported kiwifruit.[36]

In sum, the derived demand equation is

$$FOBDOM_i = f(\ QDOM_i,\ QMIM_i,\ QOTHER_i,\ INC_i,\ ADDOM_i,\ ADNZ_i,\ SPR_i,\ QUS_{i-1},\ \varepsilon_{F,i}\ ). \qquad [C_m\text{-}5]$$

Annual average price

The annual f.o.b. price (*FOB*) is obtained as a crop-year average of real monthly prices for domestic and export shipments, weighted by respective shipment volumes (equation C_a-1, table II-1). The annual price is the major determinant of growers' profit expectations which, in turn, determine production levels in subsequent years.

2. Monthly shipment and demand - period 2 (1986/87-1993/94)

The monthly marketing process was conceptualized above as a simultaneous block consisting of allocation equations for domestic and export markets, an import demand equation, an inventory identity, and a domestic demand equation. The empirical analysis, due to the data availability, takes a simpler approach, i.e., imports and exports do not have behavioral equations. Also, preliminary analyses suggest that it is preferable to model the allocation decisions in terms of inventory changes.[37] Thus, the model includes behavioral equations for domestic shipments, changes in inventory, and domestic demand; that is, the three current endogenous variables in this system of equations are (1) domestic shipments (*QDOM*), (2) change in inventory (*DINV*), and (3) the monthly f.o.b. price (*FOBDOM*). Imports are treated as exogenously determined and exports are linked to the behavioral equations via an identity.

Price data used in the monthly analysis are computed from daily quotes in the "California Deciduous Fruit Report" issued by the Federal-State Market News Service office at Sacramento, California (see Appendix B for details on the procedure). For consistency, annual observations were computed as weighted averages of domestic monthly prices with monthly domestic shipments as weights (*AVGFOB*), and were compared with the annual prices reported by the CKC (*FOB*), both deflated.[38] The following results are obtained by regressing the CKC's annual f.o.b. price on the weighted average of monthly prices, by

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[36] $QUS_i = QDOM_i + QMIM_i$. $\qquad$ $[C_m\text{-}5a]$

[37] The period, 1986/87 through 1994/95, corresponds to a time of decline in the export share (figure I-4). Moreover, only a few handlers deal with exporting, and export volume for any individual handler is currently no more than their volume shipped domestically.

[38] Daily f.o.b. prices for large sized fruit in single-layer trays are quoted much more frequently than other container-types which command much lower prices. Thus, export prices are excluded from this process, because it was judged that the inclusion of export prices would distort the result.

ordinary least squares, for the nine years where corresponding monthly observations exist:[39]

$$FOB_t = 0.069 + 0.909\, AVGFOB_t. \qquad [E^2_a\text{-}1]$$
$$(0.42) \quad (24.37)$$

The R-squared value is 0.988. The results suggest that monthly price averages are consistently biased upward due to the nature of data.[40] Consequently, the weighted average of monthly price is adjusted by equation E^2_a-1 to obtain the estimated annual price.

The concept of expected prices must be defined using observed data. We assume that monthly price expectations are formed at the end of every month based on the difference between the actual and a preliminary expected price in that month, where preliminary expectations are based on monthly pattern and yearly trend.[41] Because export shipment is not an option for the majority of handlers, expected price for export shipment is not used in the analysis.

Domestic shipments

Monthly quantity of domestic shipment, reported by the CKC, is regressed on the relevant prices (current prices for domestic shipments and exports, and expected future prices) and total available supply. The current and expected real prices for domestic shipment are included in the equation as the ratio

$$FOBRAT_i = FOBDOM_i/FOBDOME_i \qquad [E^2_m\text{-}1.1]$$

while the current real export price (*FOBEX*) is incorporated by itself[42]. The coefficient on the ratio is expected to yield a positive sign, while the sign of the export price coefficient is expected to be negative.

Total available supply is specified as total volume to be allocated over the marketing season starting in October 1 (according to the availability of price data) (*QALL*).[43] The coefficient

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[39]The figures in parentheses are t-ratios.

[40]The annual f.o.b. prices published by the Commission are based on the prices of all shipments according to size and container-type, reported by every handler in the industry. To the contrary, daily f.o.b. prices for peripheral sizes and container-types, which are generally lower, tend not to be reported. Moreover, the initial pack-out percentage for single-layer trays is higher than the actual shipment percentage, since some fruit which were initially packed in trays are repacked into other container types during a marketing season. Using the initial pack-out percentage as weights in the calculating the average, therefore, overemphasizes the higher prices of single-layer trays.

[41]The preliminary expectations are the predicted values based on an initial regression, which regressed monthly real prices on 7 zero-one variables for each marketing month and an annual trend variable (1986/87=1). The details of the calculation are found in Appendix B.

[42]Since price variables are correlated, the ratio may have little variation. Nonetheless, it should be sufficient to distinguish the export market from the domestic market and to capture the trade-off between shipment and storage.

[43]This *volume-to-be-allocated* (*QALL*) is total annual shipment less some kiwifruit which are occasionally harvested early and shipped in September.

$$QALL_t = QSHIP_t - QSEPT_t \qquad [E^2\text{-}3b]$$

where *QSEPT* denotes any shipment in September. For every ith observation in crop year t, the annual value of *QALL* is repeated (equation E^2_m-4.2, table IV-1).

on the crop size is expected to be positive. Additionally, monthly zero-one variables are included to take into account quality differences due to storage over time, since kiwifruit ultimately spoils. For the eight months, seven variables are used, and May is selected as the base month (*OCT, NOV, DEC, JAN, FEB, MAR, APR*). An interaction dummy variable between *QALL* and *OCT*, *OCTALL*, is included in order to distinguish shipment decisions made concurrently with the incoming harvest.[44]

Hence, the domestic shipment equation is

$$QDOM_i = \beta_{D,1} + \beta_{D,2}FOBRAT_i + \beta_{D,3}FOBEX_i + \beta_{D,4}QALL_{i-1} + \beta_{D,5}OCTALL_i + \beta_{D,6}OCT_i + \beta_{D,7}NOV_i + \beta_{D,8}DEC_i + \beta_{D,9}JAN_i + \beta_{D,10}FEB_i + \beta_{D,11}MAR_i + \beta_{D,12}APR_i + \varepsilon_{D,i}. \quad [E^2_m\text{-}1]$$

<u>Change in Inventory</u>

The change in inventory (*DINV*) was measured assuming that imports which arrive during month *i* are marketed within that month and that handling loss has been adjusted before the shipment decisions.[45] Right-hand side variables are analogous to the domestic shipment equation. As for relevant prices, the current return (*RET*) is calculated as the average of domestic and export prices weighted by respective volumes, i.e.,

$$RET_i = (FOBDOM_i \times QDOM_i + FOBEX_i \times QEX_i)/(QDOM_i + QEX_i). \quad [E^2_m\text{-}4.1]$$

and the expected future return is represented by the expected price for domestic shipments (*FOBDOME*). The expected sign on current return is positive, and that on expected price is negative. The crop size (*QALL*) is included for total available supply, the monthly dummy variables account for the quality differences associated with the length of time after harvest (*OCT, NOV, DEC, JAN, FEB, MAR, APR*), and an interaction dummy variable *OCTALL* reflects the dynamic change in the inventory during the month of harvest.

The change in inventory equation is determined as

$$DINV_i = \beta_{I,1} + \beta_{I,2}RET_i + \beta_{I,3}FOBDOME_i + \beta_{I,4}QALL_i + \beta_{I,5}OCTALL_i + \beta_{I,6}OCT_i + \beta_{I,7}NOV_i + \beta_{I,8}DEC_i + \beta_{I,9}JAN_i + \beta_{I,10}FEB_i + \beta_{I,11}MAR_i + \beta_{I,12}APR_i + \varepsilon_{I,i}. \quad [E^2_m\text{-}4]$$

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[44] $OCTALL_i = OCT_i \times QALL_i$. $\quad [E^2_m\text{-}4.3]$

[45] Furthermore, in order to use the conceptual inventory identity (equation C_m-4), production volume is replaced by total crop-to-be-allocated (*QALL*), assuming that *QALL* is harvested during October. The change in inventory was measured empirically by the formula:

$$DINV_i = INV_{i-1} - INV_i = QEX_i + QDOM_i - QALL_t \quad [C^2_m\text{-}4']$$

This specification consequently assumes that *total shipment volume*, i.e., production volume, net of loss during harvest, cull from initial pack-out, and repacking loss, is known at the time of harvest. Despite the deviation from reality in this assumption, it is appropriate to utilize the shipment data, since the *r* coefficients are unknown and likely small. (Equation C^2_m-4′ is neither included in table II-1 nor in table IV-1, since the equation depicts an empirical measurement and not a model relationship.)

Export shipments

Given annual shipment volume, monthly domestic shipment, and the change in inventory, export shipment (*QEX*) is obtained by solving equation C^2_m-4′ (footnote 45) for export shipment

$$QEX_i = DINV_i + QALL_t - QDOM_i \qquad [E^2{}_m\text{-}2]$$

The subscript *t* on *QALL* implies that the variable takes on a positive value only in October.

Domestic demand

The domestic demand equation is specified as the real monthly f.o.b. price (*FOBDOM*) dependent on quantities of domestic and imported kiwifruit disappearance as well as other demand shifters. First, both current and one month lagged domestic shipments (*QDOM*) are included to investigate the nature of the price adjustment. The expected sign of the coefficient on the current quantity is negative, but that of the lagged quantity is unknown. It may be negative or positive depending on the nature of the adjustment process.

Second, since the length of time between when kiwifruit imports arrive and when they are actually shipped for consumption is unknown, current and one- through three-month-lagged imports (*QIM*) are included, as indicated by preliminary analyses. Imports are expected to be substitutes in the monthly specification, since they appear in the market concurrently with the domestic fruit. Their coefficients are expected to yield negative signs. Because imports are substitutes for domestic production and the inclusion of lagged imports is costly in terms of degrees of freedom, measures of other fruit are not used in the monthly specification.

Other demand factors are a proxy for monthly promotional activities by the CKC[46], per capita income, and a measure of marketing costs. A proxy for CKC's monthly promotional activities is specified as annual advertising expenditures per domestic shipment unit, divided by the number of months in the California marketing year which is assumed to be from October to May for all years (*UNITDOM*)[47]. No lag is included, because the construction of the variable eliminates monthly variation. Monthly per capita disposable personal income was deflated by CPI for all items (*MINC*), and the expected sign on the coefficient is positive. The monthly farm and retail price spread for fresh fruit is used as a measure of marketing costs, and was deflated by CPI for all items. Since it is trending upward over the years despite its seasonal variation, a monthly difference is specified to ensure that the variable is stationary (*DSPR*). The expected sign on the coefficient depends on the nature of marketing costs. If it is a new service at the retail level, its impact on derived demand would be negligible. If it is an increase in cost of the existing service, it would decrease the farm-level price. If the service shifts primary demand sufficiently outward so that it leads to an outward shift in derived demand, the coefficient would have a positive sign.

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[46] There are no data regarding New Zealanders' promotional activities.

[47] The specification is motivated by the fact that a monthly breakdown of advertising expenditures is limited to 1992/93. Moreover, the specification is justified, since in any case, given the various methods of payment and implementation of promotional activities, advertising expenditures would not properly reflect the actual promotional activities implemented during particular months.

The fitted domestic demand equation is

$$FOBDOM_i = \beta_{F,1} + \beta_{F,2}QDOM_i + \beta_{F,3}QDOM_{i-1} + \beta_{F,4}QIM_i + \beta_{F,5}QIM_{i-1} + \beta_{F,6}QIM_{i-2} + \beta_{F,7}QIM_{i-3} + \beta_{F,8}UNITDOM_i + \beta_{F,9}MINC_i + \beta_{F,10}DSPR_i + \varepsilon_{F,i}. \qquad [E^2_m\text{-}5]$$

Annual average price

After monthly f.o.b. prices and shipment volumes have been obtained for an entire season, a weighted average price (*AVGFOB*) is calculated over the crop year (equation E^2_a-1a, table IV-1). The average price is then corrected for bias as explained previously (equation E^2_a-1). Subsequently, the price is used as a determinant of revenue which influence production in the following year.

3. Annual demand - period 1 (1980/81-1985/86)

As discussed above, data limitation requires a single demand equation to represent demand for all California kiwifruit during the period preceding 1986/87. Due to the limited degrees of freedom, the equation is estimated using the data from 1980/81 through 1994/95. The dependent variable is the annual average f.o.b. price deflated by CPI for food (*FOB*), which represents the price for total disappearance of California kiwifruit. It is dependent on the corresponding quantity of disappearance, represented by total shipment volume (*QSHIP*), the volume of imports, advertising proxies, the volume of a substitute commodity, and income.

Kiwifruit is seasonally produced, but imports from the Southern Hemisphere allow it to be consumed year-round which led to its wide acceptance by retailers (McClure, et al., 1989). Moreover, considering the fact that the number of months where marketing seasons for imported and domestic kiwifruit overlap is limited, the aggregate impact of imports during the summer preceding the California marketing season (*LQIM*) is expected to be complementary to domestic kiwifruit and to exhibit a positive sign on its coefficient.[48] However, this would imply that the industry efforts to restrict imports, i.e., the extension of the federal marketing order and the imposition of anti-dumping tariffs, were irrational. If the industry has indeed been rational, imports should be substitutes, indicated by a negative coefficient. The price effect of imports is to be determined empirically.

Domestic promotional activities by California growers began in 1980 concurrently with the establishment of the CKC, while the first export promotion expenditures took place in 1988/89.[49] To evaluate the aggregate effect of advertising by the CKC, total advertising expenditures are included. Because actual advertising expenditures are highly correlated with total shipment volumes, due to the adjustment of advertising budget for crop size, advertising expenditures per tray equivalent of shipment (*UNITAD*), i.e., total advertising

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[48]Imports from the Southern Hemisphere are also marketed from storage after the California harvest, and Italian kiwifruit marketing concur with that of California fruit. Although these kiwifruit compete with U.S. kiwifruit directly, their relative volume is small.

[49]Export advertising expenditures are comprised of Market Promotion Program (MPP) funds and matching funds from assessment. The CKC received MPP funds in 1987 for the first time, but did not spend it until the following crop year. See footnote 6 for the discussion of MPP funds.

expenditures divided by total shipment and deflated by CPI for all items, is used in the model (equation E^1_a-1.1, table IV-1). No lagged effect of advertising is incorporated because of the annual model specification.[50]

The 1980 figure for unit advertising expenditures was considerably lower than the rest of the observations, as the CKC began its operation at a trial level of budget in the first year. Judging that the irregularity is significant enough to alter the coefficient on *UNITAD*, a dummy variable interacting with *UNITAD* in 1980 is included (*UNITAD80*). Logically, the overall advertising effect is expected to be positive. The marginal effect of 1980 is expected to be negative, if the current advertising expenditure level is relatively more effective than that in 1980.

Per capita consumption of total fresh fruit less kiwifruit, a calendar year observation reported in pounds, is specified as a substitute commodity. In the crop year demand function, this observation is, in effect, lagged, because three quarters of a crop year falls in the following calendar year. Furthermore, to ensure that the variable is stationary, the difference from the previous year is specified (*DFRUIT*). For example, the 1990/91 crop year observation is the difference between 1990 and 1991 consumption levels. The expected sign on its coefficient is positive if other fruits are complementary to kiwifruit consumption and negative if they are substitutes.

As an income variable, U.S. per capita income was considered sufficient, despite the specification for demand in both domestic and overseas markets, because the share of domestic shipments is substantial (figure I-4). Per capita disposable personal income reported by the Bureau of Economic Analysis is another calendar year observation which is trending upward. Thus, adjustments are made analogous to the fruit consumption variable, i.e., the 1990/91 crop year income is measured by the difference between 1990 and 1991 income levels deflated by CPI for all items (*DINC*). Kiwifruit is expected to be a normal good, implying a positive coefficient on the income variable.

Other variables such as those related to export markets and marketing margin were considered but were discarded due to degrees of freedom. The empirical annual demand equation is

$$FOB_t = \alpha_{A,1} + \alpha_{A,2}QSHIP_t + \alpha_{A,3}LQIM_t + \alpha_{A,4}UNITAD_t + \alpha_{A,5}UNITAD80_t + \alpha_{A,6}DFRUIT_t + \alpha_{A,7}DINC_t + \varepsilon_{A,t}. \qquad [E^1_a\text{-}1]^{51}$$

[50]This specification is based on Mr. Houston's statement that no difference in market demand would be apparent within a year if advertising were terminated.

[51]The notation is explained in footnote 19.

Table II-1 Conceptual Framework[a]

[1]Production

Bearing acreage:	
$BA_t = BA_{t-1} + N_{t-k} - R_{t-1}$	[C-1][b]
New plantings:	
$N_t = f(\ PROFIT^e_t,\ \underline{PROFITA^e_t},\ \underline{URB_t},\ TNA_{t-1},\ \varepsilon_{N,t}\ )$	[C-1.1]
Total net acres:	
$TNA_t = BA_t + NBA_t - R_t$	[C-1.1a]
$NBA_t = N_{t-3} + N_{t-2} + N_{t-1} + N_t$	[C-1.1b]
Long-run profit expectations from kiwifruit:	
$PROFIT^e_t = f(\ FOB^E_t \times YIELD^E_t,\ \underline{EST_t},\ \underline{C^E_t},\ \underline{MO_t},\ \underline{AD_t},\ \varepsilon_{P,t}\ )$	[C-1.1c]
Long-run profit expectations from an alternative crop:	
$\underline{PROFITA^e_t} = f(\ \underline{FOBA^E_t} \times \underline{YIELDA^E_t},\ \underline{ESTA_t},\ \underline{CA^E_t},\ \varepsilon_{PA,t}\ )$	[C-1.1d]
Removals:	
$R_t = f(\ SPROFIT^e_t,\ \underline{SPROFITA^e_t},\ \underline{URB_t},\ \underline{W_t},\ \varepsilon_{R,t}\ )$	[C-1.2]
Short-run profit expectations from kiwifruit:	
$SPROFIT^e_t = f(\ SPROFIT^E_t,\ \underline{MO_t},\ \underline{AD_t},\ \varepsilon_{SP,t}\ )$	[C-1.2a]
Short-run profit expectations from an alternative crop:	
$\underline{SPROFITA^e_t} = f(\ \underline{SPROFITA^E_t},\ \varepsilon_{SPA,t}\ )$	[C-1.2b]
Yield:	
$YIELD_t = f(\ NBA_{t-4}/BA_t,\ \underline{W_t},\ \underline{TR_t},\ FOB_{t-1},\ \varepsilon_{Y,t}\ )$	[C-2]
Production in the U.S.:	
$QP_t = BA_t \times YIELD_t$	[C-3]

[a]The supercript e denotes that the variable is unobservable expectations; E denotes that the expected variable is defined in terms of observable variables and that specific forms are left to be empirically specified.

[b]C denotes that the equation belongs to the conceptual model.

