The Domestic and Export Markets for California Almonds

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THE DOMESTIC AND EXPORT MARKETS FOR CALIFORNIA ALMONDS

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1. INTRODUCTION

Over the last three decades, California has become the dominant supplier of almonds in most world markets. Production increased from 17,100 metric tons in 1950 to 184,800 metric tons in 1981. Further increases in production are expected, given the current area in bearing and nonbearing almonds and the upward trend in yields. Domestic consumption also has increased with new product development and marketing. However, exports are a key factor for the industry.

This report attempts to specify the major elements of the economic structure of the industry, and to analyze forces affecting it from 1950 to 1980. Some of the important aspects include: the roles of the federal marketing order and of the marketing cooperative (California Almond Growers Exchange); the development of water resources encouraging large increases in acreage particularly in the southern San Joaquin Valley; the changing impacts of competitive suppliers in Europe (Spain, Italy, and Portugal) and of Common Agricultural Policies in the European Economic Community (EEC); and the sharp changes in the exchange rates which decreased from 1969 to 1979 reflecting a weaker dollar and then reversed as the dollar strengthened. The major focus of this report is on the effect of export markets on the domestic industry.

The report is organized following the major objectives of the study:

1. A description of world almond production, consumption and trade, and the marketing institutions and government policies which influenced trends from 1950 to 1980. More recent data for the U.S. production and exports are reported in the appendix.
2. The development and estimation of an econometric model including almond demand in the domestic market, the export market and for stocks; price linkage relations between farm and processor prices; and supply relationships for California producers.
3. The use of the above model in analyzing such questions as the probable impact of Spain and Portugal's entry into the EEC; the effect of the reserve provision of the marketing order on prices; the effect of exchange rates on U.S. exports; and the implications of supply changes on markets.

The markets analyzed in this study are the United States, Canada, Japan, West Germany, France, United Kingdom, Northern Europe (Belgium, Luxembourg, Denmark, and the Netherlands), Spain, Italy, and three non-EEC countries treated as a group (Sweden, Norway, and Switzerland). Producing areas are the United States, Europe (Italy, Spain, and Portugal), and "other"countries (Morocco and Iran).

2. THE WORLD ALMOND MARKET

This section reviews some features of the world almond market that are relevant to an economic analysis of the industry. The overall structure of this market is given followed by a discussion of five important aspects of the industry: (1) consumption in major markets; (2) production in the United States, Spain, Italy, Portugal, and the rest of the world (ROW); (3) market structure; (4) trade patterns; and (5) government policies.

OVERALL STRUCTURE OF THE MARKET

Three major producers, United States, Spain, and Italy, currently account for over 95 percent of commercial almond production and trade (Table 1). Minor production and exports originate in Iran, Portugal and Morocco.[1] The United States has become the major exporter in recent years as compared with 1950-54 when exports were balanced by imports. Italy's share of exports has decreased during this period from one half of world exports to less than 10 percent. The quantity of world exports has risen from an annual average of 60,000 metric tons in 1950-54 to 112,000 metric tons in 1976-80.

Western Europe accounts for about 70 percent of world imports. Japan and Canada are important markets, and in recent years importers include more than 40 countries where markets are being developed.

1. Some commercial production occurs in Algeria, Cyprus, Canary Islands, France, Israel, Tunisia and Yugoslavia. Data on trade are not consistently reported and these countries are excluded.

Table 1. World Trade in Almonds (Shelled Basis): Principal Exporters and Importers, Selected Periods, 1950-1980

Item	Annual Average (July-June) 1950-54	1960-64	1970-74	1976-80
	million metric tons			
Total Exports	60.0	65.1	78.8	112.5
	percent			
Major Exporters:				
United States	3.4	8.5	47.0	69.2
Europe				
Spain	25.6	35.8	28.0	21.1
Italy	50.1	42.4	11.7	7.3
Portugal	9.1	4.7	4.7	2.1
Iran & Morocco	11.8	8.6	8.6	0.3
Total	100.0	100.0	100.0	100.0
Major Importers:				
United States	3.2	0.6	0.1	0.0
Canada	1.2	1.9	2.3	3.1
Japan	0.0	1.5	8.0	8.8
Europe	(75.3)	(79.3)	(74.6)	(71.0)
West Germany	20.2	27.9	29.6	34.1
France	12.5	15.3	12.9	11.5
United Kingdom	18.7	13.6	8.8	6.9
Northern Europe[a]	9.1	7.6	8.2	7.4
Scandinavia, Switzerland[b]	14.7	14.7	11.8	9.4
Italy	0.1	0.2	3.3	1.7
Rest of the World	20.3	16.7	15.0	17.1
Total	100.0	100.0	100.0	100.0

[a]Includes Belgium, Luxemburg, Denmark and Netherlands.
[b]Includes the non-EEC countries of Norway, Sweden and Switzerland.

Source: Based on U.S. Foreign Agricultural Service "World Production and Trade in Tree Nuts," (1980) and updated information.

It should be realized that the United States, Spain, Italy, and Portugal all consume significant quantities of almonds which are sold domestically, and these data are not shown in Table 1.

The section title implies that there is one market for almonds, and that almonds are a homogeneous product. Admittedly, many different varieties are grown and are particularly suited to a given end-use. For example, in the United States, the principal variety, Nonpareil, goes mainly to confectionery use whereas the Mission variety is used mainly as snacks. Lack of data on varietal uses precludes disaggregated analysis here. However, supplies from the United States are probably differentiated from European nuts (Spain, Italy and Portugal). In support of this, trade journals mention differences in the flavor, quality control, and merchandising of the different regions.

CONSUMPTION

Domestic disappearance of almonds for selected countries is shown in Table 2. All three of the major producing and exporting countries, the United States, Spain and Italy, have a large domestic consumption of almonds. For most of the period 1950-1980, the United States has been the largest market for almonds, but West German domestic disappearance increased over the period and actually was larger than U.S. consumption in 1961 and 1979. In contrast, the United Kingdom market has declined. Japanese usage has increased sharply.

Trends in almond consumption differ among the countries shown although each country exhibits considerable variation around its trend. It is possible that some of this variation may be accounted for by changes in stocks of almonds. Data on these stocks are unavailable, and the use of disappearance data thus entails the necessary assumption that such stock changes are negligible. When consumption is expressed on a per capita basis this trend disappears for most countries. The exceptions to this are West Germany and Japan which show increases in per capita consumption and the United Kingdom which shows a decrease (see Table 3). West Germany is an important transshipment point for other European countries for almonds from the United States. To the extent that these shipments are included in German consumption, those figures will be overstated. It was impossible to adequately account for these transshipments and so they are ignored.

The main uses of almonds are reported for each of the exporters and for the main importers in the following paragraphs.

United States

The distribution of sales outlets for California almonds has changed considerably from 1962 to 1979 (see Table 4). The major change is the increased importance of exports. Domestic sales to confectioners are relatively less important whereas sales to cereal manaufacturers have become relatively more important. One factor affecting this recent diversification has been the large number of forms into which almonds have been processed and packed. For instance, the California Almond Growers Exchange (CAGE) has developed over 2,000 product lines.

Spain

Confectionery uses account for over half the Spanish almond consumption. Some of the major uses include marzipan manufacture, nougat production, sugar coated almonds, and pastry. Other uses include salted nuts, almond syrup, and milk and soft drink flavoring. Almond oil is also used in perfumes and cosmetics.

Italy

Confectionery is an even more important use for almonds in Italy than in Spain and accounts for almost 90 percent of domestic consumption. However, the term confectionery differs from that used in the United States since for Italy it also includes bakery goods.

Bryan (1966) estimated industrial use of almonds as:

Use	Percent
Bakery	80
Confetti (Sugar Coated Almonds)	13
Ice Cream	7
	100

Horoschak (1971) reported that major uses included confetti pastry and baked goods, in general, candy and ice cream.

Importing Countries[2]

In Japan, confectionery, especially chocolate products, is an important use for almonds. Canadian consumption patterns are similar to those in the United States.

2. Based on communications with representatives of the California Almond Growers Exchange.

Table 2. Total Almond Disappearance (Shelled Basis): Principal Consuming Countries, 1950-1980

Crop Year (July-June)	United States	Canada	Japan	West Germany	France	United Kingdom	Northern Europe	Scandinavia & Switzerland	Spain	Italy
	metric tons									
1950	19,708	328	0	13,914	8,132	18,239	5,112	7,599	6,500	7,400
1951	16,747	258	0	8,044	5,753	10,359	4,002	5,647	7,800	7,220
1952	16,182	903	0	12,760	7,852	5,033	7,066	9,613	8,800	7,562
1953	18,468	1,202	8	13,884	8,833	12,402	6,332	11,397	9,300	3,022
1954	18,297	906	10	12,128	7,070	10,027	4,681	9,772	11,100	3,718
1955	16,964	697	49	7,314	5,280	3,940	2,703	5,512	8,200	3,180
1956	15,300	1,295	103	5,020	4,656	2,135	2,099	4,096	8,500	3,290
1957	16,960	1,261	496	17,409	11,235	4,360	4,917	15,689	4,200	8,311
1958	15,099	319	335	5,684	5,688	4,697	1,538	5,946	4,300	5,312
1959	22,031	1,927	893	18,782	8,238	10,797	6,473	10,986	3,600	10,044
1960	24,849	1,073	456	13,750	9,154	7,619	4,412	7,882	4,600	6,150
1961	25,436	1,731	804	29,456	11,714	13,878	7,987	14,814	4,700	7,526
1962	24,780	930	778	11,483	8,406	6,411	3,395	7,433	5,400	5,398
1963	22,942	1,304	1,185	19,206	9,650	8,941	4,849	9,365	5,400	5,866
1964	26,176	1,276	1,625	16,819	10,915	7,378	4,162	8,403	6,000	6,150
1965	26,010	1,440	1,438	16,121	10,047	9,331	5,167	7,405	6,000	13,083
1966	28,105	1,533	2,902	16,465	11,860	8,459	4,654	8,828	6,100	7,405
1967	26,446	1,441	3,971	19,015	11,037	8,063	4,677	9,045	5,400	8,807
1968	29,048	1,352	3,097	22,065	12,489	8,406	4,153	9,469	9,500	10,284
1969	27,398	1,422	3,701	18,752	10,489	6,640	5,671	7,852	8,800	7,548
1970	31,359	1,654	5,247	21,703	10,456	7,116	6,011	8,622	14,000	16,612
1971	34,381	2,058	5,857	25,641	12,176	8,468	8,117	9,940	9,600	6,079
1972	34,368	2,040	8,094	25,949	11,390	8,591	6,180	10,660	14,100	12,929
1973	24,628	1,767	8,795	18,268	8,449	5,997	5,197	7,690	19,100	10,302
1974	25,547	1,696	3,502	25,090	8,435	4,570	6,593	9,599	22,100	13,573
1975	34,132	2 494	7,317	24,470	10,169	6,821	7,220	9,221	25,000	13,181
1976	42,535	3,484	10,093	31,707	12,555	8,262	8,049	11,891	26,100	9,983
1977	44,929	3,702	11,150	38,963	13,055	8,436	8,661	11,973	15,800	9,611
1978	40,075	2,971	9,830	35,843	12,052	7,384	7,481	9,496	26,500	12,856
1979	39,875	3,403	10,072	50,666	14,421	8,507	9,156	10,254	17,600	835
1980	43,323	4,075	8,340	34,747	12,600	6,221	8,072	9,076	24,200	17,358

Source: Calculated from U.S. Foreign Agricultural Service (1980) and updated information.

Table 3. Per Capita Almond Disappearance (Shelled Basis): Principal Consuming Countries, 1950-1980

Crop Year (July-June)	United States	Canada	Japan	West Germany	France	United Kingdom	Northern Europe	Scandinavia & Switzerland	Spain	Italy
	grams/person[a]									
1950	129.91	23.77	0.00	291.70	194.08	360.45	219.40	507.41	232.97	159.83
1951	108.47	18.43	0.00	167.23	136.33	204.72	169.58	373.53	277.58	154.94
1952	103.07	62.71	0.00	268.09	184.32	99.86	298.14	629.66	310.95	161.24
1953	115.43	81.22	0.09	283.93	205.90	243.65	263.83	739.73	326.32	64.30
1954	112.67	59.61	0.11	234.58	164.42	196.22	194.23	629.27	385.42	77.95
1955	102.63	44.68	0.55	140.11	121.94	76.95	110.78	351.89	282.76	66.25
1956	90.96	80.43	1.14	94.72	106.79	41.54	85.33	258.96	291.10	68.12
1957	99.07	75.96	5.46	324.19	254.76	84.33	195.02	984.99	142.86	171.36
1958	86.38	18.65	3.65	104.49	127.53	90.50	61.27	368.61	144.78	109.08
1959	123.98	110.75	9.63	342.11	182.66	206.84	255.85	676.06	120.40	204.56
1960	137.52	60.28	4.89	247.30	201.19	145.12	173.02	480.11	152.82	124.49
1961	138.46	94.59	8.54	524.13	255.21	262.34	310.78	890.96	153.59	152.04
1962	132.80	50.00	8.20	201.81	179.23	120.06	130.58	440.84	175.32	107.53
1963	121.26	68.99	12.36	333.44	201.88	166.81	184.37	549.56	173.63	114.57
1964	136.26	66.11	16.77	288.49	225.52	136.13	157.06	487.72	191.69	120.35
1965	133.66	73.47	14.69	273.24	205.46	170.90	192.08	425.53	189.87	253.55
1966	142.74	76.27	29.34	275.80	240.08	154.64	171.73	502.73	191.22	142.68
1967	132.83	70.64	39.75	317.45	221.18	146.33	171.32	510.32	168.22	168.07
1968	144.37	65.00	30.63	366.53	250.28	152.01	151.02	529.88	291.41	194.77
1969	134.83	67.71	36.18	308.42	208.53	119.64	204.73	434.94	267.48	141.88
1970	153.05	77.65	50.31	357.55	205.83	128.45	215.45	473.66	414.20	309.35
1971	165.29	95.28	55.94	418.29	237.35	152.30	287.84	542.22	281.52	112.37
1972	164.44	93.58	75.64	420.57	220.31	153.96	218.37	576.93	408.70	238.10
1973	116.72	79.95	81.21	294.65	162.17	107.28	181.71	415.00	547.28	187.65
1974	120.50	75.38	31.95	404.68	160.67	81.61	230.52	516.46	627.84	245.00
1975	159.50	109.39	65.92	395.95	192.59	121.80	249.83	495.49	704.23	236.22
1976	197.84	150.82	89.48	515.56	237.33	147.54	276.60	639.64	727.02	176.07
1977	207.05	158.88	97.89	634.58	246.32	150.91	296.61	643.02	431.69	170.41
1978	183.83	126.43	85.55	584.71	226.12	132.33	255.32	508.90	720.11	226.74
1979	181.25	143.59	86.90	825.18	269.55	152.18	312.49	547.76	473.12	14.67
1980	190.01	170.50	71.40	564.07	234.64	111.09	274.56	483.54	647.06	304.53

[a]One gram equals 0.0022046 pounds. The 1980 U.S. per capita consumption, for example, is 0.42 pounds per capita.

Source: Calculated from U.S. Foreign Agricultural Service (1980) and updated information.

Table 4. Distribution of End Uses for U.S. Almonds

User	1962	1973	1979
	----------percent----------		
Confectioners	44	11	10
Nut Salters	14	8	7
Cereal Manufacturers	-	6	3
Bakers	9	4	1
Other Food Manufacturers	-	4	3
Ice Cream Manufacturers	8	4	6
Retail and Wholesalers	17	8	10
Others	-	3	0
Exports	8	52	60
TOTAL	100	100	100

Source: California Almond Growers Exchange, Annual Reports, and Powell (1964)

In all European countries, marzipan (a confection made from almond paste) is a major form in which almonds are consumed. However, specific countries have other differing uses. For instance, in both West Germany and the British Isles, many almonds are used in the form of almond paste. A layer of almond paste traditionally is spread over Christmas cakes in Britain and, in turn, is covered by a layer of icing (frosting). In France, many almonds are used for baking; minor uses include candy and nougat production, and pharmaceutical oils for cosmetics and perfumes. As might be expected the Swiss, with their large chemical industry, also use almonds for pharmaceutical oils. Almonds are also included in the chocolate for which Switzerland is famous. The Scandinavian countries show a cross section of uses including paste, chocolate, and pastry products. There are more direct sales of almonds to consumers here than in other regions. Throughout Europe there is noted a small but growing preference for almonds in their natural form and for snack almonds.

PRODUCTION[3]

Although this analysis treats shelled almonds within a region as a homogeneous product, many different varieties of almonds are grown. Before discussing production in each of the regions, the trends in world production and some features of almond culture that are common to all regions are considered.

Trends in World Production

World commercial production of almonds almost tripled between 1950 to 1980 (see Table 5). These aggregate figures conceal major changes in the pattern of world production.

3. The information in this section is drawn from Loyns (1967), Bryan (1965), (1966) and Horoschak (1971). Prof. D.E. Kester, Pomology Dept., University of California, Davis, provided unpublished lecture notes on European production. Only the most important points are mentioned in this section. For further information, interested readers are referred to the above sources.

Table 5. Commercial Production of Almonds (Shelled Basis): Selected Countries, 1950-1980

Crop Year[a]	United States	Spain	Italy	Iran	Portugal	Morocco	Total
	----------	----------	----------	metric tons	----------	----------	----------
1950	17,900	25,400	49,900	-[b]	-	-	-
1951	18,900	26,300	22,000	6,400	3,100	5,800	82,500
1952	16,000	24,500	40,400	7,000	5,400	3,800	97,100
1953	17,800	25,400	34,400	6,000	5,600	6,300	95,500
1954	20,000	17,700	31,000	8,000	5,100	1,900	83,700
1955	17,400	12,000	19,000	4,300	3,200	1,500	57,400
1956	27,300	16,300	11,800	5,000	2,400	1,500	64,300
1957	16,400	29,000	48,100	10,000	3,900	1,800	109,200
1958	8,700	23,600	13,600	8,200	2,000	5,700	61,800
1959	38,200	29,000	42,000	9,100	3,000	3,300	129,800
1960	24,300	29,900	12,700	3,600	1,100	2,400	74,000
1961	32,300	31,800	59,900	8,200	5,300	3,600	141,000
1962	24,000	18,100	13,200	7,300	3,900	2,000	68,500
1963	30,600	26,300	38,100	5,000	1,800	2,800	104,600
1964	37,500	31,800	35,400	6,000	3,200	4,000	117,900
1965	35,700	27,000	37,000	7,000	4,000	6,000	116,700
1966	43,000	37,000	38,000	1,500	1,500	4,000	125,000
1967	37,300	27,000	39,000	5,000	5,500	5,000	118,800
1968	36,400	37,500	42,000	7,200	4,500	3,200	130,800
1969	58,300	22,000	22,000	5,500	2,200	3,000	113,000
1970	64,400	32,000	34,000	10,000	5,700	3,000	149,100
1971	69,800	33,000	16,000	7,100	6,500	2,500	134,900
1972	64,400	50,000	15,000	9,000	6,300	3,500	148,200
1973	66,400	37,000	8,000	8,100	8,000	4,000	131,500
1974	98,700	55,000	14,000	7,400	4,500	3,000	182,600
1975	77,200	43,500	15,000	8,200	3,500	1,500	148,900
1976	117,100	65,000	16,500	7,000	5,200	2,000	212,800
1977	129,200	32,000	22,000	8,000	1,600	1,700	194,500
1978	169,700	60,000	22,000	7,500	3,000	3,500	169,700
1979	158,100	32,000	7,000	7,000	1,700	2,600	208,400
1980	146,100	45,000	20,000	13,200	5,000	2,500	226,100

[a]Year beginning September 1 for Spain, Portugal and Italy; August 1 for United States; September 23 for Iran and July 1 for Morocco.
[b]Not available.

Source: U.S. Foreign Agricultural Service (1980) various issues and U.S. Tariff Commission (1954).

The early importance of Italian production, with 36 percent of world production during 1951-54, and then the decline in the Italian industry, both absolutely and relative to other producers, may be noted in Table 5. By the period 1970-74, Italy represented only 12 percent of total world production. In contrast, U.S. output increased from 20 percent of total production during 1950-54 to 70 percent three decades later. During this same time, Spanish production increased at approximately the same rate as total production and so remained at about 30 percent of the total. Production in the three minor regions increased only slightly and consequently the regional share of total output fell from about 18 percent during 1951-1954 to about 11 percent ten years later. It has remained at this share for the past decade.

Almond trees tend to bear heavily in alternate years. This tendency is more apparent over the last decade, especially in those countries experiencing slow change in output. In Italy and the United States, however, it is masked by the rapid shift in production. All countries display large changes in production from year to year. These changes in production have obvious implications for a stock holding policy; the alternate bearing pattern would tend to encourage interseasonal stocks, while the increase in total output would suggest that, *ceteris paribus*, stock holding would be contra-indicated.

Almond Pomology

Almonds have been grown for many years and, particularly in the Mediterranean area, each district has evolved a traditional system of culture with its own set of varieties, management practices and methods of handling. Since management practices such as fertilization, irrigation and pest and disease control vary from country to country, they will be discussed under the individual country headings. In recent years, there has been some shift in the attitude that almonds should be grown only in marginal areas where nothing else will grow. This has never been the attitude in California where almonds are grown on the best soils.

The almond is one of the first trees to flower each year. In Europe, flowering occurs during January to March with first bloom occuring in the warmer districts. The Californian bloom starts a month later but finishes about the same time because of the narrower climatic range and the smaller number of varieties involved.

The early bloom period and a need for warm and dry weather while the bees pollinate the crop result in a susceptibility to large yield variations. However, there are marked varietal differences in bloom time. This coupled with a wide geographical spread reduces the risk of a total crop failure in any country.

Each of the main varieties is self sterile and must be planted with another variety which blooms at the same time.[4] As a result, production occurs of an otherwise undesired variety. A proliferation of varieties is most pronounced in Italy where over 1,000 varieties are known.

After pollination, the almonds develop a leathery green hull which encloses a shell containing the edible kernel. Before harvest, the hull splits, exposing the shell. Harvesting whether by hand or mechanically consists of knocking or shaking the nuts from the tree then picking them up. After harvest, the hulls are removed mechanically from the shells. It is normal for farm sales to be inshell.

U.S. Supply and Disposition

The major trends in U.S. almond supply are given in Figure 1. *Bearing area* remained relatively constant in the decade of the 1950s but increased as *new plantings* (and other nonbearing area) increased sharply during the late 1950s and 1960s. During this period, water deliveries to the southern San Joaquin, tax provisions (see Carman, 1981) plus relatively favorable prices encouraged plantings of large orchards. The decade of the 1970s was characterized by large fluctuations in new plantings affected in part by price expectations but also by such factors as drought years of 1976 and 1977 (see also Table 6).

Production has increased sharply due to increases in bearing acreage and yields. There is considerable year-to-year variation in yields which is characteristic of many tree crops. Orchard sizes have increased sharply allowing the cost of irrigation and mechanization to be spread over a greater production. Many observers argue that mechanization is a significant factor in increased almond production. With the decline in the agricultural labor force, many farmers have claimed difficulties in obtaining and scheduling labor and, so, it is hypothesized, have turned towards a crop involving minimal labor.

The graphs also show the variability in actual farm prices in the decade of the 1950s and the 1970s as contrasted with the relative stability of the 1960s. Gross revenues per hectare, calculated as farm price times yield per hectare divided by the CPI, reflect the variability of both the price and yield series.

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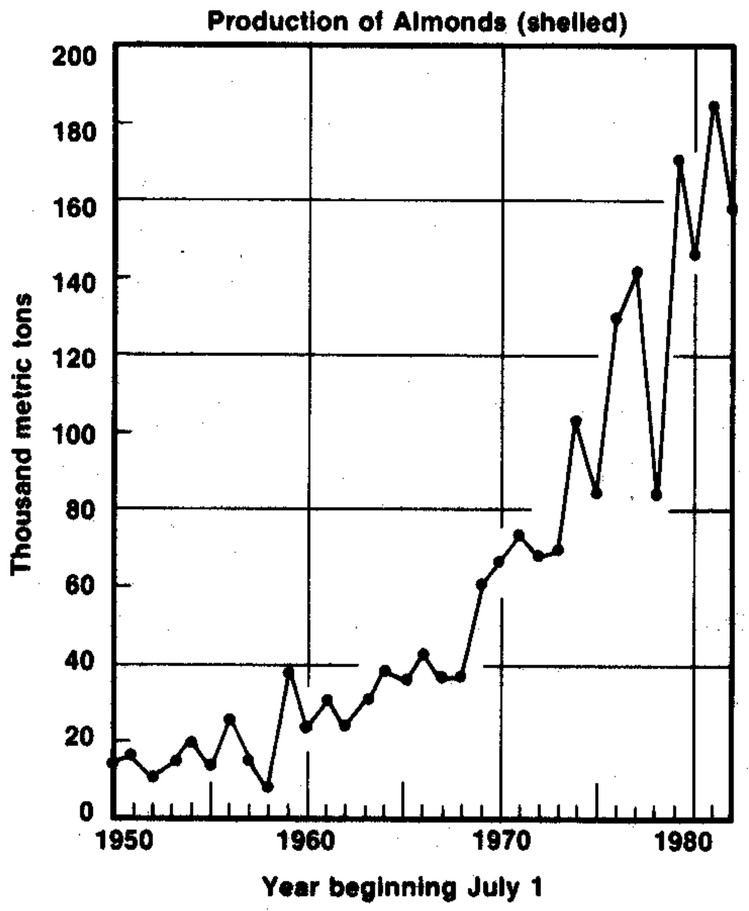
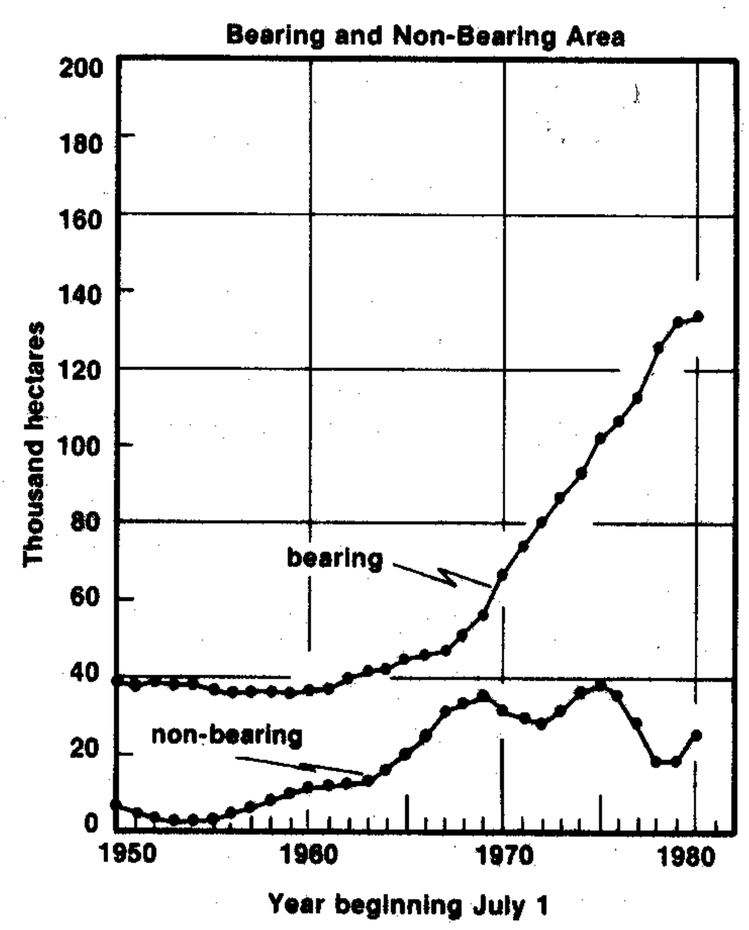
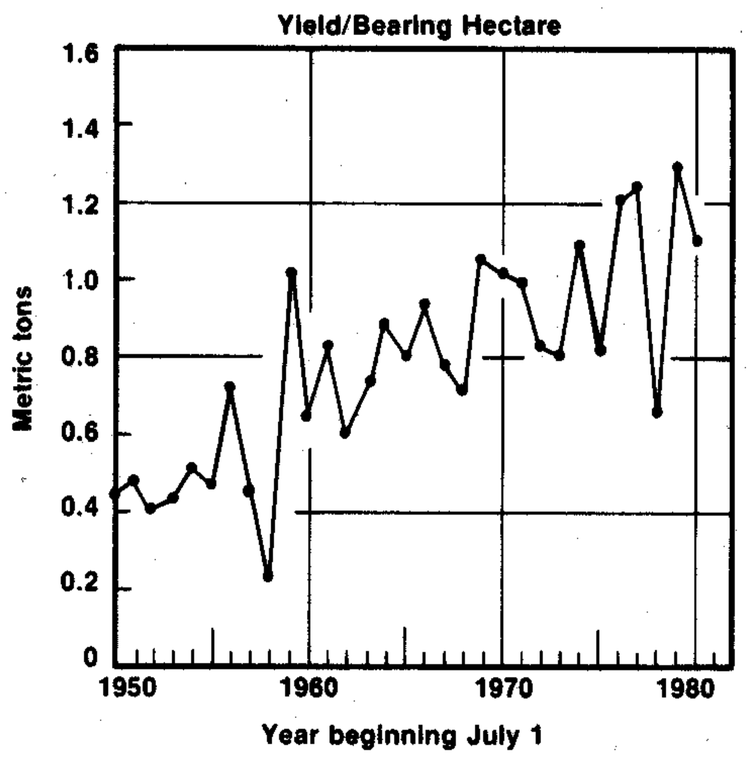
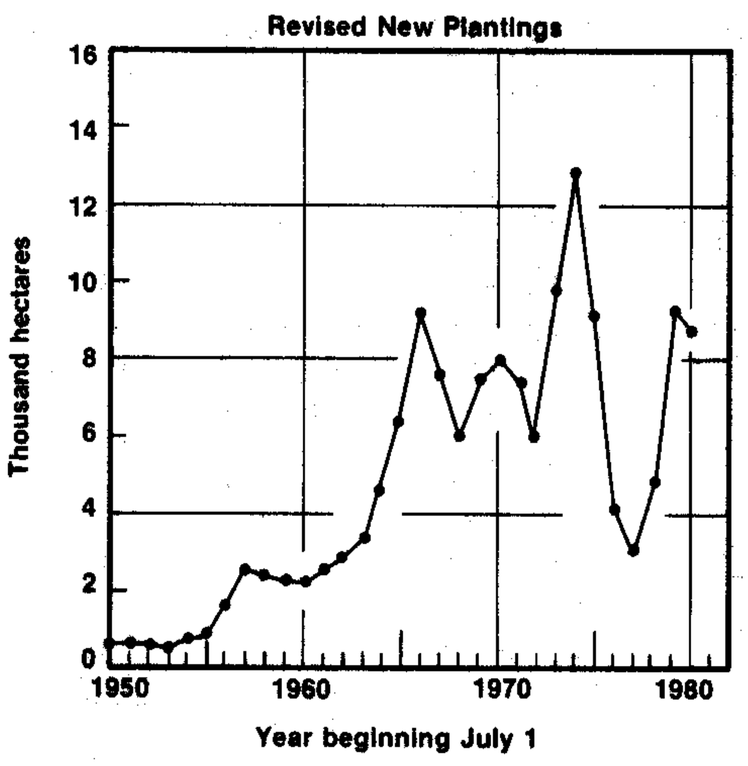
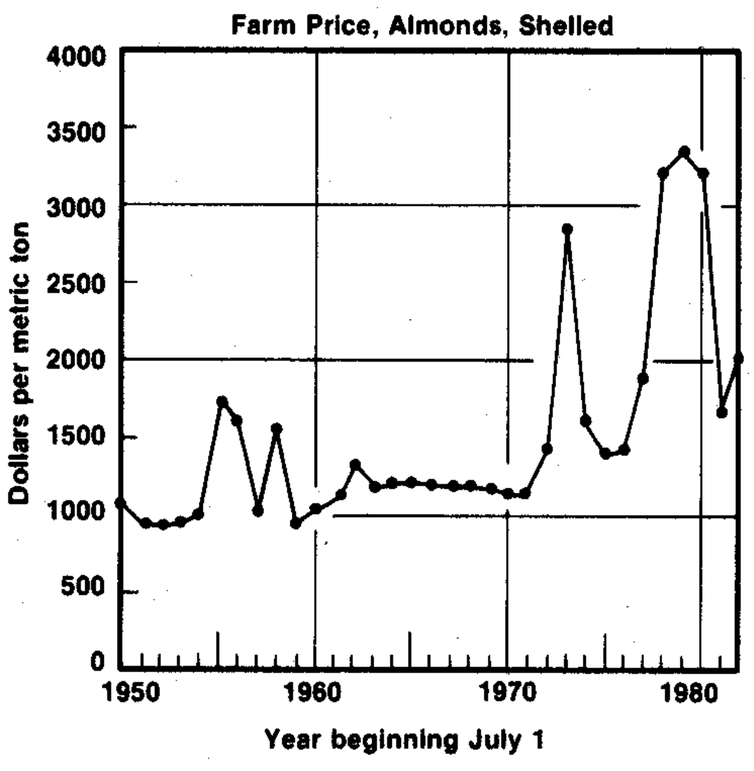
4. Kester reports the existence of minor varieties in Italy which are self fertile.