Table II-1 (Continued)

[2]Marketing

Domestic shipment:

$$\boldsymbol{QDOM_i} = f(\boldsymbol{FOBDOM_i}, \underline{FOBEX_i}, \underline{FOBDOM^E_i}, \underline{FOBEX^E_i}, INV_{i-1}, \underline{MIS_i}, \varepsilon_{D,i}) \qquad [C_m\text{-}1]^c$$

Export shipment:

$$\boldsymbol{QEX_i} = f(\underline{FOBEX_i}, \boldsymbol{FOBDOM_i}, \underline{FOBEX^E_i}, \underline{FOBDOM^E_i}, INV_{i-1}, \underline{MIS_i}, \underline{QPNH_i}, \underline{ADEX_i}, \underline{ADOTHER_i}, \varepsilon_{X,i}) \qquad [C_m\text{-}2]$$

Imports:

$$QIM_i = f(\underline{FOBIM_i}, INV_{i-1}, \varepsilon_{IM,i}) \qquad [C_m\text{-}3]$$

Shipment of kiwifruit imports:

$$QMIM_i = f(\underline{WIM_i}, \underline{WIM^E_i}, QIM_i, INV_{i-1}, \varepsilon_{M,i}) \qquad [C_m\text{-}3a]$$

Inventory identity:

$$\boldsymbol{INV_i} = INV_{i-1} + QP_t + QIM_i - (1-\underline{r}^D_i)\boldsymbol{QDOM_i} - (1-\underline{r}^X_i)\boldsymbol{QEX_i} - (1-\underline{r}^M_i)QMIM_i \qquad [C_m\text{-}4]$$

Volume of kiwifruit disappearance in the U.S. market:

$$\boldsymbol{QUS_i} = \boldsymbol{QDOM_i} + QMIM_i \qquad [C_m\text{-}5a]$$

U.S. farm-level demand:

$$\boldsymbol{FOBDOM_i} = f(\boldsymbol{QDOM_i}, QMIM_i, \underline{QOTHER_i}, \underline{INC_i}, \underline{ADDOM_i}, \underline{ADNZ_i}, \underline{SPR_i}, QUS_{i-1}, \varepsilon_{F,i}) \qquad [C_m\text{-}5]$$

Annual f.o.b. Price:

$$FOB_t = \Sigma_{i=1}^{12} [(FOBDOM_i \times QDOM_i + \underline{FOBEX_i} \times QEX_i) / \Sigma_{i=1}^{12} (QDOM_i + QEX_i)] \qquad [C_a\text{-}1]^d$$

[c] m denotes a monthly relationship.

[d] a denotes an annual relationship.

Table II-2 Conceptual Variables in Alphabetical Order

Variable[a]	Definition, units of measurement.
AD(a)	Dummy variable for the anti-dumping ruling, equals 1 beginning in 1991/92, 0 otherwise. (Exogenous)
ADDOM(m)	Promotional activities by California growers in the U.S. market, represented by advertising expenditures, real dollars. (Exogenous)
ADEX(m)	Overseas promotional activities by California growers, represented by advertising expenditures, real dollars. (Exogenous)
ADNZ(m)	Promotional activities by New Zealand growers in the U.S. market, represented by advertising expenditures, real dollars. (Exogenous)
ADOTHER(m)	Promotional activities by other producing countries in U.S. export markets, represented by advertising expenditures, real dollars. (Exogenous)
BA(a)	Number of kiwifruit bearing acres in the United States, acres. (Lagged endogenous)
C^E(a)	Expected production cost of kiwifruit, represented by a numerical summary of historical real costs, real dollars per acre. (Exogenous)
CA^E(a)	Expected production cost of an alternative crop, represented by a numerical summary of historical real costs, real dollars per acre. (Exogenous)
EST(a)	Cost of establishing an acre of kiwifruit vineyard, real dollars per acre. (Exogenous)
ESTA(a)	Cost of establishing an acre of an alternative crop operation, real dollars per acre. (Exogenous)
FOB(a)	Annual average f.o.b. price, real dollars per tray equivalent. (Lagged endogenous)
FOB^E(a)	Expected annual price for kiwifruit, represented by a numerical summary of historical real prices, real dollars per tray equivalent. (Lagged endogenous)

[a](a) denotes annual variables, and (m) denotes monthly variables.

Table II-2 (Continued)

Variable	Definition, units of measurement.
$FOBA^{E}$(a)	Expected annual price for a unit of output of an alternative crop, represented by a numerical summary of historical real prices, real dollars per unit-of-output of the alternative crop. (Exogenous)
$FOBDOM$(m)	Monthly f.o.b. price for domestic shipment, real dollars per tray equivalent. (Endogenous)
$FOBDOM^{E}$(m)	Monthly expected f.o.b. price for domestic shipment, real dollars per tray equivalent. (Exogenous)
$FOBEX$(m)	Monthly f.o.b. price for export shipment, real dollars per tray equivalent. (Exogenous)
$FOBEX^{E}$(m)	Monthly expected f.o.b. price for export shipment, real dollars per tray equivalent. (Exogenous)
$FOBIM$(m)	Monthly f.o.b. price for imported kiwifruit at port of entry, real dollars per tray equivalent. (Exogenous)
INC(m)	Per capita disposable income in the United States, real dollars per person. (Exogenous)
INV(m)	Ending inventory, tray equivalents. The variable lagged represents beginning inventory. (Endogenous)
MIS(m)	Number of months in storage, 1 to 12. (Exogenous)
MO(a)	Dummy variable for the establishment of the federal marketing order, equals 1 beginning in 1985/86, 0 otherwise. (Exogenous)
N(a)	Acres of new plantings, acres. (Lagged endogenous)
NBA(a)	Acres of non-bearing vineyard, acres. (Lagged endogenous)
$PROFIT^{e}$(a)	Long-run expected profit from kiwifruit vineyard, real dollars per acre. (Lagged endogenous)
$PROFITA^{e}$(a)	Long-run expected profit from an alternative crop operation, real dollars per acre. (Exogenous)
$QDOM$(m)	Volume of domestic shipment, tray equivalents. (Endogenous)

Table II-2 (Continued)

Variable	Definition, units of measurement.
QEX(m)	Volume of export shipment, tray equivalents. (Endogenous)
QIM(m)	Volume of imports arriving at U.S. ports, tray equivalents. (Lagged endogenous)
$QMIM$(m)	Volume of imported kiwifruit marketed to U.S. consumers, tray equivalents. (Lagged endogenous)
$QOTHER$(m)	Volume of shipment of other fruit, units of the fruit. (Exogenous)
QP(a)	Volume of U.S. kiwifruit production, tray equivalents. (Lagged endogenous)
$QPNH$(m)	Volume of annual kiwifruit production in the Northern Hemisphere net of U.S. production, tray equivalents. The value is invariant for months within a crop year. (Exogenous)
QUS(m)	Volume of domestic disappearance, tray equivalents. (Endogenous)
R(a)	Acres of removed vineyard, acres. (Lagged endogenous)
r^D(m)	Percentage of lost production from harvest, initial pack-out, and repacking in the process of domestic shipment, percentage. (Exogenous)
r^M(m)	Percentage of lost imports from handling and repacking in the process of shipping imported kiwifruit, percentage. (Exogenous)
r^X(m)	Percentage of lost production from harvest, initial pack-out, and repacking in the process of exports, percentage. (Exogenous)
SPR(m)	Marketing margin between retail- and farm-level prices, real dollars per tray equivalent. (Exogenous)
$SPROFIT^e$(a)	Short-run expected profit from kiwifruit vineyard, real dollars per acre. (Lagged endogenous)
$SPROFIT^E$(a)	Short-run expected profit from kiwifruit vineyard, represented by a numerical summary of historical profits, real dollars per acre. (Lagged endogenous)

Table II-2 (Continued)

Variable	Definition, units of measurement.
$SPROFIT^E$(a)	Short-run expected profit from kiwifruit vineyard, represented by a numerical summary of historical profits, real dollars per acre. (Lagged endogenous)
$SPROFITA^e$(a)	Short-run expected profit from an alternative crop operation, real dollars per acre. (Exogenous)
$SPROFITA^E$(a)	Short-run expected profit from an alternative crop operation, represented by a numerical summary of historical profits, real dollars per acre. (Exogenous)
TNA(a)	Total acres minus acres removed at the end of the year, acres. (Lagged endogenous)
TR(a)	Trend, 1980=1. (Exogenous)
URB(a)	Expected profit from a non-farm enterprise, represented by the rate of urbanization, percentage. (Exogenous)
W(a)	Weather factor, equals 1 in a year with extreme weather, 0 otherwise. (Exogenous)
WIM(m)	Monthly wholesale price for imported kiwifruit, real dollars per tray equivalent. (Exogenous)
WIM^E(m)	Monthly expected wholesale price for imported kiwifruit, represented by a numerical summary of observed real prices, real dollars per tray equivalent. (Exogenous)
$YIELD$(a)	Per-acre yield of kiwifruit vineyard, tray equivalents per acre. (Lagged endogenous)
$YIELD^E$(a)	Expected per-acre yield of kiwifruit vineyard, represented by a numerical summary of historical yields, tray equivalents per acre. (Lagged endogenous)
$YIELDA^E$(a)	Expected per-acre yield of an alternative crop operation, represented by a numerical summary of historical yields, units of output per acre. (Exogenous)

Section III. Estimation Results

In the previous section, the empirical model was developed from the conceptual framework. The consequences of compromises in empirical specification and the quality of data need to be considered for interpretation of the results. This section presents the estimation results following a discussion on technical issues.

A. Econometric Issues

As noted in the previous section, the fitted model represents a number of compromises relative to the preferred conceptual model: variables that are conceptually relevant are omitted due to data availability, and proxy variables substitute for unobservable expectations. Furthermore, the fitted equations have lagged endogenous variables; collinearity appears to be problem in some specifications; and the residuals in some specifications are autocorrelated. In summary, our model has many of the problems that exist in empirical analyses of time-series data. The specification has been made considering the trade-offs between the conflicting consequences, and the collective consequences of these problems for the quality of the empirical results are unknown.

Given the small sample in this study, annual equations are estimated with ordinary least squares (OLS), and the monthly equations in the simultaneous block are estimated as a system by three-stage least squares (3SLS) to circumvent simultaneous bias. When autocorrelation in the residuals could not be eliminated by reformulating the model specification, a feasible generalized least squares procedure is used. Nonetheless, it is possible and indeed likely, given the problems mentioned, that the coefficients obtained are biased and that the t-ratios are misleading about the true significance of the results.

Therefore, the discussion we provide of the individual coefficients is intended to give a sense of the possible interpretation and logic of the results. The consistency of the overall model is evaluated by the simulations and forecasts in section IV. They provide a general sense of the ability of the model to track and forecast key variables in the kiwifruit sector of the economy.

B. Estimation Results[52]

1. Supply: net acreage change and annual shipment

The estimated net acreage change equation, using 14 annual observations from 1980/81 to 1993/94, is:[53]

[52]The figures in parentheses below the coefficient estimates are t-ratios.

[53]The critical values of the statistics are: $t^*=2.306$, $d^*_L=0.505$, $d^*_U=2.296$ for T=14, K=6 at 5% significance level.

$$NET_t = 12426.84 + 0.144\ KIWI_t - 3.285\ PEACH_t - 2.769\ URB_t - 3.206\ EST_t + 639.914\ DU_t. \quad \text{[E-1.1]}$$
$$\qquad (2.85) \quad (2.72) \qquad (-3.90) \qquad (-1.27) \qquad (-1.90) \qquad (1.91)$$

The R-squared values are 0.896, and 0.830 adjusted for degrees of freedom. Durbin-Watson statistic is 2.044. All coefficients have expected signs, and most of them are supported by substantial t-ratios.

The results indicate that *ceteris paribus*, a dollar increase in average revenue from an acre of kiwifruit vineyard would increase bearing acreage by 0.14 acre. Similarly, a dollar increase in four-year average revenue from an acre of clingstone peach orchard would decrease kiwifruit bearing acreage by 3.3 acres. The impact of urbanization appears to be statistically not significant. When farm real estate values rise by a dollar per acre on average, holding all other factors constant, bearing acreage would decrease by 3.2 acres, respectively. The institutional changes are estimated to be jointly effective in retaining 640 acres of production.

The respective elasticities are evaluated at the sample mean for major right-hand side variables (table III-1). The elasticity with respect to expected revenue from kiwifruit production of 2.54 indicates that a one percent increase in average kiwifruit revenue per acre, which may accrue from an increase in either marketable yield or price, leads to a two and a half percent increase in the net change in acreage. Comparing elasticities across the regressors, it appears that net acreage change is relatively more sensitive to exogenous factors than to its own profitability, which is consistent with the history that kiwifruit production began as a speculative investment opportunity.

The linear relationship between the production volume and the annual shipment volume is estimated, using 15 annual observations from 1980/81 to 1994/95, as

$$QSHIP_t = -164.104 + 0.873\ QP_t \quad \text{[E-3a]}$$
$$\qquad (-0.72) \quad (34.25)$$

with an R-squared value of 0.989.

2. Monthly shipment and demand

There are six endogenous variables in the system of monthly equations. The behavioral equations are specified for volume of domestic shipment (*QDOM*), change in inventory (*DINV*), and domestic f.o.b. price (*FOBDOM*); the ratio between the current and expected prices (*FOBRAT*), current return (*RET*), and volume of export shipment (*QEX*) are determined by identities. The data file was created from October, 1986, to April, 1994.[54] 3SLS estimation results are:

[54]There are no observations in the off-season which is typically June through September. There is no May observation in 1994/95.

Domestic shipment:[55]

$$QDOM_i = -1249.12 + 1159.47\ FOBRAT_i - 92.741\ FOBEX_i + 0.119\ QALL_i$$
$$(-1.90) \quad (2.70) \quad (-2.06) \quad (4.27)$$
$$-0.137\ OCTALL_i + 927.687\ OCT_i + 95.091\ NOV_i + 320.192\ DEC_i$$
$$(-1.64) \quad (1.18) \quad (0.61) \quad (2.17)$$
$$+ 613.379\ JAN_i + 685.812\ FEB_i + 678.224\ MAR_i + 334.481\ APR_i$$
$$(4.07) \quad (4.55) \quad (4.48) \quad (2.30)$$
$$[R^2=0.713,\ Adj.R^2=0.658,\ D\text{-}W=1.502] \qquad [E^2{}_m\text{-}1]$$

Change in inventory:[55]

$$DINV_i = 314.245 - 32.670\ RET_i - 65.056\ FOBDOME_i + 0.091\ QALL_i$$
$$(0.60) \quad (-0.27) \quad (-0.62) \quad (2.86)$$
$$-1.124\ OCTALL_i + 878.875\ OCT_i + 287.778\ NOV_i + 394.423\ DEC_i$$
$$(-12.36) \quad (0.99) \quad (1.76) \quad (2.54)$$
$$+ 817.602\ JAN_i + 898.927\ FEB_i + 1024.21\ MAR_i + 379.788\ APR_i$$
$$(5.15) \quad (5.65) \quad (6.35) \quad (2.47)$$
$$[R^2=0.994,\ Adj.R^2=0.993,\ D\text{-}W=1.487] \qquad [E^2{}_m\text{-}4]$$

Monthly demand:[56]

$$FOBDOM_i = 21.528 - 0.00290\ QDOM_i + 0.000536\ QDOM_{i-1} - 0.000323\ QIM_i$$
$$(3.37) \quad (-4.45) \quad (1.25) \quad (-1.49)$$
$$-0.000441\ QIM_{i-1} - 0.000465\ QIM_{i-2} - 0.000217\ QIM_{i-3} + 10.103\ UNITDOM_i$$
$$(-1.94) \quad (-2.00) \quad (-1.30) \quad (0.49)$$
$$-0.00118\ MINC_i - 0.0202\ DSPR_i$$
$$(-2.47) \quad (-1.71)$$
$$[R^2=0.804,\ Adj.R^2=0.775,\ D\text{-}W=1.444] \qquad [E^2{}_m\text{-}5]$$

As a system, the three equations have reasonably good fit, and the Durbin-Watson statistics for all equations indicate no strong autocorrelation in the error terms. Most coefficients have expected signs supported by large t-ratios.

Domestic shipment reflects both economic trade-offs and physical characteristics of the commodity. High t-values support the coefficients on the two price variables and on annual crop size as well as those on the monthly dummy variables representing storage period. *Ceteris paribus*, when the ratio of current domestic price to its expectation increases by one, 1160 thousand more TE are allocated to the U.S. market in the current month. The corresponding elasticity dictates that a one percent increase in the price ratio would increase the domestic shipment by 1.40 percent (table III-1). If the current export price rises by a dollar, 93 thousand TE are diverted from the U.S. market to exports. An elasticity of -0.59 suggests that specialized requirements of size and quality for export shipments limit the allocation to exports in response to prices. A 1,000 TE increase in total kiwifruit crop at the beginning of October, *ceteris paribus*, enhances domestic shipment by 130 TE. The elasticity with respect to the crop volume is 1.30; monthly shipment volume is elastic with

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[55]The figures in parentheses are t-ratios. The critical values of the statistics are: $t^*=2.00$, $d^*_L=1.272$, $d^*_U=1.986$ for T=70, K=12 at 5% significance level.

[56]The critical values of the statistics are: $t^*=2.00$, $d^*_L=1.337$, $d^*_U=1.910$ for T=70, K=10 at 5% significance level.

respect to total available supply. The coefficients on monthly dummy variables exhibit a marketing pattern where shipments are small in months immediately following harvest and increase after January relative to the May base.

The change in inventory appears to be more strongly determined by the biological and physical nature of kiwifruit handling and storage than by economic incentives. The coefficient on current return have an unexpected sign, but both coefficients on current and expected future returns has low statistical significance; the impacts of the current and expected future returns on inventory changes are not statistically different from zero. This negligible response to prices seems as a partial explanation to the counter-intuitive tendency that fruit is stored and shipped later, despite a seasonal price pattern which suggests a disincentive for storage.

Crop size has a significant impact on the overall change in inventory, but its magnitude is small. Monthly inventory changes appear not to be quantity responsive with respect to crop size (table III-1). The interaction term between crop size and October is almost unity, directly reflecting the incoming harvest. Shipments appear to be concentrated in months January through March.

In the short run, a 1,000 TE increase in the volume of domestic shipment leads to a 0.3 cent decline in monthly f.o.b. price. Evaluated at the mean of the sample, this is a flexibility of -0.55 (table III-1). An inflexible price is consistent with elastic demand, which may be explained by the semi-perishability of kiwifruit. If there is no cross effect from substitutes and complements of the commodity in question, the reciprocal of flexibility is equal to the elasticity. Otherwise, the reciprocal of flexibility is the lower limit of the actual elasticity (Tomek and Robinson, 1990). Thus, the reciprocal of flexibility, -1.82, provides an estimate of the lower limit of the demand elasticity of kiwifruit at the farm level. The coefficient on the one-month-lagged shipment has a small t-ratio implying that most of the price adjustment, with respect to quantity, occurs within the current month.

As expected, imports in the monthly specification are revealed to be substitutes. The hypothesis that imports are stored for several months before the actual shipment is supported by statistical significance of the import coefficients. In particular, the pattern of declining statistical significance of the coefficients at longer lags, suggests that the majority of imports are stored for no longer than three months. The magnitude of influence is slight and similar across all import variables. Smaller volume of monthly imports magnifies the difference in flexibilities with respect to domestic shipments and imports.

The coefficient on the domestic unit advertising variable is positive, but small in magnitude and insignificant. This suggests that advertising expenditures allocated to the U.S. market have had little or no effect on price. Alternatively, the economic significance to presence of advertising, to maintain consumer awareness, may not be measurable by advertising expenditures. The income variable has a negative coefficient with a large t-ratio, but the magnitude is negligible. This trend in price is not necessarily related to income, but perhaps to variables omitted from the model that are correlated with income. The coefficient on the monthly difference in price spread is negative but statistically not significant

3. Annual demand

The annual demand equation is estimated with 15 observations from 1980/81 to 1994/95 correcting for first-order correlation in errors[57]:[58]

$$\begin{aligned} FOB_t = {} & 9.277 - 0.00044\ QSHIP_t - 0.00018\ LQIM_t + 0.590\ UNITAD_t \\ & (25.41) \quad (-8.98) \qquad\qquad (-3.67) \qquad\qquad (0.30) \\ & + 81.909\ UNITAD80_t + 0.0124\ DFRUIT_t - 0.00097\ DINC_t - 0.703\ \hat{\varepsilon}_{A,t-1} \\ & (11.49) \qquad\qquad (0.51) \qquad\qquad (-2.80) \qquad\qquad (-2.34) \end{aligned} \qquad [E^1_a\text{-}1]$$

The high R-squared value of 0.993 (0.985, adjusted) indicates that most of the variation in the annual f.o.b. price is explained by the regressors. The Durbin-Watson statistic, after the correction, is 1.767. Most coefficients have expected signs, with the exception of the income variable. The unit advertising expenditure and fruit consumption variables have small t-ratios, indicating low statistical importance of these variables.