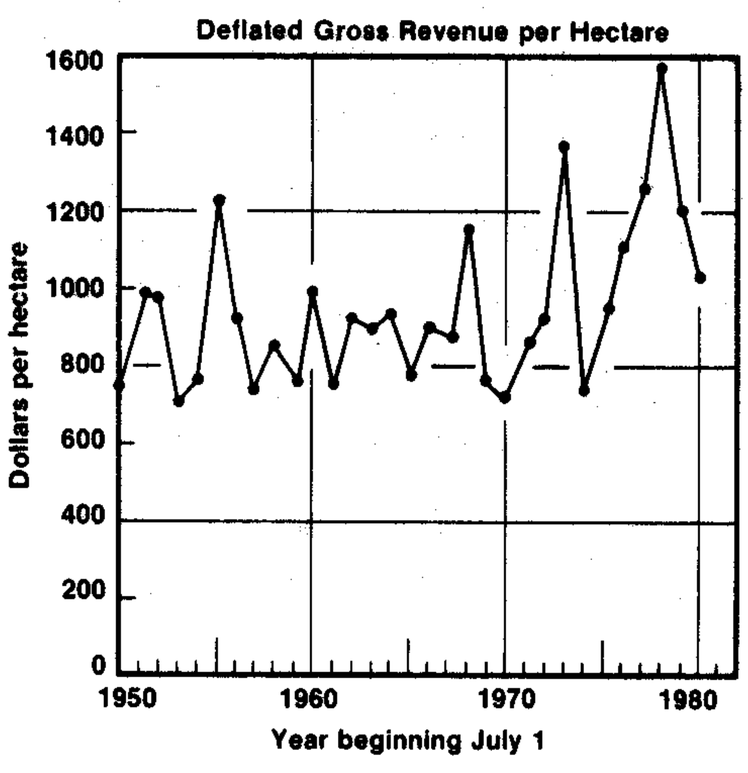












Source: See text.

Figure 1. U.S. Almond Production, Area and Prices, 1950-1980

TABLE 6. U.S. Almond Acreage and Yield (Shelled Basis), 1950-1980

As of May 31	Non-Bearing	Bearing	Total	New Plantings	Removals	Net Change	Yield Per Hectare
	hectares[a]						metric tons
1950	6,137	38,310	44,447	724	0	724	0.447
1951	5,254	38,448	43,702	762	1,507	-745	0.482
1952	4,289	38,923	43,212	566	1,056	-490	0.416
1953	3,602	38,775	42,377	564	1,399	-835	0.446
1954	3,418	38,638	42,056	802	1,121	-321	0.510
1955	3,611	37,034	40,645	917	2,328	-1,411	0.469
1956	4,481	36,665	41,146	1,633	1,132	501	0.727
1957	6,475	36,376	42,851	2,560	855	1,705	0.451
1958	8,324	36,846	45,170	2,414	95	2,319	0.234
1959	9,868	36,834	46,702	2,345	813	1,532	1.029
1960	11,266	36,951	48,217	2,331	816	1,515	0.645
1961	12,160	37,544	49,704	2,527	1,040	1,487	0.832
1962	12,428	39,942	52,370	2,812	146	2,666	0.595
1963	13,386	42,099	55,485	3,371	256	3,115	0.743
1964	15,676	43,465	59,141	4,635	979	3,656	0.881
1965	19,760	45,287	65,047	6,414	508	5,906	0.794
1966	26,420	46,074	72,494	9,187	1,740	7,447	0.937
1967	31,263	47,899	79,162	7,655	987	6,668	0.780
1968	33,014	51,177	84,191	6,049	1,020	5,029	0.715
1969	33,882	56,662	90,544	7,501	1,148	6,353	1.064
1970	32,506	65,581	98,087	7,986	443	7,543	1.026
1971	30,163	74,802	104,965	7,461	583	6,878	0.975
1972	29,000	81,122	110,122	6,052	895	5,157	0.839
1973	31,051	87,410	118,461	9,775	1,436	8,339	0.803
1974	35,830	94,801	130,631	12,764	594	12,170	1.097
1975	37,523	101,850	139,373	9,119	377	8,742	0.826
1976	35,805	106,353	142,158	4,147	1,362	2,785	1.210
1977	28,718	114,215	142,933	3,007	2,232	775	1.243
1978	19,383	125,533	144,916	4,927	2,940	1,983	0.654
1979	19,562	131,928	151,490	9,298	2,724	6,574	1.293
1980	25,420	132,254	157,674[b]	8,824	2,640	6,184	1.104

[a]Conversion factor: 1 hectare = 2.471 acres.

[b]Total hectares as of May 31, 1980 equals 1979 total hectares (151,490) plus new plantings in 1980 (8,824) minus removals (2,640) during the season prior to May 1, 1980 inventory.

Source: See Appendix D.

The trends in supply and disposition of U.S. almonds are summarized in Table 7. Marketable production (which is reported as "redetermined marketable") equals producer deliveries less computed losses due to defective kernels. These losses vary from year to year but average about 8 percent of production in the late 1970s. Beginning stocks are reported as of July 1. In most years, committed sales are more than half of these stock levels.

Disposition of supplies has increasingly been to the export market, although the domestic market continues to expand. Ending stocks vary annually, but average about 20 percent of domestic supply. Domestic disappearance continues to rely less on imports than during the 1950s.

The export market developed at a most opportune time for the United States, as seen in Figure 2. European exports which were volatile in the 1950s were somewhat more stable in the 1960s. However in 1969, Spain, Italy, and Portugal had poor crops at a time when U.S. yields were above normal and as bearing acreage continued its steep climb. Also, the exchange rate between the United States and the important market of West Germany began its sharp decline from 1968 until 1979. This meant that the real price facing West German buyers declined and encouraged imports from the United States. The econometric modeling will attempt to capture the effects of exchange rate changes as well as other factors affecting the import demand for U.S. almonds.

Spanish Production

Almonds are grown all over Spain but commercial plantings are concentrated on the Balearic Islands and along the Mediterranean coast from Barcelona to the Portugese border. These regions have a favorable climate and are the main fruit and vegetable growing areas.

It was noted that Spanish production has increased substantially although at a slower rate than in the United States. The changes in bearing, nonbearing, and total area, and in yield that underlie these production changes are shown in Table 8. It appears that total area includes noncommercial production. Since this study is concerned with commercial production, it was assumed that only specialized plantings would be for commercial output. Mixed plantings, e.g., trees interplanted with another permanent crop, and casual plantings such as those along roadsides were ignored.[5]

Over the last decade, both the total and the bearing area in specialized plantings have doubled. But during the same period the nonbearing area has increased almost threefold, so further large increases in bearing area may be expected.

Production increases have not matched the changes in bearing area. This may be partly due to the influx of young, and hence, lower yielding trees, but more likely was due to a series of years with adverse weather at flowering time. However, even in the best years, Spanish yields have not approached those in California, partly because of a lower level of technology employed by farmers and partly because almonds are usually grown on the poorest soils. Some irrigated areas are now being planted in almonds but usually crops such as citrus fruits are preferred. Yields are higher on irrigated soils because inputs, especially fertilizer, can then be applied; whereas fertilizer applied with insufficient water can kill a tree. Traditional Spanish almond culture involves the family unit with a minimum of hired labor although larger units would have some full-time workers.

Italian Production

Since 1950, Italian production has declined to about a quarter of its previous level. No breakdown of the total area into bearing and nonbearing is available; only bearing area is shown in Table 9. Both a fall in area and a drop in yields have contributed to the decreased output. Bearing area decreased from an average of 167,000 hectares (ha) during 1960-62 to 125,000 ha during 1972-74, while average yields dropped from 0.173 to 0.099 tons/ha.[6]

Average yields are much lower than those obtained in California. Kester[7] suggests that a widespread viral infestation reduced the vigor of the trees, an effect especially serious when the trees are in poor condition. This effect can be compensated for by irrigation and fertilization but this treatment is not possible in most of

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5. Horoschak (1971) estimated commercial shelled production in 1966 to be 41,000 short tons and in 1969 to be 24,000 short tons. The official total production figures were 51,300 and 36,000 tons. During these years the calculated area in mixed and casual planting was 25 percent of the total. Thus, it is a strong assumption that only specialized plantings contribute to commercial production. However, this assumption was made to account for noncommercial production and for consistency with the treatment of Italian area.

6. For the same reasons as for the Spanish data, these yields are not strictly comparable with U.S. data since it is not clear whether specialized plantings produce commercial output only or whether mixed plantings are strictly noncommercial.

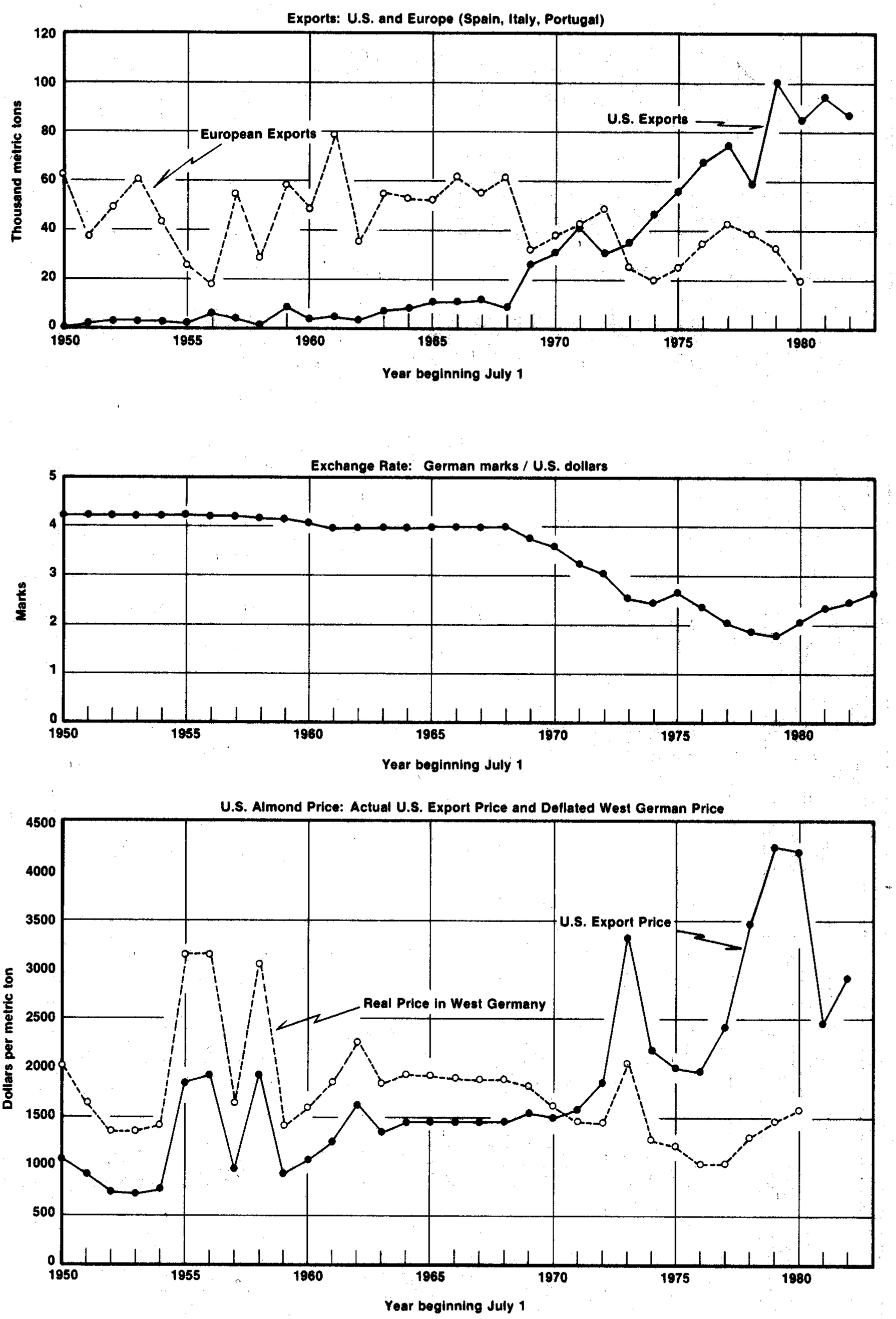
7. *Op. cit.*

Table 7. U.S. Almond Supply and Disposition (Shelled Basis), 1950-1984

Year Beginning July 1	Supply					Disposition				Consumption			
								Ending Stocks					
	Production	Computed Losses[a]	Redetermined Marketable	Beginning Stocks	Domestic Supply	US Market	Export Market	Actual	Stocks Supply	Imports	Total Supply	Total Sales	Domestic Disappearance
	metric tons								(percent)	metric tons			
1950	17,107	785	17,892	2,994	20,886	17,282	0	3,605	17.3	6,009	26,895	17,282	23,291
1951	18,546	308	18,854	3,605	22,459	15,332	1,905	5,191	23.1	1,881	24,340	17,237	17,212
1952	16,177	-209	15,968	5,191	21,159	14,742	2,404	4,039	19.1	3,299	24,458	17,146	18,040
1953	17,310	509	17,819	4,039	21,858	14,969	2,676	4,235	19.4	3,399	25,257	17,645	18,368
1954	19,721	367	20,088	4,235	24,323	17,418	3,220	2,672	15.1	755	25,078	9,361	18,173
1955	17,382	37	17,419	3,672	21,091	16,647	3,359	2,095	9.9	242	21,333	19,006	16,889
1956	26,649	653	27,302	2,095	29,397	15,241	6,396	8,113	27.6	46	29,443	21,637	16,693
1957	16,400	-10	16,390	8,113	24,503	15,419	4,309	4,847	19.8	2,321	26,824	19,728	17,740
1958	8,624	104	8,728	4,847	13,575	10,822	635	2,742	20.2	5,738	19,313	11,457	16,580
1959	37,901	302	38,203	2,742	40,945	21,146	8,210	10,243	25.0	980	41,925	29,356	22,126
1960	23,851	418	24,269	10,243	34,512	24,107	3,939	6,466	18.7	441	34,953	28,046	24,548
1961	31,233	1,110	32,343	6,466	38,809	24,898	4,894	9,306	24.0	342	39,151	29,792	25,240
1962	23,756	223	23,979	9,306	33,285	24,540	3,749	4,621	13.9	116	33,401	28,289	24,656
1963	31,291	-695	30,596	4,621	35,217	22,745	7,097	5,382	15.3	159	35,376	29,842	22,903
1964	38,287	-765	37,522	5,382	42,904	25,915	7,986	8,999	21.0	199	43,103	33,901	26,114
1965	35,959	-241	35,718	8,999	44,717	25,815	10,400	7,894	17.7	200	44,917	36,215	26,014
1966	43,193	-200	42,993	7,894	50,887	27,825	10,149	11,720	23.0	237	51,124	37,974	28,062
1967	37,348	-70	37,278	11,720	48,998	26,182	11,926	10,507	21.4	254	49,252	38,108	26,436
1968	36,612	-190	36,422	10,507	46,929	28,770	9,518	8,228	17.5	534	47,463	38,288	29,304
1969	60,299	-2,016	58,283	8,228	66,511	27,288	27,592	11,577	17.4	129	66,640	54,880	27,417
1970	67,299	-2,941	64,358	11,577	75,935	31,185	30,960	13,709	18.1	129	76,064	62,145	31,314
1971	72,904	-3,063	69,841	13,709	83,550	34,234	40,839	8,500	10.2	115	83,665	75,073	34,349
1972	68,070	-3,643	64,427	8,500	72,927	34,245	31,409	7,259	10.0	124	73,051	65,654	34,370
1973	70,186	-3,765	66,421	7,259	73,680	24,590	35,132	13,661	18.5	53	73,733	59,672	24,643
1974	103,998	-5,273	98,725	13,661	112,386	25,505	47,149	39,733	35.4	28	112,414	72,654	25,533
1975	84,164	-6,972	77,192	39,733	116,925	34,027	55,996	26,904	23.0	29	116,954	90,022	34,056
1976	128,706	-11,645	117,061	26,774	143,835	42,395	68,306	33,673	23.4	69	143,904	110,701	42,464
1977	142,014	-12,827	129,187	33,674	162,861	44,797	75,254	42,728	26.2	58	162,919	120,051	44,855
1978	82,113	-8,436	73,677	42,728	116,405	40,073	59,470	17,129	14.7	239	116,644	99,542	40,312
1979	170,565	-12,483	158,082	17,129	175,211	39,811	101,705	35,811	20.4	106	175,317	141,516	39,917
1980	145,966	-7,554	138,412	35,811	174,223	43,308	84,793	46,122	26.5	34	174,257	128,101	43,342
1981	184,817	-11,027	173,790	46,111	219,901	52,564	94,301	73,036	33.2	19	219,920	146,865	52,583
1982	157,276	-7,243	150,033	73,036	220,069[b]	58,188	80,732	81,149	36.9	257	220,326	138,920	58,445
1983	109,722	-9,118	100,604	80,264	177,850[b]	58,327	77,883	41,640	23.4	79	177,929	136,210	58,406
1984	266,222	-10,556	255,666	41,107	283,990[b]	59,584	121,003	103,402	36.4	107	284,097	180,588	59,691

[a]There are some statistical discrepancies in the series in some years prior to 1963.
[b]Excludes market development reserve of 3,000 M.T. in 1982; 3,018 M.T. in 1983; and 12,783 M.T. in 1984.

Source: See Appendix Table A.30.



Source: See text

Figure 2. U.S. Almond Exports, Exchange Rates and Prices 1950-1982

Table 8. Spain: Area in Almonds, Commercial Production, and Yields (Shelled Basis), 1950-1980

Crop Year (July-June)	Area: Specialized Plantings: Bearing Area	Area: Specialized Plantings: Nonbearing Area	Area: Specialized Plantings: Total Area	Area: Specialized Plantings: Change in Area	Area: Mixed and Casual Plantings: Total Area[a]	Area: Total: Specialized Plus Mixed and Casual: Bearing	Area: Total: Specialized Plus Mixed and Casual: Total	Area: Total: Specialized Plus Mixed and Casual: Change	Commercial Production	Yield/Bearing Hectare: Specialized Plantings	Yield/Bearing Hectare: All Plantings
	thousand hectares								metric tons		
1950	153.8	...[b]	...	...	70.6	224.4	...	...	25,400	0.1651	0.1132
1951	153.5	...	...	...	70.7	224.2	...	...	26,300	0.1713	0.1173
1952	155.7	...	...	...	74.2	229.9	...	...	24,500	0.1574	0.1066
1953	156.2	...	...	...	73.9	230.1	...	...	25,400	0.1626	0.1104
1954	159.2	...	...	...	75.8	235.0	...	...	17,700	0.1111	0.0753
1955	161.4	...	...	...	79.4	240.8	...	...	12,000	0.0743	0.0498
1956	171.4	...	...	...	78.2	249.6	...	...	16,300	0.0951	0.0653
1957	171.6	...	...	...	81.2	252.8	...	...	29,000	0.1690	0.1147
1958	172.4	...	...	...	81.2	253.6	...	...	23,600	0.1369	0.0931
1959	177.6	...	...	...	80.9	258.5	...	...	29,000	0.1633	0.1122
1960	201.5	...	...	...	80.5	282.0	...	...	29,900	0.1484	0.1060
1961	203.6	...	...	...	82.8	286.4	...	...	31,800	0.1562	0.1110
1962	206.6	...	...	...	80.9	287.5	...	...	18,100	0.0876	0.0630
1963	208.9	...	...	...	84.4	293.3	...	...	26,300	0.1259	0.0897
1964	217.0	21.6	238.6	...	76.0	293.0	314.6	...	31,800	0.1465	0.1085
1965	215.3	24.9	240.2	1.6	75.1	290.4	315.3	0.7	27,000	0.1254	0.0930
1966	210.7	31.9	242.6	2.4	69.1	279.8	311.7	-3.6	37,000	0.1756	0.1322
1967	209.7	37.6	247.3	4.7	69.8	279.5	317.1	5.4	27,000	0.1288	0.0966
1968	222.8	29.8	252.6	5.3	73.7	296.5	326.3	9.2	37,500	0.1683	0.1265
1969	217.2	49.0	266.2	13.6	67.2	284.4	333.4	7.1	22,000	0.1013	0.0774
1970	267.7	31.0	298.7	32.5	61.4	329.1	360.1	26.7	32,000	0.1195	0.0972
1971	262.5	64.3	326.8	28.1	76.2	338.7	403.0	42.9	33,000	0.1257	0.0974
1972	331.9	64.9	396.8	70.0	78.9	410.8	475.7	72.7	50,000	0.1506	0.1217
1973	382.9	58.9	441.8	45.0	70.0	452.9	511.8	36.1	37,000	0.0966	0.0817
1974	420.0	60.5	480.5	38.7	66.9	486.9	547.4	35.6	55,000	0.1309	0.1130
1975	434.8	65.2	500.0	19.5	76.0	510.8	576.0	28.6	43,500	0.1100	0.0852
1976	450.0	60.6	510.6	10.6	71.1	521.1	581.7	5.7	65,000	0.1444	0.1247
1977	461.2	66.2	527.4	16.8	71.5	532.7	598.9	17.2	32,000	0.0694	0.0601
1978	482.8	49.5	532.3	4.9	71.7	554.5	604.0	5.1	60,000	0.1243	0.1082
1979	507.6	48.1	555.7	23.4	69.5	577.1	625.2	21.2	32,000	0.0630	0.0554
1980	515.6	48.9	564.5	8.8	69.1	584.7	633.6	8.4	45,000	0.0873	0.0770

[a]Calculated using reported numbers of trees and the density of plantings (144.6 trees for hectare) implied by Bryan (1965).
[b]...denotes not available.

Source: Ministerio de Agricultura, Secretaria General Tecnica, (annual issues).

Table 9. Italy: Area in Almond Specialized Plantings, Commercial Production and Yield, 1950-1980

Crop Year (July - June)	Specialized Plantings			Total Commercial Production (Shelled)
	Total Area	Change in Area	Yield/Hectare (Kernel Weight)[a]	
	thousand hectares		metric tons	
1950	...[b]	...	...	49,900
1951	...	...	...	22,000
1952	...	...	...	40,400
1953	...	...	...	34,400
1954	...	...	...	31,000
1955	...	...	...	19,000
1956	...	...	...	11,800
1957	...	...	...	48,100
1958	...	...	...	13,600
1959	...	...	...	47,200
1960	169	...	0.0751	12,700
1961	168	-1	0.3565	59,900
1962	168	0	0.0786	13,200
1963	166	-2	0.2295	38,100
1964	165	-1	0.2145	35,400
1965	163	-2	0.2270	37,000
1966	162	-1	0.2346	38,000
1967	160	-2	0.2438	39,000
1968	160	0	0.2625	42,000
1969	158	-2	0.1392	22,000
1970	158	0	0.2152	34,000
1971	140	-18	0.1143	16,000
1972	127	-13	0.1181	15,000
1973	124	-3	0.0645	8,000
1974	123	-1	0.1138	14,000
1975	120	-3	0.1250	15,000
1976	117	-3	0.1410	16,500
1977	114	-3	0.1930	22,000
1978	111	-3	0.1982	22,000
1979	108	-3	0.0648	7,000
1980	107	-1	0.1869	20,000

[a]Calculated.
[b]...denotes not available.

Sources: Area. 1960-1974 Istituto Nazionale di Economia Agraria (1975)
1975-1980 Istituto Centrale di Statistica (1981)
Production. U.S. Foreign Agricultural Service (1981)

the present areas. Another possible reason is Italian reliance on wind pollination rather than the use of bees.

The main areas for almond production are Puglia (in the heel of Italy), Sicily and Sardinia. The government has declared the whole of southern Italy to be an economically depressed area worthy of assistance. The main forms of assistance to agriculture have been for water projects and for extension services. Government experimental farms have developed management procedures for irrigation–but only for new plantings, not for rejuvenation of old orchards. In Italy, almonds are still regarded as a crop for locations unsuitable for anything else but olives and carobs; therefore, development assistance is not expected to materially alter the trend in Italian almond production for the foreseeable future.

MARKET STRUCTURE

United States

In all three supplying countries, a large number of relatively small growers produce the almonds. In the United States, data are available only for those growers who are members of the California Almond Growers Exchange (CAGE), who numbered 4,700 in 1975. Changes in the size of orchards between 1962 and 1973 are presented in Table 10. These data do not reflect some larger holdings by nonmembers of CAGE. It is clear, though, from Table 10, that although orchards are increasing in size, they are still small in comparison with the per farm area in most field crops.

In contrast to the growing sector, handling is quite concentrated. In 1975 the entire U.S. crop was marketed by eight major firms and seven smaller ones, some of which enter the market only sporadically. Ninety-five per cent of the crop was handled by the four major firms. This degree of concentration would suggest an oligopolistic market structure. However, the largest firm is the cooperative, CAGE. Although share of production has varied from 60 percent to 75 percent, but it remains the dominant firm in the market.

Members sign a five-year crop agency agreement to supply all their production to the Exchange. Payment is based on the total return less costs to CAGE and is adjusted by the varietal, quality, and size distribution of the grower's deliveries.

Currently, sales are made by CAGE on an f.o.b. basis with one price charged for domestic and export sales. Prior to the 1973 crop, the export price was generally lower than the domestic price. There was a substantial export price differential of about 33 percent in 1950-54 but this differential was only 8 percent by 1961 and remained at about 5 percent until the 1973 crop when all sales were at the same quoted price. Although sales are on an f.o.b. basis, brokers are employed in both the domestic and export markets to actively seek purchases and then to service the needs of their customers.

Spain

As in the United States, there are many almond growers but the handling sector is quite different. In addition to exporters, speculators influence marketings of the crop. Bryan reported that about 30 firms were actively exporting almonds in 1960. Since then, increased processing costs and rising production have forced small exporters to modernize their facilities to remain competitive. In order to obtain the required capital for improvements, many mergers were undertaken that sharply reduced the number of exporters.

Exporters generally do not hold uncommitted stocks. For definite orders, they buy almonds either through their agents in the producing areas or from large speculators located in the main trade centers. These speculators buy from smaller speculators in the producing regions or may have their own agents there.

By the end of the year speculators hold almost all of the stocks. Thus, the decision on allocation between the export and domestic markets, and stock holding is strongly influenced by the speculators who decide on the level of stocks and how much they will sell to exporters.

Italy

The structure of the handling sector is similar to that in Spain. Besides exporters, there are both small and large accumulator-speculators. About 20 large firms are engaged in exports with about half of them accounting for most of the exports. Unlike those in Spain, Italian exporters generally carry large stocks of uncommitted almonds, and may carry them over into the next season.

In contrast with the export market, there are many small firms which sell on the domestic market.

TRADE PATTERNS

The changing importance of different countries in trade, shown previously in Table 1, was a natural result of changes in production and domestic consumption. Details of the changes in trade patterns between 1950-54 and 1976-80 are presented in Tables 11 and 12.

Table 10. Sizes of Orchards, by Percentage of Members of a U.S. Cooperative, Selected Years

Size Class	1962-63	1975-76
hectares	Percent	
0.4- 4.0	46.5	33.7
4.1-10.0	28.6	29.6
10.2-20.2	15.9	20.8
20.3-40.5	6.5	10.5
40.6 +	2.5	5.4
	100.0	100.0

Source: California Almond Growers' Exchange.

Table 11. Commercial Trade Flows for Almonds, Annual Average, 1950-54

Source	Destinations										Total Exports
	United States	Canada	Japan	West Germany	France	United Kingdom	Northern Europe	Scandinavia & Switzerland	Italy	Total to Rest of World	
	metric tons										
United States	a	308	4	81	0	0	422	420	0	806	2,041
Spain	1,323	187	0	1,077	2,654	4,379	1,523	2,295	14	1,929	15,381
Italy	516	124	0	9,103	3,539	4,024	2,682	5,577	a	4,517	30,082
Rest of World[b]	93	100	0	1,885	1,335	2,809	812	514	19	4,946	12,513
Total Imports	1,932	719	4	12,146	7,528	11,212	5,439	8,806	33	12,198	60,017

[a]Excludes domestic shipments.
[b]Includes Iran, Portugal, and Morocco.

Source: See Appendix A.

Table 12. Commercial Trade Flows for Almonds, Annual Average, 1976-80

Source	Destinations										Total Exports
	United States	Canada	Japan	West Germany	France	United Kingdom	Northern Europe	Scandinavia & Switzerland	Italy	Total to Rest of World	
	metric tons										
United States	a	3,450	9,897	27,091	5,961	6,242	5,013	6,347	1,050	12,855	77,906
Spain	71	78	0	6,402	5,204	947	1,772	3,648	840	4,837	23,763
Italy	0	0	0	4,290	1,408	145	977	308	a	1,069	8,197
Rest of World[b]	0	0	0	601	364	429	522	235	3	512	2,665
Total Imports	71	3,528	9,897	38,384	12,937	7,763	8,284	10,538	1,857	19,272	112,531

[a]Excludes domestic shipments.
[b]Includes Portugal and Morocco. Data not available for Iran.

Source: See Appendix A.

Italy was the major supplier to Europe during the 1950s (Table 11). For instance, during 1950-54, it supplied 75 percent of West German, 63 percent of Scandinavian and Swiss, and 49 percent of northern European imports. Between 1976 and 1980 (Table 12), the United States was the dominant supplier for Canada (98 percent of consumption), Japan (100 percent), West Germany (70 percent), the United Kingdom (80 percent), Northern Europe (60 percent), and Scandinavia (60 percent).

Over these three decades, Spanish exports increased. The Spanish share of world exports rose during the 1960s but fell back in the 1970s because of the faster increase in U.S. exports. As expected, Spanish almonds are most important in those markets in which Spain has the greatest locational advantage; namely, France, Italy, West Germany, and Switzerland.

Formation of the European Economic Community (EEC) led Italian exporters to concentrate on markets in the other member countries. Although a greater percentage of Italian exports stayed within EEC, increases in European demand and reduced Italian exports meant that even in these countries, Italy was supplying a smaller share of consumption than during the 1950s.

GOVERNMENT POLICIES

Government policies affect the world almond market either directly as with duties or indirectly through changes in exchange rates and taxation. This section concentrates on those policies having an important direct effect on almond production, trade or consumption. Other policies not amenable to analysis within the framework of this study, partly because of insufficient information, are mentioned along with possible implications for model construction. Policies that are incorporated in the study are discussed in greater detail. The first part of this section deals with production and trade policies in general; the second with the marketing order for almonds in the United States in particular.

Production Policies

Two U.S. policies undoubtedly affected production decisions. The most important was the development of irrigation projects in the Central Valley of California. Irrigation of almonds became widespread in the late 1950s (Loyns, 1968), and Kern has now become the leading producing county due largely to the development of irrigated acreage associated with water deliveries of the State Water Project.

The second U.S. policy relates to tax law revisions. Prior to 1970, special tax provisions such as current deduction of orchard development costs undoubtedly encouraged almond plantings. Carman (1981) analyzed the impact of the 1970 tax reform, finding that it *ceteris paribus* tended to reduce new almond plantings between 1971 and 1978 period as compared with the years before 1970.

Information is scanty on the policies adopted by the Spanish government such as subsidies to increase the area in almonds. Horoschak (1971) reports research by the Ministry of Agriculture on the most suitable locations for increased area.

In Italy, policies to aid the economically depressed southern region have increased the area of irrigated agriculture which, as mentioned earlier, has led to a shift from almonds to citrus and table grapes. Research on the use of poorer terrace areas has involved crops other than almonds. The only research on almonds has been for newly established orchards and does not deal with rejuvenation of the existing areas. Restrictions on the import of foreign varieties of almonds and the phasing out of extension services for almonds as well as the other policies mentioned, have all contributed to the decline in almond area and production.

Trade Policies

Athough trade in almonds is not restricted anywhere by quotas, tariffs are common. Perhaps the best known is the Common External Tariff (CET) of the EEC although many other countries also maintain customs and excise taxes. Upon formation of the Community, the original six members aligned their external customs duties to the level of the CET, while abolishing those duties applying to trade with other members. When this adjustment phase was completed in July 1968, Italy had a 7 percent *ad valorum* advantage over external suppliers due to the CET.

The United States has an import tariff on shelled almonds of 16.5 cents per pound, or $364 per metric ton. (In 1950 and again in 1959, it was raised to 26.5 cents per pound.) This tariff represented 28 percent of the domestic price in 1951, but with rising prices represented about 15 percent of the 1981 domestic price. This tariff undoubtedly has protected the U.S. industry.

The Marketing Order for U.S. Almonds

The Federal Marketing Order for Almonds Grown in California was established by the Secretary of Agriculture in August 1950 under the terms of the enabling Agricultural Marketing Agreement Act of 1937, as amended. This act declares the objectives for

marketing orders and delineates the type of policies permitted, even though individual marketing orders may not include all possible provisions.

Section 2 of the act declares that the policy of an order is to enable maintenance of a parity price for growers, the undertaking of such research, quality control and grading as is in the public interest, and the stabilization of supplies and prices in the interests of producers and consumers. Mechanisms stated in the act include controls on the purchases by handlers from growers, and controls on the handler allocation among markets or to reserve, in any specified period or periods.

Under the federal marketing order for almonds, the Almond Board of California, formerly known as the Almond Control Board, was established with the duties of providing information to the Secretary of Agriculture and acting as intermediary between the Secretary and any handler or grower.

Supply allocation is achieved by: "A percentage of each handler's receipts is declared as 'reserve' to be held for disposition by the Board. However, each handler can be an agent of the Board to dispose of his reserve holdings, in export or other designated outlets under terms and conditions set by the Board" (Almond Board of California, 1976). This regulates the allocation of production among markets by limiting the amount that can be sold on the domestic market. The reserve percentage is reported in Table 13 along with production, the calculated reserve requirement, and the actual export sales. As an attempt to indicate years in which the domestic constraint effectively altered handlers' actions, Table 13 also shows the years in which exports were within 1 percent of the amount required to be diverted from the domestic market: 1952 and 1953; in 1959 the diversion requirement was violated.

Loyns (1968) analyzed the economic effects of the surplus disposal provision of the marketing order for the period 1950 to 1966. His general conclusion was that the surplus program decreased revenue in seven seasons, increased it in four, and had minor effect in three. The reserve requirement was not in effect in four of these years (see Table 13). Since the present analysis concentrates on the period 1960 to 1980, the distortions due to the diversion policy are minor.

The next section of the report develops an economic model with emphasis on major factors affecting the industry, though of necessity, it abstracts from some of the detail such as demand for each end use.

3. AN ECONOMIC MODEL OF THE U.S. ALMOND INDUSTRY

INTRODUCTION

A complete model would specify the economic behavior of buyers, processors and producers in each important producing/consuming country in the world. Lack of reliable information forced a much less comprehensive analysis focusing on the U.S. industry and on its domestic and export markets but with consideration of supplies from other producers such as Spain.

Although there are several large processors, the California Almond Growers Exchange (CAGE) is the dominant firm in the industry. Helmberger and Hoos (1965) have argued convincingly that marketing cooperatives should be regarded as firms which attempt to maximize returns to their supplier members. CAGE operates under a five crop-year agency agreement with its members. Under this agreement the total production of a grower is sent to the Exchange which is legally obliged to take all of it. Almonds may be stored, so handlers can hold stocks in an attempt to increase interseasonal profits. Although importers also can hold stocks, such information is not available.

The economic model developed here emphasizes the key role of CAGE as a price leader and in the development of new markets and products. The framework focuses on the major determinants of demand and supply. The first block models the handler decision process on what price to establish. The second development specifies market demand functions and market equilibrium conditions. The third aspect consists of a margin relation, and the fourth part constructs orchardist supply relationships.

HANDLER OBJECTIVE FUNCTION

One of the main objectives of CAGE is to maximize returns for its growers. With given total industry stocks and marketable production, a key decision is what price to set such that a given supply is sold in domestic and export markets while keeping ending stocks at desired levels. Since 1973, one price is quoted for both domestic and export sales, whereas in previous years a price discount was set for export sales. In most years the bulk of sales are at the opening bid but occasionally

Table 13. U.S. Reserve Requirement, and Exports, 1950-1980

Crop Year	Production (metric tons)	Reserve (percent)	Reserve Requirement (metric tons)	Exports (metric tons)	Binding Constraints
1950	17,892	0	0	0	
1951	18,854	10	1,885	1,905	
1952	15,968	15	2,395	2,404	yes
1953	17,819	15	2,673	2,676	yes
1954	20,088	15	3,013	3,220	
1955	17,419	0	0	2,349	
1956	27,302	0	0	6,396	
1957	16,390	24	3,934	4,309	
1958	8,728	0	0	635	
1959	38,203	25	9,551	8,210	
1960	24,269	16	3,883	3,939	
1961	32,343	14	4,528	4,839	
1962	23,979	15	3,597	3,749	
1963	30,596	15	4,589	7,097	
1964	37,522	15	5,628	7,986	
1965	35,718	20	7,144	10,400	
1966	42,993	20	8,599	10,149	
1967	37,278	25	9,320	11,926	
1968	36,422	20	7,284	9,518	
1969	58,283	35	20,399	27,592	
1970	64,358	45	28,961	30,960	
1971	69,841	45	31,428	40,839	
1972	64,427	35	21,905	31,409	
1973	66,421	0	0	35,132	
1974	98,725	0	0	47,179	
1975	77,192	0	0	55,996	
1976	117,061	0	0	68,306	
1977	129,187	0	0	75,254	
1978	73,677	0	0	54,490	
1979	158,082	0	0	101,705	
1980	136,186	2	2,723	84,793	

Source: Almond Board of California, "Statistical Tables," Sacramento, 1981.

prices may be changed or offers withdrawn if unforeseen changes occur in the market. It seems doubtful that interseasonal inventory policy was important during the 1960-1980 period since handlers were faced with successively higher levels of bearing acreage and yields over time. However, recognition of yield variability could have induced management to hold above average inventories in high yield years with the expectation of lower yields in the next season.

The handlers receive revenue from domestic and export market sales and expected revenue from stock holding, from which costs of operation including market development are deducted. The Exchange is perceived to set price such that desired levels of sales and ending inventory result. The objective then is to maximize revenues subject to demand relations for the total domestic and major export markets, the demand for stocks, the given beginning inventory and current marketable production, and the equality of domestic and export prices:

(3.1) $\text{Max } R = (PAU_t \bullet QUU_t^* + \Sigma\, PAU_t \bullet QU_{jt}^* + PAU_{t+1}^* \bullet SEU_t^* - C(...))$

Subject to: domestic demand: $QUU_t^* = f(...)$

export demand: $QU_{jt}^* = f(...)$

stock demand: SEU_t^* f (...)

supply: $SEU_t^* = SBU_t + MPU_t - QUU_t^* - QU_t^*$

prices: domestic price = export price

where

R	=	net revenue
PAU_t	=	almond price set by the Exchange (prior to 1973, the lower export price is PXU)
PAU_{t+1}^*	=	expected almond price t+1
QUU_t^*	=	expected shipments, U.S. to U.S.
QU_{jt}^*	=	expected shipments, U.S. to market j
SBU_t	=	beginning stocks, U.S.
SEU_t	=	ending stocks, U.S. (SEU^* = desired stocks)
MPU_t	=	marketable production, U.S.
$C(...)$	=	cost function.

The expected levels of stocks, domestic and export sales are estimated from the demand functions to be discussed below. The expected price, also to be discussed, is related to the expected next year's production and other variables. The demand functions include variables representing the effect from competitors for export markets.

A simple example of a hypothesized competitive market equilibrium is given in Figure 3. It is argued that in establishing price for a given season, the decision makers have an estimate of domestic demand (dd), export demand (ee) and thus total demand (d DT DT). Total supply (S) is known, consisting of marketable production plus beginning stocks. Further, it is argued that some desired level of ending stocks is specified giving consideration to next year's probable level of production, and the tradeoff between current price and the level of stocks. Price is equal for domestic and export sales, and thus price discrimination is not present. Equating total demand to supply less desired ending stocks (S-SE) gives the price that will clear the market.

DEMAND FUNCTIONS

Some of the main uses of almonds here and abroad are in confectioneries, bakery products, and ice cream. The important sale as snacks is not modeled here. The demand for almonds thus is considered as the demand for a manufacturing input. Bushnell (1978) derived the following input demand function for almonds:

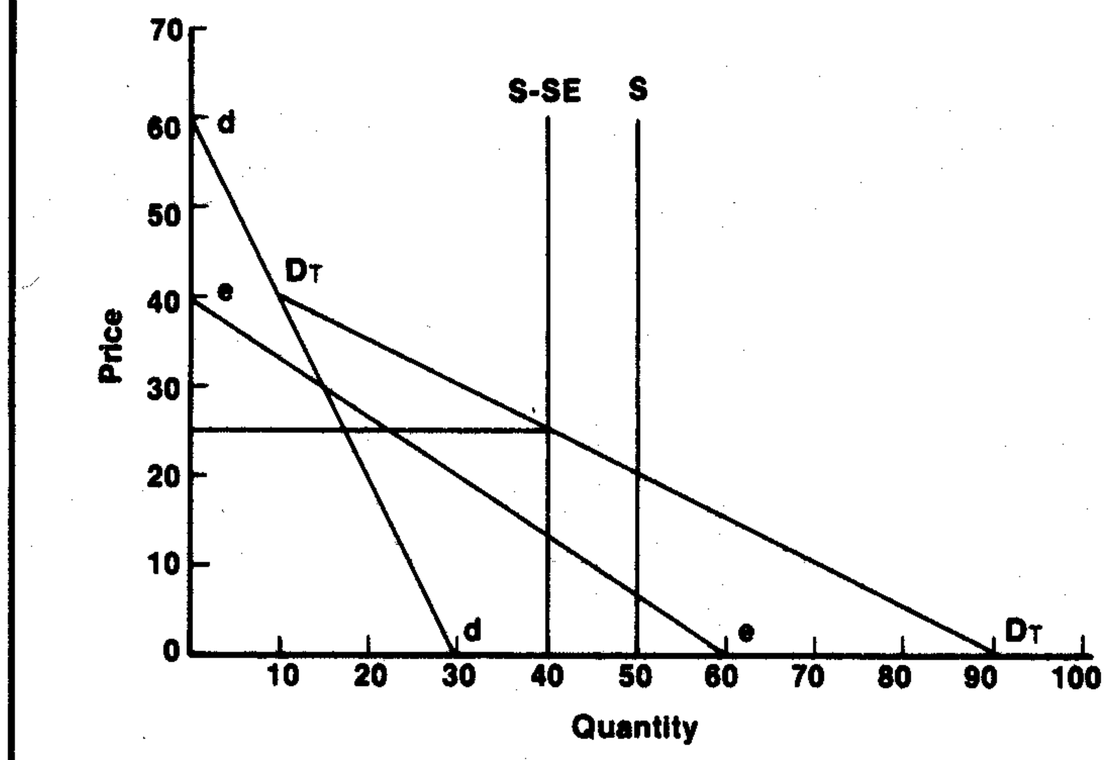
(3.2) $Q_{ijt} = f(P_{ijt}, R_{kjt}, TQ_{jt-1}, POP_j, E_j, CPI_j)$

where

Q_{ijt}	=	quantity of almonds from source i shipped to destination j in the July-June year t.
P_{ijt}	=	price of almonds from source i at destination j.
R_{kjt}	=	prices of other inputs (k) at destination j.
TQ_{jt-1}	=	quantity of almonds shipped to country j from all sources in the previous year.
POP_j	=	population of country j.
E_j	=	per capita personal consumption expenditures of country j.
CPI_j	=	consumer price index of country j.

Domestic Demand

The U.S. demand function specifies domestic shipments related to domestic price, price of European almonds, input prices such as cocoa, sugar, and filberts (a competing nut), lagged total shipments, population, per capita income and the consumer price index. As will be noted in section 4, demand functions are estimated in per capita terms and converted to the form of equation (3.2). Note that if snack demand were to be modeled, it would be appropriate to include other competing nuts.



Max R - QUU*P + QUX*P
Subject to: QUU* - 30 - 0.5 P (domestic demand d d)
QUX* - 60 - 1.5 P (export demand e e)
SE* - .20 S (desired ending stocks)
S - 50 (supply)
S - SE - Total Demand (D_T)
P = Domestic and export sales price
Solve for price:
40 - 90 - 2.0 P (add demand functions)
P - 25 ; QUU - 17.5 ; QUX - 22.5

Figure 3. Hypothetical Model of Market Equilibrium

Import Demand

Demand functions are estimated for seven major import countries or groups of countries. Quantities, prices and other variables are those of the importing country. For example, the price of U.S. almonds in West Germany is adjusted for transportation costs, duties and exchange rates.

(3.3) PUWG = (PUX + TUWG)(DUWG)(ERWGU)

where

PUWG = price of U.S. almonds in West Germany
PUX = U.S. export price of U.S. almonds
TUWG = transportation cost, San Francisco to Hamburg
DUWG = duty on imports (e.g., 7 percent duty expressed as 1.07)
ERWGU= exchange rate (Deutsche marks per dollar)

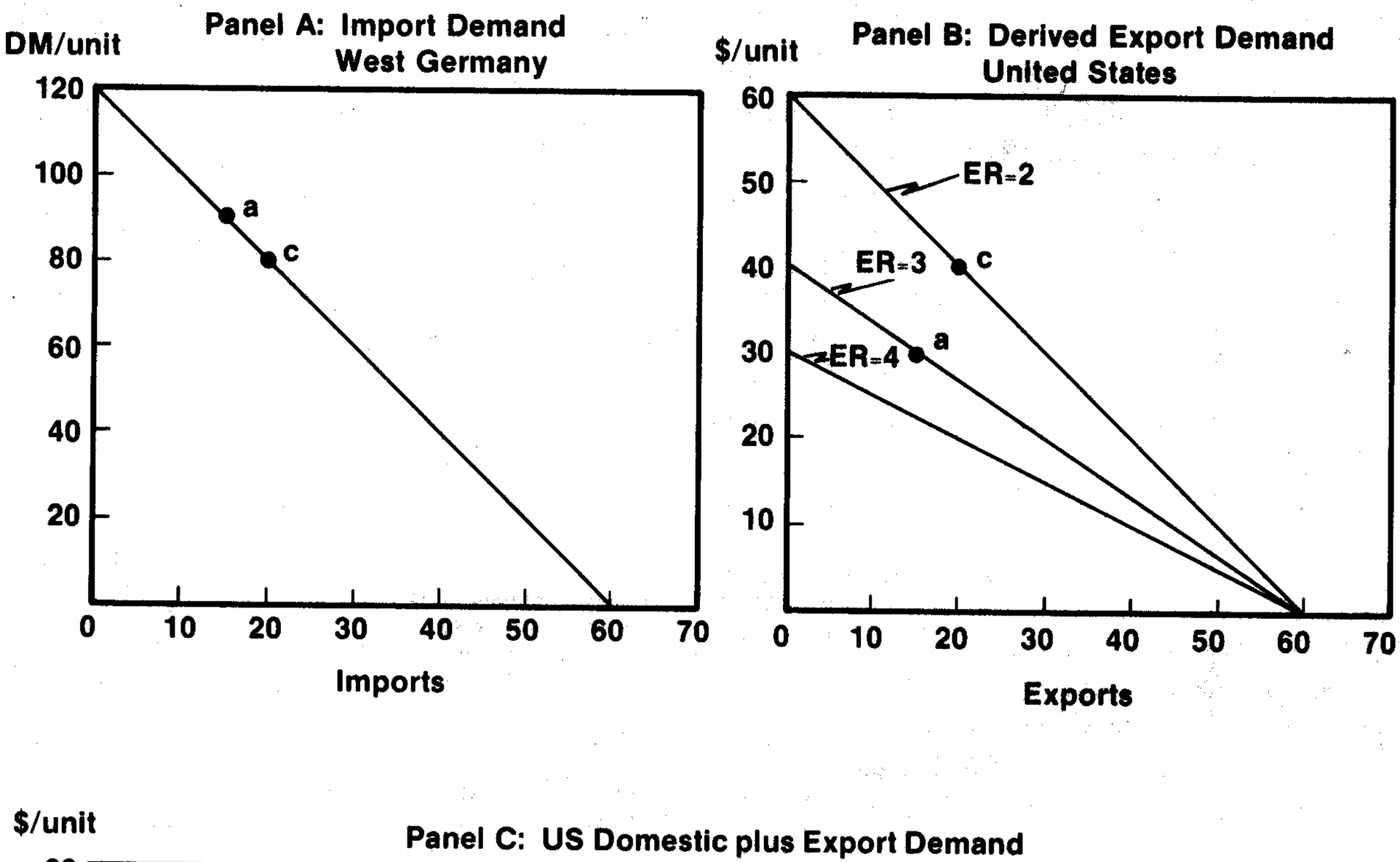
The import demand functions for U.S. almonds were estimated with prices and incomes in real terms (deflated by the importer's CPI) and expressed in 1970 dollars (see arguments for this procedure by Bjarnason, et al. (1969)). Although importers are concerned with prices in their respective domestic currencies, the U.S. exporter must translate these import demands back to U.S. currency in order to establish a price that will clear the market.

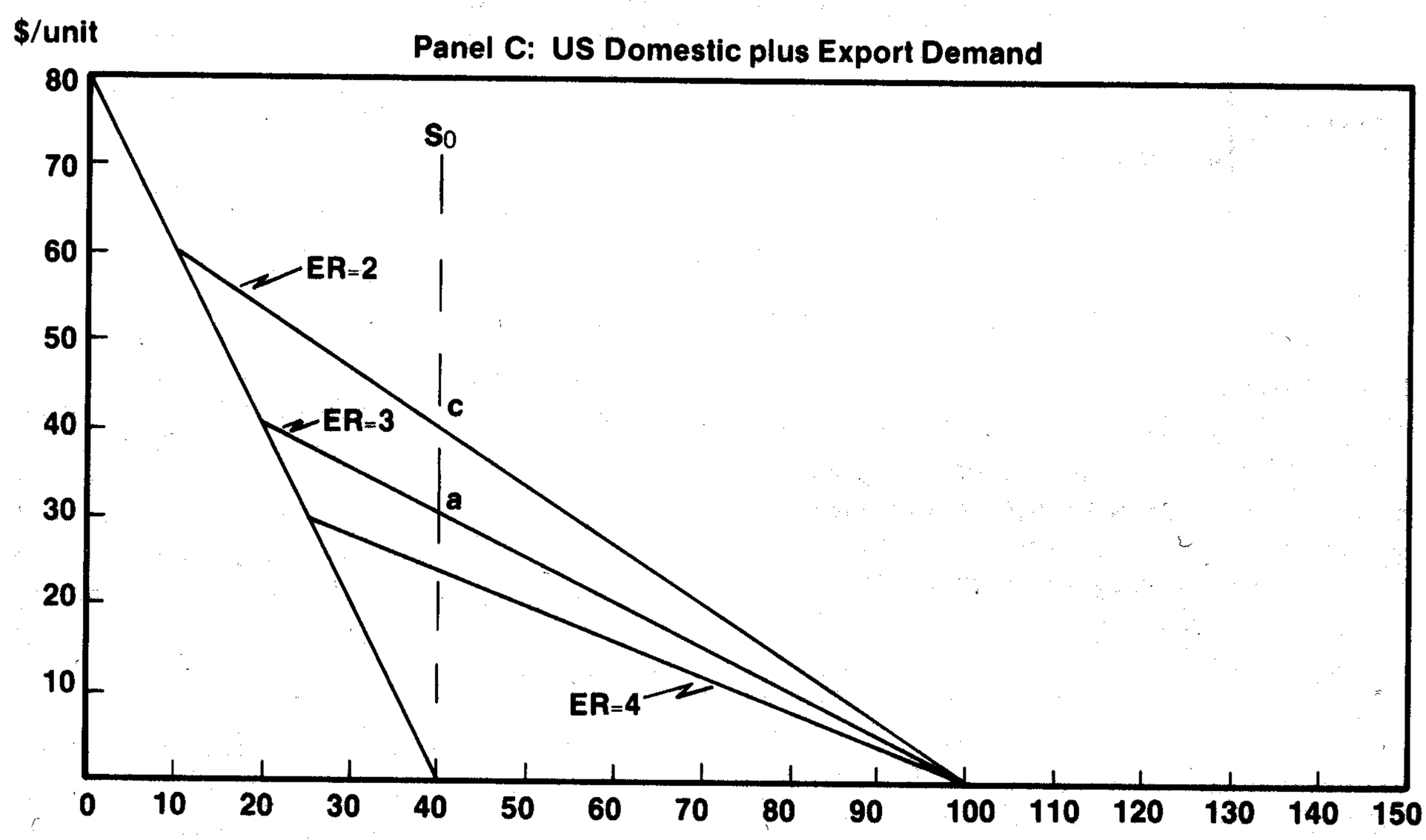
Exchange Rates and Derived Export Demand

A short degression on exchange rates appears to be warranted due to the sharp changes that have occurred since 1968 and their effect on the derived demand for U.S. exports. Consider a simple model where the import demand in West Germany is hypothesized as

(3.4) QUWG = 60 - 0.5 PUWG.

This equation is plotted in panel A of Figure 4. For simplicity assume that West Germany is the only





Source: Hypothetical data

Figure 4. The Effect of Exchange Rates on Derived Demand for Exports

importer of U.S. almonds and that transportation costs and duties are zero (i.e., DUWG = 1.0).

We can rewrite equation (3.3) as (3.3′), or PUWG = (PUX)(ERWGU), so the derived demand for exports in the United States is obtained by substituting equation (3.3′) into equation (3.4) to obtain:

(3.5) QUWG = 60 - 0.5 (PUX)(ERWGU).

Three derived export demand curves are drawn in panel B associated with different exchange rates for DM/$ which were about 4.0 in 1968, 3.0 in 1972 and 2.0 in 1980. It is evident that with all factors constant except for the exchange rates, the derived demand pivots outward as the dollar weakens to 2 then pivots to the left as the dollar strengthens to 4. Points a and c on the diagram will be discussed below. Recall the pattern of these shifts over time in Figure 2.

For a given year and exchange rate, the analyst could add the derived export demand function (3.5) to the domestic demand function to determine the appropriate price to set, with a given supply, to clear the market. Consider domestic demand to be

(3.6) QUU = 40 - 0.5 PAU

Further assume that the U.S. export price is set equal to the domestic price as was the case from 1973 on (i.e., PUX = PAU).

The total demand relationship (panel C, Figure 4) is

$$\begin{aligned} (3.7)\ QT &= QUWG + QUU \\ &= 60 - 0.5(PAU)(ERWGU) + 40 - 0.5\,PAU \\ &= 100 - 0.5\,PAU(ERWGU + 1) \end{aligned}$$

We can express price as a function of predetermined variables and solve for equilibrium price:

$$(3.8)\ PAU = \frac{100 - QT}{0.5\,(ERWGU + 1)}$$

Shipments to the domestic and export markets can then be obtained using equations (3.6) and (3.5).

Now consider the effect of a change in the exchange rate from 3DM/$ to 2DM/$ with quantity available (QT) assumed fixed at 40 units. With an exchange rate of 3, the price (PAU) would be $30 per unit with 25 units sold in the domestic market and 15 units exported (point a in panel C of Figure 4). At 2DM/$, the United States would set price at $40 per unit, would export 20 units, (point c). Note that although the United States price is increased in dollars, the price in Germany (DM) decreases from point a to c in panel A.

In the period during which the exchange rate decreased, orchardists responded to favorable returns by planting more trees. With a normally sloped supply curve, producers were able to sell more at the same or somewhat higher prices with the postulated change in exchange rates. The nature of the supply function for almonds will be discussed in a later section.

Demand for Stocks

The crop year for almonds is July-June with ending stocks reported by the Almond Board of California as of June 30. These stocks have averaged about 20 percent of domestic supply (beginning stocks plus marketable production) since 1950 (see Figure 5). The new crop generally is harvested during August and September, and the June 30 stocks are required for meeting sales prior to the availability of the new crop. The Almond Board also reports June 30 sales commitments of stocks on hand. For the 1976-80 yearly average, 69 percent of the June 30 stocks were committed sales but not yet shipped. Thus, the inventory of uncommitted sales averaged only 7 percent of domestic supplies in 1976-80. (see discussion in section 6). In this analysis, the stock demand relates to total stocks (committed plus noncommitted) since exports by destination relate only to actual shipments during the crop year.

A distinction is made between desired ending stocks (SEU*) and actual stocks (SEU). *Actual* stocks will be the residual quantity not shipped in crop year, given the price established by the processors; that is,

(3.9) $SEU \equiv SBU + MPU - QUU - \Sigma_j QU_j$.

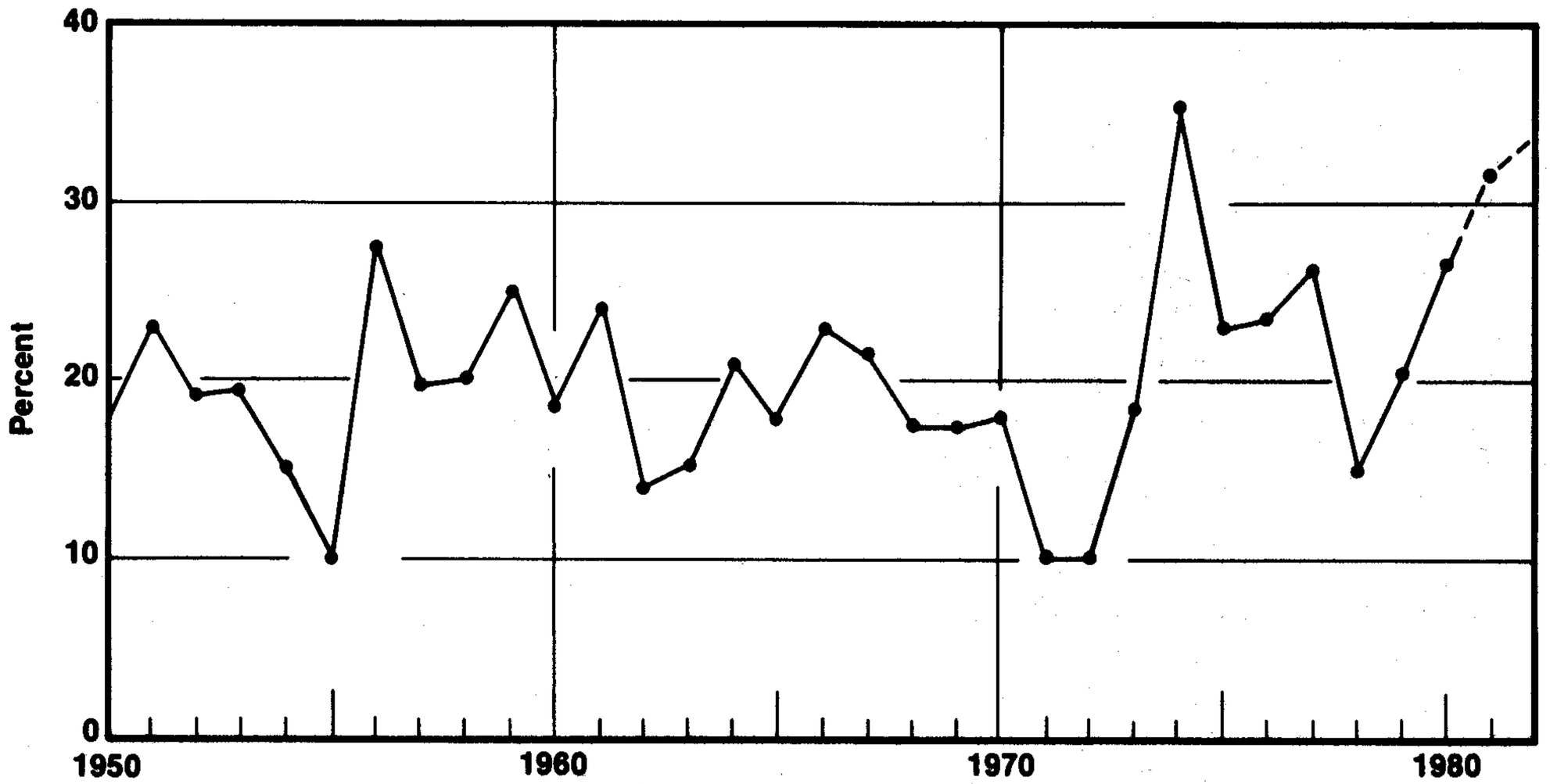
Desired ending stocks must be specified by decision makers when setting price, given estimated demand, as outlined in equation (3.1). Since this variable is not observable, we might take the desired level as the average proportion of beginning stocks and marketable production, or (3.10) SEU* = .20 (SBU + MPU).

This formulation, however, does not consider that desired stocks might be lower in years of relatively low yields, or that processors use stock-holding for profits in subsequent years. A multiyear objective function, as proposed by Bushnell (1978), has considerable theoretical appeal. However, given the rapidly increasing production since the early 1970s, it is unlikely that stock-holding for interseasonal profits would be a consideration. Processors have been faced with prospects of ever increasing production to market.

An alternative formulation that might be reasonable is

(3.10′) $SEU^* = f(SBU, MPU, PAU_t^*\ PAU_{t+1}^*)$.

Here beginning stocks and marketable production may have separate effects (i.e., a low MPU might result in smaller desired stocks to maintain sales to developed markets). Also, current and next year's expected price might be important variables. Expected price will depend on expected production (expected yield times expected bearing area), beginning stocks, and expected domestic and export demand.