If total shipment increased by 1,000 TE, the price received by handlers declines by 0.04 cent per TE, *ceteris paribus*. The price flexibility of demand at the sample mean is -0.52 (table III-1). The sum of the two *QDOM* coefficients, -0.0024, can be regarded as the long-run effect of quantity on price, which is comparable with the coefficient in the annual equation. Given that the monthly quantities average one-eighth the size of annual quantities, one expects the slope coefficient in the annual equation to be about eight times smaller (in absolute value) than in the monthly equation. Multiplying the annual quantity coefficient -0.00044 by eight, -0.0035 is comparable with -0.0024, considering that the results are based on different sample periods and models. Therefore, the monthly demand equation appears consistent with the annual specification.

Imports during the preceding summer are substitutes to domestic kiwifruit sales, although there are more months when the two marketing seasons do not overlap than they do. A 1,000 TE increase in imports would lead to a 0.02 cent price decline per TE of California kiwifruit. In flexibility terms, a one percent increase in imports brings the f.o.b. price down by 0.15 percent. Since annual import volume is comparable to domestic volume, it appears that kiwifruit price is less flexible with respect to imports than it is to domestic supply, i.e., U.S. kiwifruit demand for imports is more elastic with respect to prices. Analogous to the domestic quantity, the coefficients on *QIM*'s can be summed as the long-run effect of imports, i.e., -0.0014. The annual import coefficient multiplied by eight is -0.0017, which is consistent with the monthly result.

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[57]Here is a symptom of potential misspecification error, exhibited in autocorrelated errors. Since the alternative specification has been exhausted, however, it was judged appropriate to correct for the autocorrelated errors. In comparison to the preliminary estimation, all coefficients maintained their signs and those with statistical significance became more significant.

[58]The critical values of the statistics are: $t^*=2.365$, $d^*_L=0.343$, $d^*_U=2.727$ for T=15, K=8 at 5% significance level.

The coefficient on advertising expenditures per TE is positive but statistically insignificant, whereas the coefficient on the dummy variable for 1980/81 unit advertising is positive and markedly significant. Multiplying the estimated coefficient for *UNITAD80* by the 1980/81 advertising expenditure value, 0.0558, advertising in 1980/81 is estimated to have increased the f.o.b. price by 4.57 dollars per TE.[59] However, in subsequent years, it has had no effect in enhancing aggregate demand for California kiwifruit. Analogous to the monthly results, further investigation is necessary.

The other fruit consumption variable has a positive coefficient although the coefficient is statistically not important. Consistent with the monthly results, the sign of the coefficient on income is unexpectedly negative with a large t-ratio, which suggests that the income variable is capturing a downward trend in price that is correlated with income, but perhaps not caused by income. A reasonable interpretation is that in the sample period, when the annual change in per capita disposable personal income increased one dollar, the price of kiwifruit decreased 0.1 cent. This estimate, however, is probably not a good measure of the future effects of income on demand.

Table III-1 Elasticities and Flexibilities[a]: Evaluated at the mean of sample

Annual				
NET (1980-1993)				
KIWI	*PEACH*	*EST*		
e=2.542	*e*=-23.640	*e*=-8.856		
FOB (1980-1994)				
QSHIP	*LQIM*	*UNITAD*	*DFRUIT*	*DINC*
f=-0.521	*f*=-0.145	*f*=0.016	*f*=0.002	*f*=-0.022
Monthly (October,1986 - April, 1995)				
QDOM			***DINV*** (Positive)	
FOBRAT	*FOBEX*	*QALL*	*QALL*	
e=1.402	*e*=-0.587	*e*=1.303	*e*=0.653	
FOBDOM				
QDOM	*QIM1*	*QIM2*	*MINC*	
f=-0.549	*f*=-0.019	*f*=-0.028	*f*=-3.375	

[a]*e* denotes elasticity; *f* denotes flexibility.

[59]Together with the overall advertising effect, the results imply a price increase of 4.61 dollars [=0.055832×(81.90861+0.59013)].

Section IV. Simulation of the U.S. Kiwifruit Industry Model

In this section, the complete model is summarized from the perspective of a simulation application. Then, static and dynamic simulations are performed over the period of analysis, from 1981/82 through 1993/94, and evaluated. Finally, the model is used to forecast two crop years beyond the sample period, using known exogenous values for the 1994/95 and 1995/96 crop years.

A. Complete Dynamic Model

The complete dynamic model is presented in table IV-1. All equations and identities are arranged in the order of simulation, and all variables determined within the model are in bold face. Definitions of variables are presented in table IV-2. Not only the marketing/demand equations, but also the supply equations are denoted with superscripts *1* or *2* after the *E*, representing the period before 1986/87 and the period thereafter.

Table IV-1 Complete Dynamic Model

Period 1: 1981/82 - 1985/86	
Bearing acreage:	
$\boldsymbol{BA_t} = \boldsymbol{BA_{t-1}} + \boldsymbol{NET_{t-1}}$	$[E^1\text{-}1]^a$
Production:	
$\boldsymbol{QP_t} = \boldsymbol{BA_t} \times YIELD_t$	$[E^1\text{-}3]$
Shipment:	
$\boldsymbol{QSHIP_t} = -164.10423 + 0.87293\, \boldsymbol{QP_t}$	$[E^1\text{-}3a]$
Unit advertising expenditures:	
$\boldsymbol{UNITAD_t} = (ADDOM_t + ADEX_t)/\boldsymbol{QSHIP_t}$	$[E^1_a\text{-}1.1]$
Annual demand[b]:	
$\boldsymbol{FOB_t} = 9.27693 - 0.0004403\, \boldsymbol{QSHIP_t} - 0.0001836\, LQIM_t$ $+0.59013\, \boldsymbol{UNITAD_t} + 81.908606\, UNITAD80_t$ $+0.012411\, DFRUIT_t - 0.0009673\, DINC_t - 0.70344\varepsilon_{t-1}$	$[E^1_a\text{-}1]$
Expected revenue:	
$\boldsymbol{REV_t} = \boldsymbol{FOB_t} \times \boldsymbol{QSHIP_t} \times 1000/\boldsymbol{BA_t}$	$[E^1\text{-}1.1e]$
$\boldsymbol{KIWI_t} = (\boldsymbol{REV_t} + \boldsymbol{REV_{t-1}} + \boldsymbol{REV_{t-2}} + \boldsymbol{REV_{t-3}})/4$	$[E^1\text{-}1.1f]$
Net acreage change at the end of year:	
$\boldsymbol{NET_t} = 12426.84 + 0.14389\, \boldsymbol{KIWI_t} - 3.28481\, PEACH_t$ $-276.91400\, URB_t - 3.20551\, EST_t + 639.91440\, DU_t$	$[E^1\text{-}1.1]$

Table IV-1 (Continued)

Period 2: 1986/87 - 1993/94

Bearing acreage:

$BA_t = BA_{t-1} + NET_{t-1}$ [E^2-1]

Production:

$QP_t = BA_t \times YIELD_t$ [E^2-3]

Shipment:

$QSHIP_t = -164.10423 + 0.87293\ QP_t$ [E^2-3a]

Crop size at the beginning of October:

$QALL_t = QSHIP_t - QSEPT_t$ [E^2-3b]

Adjusting to monthly observations:

$QALL_i = QALL_t$ for every month i in crop year t [E^2_m-4.2]

$OCTALL_i = QALL_i \times OCT_i$ [E^2_m-4.3]

Monthly block I[c]:

$$QDOM_i = -1249.12 + 1159.470\ FOBRAT_i - 92.741\ FOBEX_i + 0.119\ QALL_i - 0.137\ OCTALL_i + 927.687\ OCT_i + 95.091\ NOV_i + 320.192\ DEC_i + 613.379\ JAN_i + 685.812\ FEB_i + 678.224\ MAR_i + 334.481\ APR_i \quad [E^2_m\text{-}1]$$

$$DINV_i = 314.245 - 32.670\ RET_i - 65.056\ FOBDOME_i + 0.091\ QALL_i - 1.124\ OCTALL_i + 878.875\ OCTi + 287.778\ NOV_i + 394.423\ DEC_i + 817.602\ JAN_i + 898.927\ FEB_i + 1024.210\ MAR_i + 379.788\ APR_i \quad [E^2_m\text{-}4]$$

$$FOBDOM_i = 21.527 - 0.00290\ QDOM_i + 0.000534\ QDOM_{i-1} - 0.000323\ QIM_i - 0.000441\ QIM_{i-1} - 0.000465\ QIM_{i-2} - 0.000217\ QIM_{i-3} + 10.103\ UNITDOM_i - 0.00118\ MINC_i - 0.0202\ DSPR_i \quad [E^2_m\text{-}5]$$

$QEX_i = DINV_i + QALL_t - QDOM_i$ [E^2_m-2]

$FOBRAT_i = FOBDOM_i / FOBDOME_i$ [E^2_m-1.1]

$RET_i = (FOBDOM_i \times QDOM_i + FOBEX_i \times QEX_i)/(QDOM_i + QEX_i)$ [E^2_m-4.1]

$INV_i = INV_{i-1} - DINV_i$ [E^2_m-4a]

[a]E denotes that the equation belongs to the empirical model. Superscripts *1* and *2* correspond to the time periods 1981/82 through 1985/86 and 1986/87 through 1993/94, respectively.

[b]Since UNITAD80 is not incorporated in the simulation, it is not regarded as endogenous.

[c]UNITDOM is treated as exogenous in *Monthly block I*.

Table IV-1 (Continued)

Calculate unit domestic advertising expenditures:

$\boldsymbol{UNITDOM_i} = ADPRO_t/(\Sigma_{i=1}{}^{12}(\boldsymbol{QDOM_i}\times 1000)\times 8)$ [$E^2{}_m$-6]

for every month i in crop year t

Monthly block II: (ρ_{DINV}=0.716, ρ_{QDOM}=0.687)

$\boldsymbol{QDOM_i} = -1249.12 + 1159.470\ \boldsymbol{FOBRAT_i} - 92.741\ FOBEX_i + 0.119\ \boldsymbol{QALL_i} - 0.137\ \boldsymbol{OCTALL_i} + 927.687\ OCT_i + 95.091\ NOV_i + 320.192\ DEC_i + 613.379\ JAN_i + 685.812\ FEB_i + 678.224\ MAR_i + 334.481\ APR_i$ [$E^2{}_m$-1]

$\boldsymbol{DINV_i} = 314.245 - 32.670\ \boldsymbol{RET_i} - 65.056\ FOBDOME_i + 0.091\ \boldsymbol{QALL_i} - 1.124\ \boldsymbol{OCTALL_i} + 878.875\ OCTi + 287.778\ NOV_i + 394.423\ DEC_i + 817.602\ JAN_i + 898.927\ FEB_i + 1024.210\ MAR_i + 379.788\ APR_i$ [$E^2{}_m$-4]

$\boldsymbol{FOBDOM_i} = 21.527 - 0.00290\ \boldsymbol{QDOM_i} + 0.000534\ \boldsymbol{QDOM_{i-1}} - 0.000323\ QIM_i - 0.000441\ QIM_{i-1} - 0.000465\ QIM_{i-2} - 0.000217\ QIM_{i-3} + 10.103\ UNITDOM_i - 0.00118\ MINC_i - 0.0202\ DSPR_i$ [$E^2{}_m$-5]

$\boldsymbol{QEX_i} = \boldsymbol{DINV_i} + \boldsymbol{QALL_t} - \boldsymbol{QDOM_i}$ [$E^2{}_m$-2]

$\boldsymbol{FOBRAT_i} = \boldsymbol{FOBDOM_i}/FOBDOME_i$ [$E^2{}_m$-1.1]

$\boldsymbol{RET_i} = (\boldsymbol{FOBDOM_i}\times\boldsymbol{QDOM_i} + FOBEX_i\times\boldsymbol{QEX_i})/(\boldsymbol{QDOM_i} + \boldsymbol{QEX_i})$ [$E^2{}_m$-4.1]

$\boldsymbol{INV_i} = \boldsymbol{INV_{i-1}} - \boldsymbol{DINV_i}$ [$E^2{}_m$-4a]

Calculate annual f.o.b. price:

$\boldsymbol{AVGFOB_t} = \Sigma_{i=1}{}^{12}[\boldsymbol{FOBDOM_i}\times\boldsymbol{QDOM_i}/\Sigma_{i=1}{}^{12}(\boldsymbol{QDOM_i})]$ [$E^2{}_a$-1a]

$\boldsymbol{FOB_t} = 0.06911 + 0.90934\times\boldsymbol{AVGFOB_t}$ [$E^2{}_a$-1]

Expected revenue:

$\boldsymbol{REV_t} = \boldsymbol{FOB_t}\times\boldsymbol{QSHIP_t}\times 1000/\boldsymbol{BA_t}$ [E^2-1.1e]

$\boldsymbol{KIWI_t} = (\boldsymbol{REV_t} + \boldsymbol{REV_{t-1}} + \boldsymbol{REV_{t-2}} + \boldsymbol{REV_{t-3}})/4$ [E^2-1.1f]

Net acreage change at the end of year:

$\boldsymbol{NET_t} = 12426.84 + 0.14389\ \boldsymbol{KIWI_t} - 3.28481\ PEACH_t - 276.91400\ URB_t - 3.20551\ EST_t + 639.91440\ DU_t$ [E^2-1.1]

Table IV-2 Empirical Variables in Alphabetical Order

Variable[a]	Definition, units of measurement.
ADDOM(a)	Annual advertising expenditures used by the California Kiwifruit Commission for U.S. domestic marketing, real dollars. (Exogenous)
ADEX(a)	Annual advertising expenditures used by the California Kiwifruit Commission for overseas marketing, real dollars.(Exogenous)
APR(m)	Dummy variable for April, equals 1 for April and 0 otherwise. (Exogenous)
AVGFOB(a)	Average of monthly domestic f.o.b. prices weighted by corresponding domestic shipments, real dollars per tray equivalent. (Lagged endogenous)
BA(a)	Number of kiwifruit bearing acres in California, acres. (Lagged endogenous)
DEC(m)	Dummy variable for December, equals 1 for December and 0 otherwise. (Exogenous)
DFRUIT(a)	Per capita consumption of total fresh fruit less kiwifruit, pounds per person. Annual difference. (Exogenous)
DINV(m)	Monthly change in beginning and ending inventory, 1,000 tray equivalents. (Endogenous)
DINC(a)	Per capita disposable personal income, deflated by CPI for all items, real dollars per person. Annual difference. (Exogenous)
DSPR(m)	Farm-retail price spread for fresh fruit, index: 1982-84=100, deflated by CPI for all items. Monthly difference. (Exogenous)
DU(a)	Dummy variable for institutional changes, equals 1 for 1990 and 1991 and 0 otherwise. (Exogenous)
EST(a)	Establishment cost, represented by a three-year average of farm real estate values in California, deflated by the Prices Paid by Farmers, real dollars per acre. (Exogenous)

[a](a) denotes annual variables, and (m) denotes monthly variables.

Table IV-2 (Continued)

Variable	Definition, units of measurement.
FEB(m)	Dummy variable for February, equals 1 for February and 0 otherwise. (Exogenous)
FOB(a)	Annual f.o.b. price for all shipment, deflated by CPI for food, real dollars per tray equivalent. (Lagged endogenous)
FOBDOM(m)	Monthly f.o.b. price for domestic shipment, deflated by CPI for food, real dollars per tray equivalent. (Lagged endogenous)
FOBDOME(m)	Monthly expected f.o.b. price for domestic shipment, deflated by CPI for food, real dollars per tray equivalent. (Exogenous)
FOBEX(m)	Monthly f.o.b. price for export shipment, deflated by CPI for food, real dollars per tray equivalent. (Exogenous)
FOBRAT(m)	Ratio between current and expected f.o.b. prices for domestic shipment, dimensionless. (Endogenous)
INV(m)	Ending inventory of California kiwifruit, 1,000 tray equivalents. The variable lagged, INV_{i-1}, represents beginning inventory[b]. (Endogenous)
JAN(m)	Dummy variable for January, equals 1 for January and 0 otherwise. (Exogenous)
KIWI(a)	Expected revenue from kiwifruit production, represented by a four-year average of revenue from an acre of kiwifruit vineyard, deflated by CPI for food, real dollars per acre. (Lagged endogenous)
LQIM(a)	Volume of imports during the preceding crop year, 1,000 tray equivalents. (Exogenous)
MAR(m)	Dummy variable for March, equals 1 for March and 0 otherwise. (Exogenous)
MINC(m)	Monthly per capita disposable personal income, deflated by CPI for all items, real dollars per person. (Exogenous)

[b]Current specification appears in the simulation model only (table IV-1).

Table IV-2 (Continued)

Variable	Definition, units of measurement.
NET(a)	Net change in bearing acreage, acres. (Lagged endogenous)
NOV(m)	Dummy variable for November, equals 1 for November and 0 otherwise. (Exogenous)
OCT(m)	Dummy variable for October, equals 1 for October and 0 otherwise. (Exogenous)
OCTALL(m)	Dummy variable for October multiplied by *QALL*, equals *QALL* in October and 0 otherwise. (Lagged endogenous)
PEACH(a)	Expected revenue from clingstone peach production, represented by a four-year average of revenue from an acre of clingstone peach orchard, deflated by CPI for food, real dollars per acre. (Exogenous)
QALL(m,a)	Volume of kiwifruit available for shipment at the beginning of October, 1,000 tray equivalents. The annual value is repeated for every observation i in marketing season t. (Lagged endogenous)
QDOM(m)	Volume of domestic shipment, 1,000 tray equivalents. (Endogenous)
QEX(m)	Volume of export shipment, 1,000 tray equivalents. (Endogenous)
QIM(m)	Volume of imports, 1,000 tray equivalents. (Exogenous)
QP(a)	Volume of kiwifruit production, 1,000 tray equivalents. (Lagged endogenous)
QSEPT(a)	Volume of shipment in September, used as an annual value to calculate *QALL*, 1,000 tray equivalents. (Exogenous)
QSHIP(a)	Volume of annual shipment, 1,000 tray equivalents. (Lagged endogenous)
RET(m)	Monthly return, represented by an average price for domestic and export shipment, weighted by corresponding volume, real dollars per tray equivalent. (Endogenous)

Table IV-2 (Continued)

Variable	Definition, units of measurement.
REV(a)	Revenue from an acre of kiwifruit vineyard, deflated by CPI for food, real dollars per acre. (Lagged endogenous)
UNITAD(a)	Advertising expenditures per tray equivalent shipment of California kiwifruit, deflated by CPI for all items, real dollars per tray equivalent. (Lagged endogenous)
UNITAD80(a)	Dummy variable for 1980, interacting with *UNITAD*. Equals 0.055832 for 1980, 0 otherwise. (Lagged endogenous)
UNITDOM(m)	Monthly advertising expenditures used by the California Kiwifruit Commission per tray equivalent domestic shipment, deflated by CPI for all items, real dollars per tray equivalent. (Lagged endogenous)
URB(a)	Percentage change in population of eight kiwifruit producing counties in California, percentage. (Exogenous)
YIELD(a)	Per-acre yield of kiwifruit vineyard, tray equivalents per acre. (Exogenous)

During the first period from 1981/82 through 1985/86, the model reads in lagged values of bearing acreage and net acreage change to obtain current bearing acreage (E^1-1). Sequentially, production and total shipment volumes are calculated (E^1-3, 3a). Using predicted shipment volume, unit advertising is calculated treating annual advertising expenditures as exogenous (E^1_a-1.1). Total shipment and unit advertising enter the annual demand equation, which defines annual f.o.b. price (E^1_a-1). Current revenue is obtained from annual f.o.b. price, total shipment, and bearing acreage, and is used to calculate expected kiwifruit revenue (E^1-1.1e, 1.1f). Expected revenue, in turn, is a variable in the equation defining net acreage change at the end of the current year (E^1-1.1). Once net acreage change is set, acreage and production in the following year are determined.