Source: See text

Figure 5. Ending Stocks Expressed as a Percentage of U.S. Domestic Supply, 1950-1982

MARGIN RELATIONSHIP

The margin relationship, required to link the farm sector to the handler sector is the difference between the price received by farmers for almonds (kernel weight basis) and the f.o.b. processor's selling price which reflects handler costs such as shelling, sorting, processing, packaging, storing, product promotion and new product development, and management costs. Various studies suggest that the relationship between the farm price and f.o.b. price may be some combination of an absolute amount and a percentage (see for example George and King (1971) p. 57). The margin may be expressed as:

(3.11) $M_t = a + b\ DPDXU_t$

where

$DPDXU_t = DFPAU_t + M_t$

or

$DPDXU_t = DFPAU_t + a + b\ DPDXU_t$

or

$DFPAU_t = -a + (1-b)\ DPDXU_t$

or

(3.12) $DFPAU_t = \alpha + \beta\ DPDXU_t$

where

$\alpha = -a$

$\beta = 1 - b$

M_t = absolute difference between the deflated farm price and the deflated f.o.b. price.

DFPAU = farm price of almonds in the United States deflated by the CPI.

$DPDXU_t$ = weighted average domestic price (PAU) and the export price (PXU) deflated by the CPI (after 1973, use DPAU).

PRODUCER SUPPLY

Bearing and nonbearing area in almonds reflect long-term investment decisions by producers. On the other hand, production for a given season is determined by bearing area and a stochastic yield which is affected by factors such as weather, alternate-bearing tendency, the age distribution of trees, varieties, tree spacing, and various cultural and harvesting practices.

Orchardist supply response has been theoretically and empirically modeled by several authors but in particular by French and Mathews (1971), Minami, French, and King (1979), and French, King, and Minami (1985). These authors specified supply response models for new plantings and for removals. The removal relationship has an immediate effect on bearing acreage whereas there is a lagged effect for new plantings before trees reach bearing age (about four years for almonds). The supply model thus specifies planting and removal decisions, and yield estimation.

Area Response

Next year's bearing area can be expressed as an identity

(3.13) $BA_{t+1} \equiv BA_t + NBA_t^3 - RBA_t - RNBA_t^3$

where BA = bearing area of trees aged four or more years on May 31st.

NBA^3 = nonbearing area of trees aged three years or less.

RBA = removals of bearing area of trees aged four or more years.

$RNBA^3$ = removals of nonbearing area.

For bearing area predictions up to four years in the future, we need estimates of removals only, assuming the data on nonbearing area by year of planting is reported accurately. Longer term area response must also account for new plantings.

Removals of nonbearing almonds are apparently very minor for the 1950-80 period, probably due more to cultural problems than to revised expectations about the relative profitability of almonds versus other crops. Minami, French, and King (1979) show that for clingstone peaches removals of bearing area vary with age of tree. They analyzed detailed industry data on peaches, but such data are not available for almonds.

Bushnell (1978) developed a net investment model for change in acreage, that is, new plantings less removals. His control model framework provides a rigorous basis for econometric estimation and expected signs on coefficients. However, we argue here that the supply response to expected profits is asymmetric due to the *immediate* effect of removals on bearing area and the *lagged* effect on production of plantings. Thus, mathematical elegance is sacrificed for practicality with less than adequate data.

Removal Relationships

It would be desirable to specify removals for each age group. However, such data are not reliable for almonds and removals of nonbearing area were negligible for 1950-1980. Thus a function was specified for removal of bearing area only:

(3.14) $RBA_t = f(ER_{it}^*, VAR_{it}^*, BA_{it}, NBA_{it}, LU_t)$

where variables not defined in (3.10) are

ER_{it}^* = expected revenue per hectare for crop i.

VAR_{it}^* = expected variance in revenue per hectare for crop i.

LU_t = index of farm labor input, Pacific Region, 1950=100

New Plantings

The new plantings equation has the same set of variables as the removal equation, or

(3.15) $NPA_t = f(ER_{it}^*, VAR_{it}^*, BA_{it}, NBA_{it}, LU_t)$

where NPA_t = new plantings of almonds.

An increase in expected revenue per hectare of almonds would be expected to increase new plantings (decrease removals); an expected relative increase in expected revenue of competing orchard crops would decrease new plantings (increase removals); an increase in expected variance in almonds would probably decrease new plantings (increase removals); an increase in the bearing area would probably decrease new plantings (increase removals); the effect of an increase in nonbearing area is not certain; and decreased labor availability is expected to encourage new plantings of mechanized harvested crops such as almonds. Other factors which affect new plantings include tree stock availability and water availability (particularly in new areas in the southern San Joaquin Valley).

Yield

There is considerable year to year variability in yields (see Figure 1). When decisions are made on price, yields are fairly well known, though culling losses and late-season weather conditions may affect the final outcome. Here, yield is taken as an exogenous variable (or YBHU = yield per bearing hectare).

The stock demand may be influenced by next year's expected price which, in turn, depends on expected production and expected demand. Since expected production is expected bearing acreage times expected yield, it may be useful to analyze expected yields. One possibility is:

(3.16) $YBHU_{t+1}^* = f(YBHU_t, YBHU_{t-1}, \ldots, YBHU_{t-k})$

Production

Production is simply yield times bearing area or

(3.17) $PRODU \equiv (YBHU) \bullet (BA_t)$.

Marketable Production

Production is deliveries to processors. From this is subtracted computed losses of nonmarketable nuts giving marketable production, or

(3.18) CLU = f(PRODU)

where CLU = computed losses.

Marketable production (MPU) is

(3.19) MPU = PRODU - CLU.

The marketable production plus beginning stocks gives the supply which is sold or held as ending stocks.

THE ALMOND BOARD OF CALIFORNIA (ABC)

As noted previously, the ABC with approval of the Secretary of Agriculture may declare reserves (i.e., require handlers to withhold certain quantities from the market). In 1981 there was considerable controversy concerning invoking this provision when a record crop was forecast. The actual crop was somewhat lower at 407 million pounds (184.6 metric tons) of which marketable production was 383 million pounds (173.8 metric tons). Not all processors were in agreement on the advisability of invoking the reserve provision. The economic implications of the reserve provision are discussed in section 5 of this report. Recall that prior to 1973, the ABC set levels of sales for other than the domestic market as was shown in Table 13.

SUMMARY OF MODEL SPECIFICATIONS

The model essentially is a block recursive system. The first block relates to processor's decision about what price to establish, given: (1) a desired level of ending stocks, (2) expected domestic and export demand, and (3) beginning stocks and marketable production. The second block is market equilibrium where supply equals demand. The third block is a margin relation between farm and f.o.b. prices. The fourth block is the orchardist supply response to expected gross revenues. Also specified are the relationships between production and marketable production (cullage losses) and the diversion policies of the marketing order.

I. *Processor Decision on Price*

$$(3.1)\ \max R = PAU \bullet QUU^* + \Sigma_j PAU \bullet QU_j^*$$

s.t. domestic demand: $QUU^* = f(...)$

export demand: $QU_j^* = f(...)$

desired stocks: $SEU^* = f(...)$

supply = demand: $SBU + MPU = QUU^* + QU_j^* + SEU_j^*$.

domestic price = export price (1973 on)

II. *Market Equilibrium*

$$(3.2)\ QU_{jt} = f(PAU_{jt}, R_{kjt}, TQ_{jt-1}, POP_j, E_j, CPI_j, v_{ij})$$

$$(3.3)\ PAU_{jt} \equiv (PUX_t + TU_{jt})(DU_j)(ER_jU)$$

$$(3.9)\ SEU \equiv SBU + MPU - QUU - \Sigma_j QU_j$$

III. *Margin Relationship*

$$(3.11)\ DFPAU = \alpha + \beta\ DPCXU + v_2)$$

IV. *Producer Supply*

Area Response

$$(3.14)\ RBA_t = f(ER_{it}^*, VAR_{it}^*, BA_{it}, NBA_{it}, LU_{it}, v_3)$$

$$(3.15)\ \text{~~RBA}_t = f(ER_{it}^*, VAR_{it}^*, BA_{it}, NBA_{it}, LU_{it}, v_4)$$

$$(3.13)\ BA_{t+1} \equiv BA_t + NBA_t^3 - RBA_t - RNBA_t^3$$

Production

$$(3.16)\ YBHU_t = f(YBHU_{t-1}, YBHU_{t-1}, ..., YBHU_{t-k}, v_5)$$

V. *Marketable Production*

$$(3.18)\ CLU = f(PRODU, v_6)$$

$$(3.19)\ MPU \equiv PRODU - CLU$$

VI. *Almond Board Reserve*

Decision on diversion of MPU.

Variable Definitions

Endogenous variables

QU_{jt} = U.S. shipments to market j (metric tons), j = 8

SEU_t = U.S. ending stocks (metric tons)

PAU_t = U.S. f.o.b. almond price, domestic market ($/M.T.)[a]

PXU_t = U.S. f.o.b. almond price, export market ($/M.T.)[a]

PU_{jt} = U.S. landed price, foreign market (foreign currency), j = 7[a]

$FPAU_t$ = U.S. farm price for almonds ($/M.T.)

RBA_t = removals of bearing area (hectares)

NPA_t = new plantings (hectares)

$DPDXU_t$ = weighted average domestic and export price, deflated ($/M.T.)

Expectational variables (discussed in section 4)

QU_j^* = expected U.S. shipments to j

SEU^* = desired U.S. ending stocks

ER_{it}^* = expected revenue, farm level

[a] As argued in section 3, the domestic price and the related import market prices are established by the marketing cooperative and are assumed to be predetermined variables.

Exogenous variables

PAS_{jt} = price of Spanish almonds in j (foreign currency), j = 7

QE_{jt} = quantity shipped from Europe to j (metric tons) (Note: used as alternative to PAS_j in estimated demand functions as discussed in section 4), j = 7

QRW_{jt} = quantity shipped from rest of the world to j (metric tons)

TQ_{jt-1} = total almond shipments to j (metric tons), j = 8

POP_{jt} = population of j (millions), j = 8

DE_{jt} = per capita personal consumption expenditures deflated by CPI_j, j =8

ER_jU_t = exchange rate (foreign currency/$), j =7

TU_{jt} = transportation costs, U.S. to j ($/M.T.), j =7

CPI_{jt} = consumer price index in j (1970 = 100), j =8

DU_{jt} = *ad valorem* duty (expressed as 1.07 for a 7 percent duty), j = 8

R_{kjt} = prices of other inputs (k) at destination (j), j = 8, k = 3

E_j = per capita personal consumption expenditures, j = 8

4. DATA FOR THE EMPIRICAL MODEL

The data set includes over 100 time series for the years 1950-1980, as noted under variable definitions. Detailed descriptions of the various series are given in Appendix A. Here, the major sources and series are described briefly for the primary variables.

U.S. PRICES, SUPPLY AND DISPOSITION

Data on prices for recent years were provided directly by the California Almond Growers Exchange by the courtesy of Rex H. Lake. These prices are for Nonpariel Supreme 23/25, f.o.b. Sacramento. Data for the 1950-1966 period were obtained and reported by Loyns (1968) in his excellent analysis of the industry during which there were important differences between domestic and export prices. Farm prices (kernel weight) are reported by the California Crop and Livestock Reporting Service (CCLRS) but are conveniently summarized by the Almond Board of California (1985).

Landed prices in foreign markets are calculated as described in equation (3.3) or more precisely in Appendix B. Such calculations require data on transportation costs, duties, exchange rates and consumer price indexes for each importing country (see discussion of data sources for "other variables"). The Almond Board of California (1985) provides annual summaries of data on U.S. shipments by destination, carryover stocks (total and those with June 30 committed sales), producer deliveries, computed losses, and marketable production.

Data on new plantings, bearing and nonbearing acreages are reported by the CCLRS in *Fruit and Nut Acreage*. The data on new plantings reported in a given year tend to be much lower than the reported acreage reaching bearing age four years later. Thus, the data have been adjusted for this study (see Appendix C). The CCLRS can only survey a limited number of counties each year, and it is understandable why such acreage differences occur. The estimates of acreage response, therefore, are likely subject to considerable error. This study, therefore, then places major emphasis on the demand side of the market.

EUROPEAN PRICES, SUPPLY AND DISPOSITION

The original formulation by Bushnell (1978) modeled the handler allocation problem for European as well as U.S. almonds. Particular attention was given to Spain and Italy as noted in section 2. Information was obtained on prices of Spanish almonds landed in the United Kingdom from Gill and Duffus Group, Ltd., *Edible Nut Statistics* (1983) and on farm prices from the Ministrio de Agricultura (1982). Prices for Italian almonds also were obtained, but since Spanish and Italian prices were highly correlated and Italian production was of decreased importance, emphasis was given to Spanish prices.

European shipments to various markets are reported by the U.S. Foreign Agricultural Service, *World Production and Trade in Tree Nuts* (1980), and recent unpublished data were kindly supplied by Kathleen

Moore of FAS who also provided data on shipments from Morocco and Iran (rest of the world shipments). These current estimates of such shipments should be important information for the industry.

Acreage data for Spain (Table 8) and Italy (Table 9) are from sources noted on the tables. Information on new plantings and removals for these countries are not considered reliable and thus the supply response for Europe is not modeled.

OTHER VARIABLES

Exchange rates for the July-June year were calculated from quarterly averages as reported in the International Monetary Fund, *International Financial Statistics,* (monthly) (1983). Consumer price indexes are calendar year data, averaged to give July-June estimates, as reported in United Nations, *Statistical Yearbook* (1983). This source is used also for population (July 1) and private final consumption expenditures (calendar year). Duties were compiled from various sources, such as the European Commission, *Annual Report* (1980). Transportation costs were obtained from the Pacific Coast European Conference *Master Tariffs* for European shipments and from the Pacific Westbound Conference *Master Tariffs*. Prices of sugar are reported in European Commission *Agrarstatistik* (1983). Cocoa prices are from Gill and Duffus Group Ltd., *Cocoa Statistics* (1983). The filbert price is Turkish Kerrasundes, London, c + f, duty paid, as reported in Gill and Duffus Group Ltd., *Edible Nut Statistics*.

5. ESTIMATES OF MODEL PARAMETERS

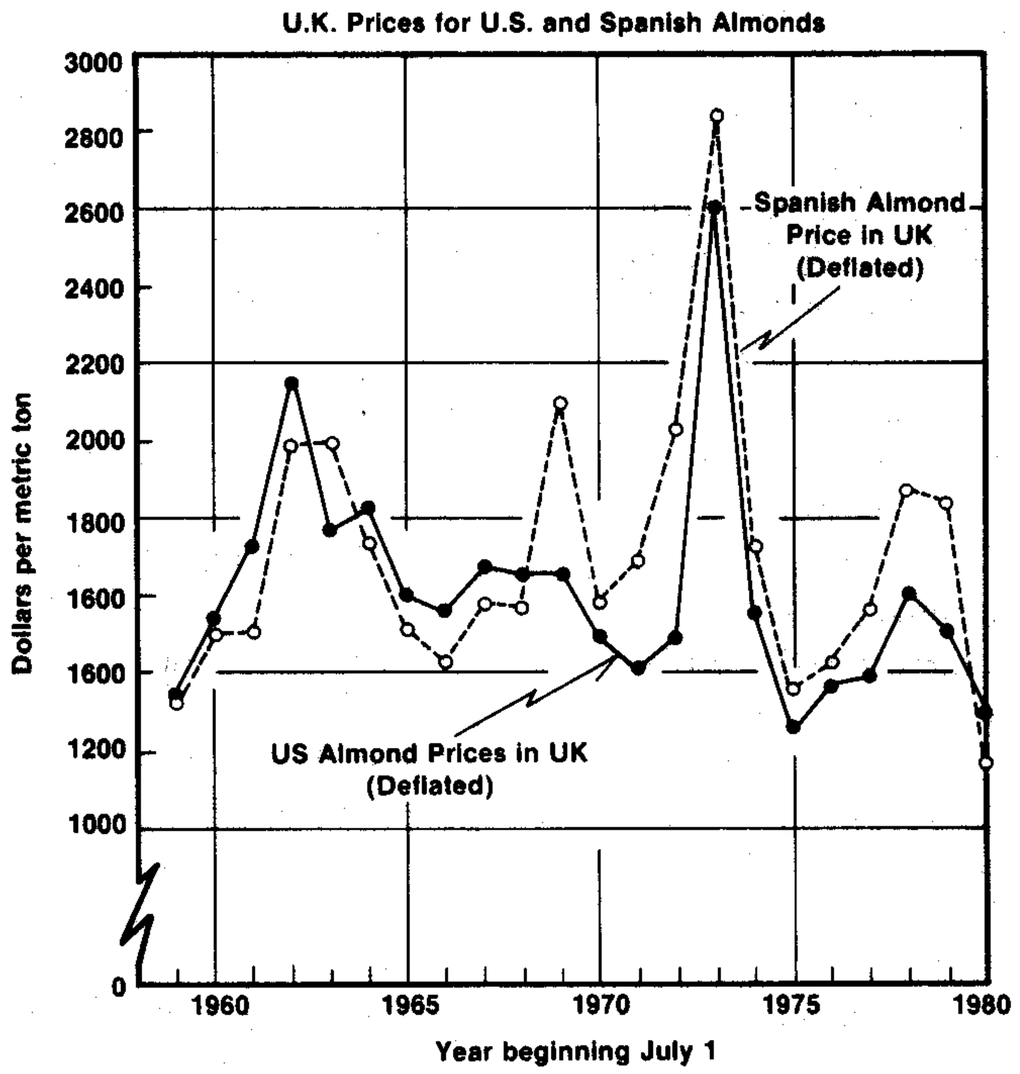
In this section, first, estimates are given of market demand functions (equation 3.2) in per capita terms, the margin relationship (equation 3.11), producer supply relationships (3.14 -3.17), and marketable production (3.18). Then, the model is expressed in a form useful for testing its performance over time.

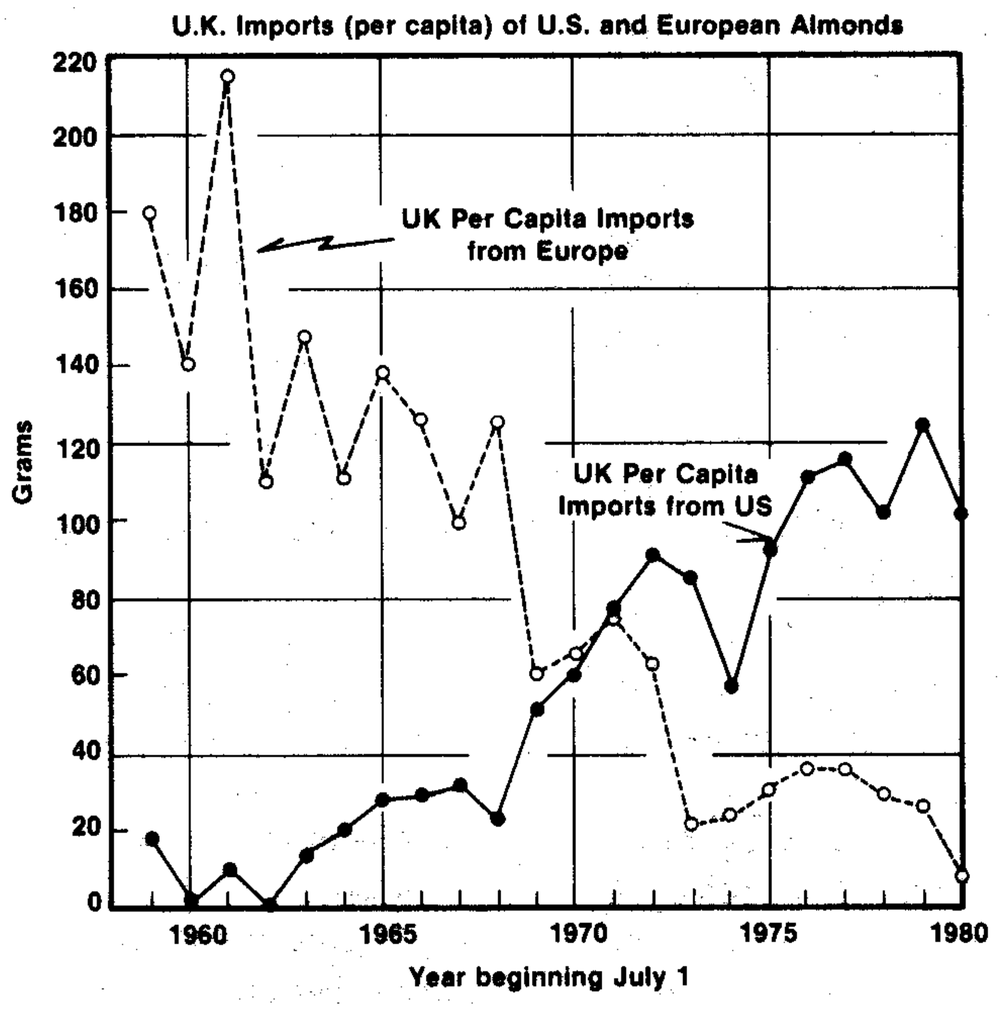
DEMAND FUNCTIONS

The econometric estimation of import demand functions presents challenging problems such as the treatment of exchange rates, prices (or shipments) of competing countries' goods, prices of substitute goods, and selection of an appropriate functional form, to name a few. The various approaches that have been used to estimate import and export functions have been reviewed by Thompson (1981), for example, and need not be repeated here. Further, since the period of analysis has such strong trends in the U.S. share of import markets, the data are not particularly appropriate for sophisticated analyses of alternative models. However, many alternative specifications were attempted prior to selection of the results presented here.

The U.S. domestic demand functions and import demand functions, given in the modified equation (3.2), express quantity consumed per capita as a function of the price of U.S. almonds in the relevant country and other variables. Per capita demand functions were estimated for 8 markets including the United States, Canada, Japan, West Germany, France, United Kingdom, northwestern Europe (Belgium, Luxembourg, Denmark, and Netherlands) and three European countries not in the EEC (Sweden, Norway, and Switzerland). Netherlands and Sweden are treated as representative of the respective country aggregates for certain variables such as per capita income, duties, exchange rates and transportation costs. All prices and incomes are expressed in terms of deflated currency of the importing country (and also a trivial conversion to 1970 dollars).

The original specification expressed per capita consumption as a function of the U.S. price, the price of Spanish almonds, prices of confectionery inputs (cocoa and sugar), the price of a competing nut (filberts), per capita income, and lagged per capita consumption of almonds from all sources. Several modifications were made due to problems of multicollinearity. For this period, Spanish and U.S. almond prices were highly correlated and wrong signs resulted for three major markets (U.S., Canada, and West Germany) and insignificant coefficients for the other markets. The nature of these price movements is given in Figure 6. Thus, per capita European almond imports were substituted for the Spanish price variable. Similarly, the input price coefficients generally were not statistically significant and several had incorrect signs, and thus these prices were deleted. The lagged per capita consumption of all almonds was replaced by lagged per capita consumption of U.S. almonds, which provided coefficients which generally were more statistically significant. This variable is included to reflect the upward trend in consumption, or perhaps a "habit" effect.





Source: See text

Figure 6. U.K. Prices and Imports from U.S. and Europe, 1959-1980

The demand model expresses per capita consumption in each of eight regions as a function of blocks of predetermined variables such as U.S. almond prices, per capita consumption of European almonds, prices of filberts, per capita consumption expenditures, and lagged consumption. As noted previously, a more complete world model would treat European shipments (or European prices) as endogenous, but preliminary analyses were not satisfactory. Also, one might argue that the CAGE opening price for U.S. almonds may not reflect all sales for the season. However, this specification seems reasonable, given the limitations of the data.

The equations were fitted by ordinary least squares (OLS). This approach is open to criticism in that errors across equations may well be correlated. Usually it would be possible to fit the system using the seemingly unrelated regression (SUR) model. The major obstacle to using SUR was that the seven import equations used data from 1960 to 1980 while the U.S. equation was for 1953 to 1980.1 Judge *et al.* (1980 p. 257) discuss the problem of sets of equations with unequal numbers of observations. The difficulties associated with possible approaches to this problem seemed to offset the benefits from simply reporting the OLS results.

The eight demand equations fitted by OLS gave fairly satisfactory results, with R^2's ranging from .86 to .93 (see Table 14). All signs are consistent with *a priori* expectations (except for the U.K. income term which was insignificant). As to the level of significance, 20 of the 53 coefficients (excluding the constant terms) have t values of two or higher; however, the standard errors of the equations are higher than desirable in several cases. The dummy variable for Japan in 1974 is highly significant, reflecting trade problems following the U.S. soybean export embargo of 1973. There is some evidence of autocorrelation using the Durbin-Watson test, but inclusion of the lagged independent variable makes this test suspect. Analyses were run with estimates of ρ, but the results did not appreciably change the regression coefficients or improve the predictive power of the equations.

The reported price elasticities are calculated at mean values but with the quantity (rather than price) of European almonds held constant. Elasticities are generally higher in European countries than for United States, Canada, and Japan. As will be discussed later, the use of linear demand functions for a period of relatively constant real prices but sharply increased consumption levels results in elasticities that decrease over time. Various other specifications were attempted such as double log and quadratic forms, but the results here were considered preferable on statistical and economic grounds.

The original model, equation (3.2), also specified similar equations for consumption of European almonds. However, the econometric results were much less satisfactory than those for U.S. almonds, and the study was then restructured to concentrate on the U.S. industry. One of the limitations of such a specification is treating European exports to various countries as predetermined. If meaningful demand functions for European almonds could be obtained, the model could be restructured as a simultaneous system. At present, this did not seem feasible due to data problems.

MARGIN RELATIONSHIP

The relationship between the deflated farm price of almonds (in \$/M.T.) in the United States (DFPAU) is expressed as a function of the deflated f.o.b. price of almonds (DPDXU) which is a weighted average of the domestic and export prices prior to 1973 and is equal to the deflated f.o.b. price (\$/M.T.) for all sales (DPAU) for 1973 to date. The OLS estimated relationship for equation (3.11) of the theoretical model is for the years 1950-1980:

$$\underset{}{\text{DFPAU}} = \underset{(2.76)}{-198.16} + \underset{(24.0)}{0.9104}\ \text{DPDXU}$$

where the numbers in parentheses are t statistics, R^2 = .95, and the D.W. = 1.87. The relationship, as expected, reflects the close movement of these price series (expressed in 1970 dollars per metric ton).

PRODUCER SUPPLY

Area Response

The equations for removals (3.14) and new plantings (3.15) originally included expected gross revenue per hectare for almonds and for walnuts, the variance of revenue for these crops, area of bearing and non-bearing almonds, and a labor availability variable (following French and Matthews' (1971) suggestion). The coefficients on variances and expected revenue for walnuts did not have expected signs or improve the explanatory power of the equations and thus were deleted.

Lagged gross returns per hectare are taken as a proxy for expected gross revenue per hectare. It would have been preferable to use net returns as in Minami, French, and King (1979), but there is considerable variation between costs of old orchards and new orchards in the San Joaquin Valley. Regression trials were attempted using various lagged responses. Table 15 reports the most satisfactory of the lags attempted, namely the average of deflated gross revenue lagged one and two years.

Table 14. Demand for U.S. Almonds: Per Capita Consumption (in grams) Related to U.S. Prices, European Quantities Per Capita, and Other Variables, 1960-1980

Country of Destination	Eq. No.	Dependent Variable: Per Capita Consumption QCU_j	Constant	Deflated Price of U.S. Almonds DPU_j	Per Capita Cons. of European Almonds QCE_j	Deflated Price of Filberts DRF_j	Personal Cons. Expenditures Per Capita (Deflated) DE_j	Lagged Per Capita Cons. of U.S. Almonds QCU_{jL}	Dummy Variable	Mean Values: Quantity Grams/Head	Mean Values: Price $70/MT	Summary Statistics: R^2	D.W.	Standard Error of Equation (Quantity)	Price Elasticity at Mean[a]
U.S.[b]	1	QCUU	86.399 (3.01)[d]	-0.03043 (4.26)	-0.89065 (1.55)	. . .[c]	13.626 (1.16)	0.54596 (3.63)	. . .	137.0	1774	.87	1.37	13.6	-0.39
Canada	2	QCUC	-152.97 (3.15)	-0.01682 (1.62)	-0.26678 (0.95)	28.644 (1.99)	91.094 (4.23)	0.11406 (0.63)	. . .	75.6	1758	.93	2.32	14.0	-0.39
Japan	3	QCUJ	27.226 (0.98)	-0.01583 (2.02)	. . .	. . .	35.296 (1.32)	0.43964 (2.21)	-49.188[e] (4.72)	47.3	1727	.92	1.44	9.55	-0.58
W. Germany	4	QCUWG	-486.34 (1.40)	-0.13168 (1.50)	-0.15504 (0.64)	155.95 (1.40)	438.22 (2.73)	0.09177 (0.37)	. . .	173.5	1638	.87	2.16	77.1	-1.24
France	5	QCUF	-105.83 (0.98)	-0.02333 (0.99)	-0.22382 (1.40)	55.797 (1.75)	91.669 (2.39)	0.22245 (0.96)	. . .	44.7	1583	.86	2.35	20.9	-0.83
U.K.	6	QCUUK	96.636 (1.83)	-0.016974 (1.29)	-0.18939 (1.41)	. . .	-27.664 (0.66)	0.73269 (3.47)	. . .	58.5	1629	.88	2.56	16.2	-0.47
NW Europe	7	QCUNE	-99.386 (1.01)	-0.05008 (1.78)	-0.14692 (0.88)	49.419 (1.60)	162.28 (3.13)	0.07045 (0.31)	. . .	80.1	1661	.90	2.31	25.2	-1.04
Norway, Sweden, and Switzerland	8	QCUSC	226.18 (0.83)	-0.13108 (2.47)	-0.32086 (3.04)	35.871 (0.53)	96.060 (0.91)	0.29285 (1.51)	. . .	207.66	1650	.86	2.38	52.3	-1.04

[a]Note that these are psuedo-elasticities, since quantities (rather than prices) of European almonds are held constant. The two price series were highly correlated.
[b]U.S. analysis is for 1953-1980.
[c]Indicates variable not included due to incorrect sign or variable not relevant.
[d]Figures in parentheses are t values.
[e]1974 exports to Japan were low in 1974 (this year given a value of 1) probably due to trade conflicts of the previous year.

Table 15. U.S. Almonds: New Plantings, Removals and Net Investment, 1952-1980

Item	Constant	Deflated Gross Revenue, Almonds[a]	Area		Labor Index	Summary Statistics	
			Bearing BHU_{t-1}	Nonbearing $NBHU_{t-1}$	LU_{t-1}	R^2	D.W.[b]
Removals	3838.5	-1.2346	0.02247	-0.04170	-16.560	.60	1.43
	(1.74)	(2.44)	(4.45)	(2.42)	(1.29)		
New Plantings	12,102	4.4153	-0.02191	0.02184	-95.671	.74	1.21
	(1.55)	(2.45)	(1.22)	(0.36)	(2.09)		
Net Change[c]	8,264	5.6499	-0.04438	0.06355	-79.11	.72	1.27
	(1.00)	(3.00)	(2.36)	(0.99)	(1.65)		

[a]Defined as the average of gross revenue (deflated by the CPI) lagged one and two years.
[b]Inconclusive test of autocorrelation.
[c]By construction, net change coefficients equal the new plantings coefficient minus the removals coefficient, since the same variables are included in the equations.

The coefficients associated with *deflated gross revenue* are as expected and are statistically significant; namely, positive for new plantings and negative for removals. Thus, there is additional evidence to support the asymmetric modeling of supply response (i.e., gross investment-disinvestment versus net investment).

The coefficients associated with lagged *bearing area* are reasonable. That is, other variables constant, removals increase with increases in bearing area, at least in the long run; and new plantings would tend to be lower as bearing area increases with given revenue expectations. Other omitted variables undoubtedly affected new plantings, such as the drought years and the State Water Project deliveries. The Durbin-Watson statistics indicate such misspecification. However, it was not possible to find suitable time series to represent such factors that would be applicable across the varied production regions of the state.

The sign on *nonbearing area* for new plantings is positive but not significant. This coefficient may reflect the upward trend in new plantings and lagged nonbearing area rather than a significant economic effect. Similarly, the negative effect of lagged *nonbearing area* on removals may reflect the fact that under favorable income expectations and a relatively young orchard age distribution, the increase in nonbearing area was associated with lower removals.

The lagged *labor index*, with negative sign, agrees with expectations; namely, that reduced labor availability would tend to increase new plantings of a low labor intensive crop such as almonds. This variable was not statistically significant, however, for the removal equation.

These supply relationships for the 1952-1980 period are not as precise as those reported by Carman (1981) for the 1962-1978 period for plantings and change in total acreage. Inclusion of the decade of the 1950's may be partially responsible for these differences (see Figure 1). Another possible reason is that Carman used lagged prices rather than lagged deflated gross revenues per hectare. Further analysis of supply response on a disaggregated level (by county) is an area for future research.

Yields

As noted, yield is highly variable from year to year. While the model specifies yield as predetermined, any stockholding decision probably considers next year's expected production (expected yield times expected bearing area). To account for yield variability, a time series analysis on yields was estimated. However, it was not possible to identify a stable autoregressive and/or moving average process for the period 1950 to 1980. Thus, the following simple yield model is given:

$$YBHU = \underset{(6.39)}{0.5154} - \underset{(2.06)}{0.3365}\, YBHU_{t-1} + \underset{(6.00)}{0.03243}\, T$$

$R^2 = 0.66$,
D.W. 2.31

where

YBHU = yield per bearing hectare in metric tons

$YBHU_{t-1}$ = lagged value of YBHU

T = time trend where T = 1 (1950),..., T = 31 (1980).

Values in parentheses are t statistics.

MARKETABLE PRODUCTION

As noted previously, reported production at the farm level is reduced by cullage losses (computed losses) at the processing level. Marketable production is defined by the industry as production less computed losses. These computed losses vary by year depending on insect and other damage to the almond crop. Since these losses are fairly well known by the industry when f.o.b. prices are set, marketable production is considered as predetermined for the empirical model. In the 1970s these losses have ranged from 4 to 10 percent of farm production (see Table 7).

6. EVALUATION OF THE MODEL

The demand and acreage response models are evaluated for their predictive accuracy for the years included in the analysis and for one year ahead (1981). Emphasis is given to the estimated total shipments based on the domestic and import demand functions. Yearly estimates of demand elasticities are presented which indicate the current inelastic nature of demand in both the domestic and export markets. This characteristic has important economic implications, to be discussed in section 7, on the use of the reserve provision and use of marketable almonds for new product development. The acreage supply response is also briefly discussed.

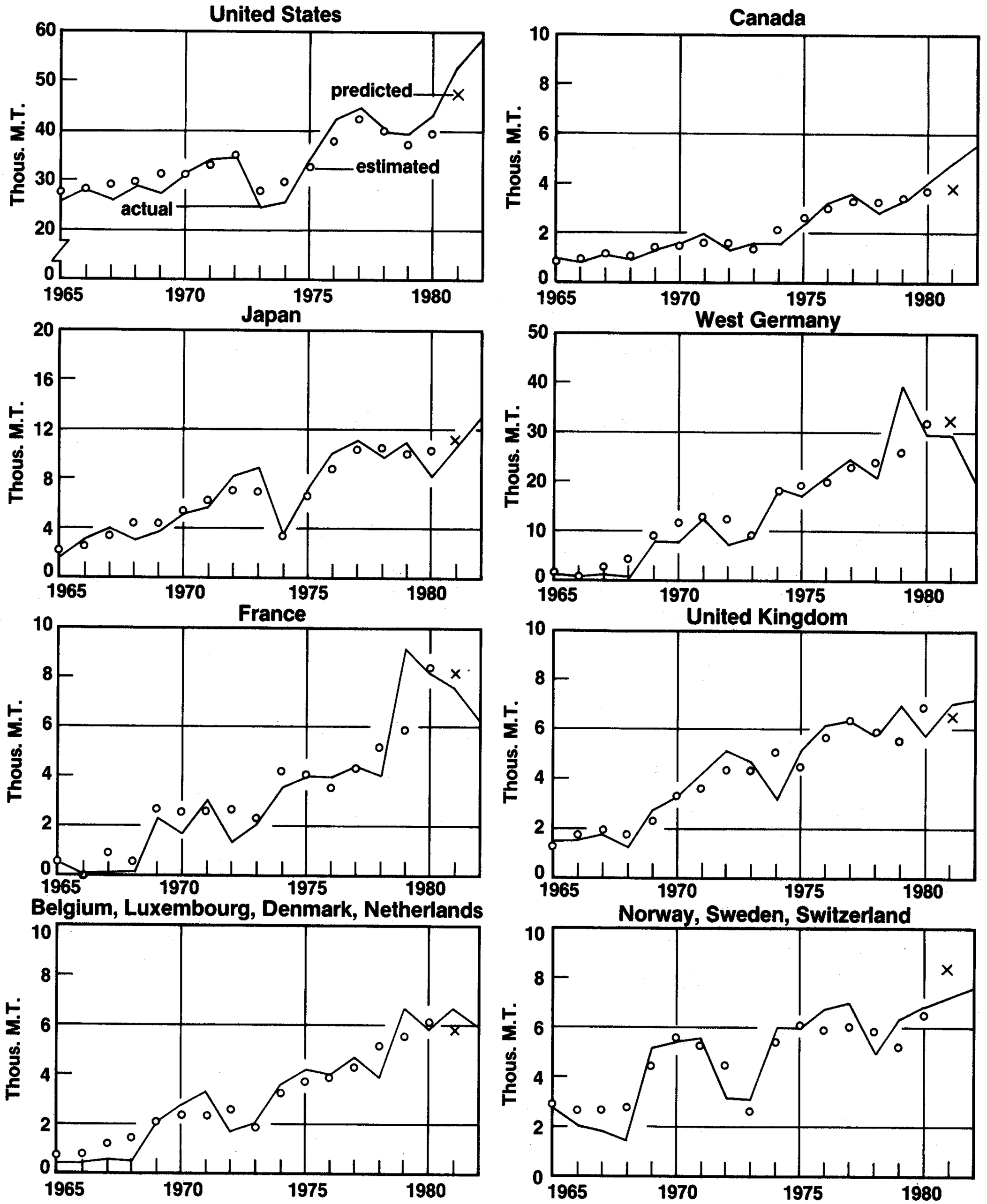
ESTIMATED SHIPMENTS

The demand equations were estimated in terms of quantities per capita (Table 14). Here we are interested in total shipments to domestic and export markets which can be obtained (1) by multiplying estimated per capita shipments by population for each year or (2) by using the derived total shipment matrix of time-varying demand coefficients described in Appendix C. The predicted total shipments, of course, are the same for each method. For the sample period (1960-1980), the demand equations explained 86 to 93 percent of the variation in shipments (R^2 values in Table 14). Here we concentrate on the 1965-1980 period since shipments in the early 1960s were relatively small.

Actual and estimated domestic and export shipments, by country, are shown in Figure 7 for the crop years 1965-1980. The estimated values track actual shipments fairly well except for 1974 (when exports to most countries were overestimated) and 1979 (when domestic and export shipments were badly underestimated). Table 16 gives aggregate data on actual and estimated domestic shipments and shipments to seven export markets. Actual shipments to these export markets increased from 92,327 M.T. in 1978 to 122,097 M.T. in 1979 concomitant with an increase in prices: Quoted prices increased in nominal terms from $3,483 per metric ton in 1978 to $4,255 in 1979; in deflated terms from $1,979 to $2,128 respectively. While the model predicted an increase in shipments, it was far below the actual level. Apparently, some handlers sold exports below the reported CAGE price; however, the 1979 farm price in nominal terms was also above the 1978 levels ($3,197 in 1978 and $3,373 in 1979).

For the 1965-1980 period, the percentage root mean square error is 11.9 percent for all shipments, 9.2 percent for U.S. shipments, and 17.0 percent for exports to the seven markets (excluding 1968). For 1981, the model predictions fall well within the expected range, with percentage errors of 2.7 percent for aggregate shipments (United States and seven export markets), 10.2 percent for U.S. shipments, and 2.6 percent for exports to the seven markets. Further refinement in the demand specification and the data is desirable. As noted, numerous specifications were attempted before selection of the equations reported here. Additional years of data may improve results. Predictions beyond 1981 were not possible due to delays in reporting European shipments. Updating these variables should be of interest to the industry.

The data on stocks were unsatisfactory. Importers' stocks are not reported, and U.S. stocks are not reported until about October 1. Because a July-June year is reported for shipments by destination, stocks were also reported as of July 1. But these stocks include both "committed sales" and "stocks not committed." There is considerable variation both in the total stock position and in stocks not committed expressed as a percentage of total stocks or total supply (see Table 17). It is not possible to reconcile shipments by destination data and stock data as of the end of a marketing period, when marketing extends beyond July 1, in fact, marketings continue until the new crop is available for shipment in September.



Source: See text.

Figure 1.
U.S. Almond Shipments: Actual and Estimated, 1965-1980 and Predicted, 1981 (July-June year) in Thousand Metric Tons.

Table 16. Actual and Estimated Shipments of U.S. Almonds, 1965-1980, with Predicted Values for 1981

Year Beginning July 1	Shipments to U.S. and 7 Export Markets[a]		U.S. Shipments		Export Shipments to 7 Markets		Export Shipments to the rest of the world b)	Total Actual Shipments
	Actual	Estimated	Actual	Estimated	Actual	Estimated		
	metric tons							
1965	34,602	37,183	25,815	27,500	8,787	9,683	1,613	36,215
1966	36,217	38,100	27,825	28,068	8,392	10,032	1,757	37,974
1967	36,743	44,452	26,182	29,617	10,561	14,835	1,365	38,108
1968	36,912	46,493	28,770	29,264	8,142	17,229	1,376	38,288
1969	52,695	57,803	27,288	31,378	25,407	26,425	2,185	54,880
1970	58,683	63,379	31,185	31,175	27,498	32,204	3,462	62,145
1971	70,554	69,033	34,234	33,763	36,320	35,270	4,519	75,073
1972	62,265	70,969	34,245	35,165	28,020	35,804	3,389	65,145
1973	55,190	57,314	24,590	28,667	30,650	28,647	4,482	59,672
1974	65,362	72,021	25,505	30,278	39,857	41,743	7,292	72,654
1975	80,031	79,464	34,027	32,420	46,005	47,044	9,991	90,222
1976	97,585	89,518	42,395	38,304	55,190	51,214	13,116	110,701
1977	106,866	100,076	44,797	42,249	62,069	57,827	13,185	120,051
1978	92,327	100,911	40,073	40,717	52,255	60,194	7,215	99,542
1979	122,097	98,464	39,811	37,081	82,286	61,383	19,419	141,516
1980	111,510	114,026	43,308	39,331	68,202	74,695	16,591	128,101
Predicted 1981	126,199	122,755	52,564	47,184	73,635	75,571	20,815	147,014

[a]Excludes shipments to the "rest of the world" shown in last column.
[b]Shipments to the "rest of the world" were assumed as given in the analysis.

Source: Almond Board of California for actual values and present study for estimated values.

Table 17. U.S. Almond Stocks as of July 1, 1950-1982

Year Beginning July 1	Total Supply	Ending Stocks		Total Ending Stocks as a Percentage of Total Supply	Not Committed Stocks as a Percentage of:	
		Total	Not Committed		Total Supply	Total Stocks
	--------Metric Tons--------			----------Percent----------		
1950	20,886	3,605	3,409	17.3	16.3	94.6
1951	22,459	5,191	4,583	23.1	20.4	88.3
1952	21,159	4,039	3,932	19.1	18.6	97.3
1953	21,858	4,235	2,662	19.4	12.2	62.9
1954	24,323	3,672	2,100	15.1	8.6	57.2
1955	21,091	2,095	1,672	9.9	7.9	80.0
1956	29,397	8,113	6,444	27.6	21.9	79.4
1957	24,503	4,847	2,542	19.8	10.4	52.5
1958	13,575	2,742	1,972	20.2	14.5	71.9
1959	40,945	10,243	6,716	25.0	16.4	65.6
1960	34,512	6,466	5,018	18.7	14.5	77.6
1961	38,809	9,306	4,785	24.0	12.3	51.4
1962	33,285	4,621	2,966	13.9	8.9	64.2
1963	35,217	5,382	3,582	15.3	10.2	66.5
1964	42,904	8,999	4,460	21.0	10.4	49.6
1965	44,717	7,894	3,723	17.7	8.3	47.2
1966	50,887	11,720	6,272	23.0	12.3	53.5
1967	48,998	10,507	2,063	21.4	4.2	19.6
1968	46,929	8,228	1,705	17.5	3.6	20.7
1969	66,511	11,577	2,599	17.4	3.9	22.4
1970	75,935	13,709	6,895	18.1	9.1	50.3
1971	83,550	8,500	1,215	10.2	1.4	14.3
1972	72,927	7,259	1,510	10.0	2.1	20.8
1973	73,680	13,661	4,486	18.5	6.1	32.8
1974	112,386	39,733	22,738	35.4	20.2	57.2
1975	116,925	26,904	8,468	23.0	7.2	31.6
1976	143,835	33,673	8,965	23.4	6.2	26.6
1977	162,861	42,728	13,886	26.2	8.5	32.5
1978	116,405	17,129	5,580	14.7	4.8	32.6
1979	175,211	35,811	9,139	20.4	5.2	25.5
1980	174,223	46,122	18,209	26.5	10.4	39.5
1981	219,901	73,036	35,488	33.2	16.1	48.6
1982	223,069	81,149	38,955	36.4	17.5	48.0

Source: Almond Board of California (1985).

ELASTICITIES OF DEMAND

Elasticities of demand for the United States and seven import markets were reported in Table 14 evaluated at the mean values of prices and shipments. These elasticities, however, have changed markedly between 1965 and 1980, due to a relatively constant real price for almonds, increased shipments of almonds, and the use of a linear demand function on which the elasticities are based. Estimates for selected years are given in Table 18.

The U.S. demand elasticity is about -0.30 in recent years.[1] The import demand elasticities for the seven major markets are based on the parameter estimates in Table 14 using real, i.e., deflated, import prices. These values vary considerably by time period and country (Table 18). In the 1960s when U.S. shipments were small to most European markets, import elasticities were highly elastic. Italy, Spain, and Portugal were the major suppliers to these importers. However, later decades, the United States became the major supplier, import elasticities decreased markedly. The weighted average elasticity for the seven import markets was -0.36 in 1980, compared to -3.31 in 1965. Thus, in 1980 the domestic and export markets have elasticies that are approximately equal. The derived export demand elasticity equals the import demand elasticity when transfer costs, duties, and exchange rates are accounted for.

1. Recall that the demand equations specify shipments as a function of U.S. price, European shipments (rather than price) and other variables. European prices were not used due to high collinearity with the U.S. price as discussed previously.

Table 18. Demand Elasticities for U.S. Almonds, Selected Years, 1965-1980

	Elasticity of Demand by Year:[a]			
	1965	1970	1975	1980
Domestic Market (U.S.)	- 0.41	- 0.31	- 0.27	- 0.30
Export Markets (7)[b]	- 3.31	- 0.87	- 0.43	- 0.36
Canada	- 0.68	- 0.33	- 0.22	- 0.21
Japan	- 2.34	- 0.53	- 0.25	- 0.26
West Germany	-11.13	- 1.76	- 0.59	- 0.44
France	- 4.14	- 1.10	- 0.38	- 0.23
United Kingdom	- 0.97	- 0.42	- 0.23	- 0.22
Northern Europe	- 6.85	- 0.83	- 0.38	- 0.36
Norway, Sweden	- 1.54	- 0.67	- 0.49	- 0.54

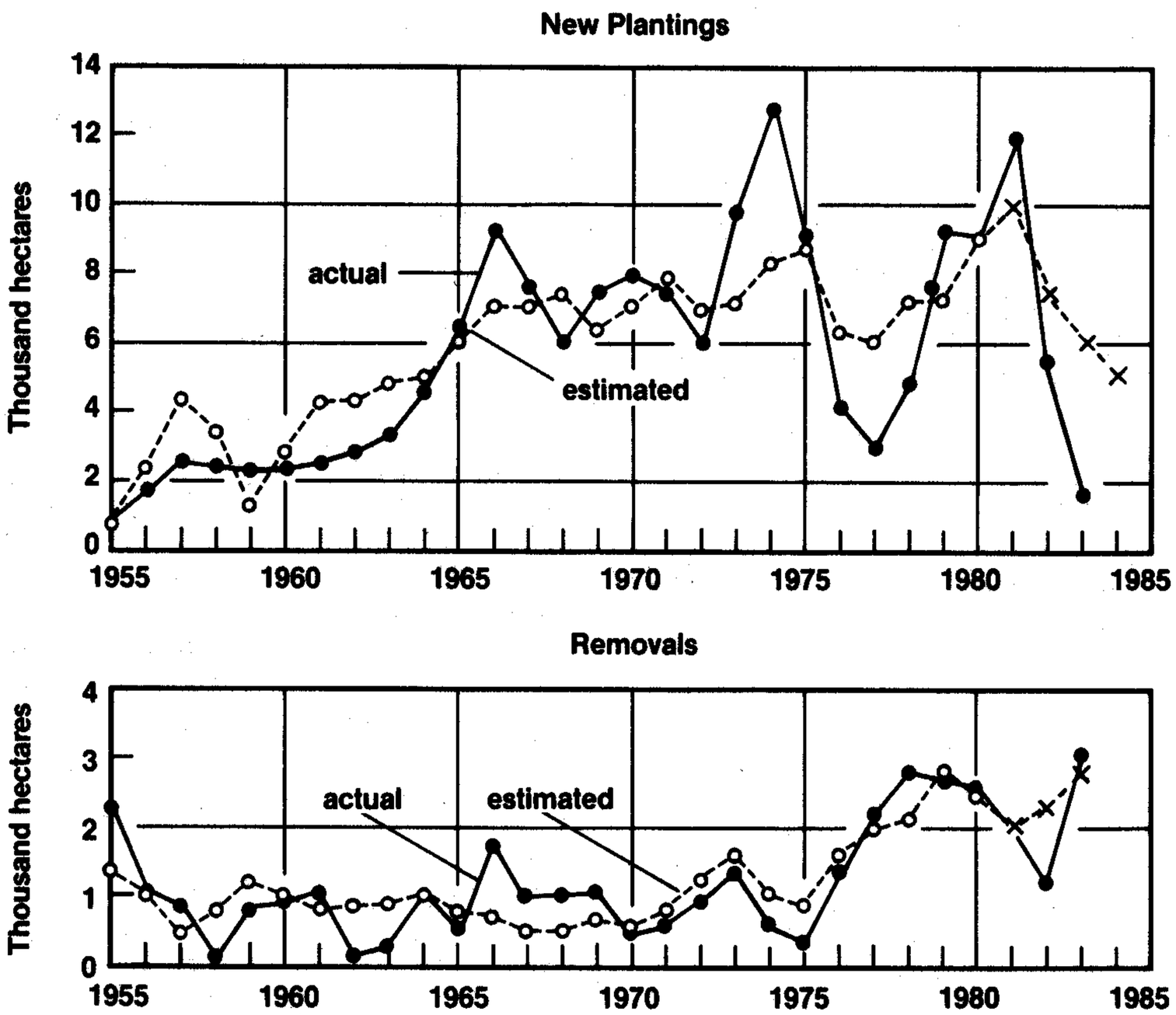
[a]Calculated by using per capita demand slope of Table 14 (holding European quantities constant) and deflated prices and actual per capita quantities.
[b]Weighted by total shipments from the United States.

ESTIMATED NEW PLANTINGS AND REMOVALS

Actual and estimated new plantings and removals of almond area (in hectares) are shown in Figure 8. Note that the "actual" data are revised estimates of CCLRS' published plantings figures. (See Appendix D for reported and revised acreage data.) The new plantings equation (Table 15) explained 74 percent of the yearly variation in the revised plantings data. Predicted and "actual" plantings are shown in Figure 8 for the 1965-1980 period and for three years beyond the sample. The estimating equation tracks the changes but does not capture the large increases in 1973 and 1974 associated with very sharp price increases. Also, the equation overestimates plantings in 1976 and 1977 when drought conditions affected water availability in the San Joaquin Valley.

The root mean square error for plantings was 40 percent for 1965-1980, and 51 percent for 1981-1983. This measure is particularly affected by the large errors in the years noted above. Here again further refinement of area response is needed. Results for new plantings and removals necessitated a focus only on short-term response, rather than attempting long-run simulations with "less than accurate" econometric estimates.

The removal equation (Table 15) explained only 60 percent of the yearly variation, but tracks changes in removals quite well as shown in Figure 8. However, the root mean square error is high for the period 1955-1980 (184 percent). One characteristic of this measure is that over-predictions tend to exaggerate the overall error for the period. If extreme values associated with 1958, 1962, and 1963 are excluded, the root mean square error for the 23 year period is 49 percent, a value that corresponds to that for the predicted years of 1981, 1982, and 1983 (51 percent).



Source: See text.

Figure 8.
U.S. Almond New Plantings and Removals: Actual and Estimated, 1955-1980 and Predicted 1981-1983, in Thousand Hectares

7. ECONOMIC ANALYSIS

The econometric model of the almond industry and the demand relationships in particular provide a basis for analyzing some problems of importance to the industry. In this section the following questions are discussed:

1. Can the demand relationships aid decision makers in setting the opening price quote for almonds?
2. What is the quantitative effect of price versus exchange rate changes on quantities imported?
3. What are the probable effects of Spain and Portugal joining the European Community on U.S. shipments to European markets?
4. What are the short-run prospects for almond supplies, given bearing area, nonbearing area, and stochastic yields? And what are the longer-term prospects for the industry?
5. What role does the reserve provision play in short- and medium-term planning and pricing?

PRICING OF ALMONDS

The theoretical model of Section 3 hypothesized that a major decision for a cooperative firm would be to establish a price such that desired levels of sales in the domestic and export markets and desired ending stocks would result, given beginning stocks and marketable production. Here we illustrate how the model works for selected years in the sample period and for one year ahead (1981).

The simplified model is as follows:

(7.1) $\max R = PAU \bullet QUU^* + PAU \bullet \Sigma_j QU_j^*$

subject to:

domestic demand	$:QUU^* = f(\ldots)$
export demand	$:\Sigma_j QU_j^*$ f(. . .)
desired stocks	$:SEU^* = f(\ldots)$
sales to ROW	=QUROW = exogenous
supply	=SBU + MPU
net supply S′	=SBU + MPU - QUROW - SEU

where the variables are as previously defined, and where one f.o.b. price is set for domestic and export sales.

The basic information required to determine a price, given supply, is the per capita demand functions (see Table 14). Next, these per capita demand coefficients are converted to total demand relationships by multiplying through by the relevant population for each year and also by converting the importer demand functions (in foreign prices) to derived U.S. export demand functions (in nominal U.S. dollars). Essentially, this requires the slope coefficients to differ each year since exchange rates, consumer price indexes, and other variables change each year. The explanation of this conversion from per capita import demand functions to total shipment export demand functions is given in Appendix C.

The resulting equations for each year (from 1973 on) may be expressed in matrix form as:

(7.2) $\beta_1 y_t + \beta_2 PAU + \beta_3 X_t = u_t$

where

β_1	=8x8 identity matrix
y_t	=8x1 vector of shipments (QUj)
β_2	=8x1 vector of price slopes
PAU	=price scalar for year t
β_3	=8x46 matrix of coefficients associated with all predetermined variables except price (see Appendix Table C-2 for first eight equations which exclude variables in the ninth equation–36, 37, 38, and 46)
X_t	=46x1 column vector of exogenous variables except prices (i.e., 3 . . . 46 in Appendix Table C-2) including the intercepts but excluding variables 36, 37, 38, and 46.

For a given year, the exogenous variables (3 . . . 46) are evaluated and added for the eight equations giving the quantity intercept term of Figure 3. Similarly, the eight price slopes are added, giving the aggregate price slope. Equating supply S′ to demand and solving for price, we have

(7.3) $S' = \sum_{i=1}^{8} \beta_{3i}' X_t - \sum_{i=1}^{8} \beta_{2i}$ PAU, or

(7.4) $S' = A' - B'PAU$, or

(7.5) $PAU = (S' - A')/B'$

where

PAU	=nominal price of almonds, $/MT
S′	=marketable production (MPU) plus beginning stocks (SBU) less shipments to the rest of the world (QUROW) less ending stocks (SEU)

A′ =aggregate intercept term for all equations, including such variables as income

B′ =aggregate of price slopes for all equations

Evaluation of Equation (7.5) for 1980

As noted previously, the coefficient values for the β_i's change each year as do supplies. For 1980, the values are as follows:

S′ =111,510 M.T. marketable production (138,412) plus beginning stocks (35,811) less shipments to the rest of the world (16,591) less actual ending stocks (46,122). (alternative assumptions on ending stocks will be evaluated shortly.)

A′ =151,056 M.T. = the aggregate demand quantity intercept

B′ =-8.7936 the aggregate demand slope with positive levels of exports

Using equation (7.4) where supply equals demand, we have

$$111{,}510 = 151{,}056 - 8.7936\ PAU.$$

Solving for price, we have

$$PAU_{1980} = \$4{,}497.$$

This price estimate is about 7 percent higher than the actual price of $4,211/M.T. as would be expected since the 1980 predicted shipments were about 2 percent lower than actual shipments.

Next, we compare the actual and predicted price for years in the sample when domestic and export prices were equal (1973-1980) and for the crop year 1981 which was not in the sample.

Evaluation of the Pricing Model for 1973-1980

The accuracy of the pricing model is a function of several factors: (1) the prediction error in the demand for almonds, (2) the elasticity of demand, (3) the treatment of "desired" level of ending stocks, (4) the assumption on shipments to the rest of the world, and (5) the assumption that all handlers charge the same price for exports.

The prediction errors for shipments (U.S. and seven export markets), as shown in Table 19, are reasonable except for 1979 as discussed previously. The resultant error in the calculated price using equation (7.5) and actual ending stocks and shipments to the rest of the world will depend on the elasticity of demand. As shown in Table 19, the prediction error in price is approximately equal to the prediction error in shipments divided by the elasticity of demand. The trend toward more inelastic demand in recent years places increased emphasis on the need for more accurate information on demand for almonds in both the domestic and export markets. Information from brokers in certain countries undoubtedly should be used to complement econometric estimates with aggregate data. For example, if the low predicted price for 1979 were quoted, sales would immediately exceed expectations and the opening price quote would undoubtedly be raised substantially.

The level of desired stocks will also influence the price that is established, since there is a tradeoff between higher prices in the current year and higher levels of ending stocks--and vice versa. The analysis used the actual level of ending stocks in estimating the supply level (S′). In 1980, for example, the actual level of ending stocks was 26.5 percent of supplies (marketable production plus beginning stocks). If processors desired ending stocks to be 20 percent of supplies, a price of $3,215/M.T. would have to be set. The actual level of 26.5 percent of supplies gave a price of $4,497, where a stock level of 30 percent of supplies would give a price of $5,196/M.T. if the demand functions were reasonably accurate. The tradeoffs between price and ending stocks are given in Table 20 for the years 1973 to 1980. These results bring into question the linear specification of the demand function, but attempts at estimating alternative functional forms were not successful.

The level of ending stocks should be disaggregated into committed and noncommitted levels, as noted previously. Such refinement in stock data and the associated shipments by destination for the relevant period could improve the estimates. Further, the decision on ending stock levels is influenced by expected production in subsequent years. With this industry, production would be expected to increase, given nonbearing acreage and yield trends; however, the fluctuations in yields makes yearly predictions difficult at the time prices must be set for the current crop.

Evaluation of the Pricing Model for 1981

The 1981 season is a particularly difficult one to use for testing the econometric model, since production and beginning stocks exceeded all observations in the 1960-1980 sample period. The preliminary crop forecast was for production of 450 million pounds (204,000 M.T.) and the reserve provision was requested, as will be discussed in a later subsection. Actual production was somewhat lower (407 million pounds), but marketable production was 26 percent above the 1980 level and beginning stocks were 29 percent higher.

Table 19. Aggregate Almond Demand: Shipments, Prices, and Elasticities

Year Beginning July 1	Actual Domestic and 7 Export Market Shipments	Prediction Error: Absolute (Actual Minus Predicted)	Prediction Error: Percent of Actual	Actual Price	Calculated Price (Actual Stocks): Estimate	Error: Absolute (Actual Minus Predicted)	Error: Percent of Actual	Elasticity of Total Demand Function[a]
	----------metric tons----------		(percent)	-----dollars per metric ton------			(percent)	
1973	55,190	-2,124	3.8	3,307	3,421	-114	3.4	-0.93
1974	65,362	-6,659	10.2	2,183	2,657	-474	21.7	-0.47
1975	80,031	567	0.7	2,050	2,008	42	2.0	-0.35
1976	97,585	8,067	8.3	1,984	1,379	605	30.5	-0.25
1977	106,866	6,790	6.4	2,425	1,807	618	25.5	-0.25
1978	92,327	-8,584	9.3	3,483	4,370	-887	25.5	-0.38
1979	122,097	23,633	19.4	4,255	1,841	2,414	56.7	-0.31
1980	111,510	-2,516	2.3	4,211	4,497	-286	6.8	-0.33
Predicted 1981	126,199	3,444	2.7	2,447	2,106	341	13.9	-.18

[a]Estimated using calculated price slope but actual levels of price and shipments to the U.S. and seven export markets.

Source: Reported shipments from the Almond Board of California and estimated values from this study. Actual prices from the California Almond Growers Exchange.

Table 20. Actual and Predicted Almond Prices, 1973-1980, with Alternative Levels of Ending Stocks[a]

Year Beginning July 1	Actual Price PAU	Price Required to Have Ending Stocks at: Actual Ending Stocks	"Desired" Stocks at Level: A	B	C	Ending Stocks: Actual Absolute	Actual Percent of Supplies	Percent of Marketable Production Plus Beginning Stocks: A: 10%	B: 20%	C: 30%
	----------nominal dollars per metric ton----------					metric tons	percent	----------metric tons----------		
1973	3,307	3,421	3,015	3,491	3,967	13,661	18.5	7,368	14,736	22,104
1974	2,183	2,657	629	1,429	2,229	39,733	35.4	11,238	22,477	33,716
1975	2,050	2,008	885	1,748	2,612	26,904	23.0	11,692	23,385	35,078
1976	1,984	1,379	—[b]	985	2,141	33,673	23.4	14,384	28,767	43,150
1977	2,425	1,807	—	893	2,358	42,728	26.2	16,286	32,572	48,858
1978	3,483	4,371	3,820	4,988	6,156	17,129	14.7	11,640	23,281	34,921
1979	4,255	1,841	—	1,755	3,720	35,811	20.4	17,521	35,042	52,563
1980	4,211	4,497	1,233	3,215	5,196	46,122	26.5	17,422	34,845	52,267

[a]Prices are calculated using equation (7.5) and varying the value of S' according to the assumed level of ending stocks.
[b]Dashes indicate a predicted price less than zero. See text for discussion.