Total shipment volume for 1986/87 is determined in this way at the beginning of the second part of the simulation model (E^2-1, 3, 3a). To be consistent with the estimation procedure, September shipments, regarded as exogenous, are deducted from the total shipment value (E^2-3b). Adjusted shipment volume is converted into monthly observations before it is incorporated into the monthly allocation process (E^2_m-4.2, 4.3). Within the system of equations, domestic shipment, monthly change in inventory, domestic f.o.b. price, export shipment, the ratio between current and expected future prices, and current return are simultaneously determined. In addition, ending inventory is explicitly defined as beginning inventory less the change in inventory (E^2_m-4a). Initially, the system of equations solves for these predicted values, treating unit domestic advertising expenditures as given. Preliminary predictions for monthly domestic shipments are summed to calculate estimated unit domestic advertising expenditures, assuming annual advertising expenditures to be exogenous ($E^2{}_m$-6). The monthly block is simulated again incorporating this estimated value of unit domestic advertising expenditures. The average of final monthly price predictions, weighted by predicted levels of corresponding domestic shipments ($E^2{}_a$-1a), is adjusted by equation $E^2{}_a$-1 to attain annual f.o.b. price. This price is used to calculate expected revenue and feeds into the net acreage change equation (E^2-1.1e, 1.1f, 1.1). Bearing acreage and quantity of production in the succeeding year are determined in sequence.

In sum, there are a total of nine endogenous variables of interest, five annual and four monthly. The key annual variables are bearing acreage (*BA*), volume of annual shipment (*QSHIP*), annual f.o.b. price (*FOB*), expected revenue (*KIWI*), and net acreage change (*NET*). The four monthly variables are domestic and export shipment (*QDOM*, *QEX*), change in inventory (*DINV*), and f.o.b. price for domestic shipment (*FOBDOM*).

B. Ex Post Simulation

1. Static simulation

In static simulation, exogenous values and actual values of lagged endogenous variables are used to compute current endogenous variables. The simulation is initiated from 1981/82 to provide beginning lagged values, i.e., the 1980/81 values of net acreage change and bearing acreage are used to obtain bearing acreage in 1981/82. In the monthly allocation process, predicted levels of quantity variables were constrained to remain non-negative. In the static simulation, this constraint was necessary for export shipments.[60] The variable *FOBEX* was also adjusted to fall within the range of study.[61]

The non-negativity constraint on exports is binding in May, 1991, and October, 1992. This is consistent with the actual data where export shipments during the first and last months of a season are considerably lower than during other months. It is relatively difficult to meet the narrow quality and size requirements for export shipments when inventory is limited.

Various goodness-of-fit statistics are presented for the selected variables in table IV-3.[62]

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[60]Non-negative inventory need not to be considered in a static simulation context, because the levels of beginning inventory employed are actual observations.

[61]In a preliminary run, large observations of *FOBEX* in October and November, 1986, produced negative predictions for domestic shipments. Since these observations were at the upper range of the sample, they were replaced by predicted values from a trend-based equation (Appendix B). The substituted values were respectively 8.1139 and 7.3773.

[62]As a consequence of using actual values for lagged endogenous variables, solutions to the bearing acreage equation, which depend solely on past values, equal actual values. Hence, goodness-of-fit statistics are not reported for *BA*.

Table IV-3 Goodness-of-Fit: Static Simulation[1]

Variable	Data mean	Model mean	ME	MPE	MAE	MAPE	RMSE
QSHIP	6928.800	6997.100	68.297	0.01556	288.756	0.05713	371.919
FOB	5.374	5.348	-0.026	-0.00156	0.162	0.03258	0.186
KIWI	6358.620	6379.090	20.471	0.00297	53.686	0.00674	115.864
NET	300.000	313.793	13.793	0.30181	157.207	0.63543	180.204
QDOM	799.626	804.282	4.655	0.14558	158.481	0.36581	199.798
DINV	-27.733	-28.269	-0.537	0.02573	191.996	0.15839	254.940
FOBDOM	4.568	4.559	-0.009	0.00554	0.299	0.06629	0.402
QEX	342.666	342.752	0.086	0.35416	122.149	0.69644	159.065

	RMSPE	U	U1	U2	U^M	U^S	U^C
QSHIP	0.07633	0.02416	0.09832	0.19488	0.03372	0.00043	0.96585
FOB	0.03811	0.01627	0.06401	0.12821	0.02003	0.16769	0.81227
KIWI	0.01447	0.00889	0.08067	0.16056	0.03122	0.00671	0.96207
NET	1.15946	0.16223	0.16668	0.33824	0.00586	0.00477	0.98937
QDOM	0.95696	0.10853	0.29157	0.57817	0.00054	0.04659	0.95286
DINV	0.24078	0.03707	0.02659	0.05337	0.00000	0.00046	0.99954
FOBDOM	0.08315	0.04226	0.40485	0.78284	0.00049	0.03195	0.96755
QEX	1.22355	0.20150	0.34403	0.70609	0.00000	0.05853	0.94148

[1]ME=Mean error, MPE=Mean percentage error, MAE=Mean absolute error, MAPE=Mean absolute percentage error, RMSE=Root mean square error, RMSPE=Root mean square percentage error, U=Theil's inequality coefficient U, U1=Theil's inequality coefficent U1, U2=Theil's inequality coefficient U2, U^M=Bias proportion of inequality, U^S=Variance proportion of inequality, U^C=Covariance proportion of inequality.

Errors defined in percentage terms allow comparison across variables. Mean percentage error (MPE) is small for all variables, while mean absolute percentage error (MAPE) for net acreage change (*NET*) and export shipments (*QEX*) are notably large. A large error is expected for net acreage change, since the variable represents the combined outcome of two decisions. The model is not able to reflect various factors affecting the two decisions independently. Similarly, export shipment is defined as a residual. The error for this variable accounts for errors relating to all endogenous variables in the identity.

Root mean square error (RMSE) penalizes large individual errors more heavily than MAE (Pindyck and Rubinfeld, 1991). Consequently, root mean square percentage errors (RMSPE) for net acreage change and export shipment are accentuated. In addition, RMSPE for domestic shipments (*QDOM*) is considerable, indicating substantial individual errors.

Theil's inequality coefficients, U, U1, and U2, are all reasonably small.[63] U2 statistics less than one indicate that the model is more accurate than the naive no-change extrapolation model, where the forecast for the next period is this period's actual observation (Leuthold, 1975). The decomposition of U statistic for most variables appears desirable as well, with at least 90 percent of the error accruing to the covariance proportion, U^C. The exception is the annual f.o.b. price, yet the covariance proportion of 81 percent is still acceptable. Small bias and variance proportions, U^M and U^S, support that there is no systematic error and that the model is successfully replicating the degree of variability in respective variables.

2. Dynamic simulation

Dynamic simulation is distinguished from static simulation by using predicted values of endogenous variables in lagged specifications. The model reads in 1980 values for net acreage change and bearing acreage and lagged revenue values, and incorporates self-generated values for subsequent lagged endogenous variables.

Analogous to the static simulation, export shipments are constrained to be greater than or equal to zero. In addition, to prevent inventory from being negative, inventory change is equalized to beginning inventory if the predicted value of inventory is below zero. Once beginning inventory is zero, domestic and export shipments are forced to be zero, as well as prices for that month. Hence, the simulation would be aborted for the marketing season. A similar adjustment as in the static simulation was performed on the variable *FOBEX*.[64]

The export constraint is binding in May, 1989 and October, 1993, the inventory constraint is binding in April, 1992, and both constraints are binding in May, 1991. All cases correspond

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[63]Theil's U is calculated employing the *levels* of the predicted and actual values, according to Pindyck and Rubinfeld (1991). U1 and U2 employ *changes* in variables, where *predicted change* is defined as $\Delta P_t = P_t - A_{t-1}$, and *actual change* as $\Delta A_t = A_t - A_{t-1}$ (Leuthold, 1975).

[64]In addition to the two adjustments discussed in the static simulation section, the observation for May, 1988 was replaced by the corresponding prediction based on the same regression. The substituted value was 5.8206.

Table IV-4 Goodness-of-Fit: Dynamic Simulation[1]

Variable	Data mean	Model mean	ME	MPE	MAE	MAPE	RMSE
BA	5684.620	5918.510	233.892	0.04181	249.651	0.04534	290.160
QSHIP	6928.800	7253.10	324.301	0.05084	420.450	0.07571	503.255
FOB	5.374	5.290	-0.084	-0.01161	0.188	0.03488	0.213
KIWI	6358.620	6345.690	-12.929	-0.00242	167.194	0.02557	196.101
NET	300.000	308.987	8.987	0.23183	156.233	0.58498	179.973
QDOM	799.626	822.584	22.958	0.17041	160.661	0.36680	201.259
DINV	-27.733	-48.111	-20.378	0.05167	248.041	0.17947	341.473
FOBDOM	4.568	4.506	-0.062	-0.00877	0.288	0.06254	0.406
QEX	342.666	349.206	6.540	0.03700	123.858	0.69820	161.414

	RMSPE	U	U1	U2	U^M	U^S	U^C
BA	0.05433	0.02393	0.18859	0.43071	0.64976	0.03435	0.31588
QSHIP	0.09105	0.03213	0.12649	0.26370	0.41526	0.02032	0.56442
FOB	0.03929	0.01873	0.07320	0.14694	0.15482	0.09940	0.74577
KIWI	0.02982	0.01507	0.12958	0.27174	0.00435	0.01738	0.97827
NET	1.09124	0.16134	0.16512	0.33780	0.00249	0.00040	0.99711
QDOM	0.94395	0.10819	0.29331	0.58239	0.01301	0.03280	0.95418
DINV	0.26812	0.04877	0.03528	0.07148	0.00356	0.14377	0.85266
FOBDOM	0.08287	0.04294	0.40818	0.79171	0.02324	0.01697	0.95979
QEX	1.20084	0.20269	0.34702	0.71652	0.00164	0.04931	0.94905

[1]ME=Mean error, MPE=Mean percentage error, MAE=Mean absolute error,MAPE=Mean absolute percentage error, RMSE=Root mean square error, RMSPE=Root mean square percentage error, U=Theil's inequality coefficient U, U1=Theil's inequality coefficent U1, U2=Theil's inequality coefficient U2, U^M=Bias proportion of inequality, U^S=Variance proportion of inequality, U^C=Covariance proportion of inequality.

with the actual data.

Goodness-of-fit measures for the dynamic simulation are found in table IV-4. Dynamic simulation typically yields larger errors than static simulation, because predicted values of lagged endogenous variables are used. However, the greatest RMSPE for net acreage change and domestic and export shipments improved slightly over the static simulation result. As discussed above, it is not unreasonable that the model is unable to simulate these values as accurately as other variables. There is no drastic change in Theil's statistics as well. The U2 inequality coefficients remained smaller than one for all variables. Overall, the statistics seem to support the appropriateness of the model as a dynamic system.

C. Forecasting

Setting the last period of the sample period, 1993/94, as *year 0*, the model is used to forecast two crop years beyond the sample period using dynamic simulation. Observing the entire sample, the marketing season was assumed to be eight months long, beginning in October. The predictions can be regarded as an outcome under similar exogenous situations to those during the 1994/95 and 1995/96 seasons, if all assumptions underlying the model specifications are met. Since this latter condition is critical, the predictions are denoted as *year 1* and *year 2* forecasts, instead of the 1994/95, 1995/96 forecasts. For the *year 1* forecast, actual 1994/95 values are available for all exogenous variables. Any actual value available for 1995/96 is used for forecasting *year 2*. Missing observations for *year 2* were added, as described in Appendix B.

1. Year 1

The model reads in the actual 1993/94 values of bearing acreage and net acreage change. Thus, analogous to the dynamic simulation, bearing acreage and volume of production in *year 1* are determined by definition. Predicted values for the main variables are presented in table IV-5, along with actual 1994/95 values for comparison.

Despite the slight under-prediction of total shipment volume (*QSHIP*), the monthly allocation process generates predictions which closely follow the time path of actual values. The predicted peak of domestic shipments (*QDOM*) in *month 4* coincides with the actual pattern in the 1994/95 season, as does the peak of export shipments (*QEX*) in *month 6*. The seasonal trend in prices (*FOBDOM*) is successfully replicated, starting and ending the season at a high level. However, the ending price did not exceed the initial price in the simulated pattern.

The level of export shipment constraint is binding in *month 1*. The predicted annual shipment volume, i.e., incoming harvest in *month 1*, was too small to exceed the sum of domestic shipment and change in inventory, despite the fact that both measures were predicted lower than actual absolute levels. The small forecast for annual shipment volume partly reflects low production, which was due to a significant decrease in bearing acreage at the end of 1993/94. Also, handling loss was smaller than average years during the actual

Table IV-5 Forecasts: Actual and Predicted Values

Variable:(month)		1994/95 Actual	*Year 1* Forecast	*Year 2* Forecast
BA		6900	6900.00	7274.23
QSHIP		10252.30	9662.54	10396.65
QDOM	(1)[1]	840.60	596.51	638.27
	(2)	1282.80	1118.77	1154.20
	(3)	1349.71	1229.52	1458.69
	(4)	1664.73	1419.74	1620.89
	(5)	1237.48	1341.60	1674.02
	(6)	1200.79	1242.00	1632.19
	(7)	456.51	782.49	1031.53
DINV	*(1)*	-9311.01	-9066.03	-9758.39
	(2)	1581.87	1246.23	1345.86
	(3)	1681.72	1338.66	1459.97
	(4)	2016.39	1750.63	1884.60
	(5)	1539.14	1788.84	1960.54
	(6)	1772.10	1861.27	2075.89
	(7)	579.33	1080.39	1031.53
QEX	*(1)*	100.69	0.00	0.00
	(2)	299.08	127.46	191.66
	(3)	332.01	109.14	1.28
	(4)	351.66	330.90	263.71
	(5)	301.66	447.24	286.53
	(6)	571.31	619.27	443.69
	(7)	122.82	297.90	0.00
FOBDOM	*(1)*	3.0258	3.8855	2.6683
	(2)	2.6826	2.8242	2.2860
	(3)	2.4882	2.8527	2.3164
	(4)	2.7933	2.7845	2.0972
	(5)	3.3235	2.9962	2.1290
	(6)	3.5499	3.3450	2.1768
	(7)	3.5341	3.1238	2.5189
FOB		2.8621	2.8400	2.1263
KIWI		4383.88	4315.00	3971.14
NET		-100	374.23	1414.62

[1]Month of the marketing season. *Month 1* corresponds to October for the 1994/95 actual data.

1994/95 season. In any case, shipment during the first month is not large historically. The inventory constraint is binding in *month 7*, which complies with the actual end of the 1994/95 season.[65]

At the end of *year 1*, net acreage change (*NET*) is predicted to be positive. Although this prediction seems to diverge greatly from the actual value in 1994/95, it is not much different from the sample mean (table IV-4). The predicted net acreage increase is due to a relatively small percentage increase in population and a low level of peach revenue expectation.[66]

There has been a continuing downward trend in past annual revenue from kiwifruit production, which may have induced additional acreage to be actually removed in 1994/95. Since revenue is averaged over years, the model is unable to weigh the relative importance of revenue across seasons.

2. Year 2

Year 1 forecasts of net acreage change, bearing acreage, and revenue are incorporated to forecast another crop year ahead. Reflecting the positive net acreage change at the end of *year 1*, bearing acreage and production are predicted to increase. The crop is marketed in a similar pattern as in *year 1*. The largest volume of domestic shipments takes place in *month 5*, while exports peak in *month 6*. Export shipments in *month 3* is unusually small. The prices are generally lower than *year 1*, but follow a similar pattern, i.e., the price begins at a high level, diminishes in the middle, and rises later in the season.

The inventory constraint became binding in *month 7*, forcing endogenous variables to zero in *month 8*. Thus, the marketing season in *year 2* was predicted to finish after seven months. The *year 2* forecasts appear to be reasonable, with the exception of net acreage change at the end of the year.

3. Year 2 revised

Given the increase in crop size from *year 1* to *year 2*, the annual average price (*FOB*) declined substantially. Consequently, current revenue dropped to approximately three-fourths of the *year 1* level, which is exhibited in expected revenue (*KIWI*). However, net acreage change was predicted to be markedly positive.

This prediction is caused by an exceptionally low level of urbanization and a continuing drop in peach revenue. The 1995/96 urbanization value, which was used in the analysis, is only one-fourth of the sample mean. It implies a potential structural change which the model is not expected to capture. Furthermore, using expected peach revenue when it is at the bottom of its cycle does not provide a meaningful forecast of opportunity cost associated

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[65]Shipment was recorded in May, 1995, but the May volume is small relative to other monthly shipments. Since corresponding price data were missing, the May observation was discarded from the analysis.

[66]The four-year average revenue from peach production, which notably displays a cycle, is decreasing, as it follows the downward portion of its cycle in 1994/95.

with an alternative crop, since in such cases, other crops may be more profitable. Hence, it was decided that *year 2* would be re-forecast, replacing the urbanization and peach revenue observations with values which were more consistent with recent trends in the data.[67]

These changes affect only the prediction of net acreage change (*NET*) at the end of *year 2*. The resulting value was -144.98, which is close to the actual 1994/95 value. Thus, the model appears to be valid in terms of its forecasting ability.

4. Implications

The results from *year 1* and *year 2* forecasts indicate that there is a potential for net acreage to increase under current exogenous conditions with respect to alternative crops, land cost, and urbanization. What presumably overrides this potential is the current level of revenue.

The model successfully replicates the current price and shipment pattern. Yet, there may be an alternative shipment pattern which would yield higher annual revenue. Since price and quantities are defined to be simultaneously determined, this would imply an alternative price pattern as well. Moreover, the seeming inconsistency with theory has not been explained.

[67]The urbanization level peaked in 1990/91, and has been declining at a decreasing rate thereafter. An average of 1993/94 and 1994/95 values, 2.30995, was employed as a suitable level. During the sample period, expected peach revenue first peaked in 1982/83, hit the bottom of its cycle in 1986/87, and reached a second peak in 1991/92. The average from 1990/91 through 1994/95, which was calculated as 2821.97, was judged to be representative.

Section V. Conclusions

The objective of this study was to identify the factors that affect industry growth, i.e., production and acreage expansion and to investigate how U.S. kiwifruit growers could enhance their returns. The specific objectives were to analyze the determinants of annual supply and demand and the monthly prices received by the growers, and to project the near future of the industry. The impact of advertising expenditures on the price level was of special interest.

In the beginning, features of the U.S. kiwifruit industry were discussed. Then, referring to the relevant literature and economic theory, the U.S. kiwifruit industry model was conceptualized. An empirical model, based on the conceptual framework, was developed and estimated. Static and dynamic simulations were performed on the model, which validated it as a dynamic system. Subsequently, the model was used to forecast two crop years beyond the sample period.

In this concluding section, the research implications to the industry are summarized with a further analysis of the monthly price and shipment patterns. Then, we discuss limitations of this study and additional topics to be pursued.

A. Implications for the Industry

1. Supply

On the supply side of the kiwifruit industry, the key variable in our model was the net acreage change. It was regarded as a function of revenues from kiwifruit production and exogenous factors. The exogenous factors in the specification were the urbanization rate and land value. The mean of the rate of population increase in the major kiwifruit growing regions from 1980 through 1994 is 2.85 percent with the standard deviation of 0.61. In 1995, however, the rate has dropped to 0.77, which indicates that the urban pressure to divert acreage from kiwifruit production has lessened significantly. On the other hand, farm real estate value in real dollars peaked in the mid-1980's and has been stable thereafter. The trend of these exogenous factors, therefore, suggests a potential for acreage increase.

Yield, another supply-side factor affecting growers' return, is most likely to be fixed by biological and weather conditions and it was treated as exogenous in this study. Nonetheless, it is affected by an economic factor by means of the quality of cultural practices. Consequently, higher revenue contributes to higher revenue both directly and indirectly, holding quantities constant.

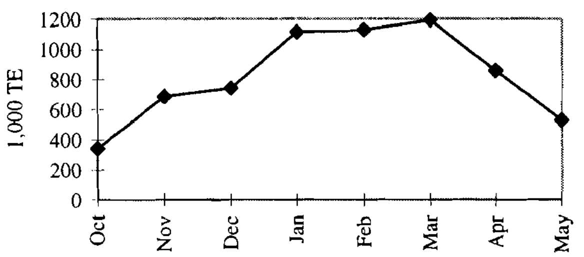
2. Marketing / demand

Our study has found that the demand for kiwifruit is price elastic, at least at the mean of the data, for both annual and monthly cases. Thus, marginal revenues are positive. Our results provide further information to seek ways of enhancing revenues.

Seasonal marketing/demand

The price pattern during a regular marketing season is a reflection of the underlying marketing pattern, where the bulk of shipments is concentrated in the middle of the season, suppressing prices (figure V-1). Consequently, prices are high in the first month and then decrease. Towards the end of the season, prices recuperate but not necessarily to the original level (figure I-6). Thus, shipments early in the season could command higher prices, in addition to saving storage costs. In particular, November prices are 0.50 cents higher on average than February prices during the sample period. The lower bounds of monthly elasticities reflect the price and quantity pattern; months October through December have a more elastic demand than January through March. Thus, there appears to be a potential to reallocate the shipment to the fall months and thereby increase marginal revenue.

Figure V-1 Monthly Average Domestic Shipments



In theory, arbitrage between markets in time leads to an equilibrium where future and present prices differ by storage costs. We would expect a larger quantity marketed at the beginning of a season and tapering off throughout the season, holding all other things constant. Monthly price and shipment patterns in the U.S. kiwifruit industry, however, diverge from such expectation. The question is, which pattern yields higher revenues?

In order to estimate the potential difference in annual revenues, theoretically appropriate monthly price and shipment patterns are obtained following Bressler and King's (1970) framework. The problem is simplified so that a given kiwifruit crop harvested in October is to be allocated over eight months with identical demand curves through the marketing season. Marketing costs involve a fixed charge comprised of packing cost, precooling cost, and assessment and a variable storage cost per month. If we denote the monthly prices as P_1, P_2, ..., P_8, P_1 represents the price in October including the fixed marketing charge, and P_2, the price in November, is higher than P_1 by one-month storage cost. Prices in subsequent months increase each month by the variable storage cost, i.e.,

$$P_i = P_1 + s(i-1) \qquad i = 1,\dots, 8$$

where s is the variable storage cost. Assuming identical demand curves, shipments in month i can be written as

$$Q_i = a - bP_i \qquad i = 1,\dots, 8$$

The sum of monthly shipments equals the annual crop size, C. Thus, we can solve for P_1

$$C = [a - bP_1] + [a - b(P_1 + s)] + [a - b(P_1 + 2s)] + \cdots + [a - b(P_1 + 7s)]$$

$$C = 8a - 8bP_1 - 28bs$$

and obtain the prices and shipments for the entire marketing season.

The calculation is carried out by solving the estimated monthly demand equation (equation $E^2{}_m$-5) for domestic shipments (*QDOM*) and evaluating the remaining variables at sample means. Marketing costs per TE are obtained from an average-price packing operation in California (Barbara Toews, CKC).[68] Figures V-2 and V-3 illustrate price and shipment patterns obtained.[69]

Figure V-2 Theoretical monthly prices

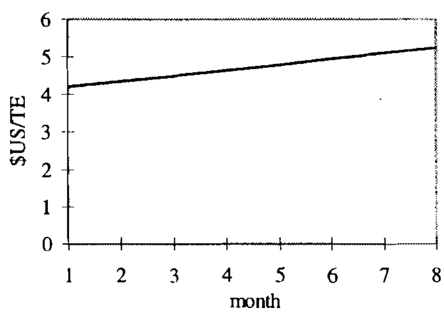
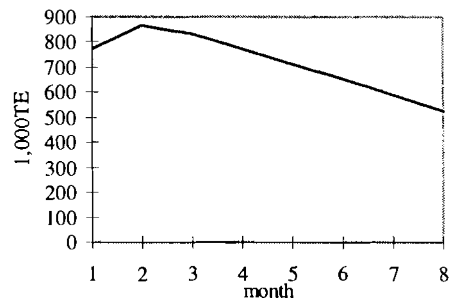


Figure V-3 Theoretical monthly shipments



The historical average of annual gross revenue (the sum of monthly prices times shipment over the marketing season) from 1986/87 through 1994/95 is $24,602,000, while the theoretical revenue is $27,632,000. The difference expands during the most recent 1993/94-1994/95 averages: $25,015,000 actual and $32,543,000 in theory. Since larger shipments are made earlier in the season, it is not likely that theoretical pattern would incur larger marketing costs in total. To the contrary, it is probable that the difference in net revenues is larger.

The foregoing analysis is rudimentary, but it suggests a possible area for improved seasonal marketing. At a minimum, further investigation of possible explanations for the seemingly uneconomic marketing pattern is needed. One possible explanation is that a principal-agent problem exists. Most growers (the principals) rely on handlers (the agents) to market the fruit. It could be that the incentives for agents differ from those of the growers. If so, then

[68] To calculate fixed portion of marketing costs, packing, precooling, and assessment costs per TE (table A-6) are weighted by the average pack-out percentage by container-type (table A-5) and deflated by 1995 CPI for food (148.8). The obtained fixed cost is $1.38 per TE using the average pack-out percentage from 1986/87 to 1994/95 and $1.03 per TE using 1993/94-1994/95 average. Monthly storage cost is obtained in a similar way: $0.10 per TE for the longer period and $0.08 per TE for the shorter period.

[69] The fact that October shipment is slightly less than that of November results from the lagged shipments ($QDOM_{i-1}$).

growers may need to be more proactive in monitoring marketing decisions. A second explanation is that marketing decisions have been based on mistaken expectations about seasonal price changes. Perhaps those marketing kiwifruit have expected seasonal price rises to cover storage costs, but this has not in fact happened. If this is so, then our analysis might be used to improve estimates of seasonal price changes. A third possibility is that our analysis has not taken into account some unknown factor that influences the economics of storage and marketing kiwifruit. It does seem illogical that firms would consistently store fruit at a considerable cost, only to sell the fruit at a lower price than could have been obtained earlier in the season.

Other findings

Another determinant of domestic f.o.b. price is the level of imports. In the summer of 1995, the quantity imported was greater than 1994/95 domestic shipments of California fruit. Formerly, the industry has been successful in restricting import flows by lobbying for the extension of the marketing order and the placement of anti-dumping tariffs. Yet, as world producers have improved their quality, these measures are no longer effective. A desirable strategy for growers, with regard to shipments to the U.S. market, is perhaps to secure demand earlier in a season despite the competition with imported kiwifruit.

An alternative means of enhancing growers' return is export shipments. The current limitation is the narrow quality and size requirements. An effective approach may be to encourage more handlers to be interested in exports. Then, growers would be given an incentive to produce satisfactory fruit for exporting. To improve quality and size is a costly procedure involving risk. Thus, it must be rewarding within a short time.

Although the initial impact of advertising in 1980/81 is unambiguous, advertising is difficult to assess. The intuitive appeal of maintaining and enhancing consumer awareness did not appear to be statistically prominent in this study. A suggested strategy for assessment usage would be to focus efforts on the cultivation of early-season demand and the encouragement of early-season shipment and export, as prescribed above.

B. Limitations and Further Topics

As is common in empirical econometric work, the quality of results is influenced by the quantity and quality of data available. This study of kiwifruit is limited in several ways. First, producers' expectations are not observable, and proxy measures had to be developed. Second, the quality of data on advertising, imports, and exports is uncertain, and alterations of the data to adjust for crop years were unrefined. Moreover, cross-promotional effects of other kiwifruit producers and other advertised fruit are ignored. Third, quality and size differences in fruit, distinguished in practice, are not incorporated. Fourth, kiwifruit logically has many substitutes, but it is difficult to measure the precise individual relationships. Lastly, there are potential structural changes as the export share shifted, which could not be analyzed due to the limited time period. Thus, while this research represents an attempt to quantify supply-demand relationships in the U.S. kiwifruit industry, these relationships must be treated as approximations, which are subject to change as more and better data become available. Specific topics for future studies are elaborated on below.

A refined analysis of advertising, such as those conducted in cooperation with the dairy and apple industries, is necessary. For such a study to be of maximum use for the kiwifruit industry, the focus should not be limited to the effectiveness of consumer-targeted promotions, but should also encompass the achievement of industry-targeted programs on quality enhancement for export. Implications regarding potential expansion of exports could be drawn from the findings. Furthermore, the supply response of advertising should be fully explored. The approach taken by Carman and Green (1993) with an assumption that the structure of the industry is maintained regardless of the existence of advertising is debatable. An alternative approach needs to be investigated.

It is desirable to explicitly model export demand for U.S. kiwifruit. The major shift from European markets to the current markets in America and the Pacific Rim could be illustrated. The dynamics of the Commission's marketing strategy could be examined by jointly specifying exports with domestic shipments. In understanding the historical development of the U.S. and the world kiwifruit industry, the impact of New Zealand kiwifruit and its promotions are critical. This issue is left for the future when political pressures are relieved and information, currently kept as proprietary, is disclosed. In principle, a global model of kiwifruit would be beneficial. All major players in the world kiwifruit industry could be incorporated in terms of production, trade, and promotional activities.

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Appendix A. Data

Table A.1 Annual Variables Used in the Analysis[a]

Crop year	CKC Domestic Advertising Expenditures *ADDOM* real$	CKC Export Advertising Expenditures *ADEX* real$	Average of Monthly Prices *AVGFOB* real$	Bearing Acreage *BA* acres
1976	0	0	-	-
1977	0	0	-	430
1978	0	0	-	600
1979	0	0	-	800
1980	63632	0	-	1600
1981	322133	0	-	3000
1982	338435	0	-	3400
1983	461252	0	-	3100
1984	741909	0	-	3800
1985	790196	0	-	4800
1986	918028	0	6.49076	5600
1987	1100353	0	5.85290	6800
1988	1253280	562227	4.75938	7100
1989	1179749	966764	4.21199	7200
1990	869799	1017762	3.61490	7300
1991	595776	702491	4.63095	7300
1992	889795	585407	2.85476	7300
1993	948075	413607	2.84535	7200
1994	814358	194994	2.98558	6900
1995	776247	164042	-	6800

[a]– denotes not applicable and/or not available at the time of analysis.

Table A.1 (Continued)

Crop year	Per Capita Fruit Consumption (difference) *DFRUIT* lbs/person	Per Capita Income (difference) *DINC* real$/person	Institu-tional Changes *DU*	Establish-ment Cost *EST* real$/acre
1976	-	-	0	-
1977	-	-	0	-
1978	-	-	0	-
1979	-	-	0	-
1980	-2.26	-49.83	0	875.21
1981	5.95	-315.99	0	894.80
1982	-2.65	7.87	0	952.84
1983	0.97	-49.04	0	1041.24
1984	5.01	332.62	0	1125.81
1985	-1.77	633.58	0	1185.94
1986	-2.17	257.15	0	1200.04
1987	6.23	385.98	0	1168.00
1988	4.53	107.08	0	1115.02
1989	-0.19	367.73	0	1058.70
1990	-0.66	136.41	0	1020.09
1991	-4.87	59.24	1	1001.72
1992	-2.07	-132.52	1	993.09
1993	8.51	251.96	0	1009.22
1994	1.47	-35.09	0	1018.56
1995	-2.24	152.48	0	1008.87

Table A.1 (Continued)

Crop year	Annual F.o.b. Price *FOB* real$/TE	Kiwifruit Expected Revenue *KIWI* real$/acre	Imports During the Preceeding Year *LQIM*×1000 TE[b]	Net Acreage Change *NET* acres
1976	-	-	-	-
1977	18.3147	-	-	-
1978	16.6513	-	-	-
1979	15.0110	-	-	-
1980	13.0645	10968.04	441406	1400
1981	9.4231	9140.86	653573	400
1982	7.3306	7893.37	621488	-300
1983	8.0282	7443.70	1329330	700
1984	6.5116	6900.33	1559152	1000
1985	6.0322	7198.23	2600000	800
1986	6.0367	7140.60	2928571	1200
1987	5.2423	6534.81	5414286	300
1988	4.4416	6061.23	4571429	100
1989	3.6931	5666.53	6372776	100
1990	3.4366	5089.74	9530466	0.00
1991	4.4681	4715.70	9862286	0.00
1992	2.5381	4524.14	6352571	-100
1993	2.6828	4352.79	7808000	-300
1994	2.8621	4383.88	9238857	-100
1995	-	-	13307572	-

[b]The figures were converted to 1,000 tray equivalents in the analysis.

Table A.1 (Continued)

Crop year	Cling Peach Expected Revenue *PEACH* real$/acre	Crop Size in October *QANN*×1000 TE[c]	Production *QP*×(7/2) tons[c]	September Shipment *QSEPT*×1000 TE[c]
1976	-	-	-	0
1977	-	300000	-	0
1978	-	420000	-	0
1979	-	540000	-	0
1980	2788.87	1139714	5300	0
1981	2979.36	1741143	6900	0
1982	2991.20	3091714	15500	0
1983	2602.85	3218000	13500	0
1984	2524.35	4162429	18000	0
1985	2440.58	5300000	22000	0
1986	2436.30	5950716	24300	19145
1987	2635.20	7666853	29000	50
1988	2652.91	8373621	32700	0
1989	2657.22	9907379	40000	0
1990	2797.48	8768967	39000	377
1991	2922.22	7212329	29600	0
1992	2883.05	12862733	52300	0
1993	2831.28	11798959	49200	0
1994	2675.82	10252299	39400	0
1995	2477.06	-	-	-

[c]The figures were converted to 1,000 tray equivalents in the analysis.

Table A.1 (Continued)

Crop year	Annual Shipment *QSHIP*×1000 TE[d]	Revenue ***REVENUE*** real$/acre	Advertising Expenditures Per Tray Equivalent ***UNITAD*** real$/TE	Dummy variable for 1980 *UNITAD* ***UNITAD80*** real$/TE
1976	-	-	-	0
1977	300000	12777.68	-	0
1978	420000	11655.90	-	0
1979	540000	10132.43	-	0
1980	1139714	9306.14	0.05583	0.05583
1981	1741143	5468.98	0.18501	0
1982	3091714	6665.92	0.10947	0
1983	3218000	8333.76	0.14333	0
1984	4162429	7132.68	0.17824	0
1985	5300000	6660.55	0.14909	0
1986	5969861	6435.40	0.15378	0
1987	7666903	5910.61	0.14352	0
1988	8373621	5238.37	0.21681	0
1989	9907379	5081.73	0.21666	0
1990	8769344	4128.27	0.21525	0
1991	7212329	4414.43	0.18001	0
1992	12862733	4472.13	0.11469	0
1993	11798959	4396.34	0.11541	0
1994	10252299	4252.61	0.09845	0
1995	-	-	-	0

[d]The figures were converted to 1,000 tray equivalents in the analysis.

Table A.1 (Continued)

Crop year	%Change in Population *URB* %	Yield *YIELD* 1000TE/acre
1976	-	-
1977	-	-
1978	-	-
1979	-	-
1980	2.81559	0.94643
1981	2.59076	0.65714
1982	2.66379	1.30252
1983	2.70795	1.24424
1984	2.33193	1.35338
1985	2.42250	1.30952
1986	2.19984	1.23980
1987	2.65751	1.21849
1988	3.13799	1.31590
1989	3.11198	1.58730
1990	4.38786	1.52642
1991	3.82911	1.15851
1992	3.21137	2.04697
1993	2.38478	1.95238
1994	2.23512	1.63147
1995	0.76933	1.66315

Table A.2 Annual Variables Used in Calculations[a]

Crop year	CPI for All Item *CPIA* 1982-84=100	CPI for Food *CPIF* 1982-84=100	Per Capita Fruit Consumption (lagged) *FRUIT* lbs/person	Nominal Farm Real Estate Value *NFARM* $/acre
1976	-	-	-	845.55
1977	-	65.5	-	851.77
1978	-	72.1	-	963.37
1979	65.2	79.9	-	1186.00
1980	72.6	86.8	81.05	1426.00
1981	82.4	93.6	87.00	1735.00
1982	90.9	97.4	84.35	1900.00
1983	96.5	99.4	85.32	1918.00
1984	99.6	103.2	90.33	1918.00
1985	103.9	105.6	88.56	1726.00
1986	107.6	109.0	86.39	1571.00
1987	109.6	113.5	92.62	1554.00
1988	113.6	118.2	97.15	1575.00
1989	118.3	125.1	96.96	1657.00
1990	124.0	132.4	96.30	1704.00
1991	130.7	136.3	91.43	1787.00
1992	136.2	137.9	89.36	1765.00
1993	140.3	140.9	97.87	1722.00
1994	144.5	144.3	99.34	1722.00
1995	148.2	148.4	97.10	-

[a]– denotes not applicable and/or not available at the time of analysis.

Table A.2 (Continued)

Crop year	Nominal Per Capita Income *NINC* $/person	Peach Bearing Acreage *PEACHBA* acres	Nominal Peach Grower Return *PEACHGR* $/ton[b]	Peach Utilized Production *PEACHUP* tons
1976	-	-	-	-
1977	-	45900	117	696500
1978	-	41550	137	555000
1979	7098	39700	156	655000
1980	7861	39200	160	691000
1981	8665	33800	182	553000
1982	9566	34300	164	471500
1983	10108	29900	160	309500
1984	10764	28700	180	483000
1985	11887	29000	190	458750
1986	12587	29300	168	436750
1987	13244	28900	190	425000
1988	13849	27600	208	471500
1989	14857	27600	214	462000
1990	15742	27000	214	477500
1991	16670	26200	218	485000
1992	17191	30700	216	558500
1993	18062	30200	218	518500
1994	18552	30200	180	541500
1995	19253	28100	220	410500

[b]For 1977 and 1978, dollars per metric ton.