Source: See Section 4 for actual data.

The CAGE opening price was $2,447/M.T. for 1981, compared with $4,211 for 1980—a 72 percent decrease. However, it is reported that some other processors sold almonds at under $1.00 per pound ($2,200/M.T.) (CAGE, Annual Report, 1981-82, p. 2). Using the 1981 price of $2,447/M.T., shipments to the United States and seven export markets were predicted at 122,755 M.T. or 2.7 percent lower than actual shipments. The elasticity of demand for total shipments, using actual prices and shipments and the estimated slope of the demand function, equaled -0.18 or about one-half the value for 1980. The percentage error in shipments (2.7 percent) divided by the elasticity of demand (-0.18) gives a rough approximation of the error in price: 15 percent. The procedure described in equation (7.5) estimates that with given supplies (S'), demand effects other than price (A') and the time-varying demand slope (B'), would suggest a price level of $2,106/M.T. for 1981–an underestimation of 13.9 percent.

There are several avenues for future research: The use of a linear demand function appears to underestimate the elasticities. There is evidence that deflation by the consumer price index of the respective country may cause difficulties. Estimates of equations that should be updated each year to reflect changing conditions, are hindered by delays in information on European shipments by source and destination. (The latest published data available from the Foreign Agricultural Service are for 1981-82.) In spite of these and other limitations, the results provide a framework for incorporating information from other sources. Suppose an analyst had information that the estimated level of the demand curve was too low due to new product development or successful development of new markets. Such information could be used to adjust the level of the demand curve.

THE EFFECT OF EXCHANGE RATES

Changes in the exchange rate aided industry exports from 1968 to 1979 and have been detrimental from 1979 to 1984 (see discussion in Section 2). The import demand curves explicitly use exchange rates in calculating prices facing importers. Here, a comparison is given on the effect of price versus exchange rate changes on quantities exported.

The 1980 supply and demand curves are defined as follows:

(7.6) Supply: S′ = 111,510 M.T. via equation (7.3)

(7.7) Domestic demand: QUU = 52,433 - 3.1112 PAU

(7.8) Export demand: QUX = 98,623 - 5.6823 PAU

(7.9) Export demand using the 1980 West German exchange rate (2.06DM/$):

QUX = 98,623 - 2.7584 PAU • ERWGU.

Price Elasticity of Export Demand (ηxp)

The price elasticity of exports is defined as:

$$(7.10)\ \eta xp = \frac{\delta QUX}{\delta PAU} \cdot \frac{PAU}{QUX}$$

$$= -2.7584\ (2.06) \bullet 4211/68{,}202 = -0.35.$$

Exchange Rate Elasticity of Export Demand (ηxer)

The export demand function (7.8) was expressed in terms of the West German exchange rate (2.06) and U.S. price since West Germany is the major importing country, as shown in equation (7.9). Supply (S') is equated to domestic plus export demand, or

(7.11) 111,510 [52,433 - 3.1112 PAU] +
[98,623 - 2.7584 PAU • ERWGU].

Rewrite (7.11) as

(3.1112 + 2.7584 ERWGU)PAU = 39,546, or

(7.12) PAU = 39,546/(3.1112 + 2.7584 ERWGU).

Substituting (7.12) into (7.9) gives

$$(7.13)\ QUX = 98{,}623 - 2.7584 \left(\frac{39{,}546\ ERWGU}{3.1112 + 2.7584\ ERWGU} \right)$$

$$(7.14)\ QUX = 98{,}623 - \frac{35{,}062\ ERWGU}{1 + .89\ ERWGU}.$$

Substitute the exchange rate (ERWGU = 2.06) into (7.14) and take the partial derivative of QUX with respect to the exchange rate giving:

$$(7.15)\ \frac{\delta QUX}{\delta ERWGU} = -4367.$$

The exchange rate elasticity of export demand is defined as:

$$(7.16)\ \eta xer = \frac{\delta QUX}{\delta ERWGU} \cdot \frac{ERWGU}{QUX},$$ which gives

$$= -4367\ (2.06)/68{,}202 = -0.13.$$

This implies that as the dollar strengthened in the 1980s, a 10 percent increase in the exchange rate (DM/$) would result in a 1.3 percent decrease in exports. This compares with the price elasticity where a 10 percent increase in price would result in a 3.5 percent decrease in exports. The exchange rate elasticity is equal to the price elasticity only if supply is infinitely elastic, and here the exchange rate elasticity is about one-third of the price elasticity.

SPAIN AND PORTUGAL AND THE EEC

Currently, exporters in Spain and Portugal face the European Community import duty of 7 percent. On entry into the EEC, they would have a 7 percent price advantage over U.S. exporters. One might expect a supply response there to a more favorable price; however, it is not clear where (or whether) this new almond area in Spain would be developed.

Spain increased specialized plantings from 201,500 hectares in 1960 to 515,600 hectares in 1980 and production has increased (recall Table 8). However, yield has remained low in comparison with the irrigated California yield (0.10 M.T./hectare to compared with 1.2 M.T./hectare in California). Nor has Portugal's production increased appreciably.

Moulton (1983) has analyzed the implications of European Community (EC) enlargement on the almond market. His general conclusions (p. 67) are:

> EC enlargement would eliminate the already modest EC tariffs facing Spain and Portugal. Consequent changes in market shares would be insignificant because of wide variations in almond qualities, taste preferences, and terms of sale. Considerations concerning anticipated production increases and uncertainties about trade policies will likely be more important than those concerning enlargement.

Analysis of area developments in Spain would be an important area of research. Perhaps of equal importance would be analysis of irrigation development projects in all Mediteranean climate areas such as in Turkey. Production trends of other nuts such as filberts (hazelnuts) also should be considered. In conclusion, an analysis of supply response by Spain and other producers was inconclusive due to data problems, but we emphasize the need for further research on countries such as Spain and Turkey.

U.S. SHORT-RUN SUPPLY

Production is dependent on stochastic yields and bearing area. Information available in 1984 includes bearing area, yields and production through 1984 and also the nonbearing area that will reach bearing age through 1987. Estimates of new plantings and removals are given in Table 21 for 1984 using the equations in Table 15. Removals for 1985-88 were assumed to remain at 1984 levels, based on the reasoning that while old trees would be removed, cropping alternatives would not be sufficiently attractive in the next few years to induce removal of other almond acreage.

Yields were projected using the equation shown in Table 15 (based on the years 1950-1980). Actual and estimated yields for 1960-1980 are shown in Figure 9, as well as actual yields through 1984 and projected values through 1988. Although objective crop forecasts of yields can provide a good indication of crop size in July before pricing decisions are made, forecasts for several years ahead must rely on past relationships such as in Figure 9.

Projections of area and production are also given in Table 21 for 1985-88 based on the above assumed relationships. These results are indicative of continued pressure for the development of new products and markets in the years ahead. Although these point estimates are subject to large errors associated with the yield variability noted in Figure 9, and also with errors in estimating removals and new plantings, the information should be useful for industry planning.

THE RESERVE PROVISION

The reserve provision of the federal marketing order for almonds was discussed previously in Section 2 of this report. The reserve was used in the 1950s and 1960s to encourage export sales and to maintain higher prices in the domestic market than in the export market. The reserve was not used much in the 1970s due to favorable export markets and the decision to price almonds the same in both markets. Here, we discuss the use of the reserve in the 1980s and the economic effects of the reserve provision.

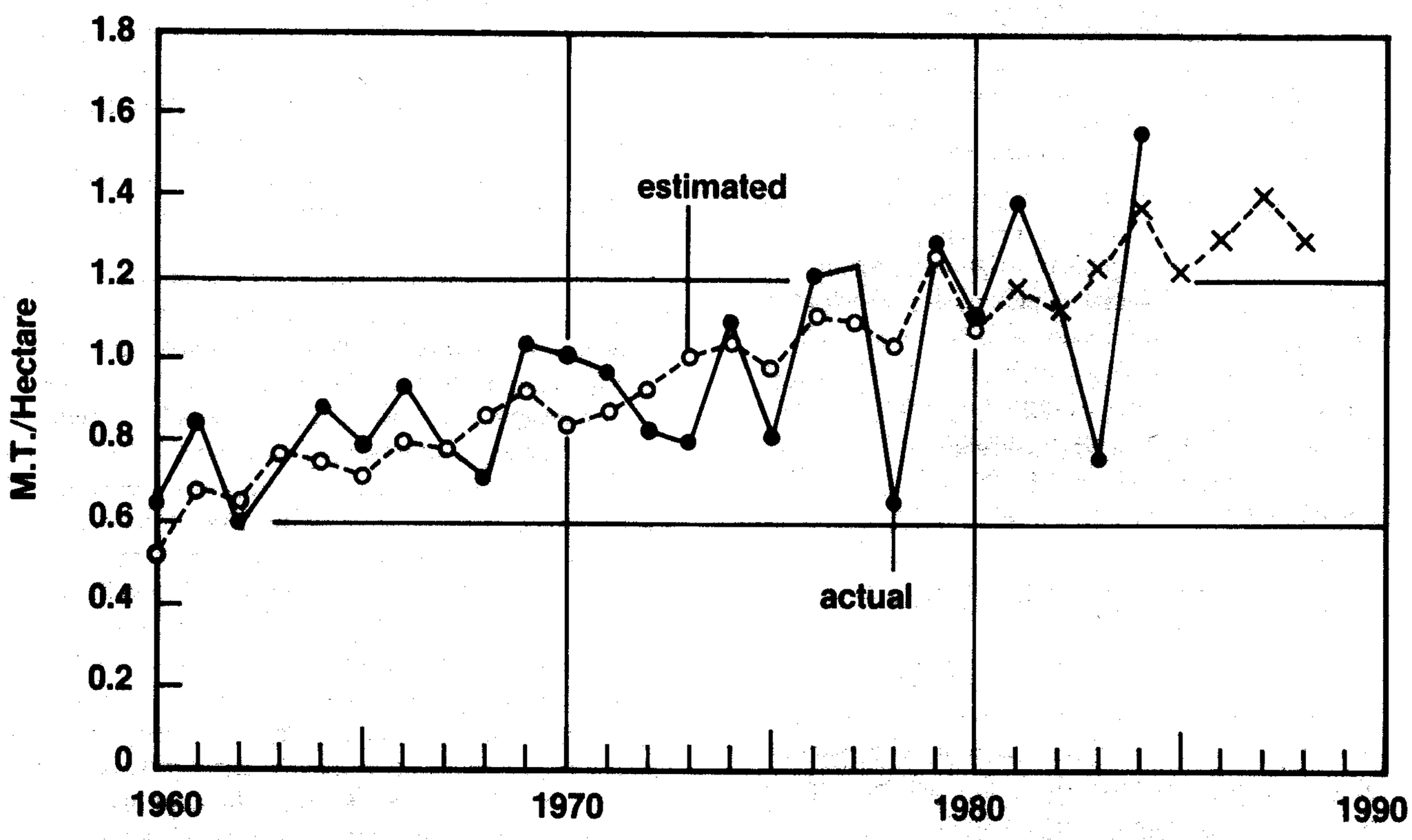
The reserve provision was imposed by the Secretary of Agriculture for the unusually large crops of 1981 and again in 1984 at 25 percent of marketable production plus July 1 beginning stocks. In 1981, the early projections were for a crop of 450 million pounds (204,000 M.T.). The actual crop was about 407 million pounds (184,816 M.T.), and it was possible to release all supplies from the reserve by May 1982 due to favorable export markets. There were strong differences of opinion in the industry as to whether the reserve should be declared. If it had not been used, prices undoubtedly would have been lower since 25 percent of total salable supplies were initially removed from the market. The inelastic nature of both domestic and export markets would indicate sharp price declines which would depend on stock holding decisions (ending stocks in 1981 were 33 percent of total salable supplies).

The 1982 total salable supplies were about equal to those of 1981 but the reserve provision was not used. However, a market devlopment reserve was established at 3 percent of marketable supplies (i.e., stocks plus receipts less losses). Prices were set somewhat

Table 21. Almond Area, Yield and Production, Selected Years, 1976 to 1988

As of May 31	Nonbearing Area[a]				Bearing Area			Yield Per Hectare	Production
	New Plantings	1 Year Old Trees	2 Year Old Trees	3 Year Old Trees	Added	Removals	Total		
	hectares							metric tons	
1976	4,147	---[b]	---	---	---	---	---	---	---
1977	3,007	3,828	---	---	---	---	---	---	---
1978	5,008	2,614	2,888	---	---	---	---	---	---
1979	9,558	5,008	2,614	2,888	---	---	133,286	---	---
1980	9,355	9,558	5,008	2,471	2,888	2,498	133,676	1.092	145,966
1981	11,867	9,355	9,558	5,008	2,290	2,078	133,888	1.380	184,816
1982	5,553	11,867	9,355	9,558	5,008	1,251	137,645	1.143	157,276
1983	1,161	5,553	11,867	9,355	9,336	2,818	144,163	0.761	109,723
1984	5,284[c]	1,161	5,553	11,867	9,355	3,425	150,073	1.774	266,222
1985		5,284	1,161	5,553	11,867	3,425	158,515	1.22	193,388[d]
1986			5,284	1,161	5,553	3,425	160,643	1.30	208,836[e]
1987				5,284	1,161	3,425	158,379	1.41	223,314
1988					5,284	3,425	160,238	1.30	208,309

[a]Based on acreage data in Appendix C.
[b]Dashes indicate not relevant for present analysis.
[c]Data below the line are estimated as explained in the text.
[d]Estimated production as of September 1985 was 204,000 metric tons, somewhat higher than obtained from the yield function.
[e]Due to poor spring weather, the 1986 crop is expected to be well below this estimate at the time this report was prepared.



Source: See text.

Figure 9.
California Almond Yields (metric tons per hectare):
Actual and Estimated 1960-1984 and
Predicted, 1985-1988

higher than for the 1981 crop ($1.33 per pound for Nonpareil Supreme 23/25 for 1982 compared to $1.11 for 1981). Ending stocks were about 37 percent of total salable supplies for the 1982 crop. The short crop of 1983 allowed reduction of stocks to 23 percent of total salable supplies, with prices set at about $1.65 per pound.

The unusually high yields of the 1984 crop plus increased bearing acreage resulted in production of 587 million pounds (266,222 M.T.) as noted in Table 21, with cullage losses of 4 percent, and beginning stocks of 90.6 million pounds, total supply was 654.4 million pounds. The industry continued the research and development reserve of 3 percent plus the reserve provision of 25 percent. Prices were set somewhat lower than for the 1982 crop at $1.27 per pound, and sales were at record levels in spite of the high dollar, due to depleted stocks in many import markets according to industry sources.

It is difficult to quantify the short- and long-term effects of the reserve provision. However, with the sharp fluctuations in yields shown in Figure 9, it is evident that use of the reserve allows short-term stability to prices and grower returns. Members of the cooperative have to pay for storage costs associated with the reserve and other stocks. The level of these costs depends on prices set and the related demand for almonds. Thus, there is the tradeoff mentioned previously between price and stock levels. The prospective supplies for the next few years noted in the rough calculations of Table 20 indicate the importance of continued new product development and of new markets. In the long term, the reserve provision's success will be influenced by the capricious nature of weather on yields and producer response on new plantings and removals. The reserve provision is not intended for a long term withholding of stocks, but it does allow time for the development of new products, which may be required to reduce high stock levels, in certain years.

8. SUMMARY AND CONCLUSIONS

This study analyzes the California almond industry's growth from 1950 to the 1980s with emphasis on the domestic and export markets. Trends in production, consumption, and trade are analyzed by country. Consideration is given to market structures and government policies that influence economic trends. Particular attention is given to the effects of changing exchange rates on market demand.

The econometric analysis centers on estimating domestic and import demand functions for major markets of U.S. almonds. Consideration is given to the effects of European almonds on the demand for U.S. almonds as well as the effects of changing real income and competing nuts (filberts). The results indicate a highly inelastic demand of about -0.33 in both markets.

The effects of exchange rates are analyzed. For example, production and exports were stimulated as the dollar depreciated from 1968 to 1979, and then depressed exports as the dollar appreciated from 1979 to the mid-1980s. The elasticity of exports with respect to the exchange rate is estimated to be about one-third as large as the price elasticity of export demand.

Supply response also was analyzed for California, considering factors affecting new plantings, removals, and yields. Although results were not considered precise enough for long-term analysis of the industry, short-term production prospects were estimated through 1988. The highly variable yields of almonds make point estimates subject to considerable error. However, it is evident that large supplies will be produced during the decade.

The demand functions were used in estimating an equilibrium price, given supplies and exogenous factors such as income and population in various markets. Findings suggest that errors in predicting shipments are compounded by a highly inelastic demand when estimating price. Alternative demand functional forms were explored but were found to be unsatisfactory.

Information on importer's stocks would appear to be an important variable to include in the analysis; however, such data are not published. On the supply side, there is considerable error in reported new plantings compared with later published estimates of acreage of trees say three years old. Funds for improved sampling of counties might be important to the industry.

APPENDIX TABLE A.1 U.S. Almond Shipments: Principal Importing Countries, 1950-1984 (metric tons) a/ b/

YEAR	QUU	QUX	QUC	QUJ	QUWG	QUF	QUUK	QUNE	QUSC	QURW
1950	17282	0	0	0	0	0	0	0	0	0
1951	15332	1905	0	0	0	0	0	0	0	1905
1952	14742	2404	333	0	0	0	0	321	330	1420
1953	14969	2676	666	8	245	0	0	1025	660	72
1954	17418	3220	542	10	160	0	0	763	1109	636
1955	16647	2359	212	49	489	0	0	795	630	184
1956	15241	6396	589	103	1789	5	0	1211	2296	403
1957	15419	4309	723	496	1407	0	10	382	810	481
1958	10822	635	41	335	100	0	14	40	45	60
1959	21146	8210	1084	893	2297	213	998	670	1184	871
1960	24107	3939	396	456	1484	113	73	229	705	483
1961	24898	4894	566	804	955	92	528	249	804	896
1962	24540	3749	341	778	724	101	1	134	899	771
1963	22745	7097	670	1185	1240	209	753	638	1275	1127
1964	25915	7986	490	1625	1216	287	1060	331	1756	1221
1965	25815	10400	889	1438	1341	469	1524	404	2722	1613
1966	27825	10149	790	2902	582	37	1565	424	2092	1757
1967	26182	11926	1086	3971	1124	117	1750	589	1924	1365
1968	28770	9518	896	3097	700	171	1288	483	1507	1376
1969	27288	27592	1340	3701	7829	2370	2842	2082	5243	2185
1970	31185	30980	1602	5247	7441	1763	3320	2724	5401	3462
1971	34234	40839	1950	5857	12387	3002	4254	3347	5524	4519
1972	34245	31409	1307	8094	7210	1367	5089	1693	3259	3389
1973	24590	35132	1652	8795	8280	1994	4760	2049	3120	4482
1974	25505	47149	1602	3502	18503	3498	3217	3646	5889	7292
1975	34027	55996	2401	7317	16953	3984	5165	4206	5979	9991
1976	42395	68308	3362	10093	20750	3934	6231	4047	6773	13116
1977	44797	75254	3618	11150	24713	4451	6434	4710	6993	13185
1978	40073	59470	2884	9830	21046	4050	5740	3885	4820	7215
1979	39811	101705	3308	10072	39712	9181	7040	6650	6323	19419
1980	43308	84793	4075	8340	29236	8187	5763	5774	6827	16591
1981	52564	94301	4908	10697	29434	7638	7068	6671	7219	20866
1982	58188	80939	5621	13052	20333	6348	7254	5897	7483	14951
1983	58327	78664	5523	14738	18110	5905	7918	4908	7022	14540
1984	59584	122509	5196	14556	29186	7810	7274	6111	8851	43525 c/

a/ Crop year July 1 - June 30.
b/ Notation for U.S. shipments (QU) to destination (j) is as follows: U = US; C = Canada; J = Japan; WG = West Germany; F = France; UK = United Kingdom; NE = Northern Europe (Belguim, Luxemburg, Denmark and the Netherlands); SC = Non EC countries of Norway, Sweden and Switzerland; and RW = Rest of the World. QUX = total U.S. exports.
c/ Exports to the USSR were 20,490 M.T. in 1984, but were of minor importance in previous years.

Source: Almond Board of California (1985)

APPENDIX TABLE A.2 U.S. Per Capita Shipments: Principal Importing Countries, 1950-1981 (grams) a/

YEAR	QCUU	QCUC	QCUJ	QCUWG	QCUF	QCUUK	QCNE	QCSC
1950	113.9222	0.	0.	0.	0.	0.	0.	0.
1951	99.3005	0.	0.	0.	0.	0.	0.	0.
1952	93.8981	23.1250	0.	0.	0.	0.	13.5443	21.6152
1953	93.5563	45.0000	0.0923	5.0102	0.	0.	42.7083	42.8377
1954	107.2537	35.6579	0.1134	3.0948	0.	0.	31.6597	71.4148
1955	100.7078	13.5897	0.5499	9.3678	0.	0.	32.5820	40.2196
1956	90.6124	36.5839	1.1444	33.7547	0.1147	0.	49.2276	145.1603
1957	90.0643	43.5542	5.4565	26.2011	0.	0.1934	15.4656	50.8538
1958	61.9108	2.3977	3.6492	1.8382	0.	0.2697	1.5936	2.7897
1959	118.9983	62.2989	9.6332	41.8397	4.7228	19.1188	26.4822	72.8615
1960	133.4090	22.2472	4.8927	26.6906	2.4835	1.3905	8.9804	42.9433
1961	135.5362	30.9290	8.5441	16.9929	2.0044	9.9811	9.6887	48.3551
1962	131.5112	18.3333	8.1981	12.7241	2.1535	0.0187	5.1538	53.3183
1963	120.2167	35.4497	12.3566	21.5278	4.3724	14.0485	24.2586	74.8195
1964	134.9037	25.3886	16.7699	20.8576	5.9298	19.5572	12.4906	101.9212
1965	132.6567	45.3571	14.6885	22.7288	9.5910	27.9121	15.0186	156.4188
1966	141.3154	39.3035	29.3428	9.7487	0.7490	28.6106	15.6458	119.1344
1967	131.5018	53.2353	39.7497	18.7646	2.3447	31.7604	21.5751	108.5534
1968	142.9921	43.0769	30.6330	11.6279	3.4269	23.2911	17.5636	84.3313
1969	134.2913	63.8095	36.1779	128.7664	47.1173	51.2072	75.1625	290.4226
1970	152.1962	75.2113	50.3068	122.5865	34.7047	59.9278	97.6344	296.7093
1971	164.5865	90.2778	55.9408	202.0718	58.5185	76.5108	118.6879	301.3310
1972	163.8517	59.9541	75.6449	116.8558	26.4410	91.2007	59.8233	176.3815
1973	116.5403	74.7511	81.2096	133.5484	38.2726	85.1521	71.6434	168.3756
1974	120.3066	71.2000	31.9526	298.4355	66.6286	57.4464	127.4825	316.8514
1975	159.0047	105.3070	65.9189	274.3204	75.4545	92.2321	145.5363	321.2789
1976	197.1861	145.5411	89.4770	337.3984	74.3667	111.2679	139.0722	364.3357
1977	206.4378	155.2790	97.8929	402.4919	83.9811	115.0984	161.3014	375.5639
1978	183.8211	122.7234	85.5527	343.3279	75.9850	102.8674	132.5939	258.3065
1979	180.9591	139.5780	86.9025	646.7752	171.6075	125.9392	226.9625	337.7671
1980	189.9474	170.5021	71.4041	474.6104	152.4581	102.9107	196.3946	363.7187
1981	228.7380	201.9753	90.9609	477.0502	141.4444	125.5417	225.3716	382.9708

a/ One pound is equal to 453.6 grams.

Source: Data reported in Appendix Table A.1 divided by population data shown in Appendix Table A.28.

APPENDIX TABLE A.3 Spanish Almond Shipments: Principal Importing Countries, 1950-1981 (metric tons) a/

YEAR	QSS	QSX	QSU	QSC	QSWG	QSF	QSUK	QSNE	QSSC	QSI	QSRW
1950	6500	18200	1464	0	1304	898	7875	2174	0	0	4487
1951	7800	16700	1278	184	1441	1553	6065	2151	2474	20	1534
1952	8800	16700	1217	372	1348	4697	2758	2078	3168	31	1035
1953	9300	17700	2148	216	439	4631	3815	896	3977	6	1572
1954	11100	7606	506	165	856	1493	1383	318	1855	14	1016
1955	8200	4693	195	308	162	996	1562	67	568	0	835
1956	8500	5999	59	664	105	833	293	23	259	0	3763
1957	4200	22486	1213	415	57	9389	915	143	7062	0	3292
1958	4300	13385	3320	235	1002	1572	2945	80	1644	122	2465
1959	3600	29000	793	736	3628	5916	7980	426	3940	0	5581
1960	4600	26321	722	665	4081	5980	6424	489	3591	125	4244
1961	4700	30664	538	1165	4335	7986	8371	1019	4322	43	2885
1962	5400	13565	170	589	1233	4141	2873	322	3042	86	1109
1963	5400	20905	187	634	2160	6227	5384	494	4027	223	1569
1964	6000	24974	261	786	4291	7345	3670	763	4659	122	3077
1965	6000	21922	195	551	1761	4889	4888	573	4107	131	4827
1966	6100	29389	280	743	2770	5734	6097	676	5066	91	7932
1967	5400	21567	244	355	3593	4549	3670	529	4382	33	4212
1968	9500	26235	278	456	3925	5182	5448	929	6578	103	3338
1969	8800	13175	110	82	2383	3384	2900	348	1959	72	1937
1970	14000	17601	174	52	3877	4948	2813	512	2748	644	1833
1971	9600	23441	147	108	4710	6296	2744	1083	3863	2555	1935
1972	14100	34895	123	723	9963	7647	2872	2332	6823	2435	1977
1973	19100	17945	38	115	4693	4210	1044	1417	3665	2171	592
1974	22100	16353	42	94	3982	3751	1188	1606	3339	1084	1267
1975	25000	20060	105	90	5787	5642	1453	1699	3115	1070	1099
1976	26100	25906	140	122	6544	7397	1539	2342	4608	756	2458
1977	15800	26202	132	84	6371	5487	1115	2221	4093	377	6322
1978	26500	26520	2	87	8009	5625	902	1903	3824	1213	4955
1979	17600	24357	64	95	6966	4046	922	1242	3513	835	6674
1980	24200	15829	15	0	4122	3467	256	1150	2202	840	3777
1981	b/	24445	0	11	5657	5542	728	2689	3510	687	5621

a/ Notation for Spanish shipments (QS) to destination (j) is the same as given in Appendix Table A.1 except for the addition of Spain (QSS) and Italy (QSI).
b/ Data not available.

Source: See text, section 4 (shelled plus inshell converted to shelled using factor of 0.30).

APPENDIX TABLE A.4 Italian Almond Shipments: Principal Importing Countries, 1950-1982 (metric tons) a/

YEAR	QII	QIX	QIU	QIC	QIWG	QIF	QIUK	QINE	QISC	QIRW
1950	7400	40700	837	108	10730	5441	7883	2310	7481	5912
1951	7110	16800	98	38	3665	3209	2239	1141	2878	3532
1952	7531	28500	172	142	10457	2098	1129	3857	5553	5092
1953	3011	36500	1137	227	12087	3369	5502	3638	6357	4183
1954	3704	27910	338	106	8576	3579	3367	2462	5816	3866
1955	3180	15820	113	177	4169	2665	388	1478	3687	3143
1956	3285	8830	0	11	1879	2170	721	567	1358	2124
1957	8273	29868	276	51	11987	1109	1611	3523	7526	3785
1958	5188	13136	390	33	3108	2361	324	900	3881	2139
1959	10044	28056	0	107	10519	1652	1251	4639	5695	4193
1960	6025	20400	11	12	6685	2574	673	3129	3533	3783
1961	7463	43400	0	0	19720	3136	1559	5865	9121	3999
1962	5299	18000	0	0	6900	3411	1369	2082	3140	1098
1963	5643	31280	10	0	15289	2994	952	3234	3927	4874
1964	6028	24994	0	0	10506	2832	54	2752	1963	6887
1965	12952	27379	0	0	12398	3895	41	3812	576	6677
1966	7314	31677	0	0	13105	6087	72	3294	1587	7532
1967	8774	28459	0	0	12780	5187	31	2631	833	6997
1968	10181	31922	0	0	16191	5989	11	1873	0	7858
1969	7476	17571	0	0	7711	3330	11	2783	28	3708
1970	15968	17863	0	0	8609	2663	15	1807	16	4753
1971	3211	13089	0	0	6647	1202	15	2323	0	2902
1972	10074	9628	0	0	5345	693	11	845	0	2734
1973	7361	3318	0	0	1665	376	3	476	286	512
1974	11739	2261	0	0	917	307	65	380	197	395
1975	12089	2911	0	0	1379	402	48	670	55	357
1976	9227	7273	0	0	4029	1105	77	936	352	774
1977	9234	12766	0	0	6712	2653	239	952	678	1532
1978	11629	10371	0	0	5926	1221	255	1165	399	1405
1979	b/	7093	0	0	3585	1167	153	972	111	1105
1980	16518	3482	0	0	1201	892	0	862	0	527
1981	b/	6937	0	0	2810	1493	0	1601	69	964
1982	b/	6129	0	0	3483	961	145	1013	0	527

a/ Notation for Italian shipments (QI) to destination (j) is the same as given in Appendix Table A.1 except for domestic use (QII) and total exports (QIX).
b/ Data not available.

Source: See text, section 4.

APPENDIX TABLE A.5 Portugal Almond Shipments: Principal Importing Countries, 1950-1982 (metric tons) a/

YEAR	QPX	QPU	QPC	QPWG	QPF	QPUK	QPNE	QPSC	QPI	QPRW
1950	3909	44	222	16	888	1609	671	118	0	341
1951	4063	39	36	193	573	1702	623	295	0	602
1952	3828	30	56	225	229	1046	880	515	0	847
1953	6614	137	93	444	342	3036	842	400	0	1320
1954	8849	0	93	415	1424	4547	936	900	0	534
1955	5531	8	0	854	1268	1860	451	535	0	555
1956	2945	0	31	171	1017	983	251	183	0	309
1957	2838	15	72	323	31	856	870	281	0	390
1958	2119	20	10	96	547	351	538	309	0	248
1959	1597	20	0	206	67	135	774	79	0	316
1960	1569	0	0	285	61	248	590	0	0	385
1961	4518	0	0	1134	126	1439	793	480	0	555
1962	3959	0	0	405	370	1660	822	304	0	398
1963	2562	0	0	80	29	1558	436	136	0	323
1964	2719	0	0	1	0	2330	264	10	0	114
1965	3031	0	0	18	0	2581	286	0	0	146
1966	1242	0	0	8	2	725	233	83	0	191
1967	5086	0	0	156	76	1756	947	1906	0	245
1968	4145	0	0	67	7	1427	843	1335	0	466
1969	1721	0	0	84	2	458	463	527	0	187
1970	2869	0	0	361	94	774	914	436	0	290
1971	5291	0	0	1168	129	1384	1502	553	142	313
1972	4478	0	10	1601	59	593	1331	560	98	226
1973	4009	0	0	1652	169	143	1210	619	54	162
1974	1874	0	0	276	70	81	876	174	22	368
1975	2022	0	0	338	65	155	662	72	22	708
1976	2358	0	0	384	119	415	724	158	0	558
1977	4358	0	0	1167	256	648	814	209	0	1264
1978	2557	0	0	639	90	448	613	453	0	314
1979	1594	0	0	403	27	392	352	307	0	113
1980	889	0	0	188	46	202	286	47	0	120
1981	784	0	0	180	14	349	104	14	0	123
1982	883	0	0	245	22	336	139	31	0	110

a/ Notation for Portugal shipments (QP) to destination (j) is the same as given in Appendix Table A.1 except for the addition of Italy (QPI).