Table A.2 (Continued)

Crop year	Population ***POP*** persons	Prices Paid by Farmers ***PPF*** 1977=100
1976	-	95
1977	-	100
1978	-	109
1979	1711900	125
1980	1760100	139
1981	1805700	151
1982	1853800	158
1983	1904000	159
1984	1948400	161
1985	1995600	156
1986	2039500	150
1987	2093700	152
1988	2159400	159
1989	2226600	167
1990	2324600	171
1991	2413300	172
1992	2490800	173
1993	2550200	178
1994	2607200	182
1995	2627258	-

Table A.3 Monthly Variables Used in the Analysis[1]

Mon-Yr	Dummy Variable for April *APR*	Dummy Variable for December *DEC*	Change in inventory *DINV*×1000 TE	Price Spread *DSPR* 82-84=100	Dummy Variable for February *FEB*
Jul-86	0	0	-	-	0
Aug-86	0	0	-	-	0
Sep-86	0	0	-	-	0
Oct-86	0	0	-5707905	-5.2508	0
Nov-86	0	0	768419	-6.9662	0
Dec-86	0	1	756801	-1.4488	0
Jan-87	0	0	1168484	14.6726	0
Feb-87	0	0	964352	2.6366	1
Mar-87	0	0	1189127	2.8411	0
Apr-87	1	0	677349	10.4823	0
May-87	0	0	183373	1.8056	0
Jun-87	0	0	0	-4.6894	0
Jul-87	0	0	0	-7.6523	0
Aug-87	0	0	0	1.7127	0
Sep-87	0	0	0	-2.1732	0
Oct-87	0	0	-7484720	3.3808	0
Nov-87	0	0	1038941	-18.2083	0
Dec-87	0	1	1184709	-2.8800	0
Jan-88	0	0	1283165	13.9003	0
Feb-88	0	0	1235292	1.8500	1
Mar-88	0	0	1493254	2.9955	0
Apr-88	1	0	792084	11.7362	0
May-88	0	0	457275	-2.2973	0
Jun-88	0	0	0	-1.3158	0
Jul-88	0	0	0	-3.7824	0
Aug-88	0	0	0	6.6945	0
Sep-88	0	0	0	4.0164	0
Oct-88	0	0	-8035007	0.7329	0
Nov-88	0	0	715895	-12.7468	0
Dec-88	0	1	1257257	4.3675	0

[1]- denotes not applicable and/or not available at the time of analysis. Kiwifruit quantity variables were converted to 1,000 tray equivalents in the analysis.

Table A.3 (Continued)

Mon-Yr	*APR*	*DEC*	*DINV*×1000	*DSPR*	*FEB*
Jan-89	0	0	1410994	5.0617	0
Feb-89	0	0	1196234	3.8494	1
Mar-89	0	0	1286261	-1.1202	0
Apr-89	1	0	1192936	0.9295	0
May-89	0	0	759753	2.4023	0
Jun-89	0	0	215677	-1.4043	0
Jul-89	0	0	0	-6.8150	0
Aug-89	0	0	0	0.8836	0
Sep-89	0	0	0	-0.5775	0
Oct-89	0	0	-9459415	0.3684	0
Nov-89	0	0	862366	-9.3483	0
Dec-89	0	1	797419	11.3592	0
Jan-90	0	0	1589530	13.4431	0
Feb-90	0	0	1817900	-4.6279	1
Mar-90	0	0	1751741	0.4241	0
Apr-90	1	0	1602567	9.1055	0
May-90	0	0	801719	-1.5641	0
Jun-90	0	0	168084	-3.3620	0
Jul-90	0	0	68089	-0.8255	0
Aug-90	0	0	0	-4.9400	0
Sep-90	0	0	0	-5.9554	0
Oct-90	0	0	-8174610	-4.3853	0
Nov-90	0	0	863932	-6.3957	0
Dec-90	0	1	577840	13.5382	0
Jan-91	0	0	1358154	-3.6619	0
Feb-91	0	0	1615715	2.6793	1
Mar-91	0	0	1692833	7.5566	0
Apr-91	1	0	1380644	9.3359	0
May-91	0	0	674119	-1.2434	0
Jun-91	0	0	11373	-4.4413	0
Jul-91	0	0	0	2.8218	0
Aug-91	0	0	0	-5.3720	0
Sep-91	0	0	0	6.1481	0
Oct-91	0	0	-7141082	-2.1695	0
Nov-91	0	0	875582	-6.3748	0

Table A.3 (Continued)

Mon-Yr	*APR*	*DEC*	*DINV*×1000	*DSPR*	*FEB*
Dec-91	0	1	827636	10.2350	0
Jan-92	0	0	1136423	1.5985	0
Feb-92	0	0	1346464	-8.2066	1
Mar-92	0	0	1931103	1.5958	0
Apr-92	1	0	750286	5.7781	0
May-92	0	0	273588	4.1990	0
Jun-92	0	0	0	-10.6283	0
Jul-92	0	0	0	-9.4775	0
Aug-92	0	0	0	4.4424	0
Sep-92	0	0	0	9.0697	0
Oct-92	0	0	-12303662	-4.5605	0
Nov-92	0	0	975357	-1.6673	0
Dec-92	0	1	876246	-0.5684	0
Jan-93	0	0	1839827	7.4506	0
Feb-93	0	0	2686736	-8.0343	1
Mar-93	0	0	2807003	-3.5254	0
Apr-93	1	0	1559846	-0.5191	0
May-93	0	0	877464	4.2642	0
Jun-93	0	0	655979	-12.8485	0
Jul-93	0	0	25204	3.6786	0
Aug-93	0	0	0	5.1888	0
Sep-93	0	0	0	7.5470	0
Oct-93	0	0	-10965479	6.8105	0
Nov-93	0	0	1321875	-0.1057	0
Dec-93	0	1	1535807	12.4466	0
Jan-94	0	0	2350407	-1.2813	0
Feb-94	0	0	2107289	-13.2825	1
Mar-94	0	0	2085170	4.7015	0
Apr-94	1	0	1263506	1.2902	0
May-94	0	0	301425	4.1093	0
Jun-94	0	0	0	-6.3858	0
Jul-94	0	0	0	3.0569	0
Aug-94	0	0	0	-0.6766	0
Sep-94	0	0	0	1.9395	0
Oct-94	0	0	-9311009	-5.1730	0

Table A.3 (Continued)

Mon-Yr	*APR*	*DEC*	*DINV*×1000	*DSPR*	*FEB*
Nov-94	0	0	1581874	3.5858	0
Dec-94	0	1	1681721	12.5893	0
Jan-95	0	0	2016388	-4.5831	0
Feb-95	0	0	1539139	-0.8134	1
Mar-95	0	0	1772103	-7.9313	0
Apr-95	1	0	579327	4.5221	0
May-95	0	0	120236	6.5792	0
Jun-95	0	0	20221	-6.1027	0
Jul-95	0	0	0	5.3883	0
Aug-95	0	0	0	2.3971	0
Sep-95	0	0	-	7.2064	0
Oct-95	0	0	-	-4.5773	0
Nov-95	0	0	-	-5.3853	0
Dec-95	0	1	-	-1.7724	0
Jan-96	0	0	-	3.9741	0
Feb-96	0	0	-	-1.2816	1
Mar-96	0	0	-	0.8375	0
Apr-96	1	0	-	5.8512	0
May-96	0	0	-	2.0283	0

Table A.3 (Continued)

Mon-Yr	F.o.b. price, domestic *FOBDOM* real$/TE	Expected domestic price *FOBDOME* real$/TE	F.o.b. price, exports *FOBEX* real$/TE	Actual/ expected price ratio *FOBRAT*	Inventory *INV*×1000 TE
Jul-86	-	-	-	-	-
Aug-86	-	-	-	-	-
Sep-86	-	-	-	-	0
Oct-86	8.2449	6.1394	9.9234	1.3430	5707905
Nov-86	7.1675	7.4294	8.1992	0.9647	4939486
Dec-86	6.4548	6.9540	7.1281	0.9282	4182685
Jan-87	6.0591	6.5826	6.4790	0.9205	3014201
Feb-87	5.9770	6.4419	5.9099	0.9278	2049849
Mar-87	5.7045	6.4892	5.5655	0.8791	860722
Apr-87	6.6318	6.2731	6.5663	1.0572	183373
May-87	7.4106	6.9606	7.4106	1.0647	0
Jun-87	-	-	-	-	0
Jul-87	-	-	-	-	0
Aug-87	-	-	-	-	0
Sep-87	-	-	-	-	0
Oct-87	5.9609	5.6767	7.0607	1.0501	7484720
Nov-87	5.3284	5.5747	6.3241	0.9558	6445779
Dec-87	5.1358	5.1150	6.1234	1.0041	5261070
Jan-88	5.3211	5.2637	6.0547	1.0109	3977905
Feb-88	5.4120	5.7039	6.0053	0.9488	2742613
Mar-88	5.7764	5.9242	5.9202	0.9750	1249359
Apr-88	6.7177	6.3450	6.7978	1.0588	457275
May-88	7.4722	7.0465	7.4722	1.0604	0
Jun-88	-	-	-	-	0
Jul-88	-	-	-	-	0
Aug-88	-	-	-	-	0
Sep-88	-	-	-	-	0
Oct-88	5.7448	5.2140	6.9738	1.1018	8035007
Nov-88	5.1123	5.1120	6.2372	1.0000	7319112
Dec-88	4.8273	4.8988	6.0584	0.9854	6061855
Jan-89	4.6269	4.9552	5.9612	0.9338	4650861
Feb-89	4.5448	5.0097	5.9369	0.9072	3454627
Mar-89	4.5917	5.0570	5.9455	0.9080	2168366

Table A.3 (Continued)

Mon-Yr	*FOBDOM*	*FOBDOME*	*FOBEX*	*FOBRAT*	*INV*×1000
Apr-89	4.7368	5.1603	5.8756	0.9179	975430
May-89	5.0185	5.0656	4.8912	0.9907	215677
Jun-89	-	-	-	-	0
Jul-89	-	-	-	-	0
Aug-89	-	-	-	-	0
Sep-89	-	-	-	-	0
Oct-89	5.0936	4.7513	6.1380	1.0720	9459415
Nov-89	5.0036	4.2781	6.1091	1.1696	8597049
Dec-89	4.7324	4.7901	5.9345	0.9879	7799630
Jan-90	4.0454	4.8602	5.7857	0.8323	6210100
Feb-90	3.6636	4.4282	5.7460	0.8273	4392200
Mar-90	3.9062	4.1757	5.3103	0.9354	2640459
Apr-90	4.1359	4.4748	4.8503	0.9243	1037892
May-90	4.8653	4.4647	4.9838	1.0897	236173
Jun-90	-	-	-	-	68089
Jul-90	-	-	-	-	0
Aug-90	-	-	-	-	0
Sep-90	-	-	-	-	0
Oct-90	3.6892	4.2886	5.5002	0.8602	8174610
Nov-90	3.4299	2.8737	5.2341	1.1935	7310678
Dec-90	3.2657	3.2164	4.9745	1.0153	6732838
Jan-91	3.2474	3.3935	4.9123	0.9569	5374684
Feb-91	3.1324	3.6303	4.7842	0.8628	3758969
Mar-91	3.4753	3.6445	4.7614	0.9536	2066136
Apr-91	4.2208	4.0439	4.8663	1.0438	685492
May-91	4.5403	4.5496	3.7626	0.9979	11373
Jun-91	-	-	-	-	0
Jul-91	-	-	-	-	0
Aug-91	-	-	-	-	0
Sep-91	-	-	-	-	0
Oct-91	5.4635	3.7620	6.1749	1.4523	7141082
Nov-91	4.8310	3.6324	5.4383	1.3300	6265500
Dec-91	4.8142	4.5016	5.3755	1.0694	5437864
Jan-92	4.6852	4.8024	5.3092	0.9756	4301441
Feb-92	4.5542	4.9073	5.0909	0.9280	2954977

Table A.3 (Continued)

Mon-Yr	*FOBDOM*	*FOBDOME*	*FOBEX*	*FOBRAT*	*INV*×1000
Mar-92	4.5165	4.8894	4.5689	0.9237	1023874
Apr-92	4.4102	4.9207	4.5303	0.8963	273588
May-92	-	-	-	-	0
Jun-92	-	-	-	-	0
Jul-92	-	-	-	-	0
Aug-92	-	-	-	-	0
Sep-92	-	-	-	-	0
Oct-92	4.5810	3.3632	5.3696	1.3621	12303662
Nov-92	3.7769	3.7655	4.5363	1.0030	11328305
Dec-92	3.2434	3.5635	3.6818	0.9102	10452059
Jan-93	2.7340	3.3712	3.0981	0.8110	8612232
Feb-93	2.4967	3.1168	2.7758	0.8011	5925496
Mar-93	2.5662	3.0089	2.8234	0.8529	3118493
Apr-93	2.7113	3.1348	2.8120	0.8649	1558647
May-93	2.8117	3.0401	2.2985	0.9249	681183
Jun-93	-	-	-	-	25204
Jul-93	-	-	-	-	0
Aug-93	-	-	-	-	0
Sep-93	-	-	-	-	0
Oct-93	3.5286	2.8366	5.3268	1.2440	10965479
Nov-93	2.9983	2.6216	5.0084	1.1437	9643604
Dec-93	2.4892	2.6689	4.5070	0.9327	8107797
Jan-94	2.3329	2.4774	4.0382	0.9417	5757390
Feb-94	2.7290	2.5551	4.1238	1.0681	3650101
Mar-94	2.9444	3.0642	3.7583	0.9609	1564931
Apr-94	3.5702	3.3486	3.6201	1.0662	301425
May-94	-	-	-	-	0
Jun-94	-	-	-	-	0
Jul-94	-	-	-	-	0
Aug-94	-	-	-	-	0
Sep-94	-	-	-	-	0
Oct-94	3.0258	2.3739	4.9320	1.2746	9311009
Nov-94	2.6826	2.1188	4.5316	1.2661	7729135
Dec-94	2.4882	2.3532	4.2559	1.0574	6047414
Jan-95	2.7933	2.4764	4.2676	1.1280	4031026
Feb-95	3.3235	3.0155	4.2559	1.1021	2491887

Table A.3 (Continued)

Mon-Yr	*FOBDOM*	*FOBDOME*	*FOBEX*	*FOBRAT*	$INV \times 1000$
Mar-95	3.5499	3.6587	4.2559	0.9703	719784
Apr-95	3.5341	3.9541	3.9511	0.8938	140457
May-95	-	-	-	-	20221
Jun-95	-	-	-	-	0
Jul-95	-	-	-	-	0
Aug-95	-	-	-	-	0
Sep-95	-	-	-	-	-
Oct-95	-	1.9751	4.4194	-	-
Nov-95	-	1.8731	3.6828	-	-
Dec-95	-	1.8427	3.2851	-	-
Jan-96	-	1.8640	3.0481	-	-
Feb-96	-	1.9405	2.9062	-	-
Mar-96	-	2.0686	2.7151	-	-
Apr-96	-	2.2581	2.8218	-	-
May-96	-	2.4225	2.5366	-	-

Table A.3 (Continued)

Mon-Yr	Dummy Variable for January *JAN*	Dummy Variable for March *MAR*	Per Capita Income *MINC* real$	Dummy Variable for November *NOV*	Dummy Variable for October *OCT*
Jul-86	0	0	-	0	0
Aug-86	0	0	-	0	0
Sep-86	0	0	-	0	0
Oct-86	0	0	12134.23	0	1
Nov-86	0	0	12115.46	1	0
Dec-86	0	0	12163.66	0	0
Jan-87	1	0	12160.08	0	0
Feb-87	0	0	12195.89	0	0
Mar-87	0	1	12131.49	0	0
Apr-87	0	0	12067.67	0	0
May-87	0	0	12015.02	0	0
Jun-87	0	0	12074.60	0	0
Jul-87	0	0	12133.86	0	0
Aug-87	0	0	12171.48	0	0
Sep-87	0	0	12236.47	0	0
Oct-87	0	0	12290.43	0	1
Nov-87	0	0	12354.73	1	0
Dec-87	0	0	12417.03	0	0
Jan-88	1	0	12436.12	0	0
Feb-88	0	0	12497.85	0	0
Mar-88	0	1	12505.86	0	0
Apr-88	0	0	12503.13	0	0
May-88	0	0	12500.42	0	0
Jun-88	0	0	12532.88	0	0
Jul-88	0	0	12554.53	0	0
Aug-88	0	0	12586.55	0	0
Sep-88	0	0	12595.54	0	0
Oct-88	0	0	12604.44	0	1
Nov-88	0	0	12634.25	1	0
Dec-88	0	0	12684.62	0	0
Jan-89	1	0	12703.19	0	0
Feb-89	0	0	12742.41	0	0

Table A.3 (Continued)

Mon-Yr	*JAN*	*MAR*	*MINC*	*NOV*	*OCT*
Mar-89	0	1	12713.20	0	0
Apr-89	0	0	12663.69	0	0
May-89	0	0	12645.40	0	0
Jun-89	0	0	12652.16	0	0
Jul-89	0	0	12648.73	0	0
Aug-89	0	0	12685.94	0	0
Sep-89	0	0	12706.46	0	0
Oct-89	0	0	12696.44	0	1
Nov-89	0	0	12706.68	1	0
Dec-89	0	0	12757.72	0	0
Jan-90	1	0	12728.06	0	0
Feb-90	0	0	12768.33	0	0
Mar-90	0	1	12779.07	0	0
Apr-90	0	0	12809.56	0	0
May-90	0	0	12849.85	0	0
Jun-90	0	0	12824.10	0	0
Jul-90	0	0	12828.10	0	0
Aug-90	0	0	12773.56	0	0
Sep-90	0	0	12698.84	0	0
Oct-90	0	0	12644.18	0	1
Nov-90	0	0	12627.80	1	0
Dec-90	0	0	12601.34	0	0
Jan-91	1	0	12565.70	0	0
Feb-91	0	0	12558.19	0	0
Mar-91	0	1	12593.88	0	0
Apr-91	0	0	12620.14	0	0
May-91	0	0	12646.28	0	0
Jun-91	0	0	12631.64	0	0
Jul-91	0	0	12644.88	0	0
Aug-91	0	0	12630.31	0	0
Sep-91	0	0	12621.20	0	0
Oct-91	0	0	12630.52	0	1
Nov-91	0	0	12621.46	1	0
Dec-91	0	0	12673.66	0	0
Jan-92	1	0	12725.63	0	0

Table A.3 (Continued)

Mon-Yr	*JAN*	*MAR*	*MINC*	*NOV*	*OCT*
Feb-92	0	0	12777.38	0	0
Mar-92	0	1	12789.90	0	0
Apr-92	0	0	12811.50	0	0
May-92	0	0	12851.32	0	0
Jun-92	0	0	12837.38	0	0
Jul-92	0	0	12814.37	0	0
Aug-92	0	0	12800.57	0	0
Sep-92	0	0	12886.84	0	0
Oct-92	0	0	12936.25	0	1
Nov-92	0	0	13012.68	1	0
Dec-92	0	0	12934.60	0	0
Jan-93	1	0	12829.71	0	0
Feb-93	0	0	12725.56	0	0
Mar-93	0	1	12765.62	0	0
Apr-93	0	0	12787.73	0	0
May-93	0	0	12827.44	0	0
Jun-93	0	0	12835.87	0	0
Jul-93	0	0	12835.41	0	0
Aug-93	0	0	12817.24	0	0
Sep-93	0	0	12877.79	0	0
Oct-93	0	0	12902.70	0	1
Nov-93	0	0	12936.30	1	0
Dec-93	0	0	12866.94	0	0
Jan-94	1	0	12815.35	0	0
Feb-94	0	0	12737.74	0	0
Mar-94	0	1	12828.69	0	0
Apr-94	0	0	12919.27	0	0
May-94	0	0	13018.29	0	0
Jun-94	0	0	13022.06	0	0
Jul-94	0	0	13034.57	0	0
Aug-94	0	0	13029.51	0	0
Sep-94	0	0	13056.67	0	0
Oct-94	0	0	13092.47	0	1
Nov-94	0	0	13128.17	1	0
Dec-94	0	0	13160.78	0	0

Table A.3 (Continued)

Mon-Yr	*JAN*	*MAR*	*MINC*	*NOV*	*OCT*
Jan-95	1	0	13175.74	0	0
Feb-95	0	0	13208.08	0	0
Mar-95	0	1	13192.99	0	0
Apr-95	0	0	13169.30	0	0
May-95	0	0	13154.40	0	0
Jun-95	0	0	13172.78	0	0
Jul-95	0	0	13216.98	0	0
Aug-95	0	0	13243.79	0	0
Sep-95	0	0	13269.80	0	0
Oct-95	0	0	13269.79	0	1
Nov-95	0	0	13304.29	1	0
Dec-95	0	0	13178.89	0	0
Jan-96	1	0	13165.47	0	0
Feb-96	0	0	13173.46	0	0
Mar-96	0	1	13183.38	0	0
Apr-96	0	0	13189.07	0	0
May-96	0	0	13206.46	0	0

Table A.3 (Continued)

Mon-Yr	Crop Size in October ***OCTALL*** ×1000 TE	Crop Size in October ***QALL***×1000 TE	Domestic Shipments ***QDOM*** ×1000 TE	Export Shipments ***QEX***×1000 TE	Imports ***QIM***×1000 TE
Jul-86	0	-	-	-	785714
Aug-86	0	-	-	-	200000
Sep-86	0	-	18768	377	357143
Oct-86	5950716	5950716	170152	72659	14286
Nov-86	0	5950716	439876	328543	0
Dec-86	0	5950716	368015	388786	14286
Jan-87	0	5950716	516320	652164	0
Feb-87	0	5950716	337786	626566	0
Mar-87	0	5950716	519388	669739	0
Apr-87	0	5950716	548852	128497	0
May-87	0	5950716	157133	26240	785714
Jun-87	0	5950716	0	0	2200000
Jul-87	0	5950716	0	0	585714
Aug-87	0	5950716	0	0	1657143
Sep-87	0	5950716	50	0	157143
Oct-87	7666853	7666853	92289	89844	28571
Nov-87	0	7666853	515008	523933	0
Dec-87	0	7666853	415126	769583	0
Jan-88	0	7666853	502275	780890	0
Feb-88	0	7666853	686797	548495	0
Mar-88	0	7666853	667674	825580	0
Apr-88	0	7666853	622533	169551	14286
May-88	0	7666853	395480	61795	2071429
Jun-88	0	7666853	0	0	142857
Jul-88	0	7666853	0	0	1257143
Aug-88	0	7666853	0	0	28571
Sep-88	0	7666853	0	0	1028571
Oct-88	8373621	8373621	111466	227148	42857
Nov-88	0	8373621	379766	336129	14286
Dec-88	0	8373621	751634	505623	0
Jan-89	0	8373621	800754	610240	0
Feb-89	0	8373621	682778	513456	0
Mar-89	0	8373621	960261	326000	0

Table A.3 (Continued)

Mon-Yr	*OCTALL* ×1000	*QALL*×1000	*QDOM* ×1000	*QEX*×1000	*QIM*×1000
Apr-89	0	8373621	910760	282176	166122
May-89	0	8373621	537274	222479	436931
Jun-89	0	8373621	138947	76730	795069
Jul-89	0	8373621	0	0	3047987
Aug-89	0	8373621	0	0	1293415
Sep-89	0	8373621	0	0	576110
Oct-89	9907379	9907379	221398	226566	5461
Nov-89	0	9907379	486309	376057	5148
Dec-89	0	9907379	622509	174910	0
Jan-90	0	9907379	1078934	510596	58286
Feb-90	0	9907379	1299033	518867	0
Mar-90	0	9907379	1177004	574737	714
Apr-90	0	9907379	1115224	487343	106286
May-90	0	9907379	662092	139627	1390857
Jun-90	0	9907379	148614	19470	2297143
Jul-90	0	9907379	55947	12142	1830286
Aug-90	0	9907379	0	0	1662571
Sep-90	0	9907379	377	0	2173714
Oct-90	8768967	8768967	385850	208507	11286
Nov-90	0	8768967	547648	316284	0
Dec-90	0	8768967	464527	113313	997571
Jan-91	0	8768967	978233	379921	74571
Feb-91	0	8768967	1140257	475458	0
Mar-91	0	8768967	1305823	387010	4857
Apr-91	0	8768967	1243550	137094	438286
May-91	0	8768967	619647	54472	1596000
Jun-91	0	8768967	6473	4900	1655143
Jul-91	0	8768967	0	0	2300571
Aug-91	0	8768967	0	0	1886143
Sep-91	0	8768967	0	0	897857
Oct-91	7212329	7212329	34420	36827	269857
Nov-91	0	7212329	631076	244506	5429
Dec-91	0	7212329	716688	110948	5429
Jan-92	0	7212329	851837	284586	9429
Feb-92	0	7212329	879031	467433	9000

Table A.3 (Continued)

Mon-Yr	*OCTALL* ×1000	*QALL*×1000	*QDOM* ×1000	*QEX*×1000	*QIM*×1000
Mar-92	0	7212329	1196614	734489	0
Apr-92	0	7212329	580009	170277	781429
May-92	0	7212329	285676	-12088	3475857
Jun-92	0	7212329	0	0	791429
Jul-92	0	7212329	0	0	0
Aug-92	0	7212329	0	0	317857
Sep-92	0	7212329	7	-7	686857
Oct-92	12862733	12862733	470420	88651	156286
Nov-92	0	12862733	781952	193405	34429
Dec-92	0	12862733	764786	111460	110429
Jan-93	0	12862733	1664328	175499	12714
Feb-93	0	12862733	2234056	452680	84286
Mar-93	0	12862733	2141187	665816	75286
Apr-93	0	12862733	1232728	327118	2129000
May-93	0	12862733	805828	71636	2291857
Jun-93	0	12862733	629455	26524	962000
Jul-93	0	12862733	12204	13000	529429
Aug-93	0	12862733	12813	-12813	831571
Sep-93	0	12862733	0	0	590714
Oct-93	11798959	11798959	752964	80516	100286
Nov-93	0	11798959	1128507	193368	143857
Dec-93	0	11798959	1206881	328926	145857
Jan-94	0	11798959	1858182	492225	35429
Feb-94	0	11798959	1655560	451729	59000
Mar-94	0	11798959	1537901	547269	98143
Apr-94	0	11798959	1014445	249061	2159143
May-94	0	11798959	212280	89145	2880000
Jun-94	0	11798959	0	0	1583429
Jul-94	0	11798959	0	0	637857
Aug-94	0	11798959	0	0	940000
Sep-94	0	11798959	0	0	455857
Oct-94	10252299	10252299	840596	100694	18857
Nov-94	0	10252299	1282798	299076	26143
Dec-94	0	10252299	1349708	332013	74286
Jan-95	0	10252299	1664730	351658	0

Table A.3 (Continued)

Mon-Yr	*OCTALL* ×1000	*QALL*×1000	*QDOM* ×1000	*QEX*×1000	*QIM*×1000
Feb-95	0	10252299	1237480	301659	34485
Mar-95	0	10252299	1200791	571312	245220
Apr-95	0	10252299	456505	122822	3905497
May-95	0	10252299	119226	1010	2843132
Jun-95	0	10252299	19614	607	1682457
Jul-95	0	10252299	0	0	1829863
Aug-95	0	10252299	0	0	1750091
Sep-95	0	10252299	-	-	897541
Oct-95	-	-	-	-	28120
Nov-95	-	-	-	-	38985
Dec-95	-	-	-	-	110778
Jan-96	-	-	-	-	0
Feb-96	-	-	-	-	34485
Mar-96	-	-	-	-	245220
Apr-96	-	-	-	-	3905497
May-96	-	-	-	-	2843132

Table A.3 (Continued)

Mon-Yr	Current return *RET* real$/TE	Ad expense, domestic *UNITDOM* real$/TE
Jul-86	-	-
Aug-86	-	-
Sep-86	-	-
Oct-86	8.7472	0.03730
Nov-86	7.6086	0.03730
Dec-86	6.8007	0.03730
Jan-87	6.2935	0.03730
Feb-87	5.9334	0.03730
Mar-87	5.6262	0.03730
Apr-87	6.6193	0.03730
May-87	7.4106	0.03730
Jun-87	-	-
Jul-87	-	-
Aug-87	-	-
Sep-87	-	-
Oct-87	6.5034	0.03529
Nov-87	5.8305	0.03529
Dec-87	5.7774	0.03529
Jan-88	5.7676	0.03529
Feb-88	5.6755	0.03529
Mar-88	5.8559	0.03529
Apr-88	6.7349	0.03529
May-88	7.4723	0.03529
Jun-88	-	-
Jul-88	-	-
Aug-88	-	-
Sep-88	-	-
Oct-88	6.5692	0.02971
Nov-88	5.6405	0.02971
Dec-88	5.3224	0.02971
Jan-89	5.2040	0.02971
Feb-89	5.1423	0.02971
Mar-89	4.9348	0.02971

Table A.3 (Continued)

Mon-Yr	*RET*	*UNITDOM*
Apr-89	5.0062	0.02971
May-89	4.9812	0.02971
Jun-89	-	-
Jul-89	-	-
Aug-89	-	-
Sep-89	-	-
Oct-89	5.6218	0.02148
Nov-89	5.4857	0.02148
Dec-89	4.9961	0.02148
Jan-90	4.6044	0.02148
Feb-90	4.2579	0.02148
Mar-90	4.3669	0.02148
Apr-90	4.3532	0.02148
May-90	4.8859	0.02148
Jun-90	-	-
Jul-90	-	-
Aug-90	-	-
Sep-90	-	-
Oct-90	4.3245	0.01625
Nov-90	4.0904	0.01625
Dec-90	3.6008	0.01625
Jan-91	3.7131	0.01625
Feb-91	3.6185	0.01625
Mar-91	3.7693	0.01625
Apr-91	4.2849	0.01625
May-91	4.4774	0.01625
Jun-91	-	-
Jul-91	-	-
Aug-91	-	-
Sep-91	-	-
Oct-91	5.8312	0.01439
Nov-91	5.0006	0.01439
Dec-91	4.8894	0.01439
Jan-92	4.8414	0.01439
Feb-92	4.7405	0.01439

Table A.3 (Continued)

Mon-Yr	*RET*	*UNITDOM*
Mar-92	4.5364	0.01439
Apr-92	4.4375	0.01439
May-92	-	-
Jun-92	-	-
Jul-92	-	-
Aug-92	-	-
Sep-92	-	-
Oct-92	4.7060	0.01035
Nov-92	3.9275	0.01035
Dec-92	3.2991	0.01035
Jan-93	2.7687	0.01035
Feb-93	2.5437	0.01035
Mar-93	2.6273	0.01035
Apr-93	2.7324	0.01035
May-93	2.7698	0.01035
Jun-93	-	-
Jul-93	-	-
Aug-93	-	-
Sep-93	-	-
Oct-93	3.7023	0.01265
Nov-93	3.2924	0.01265
Dec-93	2.9214	0.01265
Jan-94	2.6900	0.01265
Feb-94	3.0280	0.01265
Mar-94	3.1580	0.01265
Apr-94	3.5800	0.01265
May-94	-	-
Jun-94	-	-
Jul-94	-	-
Aug-94	-	-
Sep-94	-	-
Oct-94	3.2297	0.01246
Nov-94	3.0322	0.01246
Dec-94	2.8372	0.01246
Jan-95	3.0504	0.01246

Table A.3 (Continued)

Mon-Yr	***RET***	***UNITDOM***
Feb-95	3.5062	0.01246
Mar-95	3.7775	0.01246
Apr-95	3.6225	0.01246
May-95	-	-
Jun-95	-	-
Jul-95	-	-
Aug-95	-	-
Sep-95	-	-
Oct-95	-	-
Nov-95	-	-
Dec-95	-	-
Jan-96	-	-
Feb-96	-	-
Mar-96	-	-
Apr-96	-	-
May-96	-	-

Table A.4 Monthly Variables Used in Calculations[1]

Mon-Yr	Preliminary Expectations *FOBDOMP* real$/TE	CPI for All Items *MCPIA* 82-84=100	CPI for Food *MCPIF* 82-84=100	Nominal Farm Retail Spread *SPR* 82-84=100
Jul-86	-	-	-	-
Aug-86	-	-	-	-
Sep-86	-	109.9	-	134.1
Oct-86	6.8529	110.1	110.8	128.5
Nov-86	6.2204	110.3	111.3	121.2
Dec-86	5.9004	110.6	111.5	119.9
Jan-87	5.7220	111.4	111.9	137.1
Feb-87	5.7207	111.8	112.1	140.5
Mar-87	5.8538	112.3	112.3	144.3
Apr-87	6.2580	112.8	112.7	156.8
May-87	6.5868	113.2	113.3	159.4
Jun-87	-	113.5	113.9	154.5
Jul-87	-	113.8	113.8	146.2
Aug-87	-	114.3	113.9	148.8
Sep-87	-	114.6	114.5	146.7
Oct-87	6.3902	115.0	114.7	151.1
Nov-87	5.7577	115.3	114.8	130.5
Dec-87	5.4377	115.5	115.3	127.4
Jan-88	5.2593	116.1	115.7	144.2
Feb-88	5.2580	116.3	115.5	146.6
Mar-88	5.3911	116.7	116.0	150.6
Apr-88	5.7953	117.2	116.6	165.0
May-88	6.1241	117.7	117.1	163.0
Jun-88	-	118.1	117.8	162.0
Jul-88	-	118.6	118.9	158.2
Aug-88	-	119.0	119.5	166.7
Sep-88	-	119.5	120.3	172.2
Oct-88	5.9275	120.0	120.6	173.8
Nov-88	5.2950	120.3	120.8	158.9
Dec-88	4.9750	120.7	121.2	164.7
Jan-89	4.7966	121.4	122.2	171.8
Feb-89	4.7953	121.9	122.7	177.2

[1]- denotes not applicable and/or not available at the time of analysis.

Table A.4 (Continued)

Mon-Yr	*FOBDOMP*	*MCPIA*	*MCPIF*	*SPR*
Mar-89	4.9284	122.5	123.5	176.7
Apr-89	5.3326	123.3	124.2	179.0
May-89	5.6614	123.8	124.9	182.7
Jun-89	-	124.1	125.2	181.4
Jul-89	-	124.5	125.6	173.5
Aug-89	-	124.5	125.9	174.6
Sep-89	-	124.8	126.3	174.3
Oct-89	5.4648	125.4	126.8	175.6
Nov-89	4.8323	125.8	127.4	164.4
Dec-89	4.5123	126.3	128.0	179.4
Jan-90	4.3339	127.6	130.2	198.4
Feb-90	4.3326	128.2	131.1	193.4
Mar-90	4.4657	128.7	131.3	194.7
Apr-90	4.8699	129.0	131.2	206.9
May-90	5.1987	129.2	131.2	205.2
Jun-90	-	130.0	132.1	202.1
Jul-90	-	130.5	132.8	201.8
Aug-90	-	131.6	133.2	197.0
Sep-90	-	132.6	133.6	190.6
Oct-90	5.0021	133.4	134.1	185.9
Nov-90	4.3696	133.8	134.7	177.9
Dec-90	4.0496	134.2	134.9	196.6
Jan-91	3.8712	134.7	135.4	192.4
Feb-91	3.8699	134.9	135.3	196.3
Mar-91	4.0030	135.1	135.7	206.8
Apr-91	4.4072	135.4	136.4	219.9
May-91	4.7360	135.7	136.7	218.7
Jun-91	-	136.1	137.3	213.3
Jul-91	-	136.2	136.6	217.3
Aug-91	-	136.6	136.3	210.6
Sep-91	-	137.1	136.5	219.8
Oct-91	4.5394	137.4	136.4	217.3
Nov-91	3.9069	137.9	137.0	209.3
Dec-91	3.5869	138.2	137.4	223.9
Jan-92	3.4085	138.5	137.1	226.6
Feb-92	3.4072	138.8	137.5	215.7

Table A.4 (Continued)

Mon-Yr	*FOBDOMP*	*MCPIA*	*MCPIF*	*SPR*
Mar-92	3.5403	139.3	138.0	218.7
Apr-92	3.9445	139.7	138.1	227.4
May-92	-	139.9	137.5	233.6
Jun-92	-	140.2	137.6	219.2
Jul-92	-	140.6	137.5	206.5
Aug-92	-	140.9	138.3	213.2
Sep-92	-	141.1	138.7	226.3
Oct-92	4.0767	141.7	138.7	220.8
Nov-92	3.4442	142.0	138.8	218.9
Dec-92	3.1242	142.2	139.2	218.4
Jan-93	2.9458	142.7	139.2	229.8
Feb-93	2.9445	143.2	139.6	219.1
Mar-93	3.0776	143.5	139.9	214.5
Apr-93	3.4818	144.0	140.2	214.5
May-93	3.8106	144.3	141.1	221.1
Jun-93	-	144.4	140.7	202.7
Jul-93	-	144.6	140.7	208.3
Aug-93	-	145.0	141.2	216.4
Sep-93	-	145.1	141.6	227.5
Oct-93	3.6140	145.6	142.3	238.2
Nov-93	2.9815	146.0	142.6	238.7
Dec-93	2.6615	146.3	143.3	257.4
Jan-94	2.4831	146.4	143.1	255.7
Feb-94	2.4818	146.8	142.7	236.9
Mar-94	2.6149	147.1	142.9	244.3
Apr-94	3.0191	147.4	143.2	246.7
May-94	-	147.6	143.5	253.1
Jun-94	-	148.1	143.9	244.5
Jul-94	-	148.5	144.7	249.7
Aug-94	-	149.1	145.4	249.7
Sep-94	-	149.4	145.7	253.1
Oct-94	3.1513	149.6	142.8	245.7
Nov-94	2.5188	149.8	146.0	251.4
Dec-94	2.1988	150.1	147.1	270.8
Jan-95	2.0204	150.6	146.8	264.8
Feb-95	2.0191	150.9	147.1	264.1

Table A.4 (Continued)

Mon-Yr	*FOBDOMP*	*MCPIA*	*MCPIF*	*SPR*
Mar-95	2.1522	151.3	147.2	252.8
Apr-95	2.5564	151.8	148.0	260.5
May-95	-	152.2	-	271.2
Jun-95	-	152.6	-	262.6
Jul-95	-	152.7	-	271.0
Aug-95	-	153.0	-	275.2
Sep-95	-	153.2	-	286.6
Oct-95	-	153.7	-	280.5
Nov-95	-	153.8	-	272.4
Dec-95	-	154.1	-	270.2
Jan-96	-	154.7	-	277.4
Feb-96	-	-	-	-
Mar-96	-	-	-	-
Apr-96	-	-	-	-
May-96	-	-	-	-