Source: See text, section 4.

APPENDIX TABLE A.6 European Almond Shipments: Principal Importing Countries, 1950-1981 (metric tons) a/

YEAR	QEU	QEC	QEWG	QEF	QEUK	QENE	QESC	QEI	QES
1950	2345	328	12050	7225	17367	5155	7599	7400	6500
1951	1415	258	5299	5335	10006	3915	5647	7130	7800
1952	1419	570	12028	7024	4933	6813	9236	7562	8800
1953	3422	536	12970	8342	12353	5376	10734	3017	9300
1954	844	364	9847	6496	9297	3716	8371	3718	11100
1955	316	485	5185	4929	3810	1996	4790	3180	8200
1956	59	706	2155	4020	1997	841	1800	3285	8500
1957	1504	538	12367	10529	3382	4536	14869	8273	4200
1958	3730	278	4206	4480	3620	1518	5834	5310	4300
1959	813	843	14353	7635	9366	5839	9714	10044	3600
1960	733	677	11051	8615	7345	4208	7124	6150	4600
1961	538	1165	25189	11248	11369	7677	13923	7506	4700
1962	170	589	8538	7922	5902	3226	6486	5385	5400
1963	197	634	17529	9250	7894	4164	8090	5866	5400
1964	261	786	14798	10177	6054	3779	6632	6150	6000
1965	195	551	14177	8784	7510	4671	4683	13083	6000
1966	280	743	15883	11823	6894	4203	6736	7405	6100
1967	244	355	16529	9812	5457	4107	7121	8807	5400
1968	278	456	20183	11178	6886	3645	7913	10284	9500
1969	110	82	10178	6716	3369	3594	2514	7548	8800
1970	174	52	12847	7705	3602	3233	3200	16612	14000
1971	147	108	12525	7627	4143	4908	4416	5908	9600
1972	123	733	16909	8399	3476	4508	7383	12607	14100
1973	38	115	8010	4755	1190	3103	4570	9586	19100
1974	42	94	5175	4128	1334	2862	3710	12845	22100
1975	105	90	7504	6109	1656	3031	3242	13181	25000
1976	140	122	10957	8621	2031	4002	5118	9983	26100
1977	132	84	14250	8396	2002	3987	4980	9611	15800
1978	2	87	14574	6936	1605	3681	4676	12842	26500
1979	64	95	10954	5240	1467	2566	3931	835	17600
1980	15	0	5511	4405	458	2298	2249	17358	24200
1981	0	11	8647	7049	1077	4394	3593	b/	b/

a/ Includes shipments from Spain, Italy and Portugal.
b/ Data not available.

Source: See text, section 4.

APPENDIX TABLE A.7 European Per Capita Almond Shipments:
Principal Importing Countries, 1950-1981 (grams)

YEAR	QCEU	QCEC	QCEWG	QCEF	QCEUK	QCENE	QCESC	QCEI	QCES
1950	15.46	23.77	252.62	172.43	343.22	221.24	507.41	159.83	232.97
1951	9.16	18.43	110.17	126.42	197.75	165.89	373.53	153.00	277.58
1952	9.04	39.58	248.00	164.88	97.88	287.47	604.96	161.24	310.95
1953	21.39	36.22	265.24	194.45	242.69	224.00	698.70	64.19	326.32
1954	5.20	23.95	190.46	151.07	181.94	154.19	539.06	77.95	385.42
1955	1.91	31.09	99.33	113.83	74.41	81.80	305.80	66.25	282.76
1956	0.35	43.85	40.66	92.20	38.85	34.19	113.80	68.01	291.10
1957	8.79	32.41	230.30	238.75	65.42	183.64	933.51	170.58	142.86
1958	21.34	16.26	77.32	100.45	69.75	60.48	361.66	109.03	144.78
1959	4.58	48.45	261.44	169.29	179.43	230.79	597.78	204.56	120.40
1960	4.06	38.03	198.76	189.34	139.90	165.02	433.94	124.49	152.82
1961	2.93	63.66	448.20	245.05	214.91	298.72	837.37	151.64	153.59
1962	0.91	31.67	150.05	168.91	110.52	124.08	384.67	107.27	175.32
1963	1.04	33.54	304.32	193.51	147.28	158.33	474.74	114.57	173.63
1964	1.36	40.73	253.83	210.27	111.70	142.60	384.93	120.35	191.69
1965	1.00	28.11	240.29	179.63	137.55	173.64	269.11	253.55	189.87
1966	1.42	36.97	266.05	239.33	126.03	155.09	383.60	142.68	191.22
1967	1.23	17.40	275.94	196.63	99.04	150.44	401.77	168.07	168.22
1968	1.38	21.92	335.27	224.01	124.52	132.55	442.81	194.77	291.41
1969	0.54	3.90	167.40	133.52	60.70	129.75	139.26	141.88	267.48
1970	0.85	2.44	211.65	151.67	65.02	115.88	175.80	309.35	414.20
1971	0.71	5.00	204.32	148.67	74.51	174.04	240.89	109.21	281.52
1972	0.59	33.62	274.05	162.46	62.29	159.29	399.58	232.17	408.70
1973	0.18	5.20	129.19	91.27	21.29	108.50	246.63	174.61	547.28
1974	0.20	4.18	83.47	78.63	23.82	100.07	199.61	231.86	627.84
1975	0.49	3.95	121.42	115.70	29.57	104.88	174.21	235.82	704.23
1976	0.65	5.28	178.16	162.97	36.27	137.53	274.83	176.07	727.02
1977	0.61	3.61	232.08	158.42	35.81	136.54	266.97	170.41	431.69
1978	0.01	3.70	237.75	130.13	28.76	125.63	248.98	226.49	720.11
1979	0.29	4.01	178.40	97.94	26.24	87.58	209.40	a/	473.12
1980	0.07	0.00	89.46	82.03	8.18	78.16	119.82	304.53	647.06
1981	0.00	0.45	140.15	130.54	19.13	148.45	190.61	a/	a/

a/ Data not available.

Source: Data reported in Appendix Table A.6 (in metric tons) divided by population data shown in Appendix Table A.28.

APPENDIX TABLE A.8 Total Almond Shipments: Principal Importing Countries, 1950-1981 (metric tons) a/

YEAR	TQU	TQC	TQJ	TQWG	TQF	TQUK	TQNE	TQSC	TQS	TQI
1950	19708	328	0	13914	8132	18239	5112	7599	6500	7400
1951	16747	258	0	8044	5753	10359	4002	5647	7800	7220
1952	16182	903	0	12760	7852	5033	7066	9613	8800	7562
1953	18468	1202	8	13884	8833	12402	6332	11397	9300	3022
1954	18297	906	10	12128	7070	10027	4681	9772	11100	3718
1955	16964	697	49	7314	5280	3940	2703	5512	8200	3180
1956	15300	1295	103	5020	4656	2135	2099	4096	8500	3290
1957	16980	1261	496	17409	11235	4360	4817	15689	4200	8311
1958	15099	319	335	5684	5688	4697	1538	5946	4300	5312
1959	22031	1927	893	18782	8238	10797	6473	10986	3600	10044
1960	24849	1073	456	13750	9154	7619	4412	7882	4600	6150
1961	25436	1731	804	29456	11714	13878	7987	14814	4700	7526
1962	24780	930	778	11483	8406	6411	3395	7433	5400	5398
1963	22942	1304	1185	19206	9650	8941	4849	9365	5400	5866
1964	26176	1276	1625	16819	10915	7378	4162	8403	6000	6150
1965	26010	1440	1438	16121	10047	9331	5167	7405	6000	13083
1966	28105	1533	2902	16465	11860	8459	4654	8828	6100	7405
1967	26446	1441	3971	19015	11037	8063	4677	9045	5400	8807
1968	29048	1352	3097	22065	12489	8406	4153	9469	9500	10284
1969	27398	1422	3701	18752	10489	6640	5671	7852	8800	7548
1970	31359	1654	5247	21703	10456	7116	6011	8622	14000	16612
1971	34381	2058	5857	25641	12176	8468	8117	9940	9600	6079
1972	34368	2040	8094	25949	11390	8591	6180	10660	14100	12929
1973	24628	1767	8795	18268	8449	5997	5197	7690	19100	10302
1974	25547	1696	3502	25090	8435	4570	6593	9599	22100	13573
1975	34132	2494	7317	24470	10169	6821	7220	9221	25000	13181
1976	42535	3484	10093	31707	12555	8262	8049	11891	26100	9983
1977	44929	3702	11150	38963	13055	8436	8661	11973	15800	9611
1978	40075	2971	9830	35843	12052	7384	7481	9496	26500	12856
1979	39875	3403	10072	50666	14421	8507	9156	10254	17600	b/
1980	43323	4075	8340	34747	12600	6221	8072	9076	24200	17358
1981 c/	52564	4919	10697	38081	14687	8145	11065	10812	b/	b/

a/ Includes shipments from U.S., Europe (Spain, Italy and Portugal) and the Rest of the World (Morocco and Iran).
b/ Data not available.
c/ Includes U.S. and European shipments only. Other shipments were of minor importance.

Source: See text, section 4.

APPENDIX TABLE A.9 Per Capita Almond Shipments: Principal Importing Countries, 1950-1981 (grams)

YEAR	TCU	TCC	TCJ	TCWG	TCF	TCUK	TCNE	TCSC	TCS	TCI
1950	129.91	23.77	0.00	291.70	194.08	360.45	219.40	507.41	232.97	159.83
1951	108.47	18.43	0.00	167.23	136.33	204.72	169.58	373.53	277.58	154.94
1952	103.07	62.71	0.00	263.09	184.32	99.86	298.14	629.66	310.95	161.24
1953	115.43	81.22	0.09	283.93	205.90	243.65	263.83	739.73	326.32	64.30
1954	112.67	59.61	0.11	234.58	164.42	196.22	194.23	629.27	385.42	77.95
1955	102.63	44.68	0.55	140.11	121.94	76.95	110.78	351.89	282.76	66.25
1956	90.96	80.43	1.14	94.72	106.79	41.54	85.33	258.96	291.10	68.12
1957	99.07	75.96	5.46	324.19	254.76	84.33	195.02	984.99	142.86	171.36
1958	86.38	18.65	3.65	104.49	127.53	90.50	61.27	368.61	144.78	109.08
1959	123.98	110.75	9.63	342.11	182.66	206.84	255.85	676.06	120.40	204.56
1960	137.52	60.28	4.89	247.30	201.19	145.12	173.02	480.11	152.82	124.49
1961	138.46	94.59	8.54	524.13	255.21	262.34	310.78	890.96	153.59	152.04
1962	132.80	50.00	8.20	201.81	179.23	120.06	130.58	440.84	175.32	107.53
1963	121.26	68.99	12.36	333.44	201.88	166.81	184.37	549.56	173.63	114.57
1964	136.26	66.11	16.77	288.49	225.52	136.13	157.06	487.72	191.69	120.35
1965	133.66	73.47	14.69	273.24	205.46	170.90	192.08	425.53	189.87	253.55
1966	142.74	76.27	29.34	275.80	240.08	154.64	171.73	502.73	191.22	142.68
1967	132.83	70.64	39.75	317.45	221.18	146.33	171.32	510.32	168.22	168.07
1968	144.37	65.00	30.63	366.53	250.28	152.01	151.02	529.88	291.41	194.77
1969	134.83	67.71	36.18	308.42	208.53	119.64	204.73	434.94	267.48	141.88
1970	153.05	77.65	50.31	357.55	205.83	128.45	215.45	473.66	414.20	309.35
1971	165.29	95.28	55.94	418.29	237.35	152.30	287.84	542.22	281.52	112.37
1972	164.44	93.58	75.64	420.57	220.31	153.96	218.37	576.93	408.70	238.10
1973	116.72	79.95	81.21	294.65	162.17	107.28	181.71	415.00	547.28	187.65
1974	120.50	75.38	31.95	404.68	160.67	81.61	230.52	516.46	627.84	245.00
1975	159.50	109.39	65.92	395.95	192.59	121.80	249.83	495.49	704.23	236.22
1976	197.84	150.82	89.48	515.56	237.33	147.54	276.60	639.64	727.02	176.07
1977	207.05	158.88	97.89	634.58	246.32	150.91	296.61	643.02	431.69	170.41
1978	183.83	126.43	85.55	584.71	226.12	132.33	255.32	508.90	720.11	226.74
1979	181.25	143.59	86.90	825.18	269.55	152.18	312.49	547.76	473.12	a/
1980	190.01	170.50	71.40	564.07	234.64	111.09	274.56	483.54	647.06	304.53
1981	228.74	202.43	90.96	617.20	271.98	144.67	373.82	573.58	a/	a/

a/ Data not available.

Source: Data reported in Appendix Table A.8 (in metric tons) divided by population data shown in Appendix Table A.28.

APPENDIX TABLE A.10 U.S. Domestic Almond Prices, 1950-1982 (dollars per metric ton) a/

YEAR b/	PAU	CPIU	DPUU
1950	1296	65	1993.85
1951	1301	66	1971.21
1952	1268	67	1892.54
1953	1268	69	1837.68
1954	1235	69	1789.86
1955	2072	70	2960.00
1956	1962	72	2725.00
1957	1323	74	1787.84
1958	1984	75	2645.33
1959	1279	76	1682.89
1960	1521	77	1975.32
1961	1367	78	1752.56
1962	1543	79	1953.16
1963	1433	80	1791.25
1964	1477	81	1823.46
1965	1477	83	1779.52
1966	1477	85	1737.65
1967	1499	88	1703.41
1968	1543	92	1677.17
1969	1587	97	1636.08
1970	1587	102	1555.88
1971	1675	106	1580.19
1972	1852	111	1668.47
1973	3307	121	2733.06
1974	2183	133	1641.35
1975	2050	143	1433.57
1976	1984	151	1313.91
1977	2425	161	1506.21
1978	3483	176	1978.98
1979	4255	200	2127.50
1980	4211	223	1888.34
1981	2447	241	1015.35
1982	2932	252	1163.49

a/ Notation: Domestic Price (PAU), Consumer Price Index, U.S. (CPIU), average of calendar year indexes; and deflated domestic price (DPUU).
b/ Crop year: July 1 - June 30

Source: See text, section 4.

APPENDIX TABLE A.11 U.S. Almond Prices in Canada, 1950-1982 (dollars per metric ton) a/

YEAR	PXU	ERCU	LPUC	LPUC70	CPIC	DPUC
1950	1093	1.067	1166.01	1148.55	65	1767.01
1951	919	1.019	936.74	922.71	70	1318.16
1952	763	0.978	745.83	734.67	71	1034.74
1953	739	0.979	723.11	712.28	71	1003.22
1954	787	0.976	768.35	756.84	71	1065.98
1955	1854	0.992	1839.72	1812.18	71	2552.36
1956	1922	0.961	1848.00	1820.33	72	2528.24
1957	985	0.971	956.43	942.11	74	1273.13
1958	1936	0.966	1869.79	1841.79	75	2455.72
1959	917	0.960	879.86	866.69	76	1140.38
1960	1063	0.999	1062.47	1046.56	77	1359.17
1961	1257	1.051	1321.36	1301.57	78	1668.69
1962	1614	1.078	1739.41	1713.36	79	2168.82
1963	1347	1.080	1454.89	1433.11	80	1791.39
1964	1444	1.078	1556.63	1533.33	82	1869.91
1965	1464	1.076	1575.41	1551.82	85	1825.67
1966	1464	1.081	1582.58	1558.89	88	1771.46
1967	1455	1.078	1568.93	1545.44	91	1698.28
1968	1455	1.076	1565.14	1541.71	95	1622.85
1969	1543	1.065	1642.99	1618.39	99	1634.73
1970	1499	1.015	1521.78	1499.00	102	1469.61
1971	1587	0.998	1584.46	1560.74	108	1472.39
1972	1764	0.994	1753.59	1727.34	112	1542.27
1973	3307	0.987	3262.69	3213.84	122	2634.29
1974	2183	1.003	2188.89	2156.12	135	1597.13
1975	2050	0.997	2043.85	2013.25	149	1351.17
1976	1984	1.024	2032.01	2001.59	159	1258.86
1977	2425	1.106	2681.32	2641.18	173	1526.69
1978	3483	1.174	4089.04	4027.82	188	2142.46
1979	4255	1.167	4965.59	4891.24	206	2374.39
1980	4211	1.188	5000.56	4925.69	230	2141.61
1981	2447	1.225	2997.57	2952.69	257	1148.91
1982	2932	1.232	3612.22	3558.14	278	1279.91

a/ Notation: U.S. export price (PXU) -- It equals U.S. domestic price (PAU) for the 1973 crop year and subsequent years.
Canadian/U.S. exchange rate for crop year beginning July 1 (ERCU).
Landed price in current Canadian dollars (LPUC).
Landed price in Canada in 1970 U.S. dollars (LPUC70).
Consumer price index for Canada (CPIC).
Deflated landed price in Canada (DPUC).

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.12 U.S. Almond Prices in Japan, 1950-1982 (dollars per metric ton) a/

YEAR	PXU	TUJ	DUJ	LPUJD	ERJU	LPUJY	LPUJ70	CPIJ	DPUJ
1950	1093	77.32	1.10	1287.35	361.00	464734	1299.68	42	3094.48
1951	919	77.32	1.10	1095.95	361.00	395639	1106.45	46	2405.32
1952	763	77.32	1.10	924.35	360.90	333599	932.95	49	1903.97
1953	739	77.32	1.10	897.95	360.80	323981	906.05	52	1742.41
1954	787	78.78	1.10	952.36	360.40	343230	959.88	53	1811.10
1955	1854	86.20	1.10	2134.22	360.00	768319	2148.69	53	4054.14
1956	1922	91.88	1.10	2215.27	360.00	797497	2230.29	54	4130.17
1957	985	100.77	1.10	1194.35	360.00	429965	1202.45	55	2186.27
1958	1936	92.78	1.10	2231.66	360.40	804290	2249.29	55	4089.62
1959	917	68.81	1.10	1084.39	360.20	390598	1092.35	57	1916.41
1960	1063	68.81	1.10	1244.99	359.77	447917	1252.65	59	2123.14
1961	1257	68.81	1.10	1458.39	361.60	527354	1474.81	62	2378.72
1962	1614	68.81	1.10	1851.09	359.45	665375	1860.80	67	2777.31
1963	1347	69.72	1.10	1558.39	362.13	564333	1578.22	71	2222.85
1964	1444	74.32	1.10	1670.15	360.50	602090	1683.81	75	2245.09
1965	1464	74.59	1.10	1692.45	361.95	612582	1713.16	79	2168.55
1966	1464	76.71	1.10	1694.78	362.25	613934	1716.94	83	2068.60
1967	1455	77.69	1.10	1685.96	361.77	609938	1705.76	86	1983.44
1968	1455	78.65	1.10	1687.02	358.35	604542	1690.67	91	1857.88
1969	1543	81.22	1.10	1786.64	357.90	639439	1788.27	97	1843.57
1970	1499	86.24	1.10	1743.76	357.58	623526	1743.76	103	1692.97
1971	1587	100.11	1.09	1838.95	313.58	576649	1612.67	109	1479.51
1972	1764	99.22	1.09	2030.91	288.05	585004	1636.03	118	1386.47
1973	3307	93.83	1.09	3706.90	277.75	1029593	2879.38	138	2086.50
1974	2183	124.75	1.09	2515.45	295.08	742246	2075.78	165	1258.05
1975	2050	103.81	1.09	2347.65	289.74	680203	1902.27	180	1056.81
1976	1984	96.91	1.09	2268.19	288.85	655167	1832.25	197	930.08
1977	2425	132.00	1.09	2787.13	233.13	649750	1817.10	208	873.61
1978	3483	140.57	1.09	3949.69	251.15	991965	2774.15	214	1296.33
1979	4255	151.80	1.09	4803.41	232.60	1117274	3124.59	227	1376.47
1980	4211	123.39	1.09	4724.49	213.00	1006315	2814.28	243	1158.14
1981	2447	106.00	1.09	2782.77	238.15	662717	1853.36	251	738.39
1982	2932	100.00	1.09	3304.88	246.00	813001	2273.65	257	884.69

a/ Notation: U.S. export price (PXU)
Transportation costs, U.S. to Japan (TUJ)
Duties (DUJ)
Landed price in Japan in current dollars (LPUJD)
Exchange rate: yen per dollar (ERJU)
Landed price in yen (LPUJY)
Landed price in 1970 U.S. dollars (LPUJ70)
Consumer price index for Japan (CPIJ)
Deflated landed price in Japan (DPUJ)

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.13 U.S Almond Prices in West Germany, 1950-1982 (dollars per metric ton) a/

YEAR	PXU	TUWG	DUWG	LPUWGL	ERWGU	LPUWGD	LPUWG70	CPIWG	DPUWG
1950	1093	50.07	1.00	1143.07	4.20	4800.89	1333.58	66	2020.58
1951	919	50.07	1.00	969.07	4.20	4070.09	1130.58	69	1638.52
1952	763	50.07	1.00	813.07	4.20	3414.89	948.58	69	1374.76
1953	739	50.07	1.00	789.07	4.20	3314.09	920.58	68	1353.80
1954	787	51.86	1.00	838.86	4.21	3527.66	979.90	69	1420.15
1955	1854	56.94	1.00	1910.94	4.21	8045.06	2234.74	71	3147.52
1956	1922	59.66	1.00	1981.66	4.20	8320.00	2311.11	73	3165.91
1957	985	57.58	1.00	1042.58	4.20	4377.27	1215.91	74	1643.12
1958	1936	55.38	1.00	1991.38	4.18	8323.97	2312.21	76	3042.39
1959	917	44.46	1.00	961.46	4.17	4012.17	1114.49	77	1447.39
1960	1063	46.76	1.00	1109.76	4.07	4518.94	1255.26	78	1609.31
1961	1257	48.96	1.01	1319.67	3.99	5271.83	1464.40	80	1830.50
1962	1614	50.02	1.02	1698.96	3.99	6784.47	1884.58	83	2270.57
1963	1347	52.44	1.02	1428.83	3.98	5681.45	1578.18	85	1856.68
1964	1444	54.64	1.02	1530.11	3.98	6094.43	1692.90	88	1923.75
1965	1464	57.76	1.03	1569.70	4.01	6291.81	1747.73	91	1920.58
1966	1464	60.70	1.04	1588.74	3.98	6326.03	1757.23	93	1889.50
1967	1455	60.99	1.04	1579.66	3.99	6310.43	1752.90	94	1864.79
1968	1455	62.97	1.07	1624.23	4.00	6498.21	1805.06	96	1880.27
1969	1543	66.28	1.07	1721.93	3.74	6435.71	1787.70	99	1805.76
1970	1499	73.74	1.07	1682.83	3.60	6061.22	1683.67	103	1634.63
1971	1587	86.34	1.07	1790.47	3.23	5778.75	1605.21	108	1486.31
1972	1764	95.09	1.07	1989.23	3.04	6042.87	1678.58	115	1459.63
1973	3307	125.03	1.03	3534.99	2.54	8994.08	2498.35	123	2031.18
1974	2183	144.83	1.07	2490.78	2.43	6052.59	1681.28	131	1283.42
1975	2050	137.05	1.07	2340.14	2.59	6060.97	1683.60	138	1220.00
1976	1984	137.05	1.07	2269.52	2.37	5378.77	1494.10	144	1037.57
1977	2425	144.30	1.07	2749.15	2.06	5663.25	1573.13	148	1062.92
1978	3483	124.78	1.07	3860.32	1.86	7180.20	1994.50	153	1303.60
1979	4255	124.00	1.07	4685.53	1.79	8387.10	2329.75	160	1456.09
1980	4211	130.50	1.07	4645.41	2.06	9569.53	2658.20	169	1572.90
1981	2447	151.50	1.07	2780.40	2.36	6561.73	1822.70	179	1018.27
1982	2932	151.00	1.07	3298.81	2.47	8148.06	2263.35	186	1218.85

a/ Notation: U.S. export price (PXU)
Transportation costs, U.S. to West Germany (TUWG)
Duties (DUWG)
Landed price in West Germany in current dollars (LPUWGL)
Exchange rate: D.M. per dollar (ERWGU)
Landed price in D.M. (LPUWGD)
Landed price in 1970 U.S. dollars (LPUWG70)
Consumer price index for West Germany (CPIWG)
Deflated landed price in West Germany (DPUWG)

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.14 U.S. Almond Prices in France, 1950-1982 (dollars per metric ton) a/

YEAR	PXU	TUF	DUF	LPUFD	ERFU	LPUFF	LPUF70	CPIF	DPUF
1950	1093	48.08	1.00	1141.08	3.50	3991.84	723.49	43	1682.53
1951	919	48.08	1.00	967.08	3.50	3384.59	613.43	49	1251.89
1952	763	48.08	1.00	811.08	3.50	2838.21	514.40	51	1008.63
1953	739	48.08	1.00	787.08	3.50	2754.23	499.18	51	978.79
1954	787	48.82	1.00	835.82	3.50	2924.78	530.09	51	1039.40
1955	1854	52.05	1.00	1906.05	3.50	6671.18	1209.09	52	2325.18
1956	1922	57.67	1.00	1979.67	3.50	6928.45	1255.72	53	2369.29
1957	985	58.91	1.00	1043.91	4.20	4384.11	794.58	58	1369.97
1958	1936	56.70	1.00	1992.70	4.73	9418.10	1706.95	63	2709.44
1959	917	45.78	1.00	962.78	4.91	4724.84	856.34	67	1278.12
1960	1063	48.08	1.00	1111.08	4.90	5445.18	986.89	69	1430.28
1961	1257	50.28	1.01	1321.01	4.90	6477.95	1174.07	72	1630.66
1962	1614	51.34	1.02	1700.31	4.90	8331.53	1510.02	75	2013.36
1963	1347	53.50	1.02	1429.91	4.90	7007.71	1270.09	78	1628.32
1964	1444	55.96	1.02	1531.46	4.90	7504.15	1360.06	80	1700.08
1965	1464	60.14	1.03	1572.15	4.90	7706.37	1396.71	82	1703.31
1966	1464	63.35	1.04	1591.50	4.93	7852.93	1423.28	84	1694.38
1967	1455	63.63	1.04	1582.41	4.93	7795.76	1412.91	87	1624.04
1968	1455	65.62	1.07	1627.06	4.96	8073.98	1463.34	92	1590.59
1969	1543	69.10	1.07	1724.95	5.55	9570.01	1734.48	98	1769.88
1970	1499	76.47	1.07	1685.75	5.52	9301.14	1685.75	103	1636.65
1971	1587	88.44	1.07	1792.72	5.20	9314.98	1688.26	109	1548.86
1972	1764	99.41	1.07	1993.85	4.84	9649.83	1748.95	116	1507.72
1973	3307	129.87	1.03	3539.98	4.60	16287.43	2951.96	129	2288.34
1974	2183	152.51	1.07	2499.00	4.40	10995.58	1992.86	145	1374.38
1975	2050	137.05	1.07	2340.14	4.70	10986.97	1991.30	160	1244.56
1976	1984	137.05	1.07	2269.52	4.94	11205.77	2030.95	175	1160.54
1977	2425	144.30	1.07	2749.15	4.67	12838.54	2326.88	191	1218.26
1978	3483	124.78	1.07	3860.32	4.27	16483.59	2987.51	209	1429.43
1979	4255	124.00	1.07	4685.53	4.17	19526.95	3539.09	233	1518.92
1980	4211	130.50	1.07	4645.41	4.84	22483.76	4074.99	266	1531.95
1981	2447	151.50	1.07	2780.40	6.14	17071.63	3094.09	302	1024.53
1982	2932	151.00	1.07	3298.81	7.19	23718.45	4298.77	333	1290.92

a/ Notation: U.S. export price (PXU)
Transportation costs, U.S. to France (TUF)
Duties (DUF)
Landed price in France in current dollars (LPUFD)
Exchange rate: francs per dollar (ERFU)
Landed price in francs (LPUFF)
Landed price in 1970 U.S. dollars (LPUF70)
Consumer price index for France (CPIF)
Deflated landed price in France (DPUF)

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.15 U.S. Almond Prices in the United Kingdom, 1950-1982, (dollars per metric ton) a/

YEAR	PXU	TUUK	DUUK	LPUUKD	ERUKU	LPUUKP	LPUUK70	CPIUK	DPUUK
1950	1093	46.76	1.10	1253.74	0.36	447.95	1077.07	47	2291.64
1951	919	46.76	1.10	1062.34	0.36	380.64	915.23	52	1760.05
1952	763	46.76	1.10	890.74	0.36	317.68	763.83	55	1388.78
1953	739	46.76	1.10	864.34	0.36	307.22	738.69	56	1319.09
1954	787	46.79	1.10	917.17	0.36	328.51	789.88	58	1361.86
1955	1854	48.79	1.10	2093.07	0.36	748.19	1798.97	61	2949.14
1956	1922	56.35	1.10	2176.19	0.36	781.03	1877.92	63	2980.83
1957	985	59.79	1.10	1149.27	0.36	409.65	984.97	65	1515.33
1958	1936	57.14	1.10	2192.45	0.36	780.45	1876.54	66	2843.25
1959	917	44.48	1.10	1057.61	0.36	377.16	906.86	67	1353.52
1960	1063	46.76	1.10	1220.74	0.36	436.07	1048.50	68	1541.91
1961	1257	48.96	1.10	1436.56	0.36	511.12	1228.95	71	1730.91
1962	1614	50.02	1.10	1830.42	0.36	653.61	1571.54	73	2152.80
1963	1347	52.00	1.10	1538.90	0.36	550.47	1323.57	75	1764.75
1964	1444	54.64	1.10	1648.50	0.36	591.22	1421.55	78	1822.50
1965	1464	57.76	1.00	1521.76	0.36	544.20	1308.50	82	1595.73
1966	1464	60.70	1.00	1524.70	0.36	546.17	1313.23	84	1563.37
1967	1455	61.43	1.00	1516.43	0.40	608.25	1462.49	87	1681.03
1968	1455	64.08	1.00	1519.08	0.42	635.73	1528.57	92	1661.48
1969	1543	67.38	1.00	1610.38	0.42	671.94	1615.63	97	1665.60
1970	1499	74.42	1.00	1573.42	0.42	654.34	1573.30	105	1498.38
1971	1587	86.56	1.00	1673.56	0.40	663.06	1594.29	113	1410.87
1972	1764	94.65	1.00	1858.65	0.41	765.02	1839.43	123	1495.47
1973	3307	127.23	1.03	3537.26	0.42	1483.53	3567.02	137	2603.67
1974	2183	149.27	1.07	2495.53	0.43	1062.35	2554.33	164	1557.52
1975	2050	138.55	1.07	2341.75	0.45	1057.30	2542.20	201	1264.77
1976	1984	138.55	1.07	2271.13	0.59	1333.83	3207.10	233	1376.44
1977	2425	145.80	1.07	2750.76	0.54	1496.96	3599.33	259	1389.70
1978	3483	137.00	1.07	3873.40	0.49	1884.80	4531.85	283	1601.36
1979	4255	137.00	1.07	4699.44	0.45	2104.88	5061.02	335	1510.75
1980	4211	144.50	1.07	4660.39	0.45	2085.06	5013.36	382	1312.40
1981	2447	165.50	1.07	2795.38	0.55	1548.64	3723.58	420	886.57
1982	2932	165.00	1.07	3313.79	0.63	2100.61	5050.76	448	1127.40

a/ Notation: U.S. export price (PXU)
Transportation costs, U.S. to the United Kingdom (TUUK)
Duties (DUUK)
Landed price in the United Kingdom in current dollars (LPUUKD)
Exchange rate: pounds per dollar (ERUKU)
Landed price in pounds (LPUUKP)
Landed price in 1970 U.S. dollars (LPUUK70)
Consumer price index for the United Kingdom (CPIUK)
Deflated landed price in the United Kingdom (DPUUK)