Table A-5 Initial Pack-Out Percentages Used in the Calculation of *FOBDOM*

Pack-out by Size

crop yr	25s	28s	30s	33s	36s	39s	42s	45s	49s
1986/87	0.0308	0.0241	0.1900	0.2840	0.1974	0.0960	0.0407	0.0077	0.0002
1987/88	0.0197	0.0169	0.1117	0.1552	0.2861	0.2141	0.1141	0.0407	0.0075
1988/89	0.0079	0.0062	0.0599	0.1301	0.2723	0.2571	0.1946	0.0567	0.0021
1989/90	0.0037	0.0065	0.0420	0.1026	0.2459	0.3068	0.2664	0.0257	0.0004
1990/91	0.0008	0.0035	0.0197	0.0623	0.1861	0.2576	0.2178	0.0690	0.1831
1991/92	0.0252	0.0279	0.1303	0.1929	0.2684	0.1702	0.1142	0.0189	0.0520
1992/93	0.0164	0.0262	0.1093	0.1633	0.2570	0.1866	0.1309	0.0252	0.0863
1993/94	0.0051	0.0193	0.0701	0.1381	0.2491	0.2038	0.1753	0.0180	0.1211
1994/95	0.0084	0.0135	0.0765	0.1516	0.2507	0.2186	0.1372	0.1434	-

Pack-out by Container-Type

crop yr	Tray	3-layer	Bag	VF/CF	Bins
1986/87	0.7845	-	0.1435	0.0560	0.0160
1987/88	0.8203	-	0.0919	0.0828	0.0050
1988/89	0.7358	-	0.1225	0.0964	0.0016
1989/90	0.6491	-	0.1173	0.2003	0.0333
1990/91	0.4424	0.0828	0.1070	0.3072	0.0606
1991/92	0.5799	0.0799	0.0397	0.2539	0.0467
1992/93	0.4775	0.1043	0.0427	0.3253	0.0501
1993/94	0.2427	0.2024	0.0342	0.4556	0.0652
1994/95	0.2275	0.1581	0.0290	0.5168	0.0685

(Source: California Kiwifruit Commission)

Table A-6 Marketing Costs per TE by Container-Type

costs:	Tray	3-layer	Bag	VF/CF	Bins (125lbs)	Bins (350lbs)
packing	2.25	4.25	3.71	2.75	22.00	42.00
precooling	0.10	0.15	0.15	0.15	0.87	2.44
assessment	0.18	0.54	0.52	0.55	3.16	8.86
sum	2.53	4.94	4.38	3.45	26.03	53.30
per TE	2.53	1.65	1.53	1.05	1.46	1.07

(Source: Anonymous, July 1995)

Appendix B. Data Sources

Table B.1 Data Sources[1]

ADDOM(a):	CKC domestic advertising expenditures (real dollars)
	From 1980/81 through 1991/92, observations were entitled "Expenses: advertising, merchandising and public relations" in "CKC Statements of Revenues and Expenses." From 1992/93 to 1994/95, the series "AD/PROMO FUND: Used" in "CKC Budget summary" was used. The 1995 figure was labeled "AD/PROMO FUND: Budgeted" in the latter source. Deflated by ***CPIA***.
ADEX(a):	CKC export advertising expenditures (real dollars)
	Faxed from CKC. For 1988/89 to 1991/92, the series was entitled "Dollars spent on export shipments." For 1992/93 to 1994/95, observations were entitled "MPP targeted markets - funds spent." The 1995 figure was assigned a nominal expense of 250,000 dollars. Deflated by ***CPIA***.
APR(m):	Dummy variable for April (April=1, otherwise=0)
AVGFOB(a):	Weighted average of monthly f.o.b. prices (real dollars per tray equivalent)
	$\boldsymbol{AVGFOB_t} = \left[\sum_{i=1}^{12} \boldsymbol{FOBDOM_i} \times \boldsymbol{QDOM_i}\right] \Big/ \left[\sum_{i=1}^{12} \boldsymbol{QDOM_i}\right]$
BA(a):	Number of kiwifruit bearing acres (acres)
	Observations from 1980/81 through 1994/95 were taken from NASS, USDA, *Fruit and Tree Nuts: Situation and Outlook Report*, Yearbook Issue: FTS-274 (September, 1995), Table B-18. The 1995 figure was taken from NASS, USDA, *Non-Citrus Fruit and Nuts: 1995 Preliminary Summary*. The series was extended over the period preceding 1980/81 to retain the ratio ***QSHIP/BA*** near 700 in the calculation of ***KIWI4***.
CPIA(a):	Consumer Price Index for all items (1982-84=100)
	Economic Indicators, various issues. The 1978 and 1979 observations, reported with 1967=100, were conformed using the average ratio between the indices 1982-84=100 and 1967=100 from 1980 to 1984, 0.33383. The indices were lagged to correspond with crop years.

[1]All variables in Tables A-1 through A-4 are in bold face. (a) denotes annual variables, and (m) denotes monthly variables.

Table B.1 (Continued)

***CPIF*(a):**	Consumer Price Index for food (1982-84=100)
	Economic Indicators, various issues. The observations from 1977 to 1979, reported with 1967=100, were conformed by the average ratio between the indices 1982-84=100 and 1967=100 from 1980 to 1983, 0.34090.
***DEC*(m):**	Dummy variable for December (December=1, otherwise=0)
***DFRUIT*(a):**	Per capita consumption of total fresh fruit less kiwifruit, annual difference (pounds per person)
	$DFRUIT_t = FRUIT_t - FRUIT_{t-1}$
***DINV*(m):**	Monthly change in beginning and ending inventory (1,000 tray equivalents)
	$DINV_i = INV_{i-1} - INV_i$
***DINC*(a):**	Per capita disposable personal income, annual difference (real dollars per person)
	$DINC_t = (NINC_t/CPIA_t)\times 100-(NINC_{t-1}/CPIA_{t-1})\times 100$
***DSPR*(m):**	Farm-retail price spread for fresh fruit, adjusted for inflation, monthly difference (1982-84=100)
	$DSPR_i = (SPR_i/MCPIA_i)\times 100 - (SPR_{i-1}/MCPIA_{i-1})\times 100$ From February though May, 1996, the observations were based on regression results (n=72): $SPR/MCPIA = 116.69-6.4697\ NOV+0.1568\ DEC+5.3346\ JAN +2.6736\ FEB+3.5111\ MAR+9.3623\ APR+11.3906\ MAY+5.8673\ YEAR$ (R^2=0.84191, *YEAR*=10)
***DU*(a):**	Dummy variable for institutional changes (1990 and 1991=1, otherwise=0)
***EST*(a):**	Establishment cost (real dollars per acre)
	$EST_t = (NFARM_{t-5}/PPF_{t-5} + NFARM_{t-4}/PPF_{t-4} + NFARM_{t-3}/PPF_{t-3})\times 100/3$
***FEB*(m):**	Dummy variable for February (February=1, otherwise=0)
***FOB*(a):**	Annual f.o.b. price (real dollars per tray equivalent)
	Beginning in 1980/81, the figures entitled "Average FOB Value Per Pound" reported in the CKC annual report were multiplied by 7. A nominal value of 12.00 dollars was assigned to the 1977/78 to 1979/80 prices. Deflated by ***CPIF***.

Table B.1 (Continued)

FOBDOM(m):	Monthly f.o.b. price for domestic shipment (real dollars per tray equivalent)
	Computed from daily quotes in Federal-State Market News Service, "California Deciduous Fruit Report." Weekly observations were compiled from Mondays, or Tuesdays when Monday reports were not available, except for 1989/90 and 1990/91, when weekly reports, which were available from the Market News Service, used the prices quoted on the last week- day. Then, a monthly average of weekly prices was calculated for each size and container-type. The overall monthly average was obtained by weighting them by initial pack-out percentages by size and container type issued by CKC (Table A.5). The weights for fruit sizes 33s and larger in single-layer trays were reduced according to the annual ratio of domestic shipments to total shipments. Deflated by ***MCPIF***. For October of 1987, 88, and 91, $FOBDOM_i = FOBDOMP_i + (FOBDOM_{i+1} - FOBDOMP_{i+1})$.
FOBDOME(m):	Monthly expected f.o.b. price for domestic shipment (real dollars per tray equivalent)
	The October expectation $FOBDOME_i$ is the average of ***FOBDOMP*** from October to the end of the marketing season. The October $FOBDOMP_i$ is subtracted from corresponding $FOBDOM_i$, and the resulting difference is added to all succeeding ***FOBDOMP***'s in the season. The November expectation $FOBDOME_{i+1}$ is the average of these adjusted ***FOBDOMP***'s. Subsequently, the difference between the adjusted November $FOBDOMP_{i+1}$ and the actual $FOBDOM_{i+1}$ is added to the remaining ***FOBDOMP***'s in the season. This process is continued until the end of the marketing season, and is repeated for every marketing season.
FOBDOMP(m):	"Preliminary expectations" of domestic f.o.b. price (real dollars per tray equivalent)
	FOBDOM (n=63) was regressed on monthly dummy variables (October as the base) and a yearly trend variable (1986=1, 1987=2, etc.) by OLS. 1991/92 observations were dummied out, due to an anomaly in the data (Figure 2.6). The resulting estimates: $FOBDOM = 7.3156 - 0.6325\,NOV - 0.9525\,DEC - 1.1309\,JAN - 1.1322\,FEB - 0.9991\,MAR - 0.5949\,APR - 0.2661\,MAY - 0.4627\,YEAR + 1.0026\,DUM$ (R^2=0.81327) were used to generate predicted values based on trend only. Predicted values in 1991/92 were generated discarding the coefficient on *DUM*.

Table B.1 (Continued)

FOBEX(m):	Monthly f.o.b. price for export shipment (real dollars per tray equivalent)
	Computed from daily quotes in Federal-State Market News Service, "California Deciduous Fruit Report." A similar procedure to ***FOBDOM*** was applied to fruit sizes 33s and larger in single-layer trays only. Deflated by ***MCPIF***. The 1995/96 prices are predictions based on the regression (n=69): ***FOBEX*** = *8.5244-0.7366 NOV-1.1343 DEC-1.3713 JAN -1.5132 FEB-1.0743 MAR-1.5976 APR-1.8828 MAY -0.4105 YEAR* (R^2=0.74435, *YEAR*=10)
FOBRAT(m):	Ratio between current and expected f.o.b. prices for domestic shipment (dimensionless)
	$\boldsymbol{FOBRAT_i = FOBDOM_i/FOBDOME_i}$
FRUIT(a):	Per capita consumption of total fresh fruit less kiwifruit (pounds per person)
	For 1979 to 1993, the figures entitled "kiwifruit" were subtracted from "Total, fruit" in Table F-29, NASS, USDA, *Fruit and Tree Nuts: Situation and Outlook Report*, Yearbook Issue: FTS-274 (September, 1995). The 1994 figure was obtained from USDA, ERS, Commodity Economics Division by telephone. The observations were lagged to correspond with crop years.
INV(m):	Ending inventory of California kiwifruit (1,000 tray equivalents)
	$\boldsymbol{INV_i = INV_{i-1} + OCTQALL_i - QDOM_i - QEX_i}$
JAN(m):	Dummy variable for January (January=1, otherwise=0)
KIWI(a):	Expected revenue from kiwifruit production (real dollars per acre)
	$\boldsymbol{KIWI4_t = (REVENUE_{t-3} + REVENUE_{t-2} + REVENUE_{t-1} + REVENUE_t)/4}$

Table B.1 (Continued)

***LQIM*(a):**	Volume of import during the preceding crop year (1,000 tray equivalents)
	From 1984 to 1988 and 1989 to 1995, monthly shipment figures, reported in AMS, USDA, *Fresh Fruit and Vegetable Shipments*, and monthly import data for fresh kiwifruit, ordered from USDC, were summed from October to September and converted into tray equivalents (7 lbs=1 TE). For the period preceding 1984, New Zealand exports to the United States (calendar year), faxed from New Zealand Ministry of Agriculture, were used as reference. Since these numbers were consistently lower than calendar-year sums of AMS figures, they were modified upward using the average ratio between the AMS and New Zealand figures in 1985 and 1986, 1.2396. In order to adjust to crop year, the 1984 ratio of October to December imports to those during January through September, 0.12, was applied. Finally, the figures were conformed to tray equivalents and lagged to correspond with crop years. It should be noted that import volumes used in figure II-4 are not lagged.
***MAR*(m):**	Dummy variable for March (March=1, otherwise=0)
***MCPIA*(m):**	Monthly Consumer Price Index for all items, seasonally adjusted (1982-84=100)
	Economic Indicators, various issues. For September through December, 1986, observations were reported with 1977=100 and without seasonal adjustments. First, the ratio between seasonally unadjusted indices 1977=100 and 1982-84=100 was taken from January to December, 1987, the average of which, 2.99523, was used to conform the 1986 observation to 1982-84=100. The observations were further adjusted by multiplying by the corresponding monthly ratio between the seasonally adjusted and unadjusted indices from September to December, 1987.
***MCPIF*(m):**	Monthly Consumer Price Index for food, seasonally adjusted (1982-84=100)
	Economic Indicators, various issues. 1986 figures were reported as 1977=100. They were conformed by the average ratio between indices 1977=100 and 1982-84=100 from January to October, 1987, 2.93373.

Table B.1 (Continued)

***MINC*(m):**	Monthly per capita disposable personal income (real dollars per person)
	Obtained by telephone from the Bureau of Economic Analysis, USDC, for the revised quarterly observations through November, 1995 (April, 1995). The reported figures were regarded as the value for the middle month of quarters. The differences between observations were divided equally into three, and were used to fill the observations for the remaining months. Deflated by ***MCPIA***. From December, 1995, observations are based on the trend-based regression (n=72): *MINC = 12175.8+22.8737 NOV+36.5208 DEC+23.1019 JAN +31.0855 FEB+41.005 MAR+46.7036 APR+64.0847 MAY +96.6571*YEAR* (R^2=0.78405, *YEAR*=10)
***NET*(a):**	Net change in bearing acreage (acres)
	$\boldsymbol{NET_t = BA_{t+1} - BA_t}$
***NFARM*(a):**	Nominal farm real estate value in California (dollars per acre)
	USDA, *Agricultural Statistics*, various issues. Beginning in 1979, nominal values were reported, while the 1978 observation was reported with 1977=100. Dollars per acre was obtained by converting the index by the average ratio between the dollars per acre and index 1977=100 from 1979 to 1981, 8.52540. Then, the 1976, 1977 observations reported with 1967=100 were converted analogously, using the average of a similar ratio from 1978 to 1980, 6.21726.
***NINC*(a):**	Nominal per capita disposable personal income (dollars per person)
	Obtained by telephone from Bureau of Economic Analysis, USDC, for the revised observations (April, 1996). The observations were lagged to correspond with crop years.
***NOV*(m):**	Dummy variable for November (November=1, otherwise=0)
***OCT*(m):**	Dummy variable for October (October=1, otherwise=0)
***OCTQALL*(m):**	Dummy variable for October, multiplied by ***QALL*** (***OCTALL=QALL*** in October, otherwise=0)
	$\boldsymbol{OCTALL_i = QALL_i{*}OCT_i}$
***PEACHBA*(a):**	Number of clingstone peach bearing acres in California (acres)
	NASS, USDA, *Non-Citrus Fruit and Nuts: 1995 Preliminary Summary.*
***PEACHNGR*(a):**	Nominal return for California clingstone peach growers (dollars per ton)
	NASS, USDA, *Non-Citrus Fruit and Nuts: 1995 Preliminary Summary.*

Table B.1 (Continued)

PEACHUP(a):	Utilized production of California clingstone peach (tons)
	NASS, USDA, *Non-Citrus Fruit and Nuts: 1995 Preliminary Summary.* To calculate ***PEACH***, the 1977 and 1978 observations were converted to metric tons.
PEACH(a):	Expected revenue from clingstone peach production (real dollars per acre)
	$\boldsymbol{PEACH_t} = (PEACHP_{t-3} + PEACHP_{t-2} + PEACHP_{t-1} + PEACHP_t)/4;$ $PEACHP_t = (\boldsymbol{PEACHNGR_t \times PEACHUP_t} \times 100)/(\boldsymbol{PEACHBA_t \times CPIF_t})$
POP(a):	Population of eight major kiwifruit producing counties (persons)
	Through 1994, the sum of population in counties: Butte, Fresno, Kern, Kings, Stanislaus, Sutter, Tulare, and Yuba, as of July 1, were obtained from California Department of Finance, *California Statistical Abstract*, various issues, table B-3. The 1995 figure was obtained from the Department's phone service.
PPF(a):	Prices Paid by Farmers: production items, interest, taxes and wage rates (1977=100)
	Economic Indicators, various issues.
QALL(m,a):	Volume of kiwifruit available for shipment at the beginning of October (1,000 tray equivalents)
	$\boldsymbol{QANN_t = QSHIP_t - QSEPT_t}$
QDOM(m):	Volume of domestic shipment (1,000 tray equivalents)
	Spreadsheet created by CKC.
QEX(m):	Volume of export shipment (1,000 tray equivalents)
	Spreadsheet created by CKC.
QIM(m):	Volume of imports (1,000 tray equivalents)
	Through December, 1988, the figures published in AMS, USDA, *Fresh Fruit and Vegetable Shipments* in 1,000 CWT were converted to tray equivalents (7 lbs=1 TE). From January, 1989, through September, 1995, monthly import data in metric tons from USDC were conformed to tray equivalents. From October to December, 1995, the 1994 October through December volumes were multiplied with the ratio between the 1994 and 1995 sum of imports during April through September, 1.491. January through May observations in 1995 were repeated for 1996 observations.

Table B.1 (Continued)

QP(a):	Volume of kiwifruit production (1,000 tray equivalents)
	NASS, USDA, *Fruit and Tree Nuts: Situation and Outlook Report*, Yearbook Issue: FTS-274 (September, 1995), table B-18. Reported in tons.
QSEPT(a):	Volume of shipment in September (1,000 tray equivalents)
	Spreadsheet created by CKC.
QSHIP(a):	Volume of annual shipment (1,000 tray equivalents)
	From 1980/81 to 1984/85, "Total Pounds" published in CKC annual reports were divided by 7. Beginning in 1985/86, crop-year sums of monthly figures were extracted from a spreadsheet created by CKC. Given the 1977/78 figure from Beutel (1990), values were assigned for the 1978/79 and 1979/80 observations, to maintain the ratio ***QSHIP/BA*** near 700 in the calculation of ***KIWI***.
RET(m):	Monthly return (real dollars per tray equivalent)
	$RET_i = (FOBDOM_i \times QDOM_i + FOBEX_i \times QEX_i)/(QDOM_i + QEX_i)$
REVENUE(a):	Revenue from an acre of kiwifruit vineyard (real dollars per acre)
	$REVENUE_t = FOB_t \times QSHIP_t/BA_t$
SPR(m):	Price spread between the farm value and retail cost for fresh fruit (1982-84=100)
	USDA, *Agricultural Outlook*, various issues.
UNITAD(a):	CKC advertising expenditures per tray equivalent of shipment (real dollars per tray equivalent)
	$UNITAD_t = (ADDOM_t + ADEX_t)/QSHIP_t$
UNITAD80(a):	Dummy variable for 1980, interacting with ***UNITAD*** (1980=0.055832, otherwise=0)
UNITDOM(m):	CKC monthly advertising expenditures pre tray equivalent of domestic shipment (real dollars per tray equivalent)
	$UNITDOM_i = ADDOM_i \Big/ \left[\left(\sum_{i-1}^{12} QDOM_i\right) \times 8\right]$, where $QDOM_i$ is summed from September through August.
URB(a):	Percentage change in population of eight kiwifruit producing counties in California (percentage)
	$URB_t = (POP_t - POP_{t-1})/POP_{t-1} \times 100$

Table B.1 (Continued)

YIELD(a):	Per-acre yield of kiwifruit vineyard (1,000 tray equivalents per acre)
	$\boldsymbol{YIELD_t = QP_t/BA_t}$ from 1980/81 through 1994/95. The 1995/96 figure is an average from 1990/91 through 1994/95.

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