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.16 U.S. Almond Prices in the Netherlands, 1950-1982 (dollars per metric ton) a/

YEAR	PXU	TUN	DUN	LPUND	ERNU	LPUNG	LPUN70	CPIN	DPUN
1950	1093	46.76	1.10	1253.74	3.81	4770.47	1329.19	51	2606.26
1951	919	46.76	1.10	1062.34	3.81	4042.19	1126.27	54	2085.69
1952	763	46.76	1.10	890.74	3.80	3387.02	943.72	54	1747.64
1953	739	46.76	1.10	864.34	3.79	3275.40	912.62	55	1659.31
1954	787	46.79	1.10	917.17	3.80	3489.19	972.19	57	1705.59
1955	1854	48.79	1.10	2093.07	3.82	8003.90	2230.12	58	3845.03
1956	1922	56.35	1.10	2176.19	3.83	8331.52	2321.41	60	3869.01
1957	985	59.79	1.10	1149.27	3.80	4364.35	1216.03	63	1930.21
1958	1936	57.14	1.10	2192.45	3.77	8272.79	2305.04	64	3601.62
1959	917	44.46	1.10	1057.61	3.77	3989.29	1111.53	65	1710.05
1960	1063	46.76	1.10	1220.74	3.68	4493.53	1252.03	66	1897.01
1961	1257	48.96	1.10	1430.68	3.60	5154.45	1436.18	67	2143.55
1962	1614	50.02	1.09	1815.45	3.60	6532.62	1820.15	70	2600.21
1963	1347	52.00	1.09	1526.31	3.61	5508.45	1534.81	73	2102.49
1964	1444	54.64	1.09	1635.02	3.60	5887.37	1640.39	77	2130.38
1965	1464	57.76	1.09	1653.39	3.61	5972.55	1664.13	81	2054.48
1966	1464	60.70	1.08	1649.73	3.61	5958.81	1660.30	85	1953.29
1967	1455	60.99	1.08	1640.30	3.61	5915.75	1648.30	88	1873.07
1968	1455	62.97	1.07	1624.23	3.63	5896.76	1643.01	93	1766.68
1969	1543	66.28	1.07	1721.93	3.62	6236.83	1737.76	98	1773.23
1970	1499	73.52	1.07	1682.60	3.59	6038.84	1682.60	104	1617.88
1971	1587	86.34	1.07	1790.47	3.28	5880.45	1638.47	112	1462.92
1972	1764	94.65	1.07	1988.76	3.01	5979.19	1665.98	121	1376.84
1973	3307	125.03	1.04	3569.31	2.67	9544.34	2659.33	131	2030.02
1974	2183	147.04	1.07	2493.14	2.51	6251.56	1741.87	144	1209.63
1975	2060	137.05	1.07	2340.14	2.70	6330.09	1763.75	158	1116.30
1976	1984	137.05	1.07	2269.52	2.49	5645.44	1572.98	170	925.28
1977	2425	144.30	1.07	2749.15	2.28	6268.06	1746.47	179	975.68
1978	3483	124.78	1.07	3860.32	2.03	7817.16	2178.09	187	1164.75
1979	4255	124.00	1.07	4685.53	1.97	9218.78	2568.62	196	1310.52
1980	4211	130.50	1.07	4645.41	2.27	10521.84	2931.69	209	1402.72
1981	2447	151.50	1.07	2780.40	2.61	7256.83	2021.96	223	906.71
1982	2932	151.00	1.07	3298.81	2.74	9038.74	2518.46	232	1085.54

a/ Notation: U.S. export price (PXU)
Transportation costs, U.S. to the Netherlands (TUN)
Duties (DUN)
Landed price in the Netherlands in current dollars (LPUND)
Exchange rate: guilders per dollar (ERNU)
Landed price in guilders (LPUNG)
Landed price in 1970 U.S. dollars (LPUN70)
Consumer price index for the Netherlands (CPIN)
Deflated landed price in the Netherlands (DPUN)

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.17 U.S. Almond Prices in Sweden, 1950-1982 (dollars per metric ton) a/

YEAR	PXU	TUD	DSWE	LPUSWED	ERSWEU	LPUSWEK	LPUSWE7	CPISWE	DPUSWE
1950	1093	50.07	1	1143.07	5.18	5921.10	1143.33	47	2432.63
1951	919	50.07	1	969.07	5.18	5019.78	969.29	52	1864.03
1952	763	50.07	1	813.07	5.18	4211.70	813.28	55	1478.65
1953	739	50.07	1	789.07	5.18	4084.62	788.72	55	1434.04
1954	787	51.86	1	838.86	5.17	4339.42	837.92	56	1496.29
1955	1854	56.94	1	1910.94	5.17	9885.29	1908.80	58	3291.03
1956	1922	59.66	1	1981.66	5.17	10253.11	1979.82	60	3299.71
1957	985	57.58	1	1042.58	5.18	5395.35	1041.81	63	1653.67
1958	1936	56.04	1	1992.04	5.17	10305.82	1990.00	66	3015.15
1959	917	47.54	1	964.54	5.17	4991.01	963.74	67	1438.42
1960	1063	48.96	1	1111.96	5.17	5752.17	1110.71	69	1609.73
1961	1257	51.17	1	1308.17	5.17	6768.21	1306.91	72	1815.15
1962	1614	52.23	1	1666.23	5.18	8637.74	1667.90	74	2253.92
1963	1347	54.64	1	1401.64	5.17	7250.68	1400.07	76	1842.20
1964	1444	56.85	1	1500.85	5.16	7738.08	1494.18	79	1891.37
1965	1464	60.15	1	1524.15	5.17	7883.67	1522.30	83	1834.09
1966	1464	62.91	1	1526.91	5.17	7898.40	1525.14	88	1733.11
1967	1455	63.19	1	1518.19	5.17	7849.80	1515.76	90	1684.17
1968	1455	65.78	1	1520.78	5.17	7869.28	1519.52	92	1651.65
1969	1543	68.93	1	1611.93	5.18	8356.25	1613.55	97	1663.45
1970	1499	76.91	1	1575.91	5.18	8161.32	1575.91	104	1515.30
1971	1587	89.76	1	1676.76	4.85	8132.29	1570.30	111	1414.69
1972	1764	97.96	1	1861.96	4.52	8424.44	1626.72	118	1378.57
1973	3307	129.09	1	3436.09	4.39	15097.49	2915.25	127	2295.47
1974	2183	149.27	1	2332.27	4.11	9576.30	1849.14	140	1320.81
1975	2050	138.55	1	2188.55	4.43	9700.75	1873.17	155	1208.49
1976	1984	138.55	1	2122.55	4.24	9010.22	1739.83	170	1023.43
1977	2425	145.80	1	2570.80	4.66	11979.93	2313.26	191	1211.13
1978	3483	137.00	1	3620.00	4.33	15683.65	3028.43	204	1484.53
1979	4255	148.00	1	4403.00	4.22	18558.65	3583.58	226	1585.66
1980	4211	155.50	1	4366.50	4.55	19867.58	3836.33	257	1492.73
1981	2447	176.50	1	2623.50	5.80	15216.30	2938.19	282	1041.91
1982	2932	176.00	1	3108.00	7.15	22222.20	4290.99	306	1402.29

a/ Notation: U.S. export price (PXU)
Transportation costs, U.S. to Sweden (TUD)
Duties (DSWE)
Landed price in Sweden in current dollars (LPUSWED)
Exchange rate: krona per dollar (ERSWEU)
Landed price in krona (LPUSWEK)
Landed price in 1970 U.S. dollars (LPUSWE7)
Consumer price index for Sweden (CPISWE)
Deflated landed price in Sweden (DPUSWE)

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.18 U.S. Almond Prices in Italy, 1950-1982 (dollars per metric ton) a/

YEAR	PXU	TUI	DUI	LPUID	ERIU	LPUIL	LPUI70	CPII	DPUI
1950	1093	50.07	1.10	1257.38	625.00	785861	1261.41	52	2425.80
1951	919	50.07	1.10	1065.98	625.00	666236	1069.40	56	1909.64
1952	763	50.07	1.10	894.38	625.00	558986	897.25	58	1546.98
1953	739	50.07	1.10	867.98	625.00	542486	870.76	59	1475.87
1954	787	51.86	1.10	922.75	625.00	576716	925.71	61	1517.55
1955	1854	56.94	1.10	2102.03	625.00	1313771	2108.78	63	3347.27
1956	1922	59.66	1.10	2179.83	625.00	1362391	2186.82	65	3364.34
1957	985	57.58	1.10	1146.84	625.00	716774	1150.52	67	1717.19
1958	1936	56.04	1.10	2191.24	622.75	1364597	2190.36	67	3269.20
1959	917	47.76	1.10	1061.24	621.00	659028	1057.83	68	1555.63
1960	1063	50.07	1.10	1224.38	621.25	760644	1220.94	69	1769.47
1961	1257	52.27	1.10	1434.31	621.00	890704	1429.70	72	1985.70
1962	1614	53.33	1.09	1819.06	621.00	1129634	1813.22	76	2385.81
1963	1347	55.74	1.09	1530.39	623.50	954198	1531.62	81	1890.89
1964	1444	57.95	1.09	1638.63	625.00	1024142	1643.89	85	1933.99
1965	1464	63.71	1.09	1659.86	624.50	1036581	1663.85	87	1912.47
1966	1464	67.32	1.08	1656.89	624.25	1034313	1660.21	90	1844.68
1967	1455	67.60	1.08	1647.45	623.25	1026775	1648.11	93	1772.17
1968	1455	69.59	1.07	1631.31	625.25	1019977	1637.20	94	1741.71
1969	1543	73.34	1.07	1729.48	628.50	1086981	1744.75	98	1780.36
1970	1499	80.90	1.07	1690.49	623.00	1053177	1690.49	103	1641.26
1971	1587	91.60	1.07	1796.10	592.50	1064191	1708.17	108	1581.64
1972	1764	106.56	1.07	2001.50	583.75	1168375	1875.40	117	1602.91
1973	3307	137.13	1.04	3581.90	611.75	2191224	3517.21	132	2664.56
1974	2183	160.72	1.07	2507.78	646.00	1620026	2600.36	161	1615.13
1975	2050	142.20	1.07	2345.65	672.50	1577452	2532.03	183	1383.62
1976	1984	142.20	1.07	2275.03	876.65	1994409	3201.30	219	1461.78
1977	2425	144.30	1.07	2749.15	865.25	2378703	3818.14	251	1521.17
1978	3483	144.30	1.07	3881.21	831.45	3227033	5179.83	283	1830.33
1979	4255	145.50	1.07	4708.54	835.73	3935064	6316.31	329	1919.85
1980	4211	148.50	1.07	4664.67	1007.98	4701889	7547.17	405	1863.50
1981	2447	169.50	1.07	2799.66	1270.70	3557521	5710.31	477	1197.13
1982	2932	169.00	1.07	3318.07	1436.40	4766076	7650.20	549	1393.48

a/ Notation: U.S. export price (PXU)
Transportation costs, U.S. to Italy (TUI)
Duties (DUI)
Landed price in Italy in current dollars (LPUID)
Exchange rate: lira per dollar (ERIU)
Landed price in lira (LPUIL)
Landed price in 1970 U.S. dollars (LPUI70)
Consumer price index for Italy (CPII)
Deflated landed price in Italy (DPUI)

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.19 Spanish Almond Prices in Spain, 1950-1980 (dollars per metric ton) a/

YEAR	PASUK	ERUUK	ERSU	PXSP	PXS70	CPIS	DPSS
1950	264	2.799	26.27	19414.2	278.54	35	795.83
1951	359	2.791	24.23	24271.8	348.23	36	967.31
1952	293	2.804	25.00	20538.6	294.67	36	818.53
1953	309	2.813	25.00	21733.5	311.82	37	842.74
1954	405	2.792	27.71	31332.2	449.53	38	1182.97
1955	773	2.797	30.42	65782.3	943.79	39	2419.98
1956	596	2.786	33.31	55324.0	793.75	43	1845.92
1957	380	2.806	42.00	44775.8	642.41	48	1338.35
1958	415	2.809	42.00	48964.4	702.50	52	1350.96
1959	338	2.804	60.00	56867.1	815.88	55	1483.43
1960	387	2.799	60.08	65083.3	933.76	56	1667.44
1961	405	2.811	60.00	68294.7	979.84	58	1689.38
1962	549	2.800	59.98	92217.7	1323.07	62	2133.98
1963	566	2.796	59.96	94879.2	1361.25	67	2031.72
1964	514	2.788	59.98	85966.1	1233.37	74	1666.72
1965	517	2.796	60.03	86781.0	1245.06	81	1537.12
1966	501	2.792	60.03	83964.4	1204.65	86	1400.76
1967	573	2.493	67.34	96198.3	1380.18	91	1516.68
1968	601	2.389	69.88	100353.9	1439.80	94	1531.70
1969	847	2.397	69.90	141891.4	2035.74	98	2077.29
1970	690	2.405	69.71	115652.7	1659.29	104	1595.47
1971	795	2.524	67.76	135944.3	1950.42	113	1726.04
1972	1040	2.429	61.54	155479.1	2230.69	124	1798.94
1973	1582	2.384	57.47	216738.3	3109.59	139	2237.11
1974	1099	2.349	56.58	146058.0	2095.52	162	1293.53
1975	1067	2.215	58.79	138944.6	1993.47	189	1054.74
1976	1298	1.702	68.57	151529.1	2174.02	229	949.35
1977	1580	1.837	81.10	235453.6	3378.10	286	1181.15
1978	2065	2.055	69.14	293400.8	4209.48	331	1271.75
1979	2396	2.233	68.63	367106.7	5266.95	387	1360.97
1980	1739	2.235	83.40	324147.8	4650.61	444	1047.44

a/ Notation: Price of Spanish almonds landed in the United Kingdom expressed in pounds (PASUK)
Exchange rate: U.S. dollars per pound (ERUUK)
Exchange rate: pesos per dollar (ERSU)
Price of Spanish exports expressed in pesos (PXSP)
Price of Spanish exports expressed in 1970 U.S. dollars (PXS70)
Consumer price index for Spain (CPIS)
Deflated landed price in Spain (DPSS)

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.20 Spanish Almond Prices in the United States, 1950-1980, (dollars per metric ton) a/

YEAR	PASUK	ERUUK	LPSUKD	DLBU	DUSU	LPSU	CPIU	DPSU
1950	264	2.80	738.88	0.265	584.22	1323.10	65	2035.54
1951	359	2.79	1001.93	0.165	363.76	1365.69	66	2069.23
1952	293	2.80	821.54	0.165	363.76	1185.30	67	1769.11
1953	309	2.81	869.34	0.165	363.76	1233.10	69	1787.10
1954	405	2.79	1130.72	0.165	363.76	1494.48	69	2165.91
1955	773	2.80	2162.47	0.165	363.76	2526.23	70	3608.90
1956	596	2.79	1660.63	0.165	363.76	2024.39	72	2811.66
1957	380	2.81	1066.09	0.165	363.76	1429.85	74	1932.23
1958	415	2.81	1165.82	0.165	363.76	1529.58	75	2039.44
1959	338	2.80	947.79	0.265	584.22	1532.00	76	2015.80
1960	387	2.80	1083.37	0.165	363.76	1447.13	77	1879.39
1961	405	2.81	1138.29	0.165	363.76	1502.05	78	1925.71
1962	549	2.80	1537.47	0.165	363.76	1901.23	79	2406.62
1963	566	2.80	1582.31	0.165	363.76	1946.07	80	2432.59
1964	514	2.79	1433.19	0.165	363.76	1796.95	81	2218.45
1965	517	2.80	1445.69	0.165	363.76	1809.45	83	2180.06
1966	501	2.79	1398.59	0.165	363.76	1762.35	85	2073.35
1967	573	2.49	1428.55	0.165	363.76	1792.31	88	2036.71
1968	601	2.39	1436.09	0.165	363.76	1799.85	92	1956.36
1969	847	2.40	2029.92	0.165	363.76	2393.68	97	2467.71
1970	690	2.40	1659.17	0.165	363.76	2022.93	102	1983.27
1971	795	2.52	2006.26	0.165	363.76	2370.02	106	2235.87
1972	1040	2.43	2526.47	0.165	363.76	2890.23	111	2603.81
1973	1582	2.38	3771.33	0.165	363.76	4135.09	121	3417.43
1974	1099	2.35	2581.44	0.165	363.76	2945.20	133	2214.44
1975	1067	2.21	2363.41	0.165	363.76	2727.16	143	1907.11
1976	1298	1.70	2209.84	0.165	363.76	2573.60	151	1704.37
1977	1580	1.84	2903.25	0.165	363.76	3267.01	161	2029.20
1978	2065	2.06	4243.58	0.165	363.76	4607.33	176	2617.80
1979	2396	2.23	5349.07	0.165	363.76	5712.83	200	2856.41
1980	1739	2.23	3886.66	0.165	363.76	4250.42	223	1906.02

a/ Notation: Price of Spanish almonds landed in the United Kingdom expressed in pounds (PASUK)
Exchange rate: U.S. dollars per pound (ERUUK)
Landed price of Spanish almonds in the U.S. in dollars (LPSUKD)
Duty in cents per pound (DLBU)
Duty in dollars per metric ton (DUSU)
Landed price of Spanish almonds in the U.S. (LPSU)
Consumer price index for the United States (CPIU)
Deflated landed price in the United States (DPSU)

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.21 Sugar Prices in Selected Countries, 1950-1980, (domestic value/kg) a/

YEAR	RSU	RSC	RSWG	RSF	RSUK	RSN
1950	0.179	24.2	0.89	0.75	0.041	0.57
1951	0.183	28.7	0.89	0.76	0.041	0.68
1952	0.190	24.9	1.02	0.90	0.041	0.68
1953	0.190	22.9	1.05	0.89	0.056	0.68
1954	0.187	22.9	1.02	0.84	0.060	0.62
1955	0.187	20.2	1.02	0.83	0.062	0.61
1956	0.187	20.1	1.02	0.78	0.068	0.58
1957	0.185	21.8	1.05	0.71	0.077	0.62
1958	0.187	25.8	0.92	0.73	0.051	0.70
1959	0.190	20.0	0.95	0.76	0.068	0.74
1960	0.194	20.1	0.95	0.89	0.064	0.74
1961	0.192	21.2	0.92	0.89	0.064	0.73
1962	0.218	20.7	0.95	0.91	0.068	0.73
1963	0.247	24.5	0.95	0.95	0.068	0.73
1964	0.203	42.8	0.95	0.96	0.077	0.80
1965	0.212	21.0	0.95	0.96	0.073	0.85
1966	0.207	21.2	0.95	0.96	0.065	0.85
1967	0.218	19.2	0.95	1.00	0.064	0.88
1968	0.229	21.2	0.90	1.09	0.068	0.93
1969	0.240	23.8	0.95	1.07	0.074	0.98
1970	0.254	24.7	0.90	1.08	0.072	0.87
1971	0.265	27.3	0.93	1.18	0.083	0.89
1972	0.278	34.3	0.95	1.28	0.087	0.92
1973	0.379	35.6	0.96	1.30	0.093	0.92
1974	0.908	89.9	1.04	1.44	0.122	1.00
1975	0.505	83.3	1.23	1.74	0.251	1.18
1976	0.371	51.8	1.24	1.86	0.217	1.20
1977	0.403	47.6	1.26	2.29	0.233	1.23
1978	0.470	54.6	1.28	2.52	0.254	1.27
1979	0.652	62.8	1.29	2.72	0.288	1.29
1980	0.829	98.5	1.34	2.99	0.332	1.33

a/ Notation: Actual sugar price (RSj) in country j
United States (U) in $/kg
Canada (C) in cents/kg
West Germany (WG) in DM/kg
France (F) in fr/kg
United Kingdom (UK) in pence/kg
Netherlands (N) in guilders/kg

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.22 Deflated Sugar Prices, 1950-1980, (1970 U.S.$/kg) a/

YEAR	DRSU	DRSC	DRSWG	DRSF	DRSUK	DRSN
1950	0.275	0.367	0.375	0.316	0.207	0.311
1951	0.277	0.404	0.358	0.281	0.191	0.351
1952	0.283	0.345	0.411	0.320	0.180	0.351
1953	0.275	0.318	0.429	0.316	0.242	0.344
1954	0.272	0.318	0.411	0.299	0.249	0.303
1955	0.268	0.280	0.399	0.289	0.245	0.293
1956	0.260	0.275	0.388	0.267	0.260	0.269
1957	0.250	0.290	0.394	0.222	0.283	0.274
1958	0.250	0.339	0.336	0.210	0.184	0.305
1959	0.249	0.259	0.343	0.206	0.244	0.317
1960	0.252	0.257	0.338	0.234	0.227	0.312
1961	0.246	0.268	0.319	0.224	0.218	0.304
1962	0.276	0.258	0.318	0.220	0.224	0.291
1963	0.309	0.302	0.310	0.221	0.218	0.279
1964	0.250	0.514	0.300	0.217	0.236	0.289
1965	0.255	0.243	0.290	0.212	0.213	0.292
1966	0.244	0.237	0.284	0.207	0.186	0.279
1967	0.248	0.208	0.281	0.208	0.178	0.279
1968	0.249	0.220	0.260	0.215	0.178	0.279
1969	0.248	0.237	0.267	0.198	0.183	0.279
1970	0.249	0.239	0.243	0.190	0.166	0.233
1971	0.250	0.254	0.239	0.196	0.176	0.221
1972	0.250	0.302	0.229	0.200	0.170	0.212
1973	0.313	0.287	0.217	0.183	0.164	0.196
1974	0.683	0.656	0.221	0.180	0.179	0.193
1975	0.353	0.551	0.248	0.197	0.300	0.208
1976	0.246	0.321	0.239	0.193	0.224	0.197
1977	0.250	0.271	0.236	0.217	0.216	0.191
1978	0.267	0.286	0.232	0.219	0.216	0.189
1979	0.326	0.300	0.224	0.212	0.207	0.183
1980	0.372	0.422	0.220	0.204	0.209	0.177

a/ Notation: Sugar prices as shown in Table A.21 expressed in 1970 U.S. $/kg and deflated by the respective country CPI.

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.23 Cocoa Prices, 1950-1980 a/

YEAR	RCU	RCUK
1950	0.83	205.21
1951	0.77	280.99
1952	0.73	296.98
1953	1.11	283.13
1954	1.07	459.62
1955	0.67	297.23
1956	0.58	218.08
1957	0.87	243.27
1958	0.89	346.85
1959	0.70	280.99
1960	0.56	222.26
1961	0.49	177.08
1962	0.50	167.39
1963	0.54	204.88
1964	0.45	187.66
1965	0.45	138.36
1966	0.59	193.23
1967	0.66	238.01
1968	0.92	319.54
1969	0.88	415.48
1970	0.69	305.53
1971	0.60	232.40
1972	0.95	270.49
1973	1.85	585.35
1974	2.02	990.14
1975	1.77	722.74
1976	3.48	1399.44
1977	3.91	2545.00
1978	3.94	1868.30
1979	3.13	1557.00
1980	2.54	2004.00

a/ Notation: U.S. cocoa prices (RCU) in dollars per kilogram.
U.K. cocoa prices (RCUK) in pounds per kilogram.

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.24 Deflated Cocoa Prices, 1950-1980, (1970 U.S. $/kg) a/

YEAR	DRCU	DRCC	DRCJ	DRCWG	DRCF	DRCN	DRCSWE	DRCS	DRCI	DRCUK
1950	1.283	1.348	2.005	1.015	0.847	1.194	1.222	0.619	1.108	1.050
1951	1.170	1.108	1.695	1.326	1.015	1.540	1.508	0.757	1.405	1.299
1952	1.097	0.996	1.513	1.408	1.036	1.634	1.514	0.830	1.440	1.298
1953	1.611	1.509	2.158	1.367	0.991	1.529	1.448	0.772	1.354	1.216
1954	1.556	1.454	2.042	2.172	1.596	2.386	2.289	1.343	2.110	1.905
1955	0.952	0.917	1.266	1.370	1.014	1.527	1.432	0.931	1.324	1.172
1956	0.802	0.760	1.077	0.971	0.727	1.080	1.012	0.675	0.938	0.832
1957	1.179	1.128	1.597	1.076	0.896	1.146	1.083	0.857	1.022	0.900
1958	1.183	1.126	1.626	1.489	1.325	1.601	1.475	1.129	1.454	1.264
1959	0.926	0.875	1.243	1.186	1.046	1.274	1.175	1.233	1.155	1.008
1960	0.727	0.716	0.955	0.902	0.801	0.967	0.901	0.958	0.899	0.786
1961	0.627	0.649	0.797	0.690	0.614	0.746	0.691	0.739	0.689	0.600
1962	0.635	0.674	0.752	0.626	0.555	0.671	0.634	0.651	0.615	0.551
1963	0.676	0.719	0.771	0.744	0.652	0.789	0.753	0.735	0.708	0.657
1964	0.556	0.583	0.605	0.658	0.581	0.682	0.659	0.609	0.618	0.578
1965	0.545	0.564	0.580	0.473	0.419	0.481	0.466	0.411	0.446	0.406
1966	0.691	0.711	0.717	0.642	0.574	0.639	0.612	0.540	0.601	0.553
1967	0.748	0.768	0.774	0.700	0.609	0.678	0.658	0.630	0.638	0.658
1968	0.999	1.025	1.012	0.884	0.746	0.831	0.829	0.814	0.815	0.835
1969	0.906	0.932	0.907	1.044	1.022	1.025	1.028	1.019	1.025	1.030
1970	0.681	0.674	0.714	0.713	0.706	0.706	0.706	0.713	0.700	
1971	0.569	0.560	0.486	0.487	0.507	0.479	0.495	0.505	0.516	0.495
1972	0.852	0.827	0.646	0.482	0.497	0.455	0.487	0.468	0.526	0.529
1973	1.533	1.477	1.044	0.802	0.902	0.794	0.932	0.828	1.038	1.027
1974	1.517	1.476	1.009	1.198	1.279	1.128	1.317	1.165	1.498	1.452
1975	1.241	1.170	0.799	0.835	0.851	0.764	0.884	0.714	0.944	0.865
1976	2.307	2.211	1.429	1.089	1.218	0.971	1.149	1.024	1.531	1.444
1977	2.430	2.463	1.227	1.808	2.072	1.660	2.203	1.903	2.588	2.363
1978	2.237	2.422	1.292	1.297	1.422	1.158	1.574	1.151	1.811	1.587
1979	1.564	1.745	0.896	1.081	1.127	0.973	1.252	0.885	1.418	1.118
1980	1.137	1.289	0.621	1.971	1.919	1.757	1.990	1.568	2.325	1.639

a/ Notation: Cocoa prices (DRCj) for the United States, Canada and Japan are based on the U.S. price (Appendix Table A.23) deflated by the respective country CPI and expressed in 1970 U.S. dollars; prices for European countries are based on the United Kingdom price (Appendix Table A.23) and are adjusted for exchange rates and the consumer price indexes for respective countries.

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.25 Filbert Prices, 1950-1980,
(pounds per metric ton) a/

YEAR	RFUK
1950	272
1951	272
1952	231
1953	269
1954	249
1955	329
1956	296
1957	296
1958	296
1959	320
1960	386
1961	459
1962	454
1963	409
1964	343
1965	414
1966	396
1967	488
1968	530
1969	594
1970	528
1971	506
1972	521
1973	594
1974	781
1975	735
1976	838
1977	1038
1978	1153
1979	1340
1980	1813

a/ Prices for the years 1950-1978 are for Turkish Kerassundes and prices for the years 1979-1980 are for Turkish Levants.

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.26 Deflated Filbert Prices, 1950-1980 (1970 dollars per metric ton) a/

YEAR	DRFU	DRFC	DRFJ	DRFF	DRFUK	DRFN	DRFSWE	DRFS	DRFI	DRFWG
1950	1.171	1.231	1.830	1.123	1.391	1.583	1.620	0.820	1.469	1.346
1951	1.150	1.089	1.666	0.983	1.258	1.490	1.460	0.733	1.360	1.284
1952	0.967	0.878	1.334	0.805	1.010	1.271	1.178	0.645	1.120	1.095
1953	1.097	1.027	1.469	0.941	1.155	1.453	1.375	0.734	1.287	1.298
1954	1.008	0.942	1.322	0.865	1.032	1.293	1.240	0.727	1.143	1.177
1955	1.315	1.267	1.748	1.123	1.297	1.691	1.585	1.030	1.466	1.516
1956	1.145	1.085	1.538	0.987	1.130	1.466	1.373	0.917	1.273	1.318
1957	1.122	1.073	1.520	1.090	1.095	1.395	1.317	1.043	1.243	1.309
1958	1.109	1.055	1.524	1.131	1.078	1.366	1.259	0.964	1.241	1.270
1959	1.181	1.116	1.586	1.191	1.148	1.451	1.338	1.404	1.315	1.351
1960	1.403	1.382	1.843	1.391	1.365	1.679	1.564	1.663	1.562	1.567
1961	1.654	1.713	2.104	1.592	1.554	1.933	1.790	1.915	1.786	1.789
1962	1.609	1.708	1.908	1.506	1.495	1.821	1.720	1.765	1.668	1.699
1963	1.429	1.521	1.631	1.302	1.311	1.575	1.503	1.468	1.413	1.486
1964	1.181	1.238	1.286	1.062	1.057	1.246	1.205	1.112	1.129	1.202
1965	1.395	1.444	1.483	1.254	1.214	1.438	1.393	1.231	1.334	1.416
1966	1.301	1.338	1.349	1.177	1.134	1.309	1.255	1.107	1.231	1.315
1967	1.383	1.420	1.431	1.249	1.349	1.389	1.350	1.292	1.309	1.436
1968	1.377	1.413	1.395	1.238	1.385	1.378	1.375	1.351	1.352	1.466
1969	1.468	1.508	1.469	1.461	1.472	1.466	1.469	1.457	1.465	1.493
1970	1.245	1.245	1.233	1.233	1.209	1.221	1.221	1.221	1.233	1.233
1971	1.205	1.185	1.027	1.103	1.077	1.043	1.077	1.099	1.124	1.060
1972	1.140	1.107	0.864	0.957	1.018	0.876	0.937	0.901	1.014	0.929
1973	1.170	1.128	0.797	0.915	1.043	0.805	0.946	0.840	1.053	0.814
1974	1.379	1.342	0.917	1.009	1.145	0.890	1.039	0.919	1.182	0.945
1975	1.138	1.073	0.733	0.866	0.879	0.777	0.899	0.727	0.960	0.849
1976	0.945	0.905	0.585	0.730	0.865	0.582	0.688	0.613	0.917	0.652
1977	1.185	1.201	0.598	0.845	0.964	0.677	0.899	0.776	1.055	0.737
1978	1.346	1.457	0.778	0.877	0.980	0.715	0.972	0.710	1.117	0.800
1979	1.496	1.669	0.857	0.970	0.962	0.837	1.077	0.761	1.220	0.930
1980	1.817	2.061	0.993	1.336	1.141	1.224	1.385	1.092	1.619	1.372

a/ Notation: Filbert prices (DRFj) are based on the U.K. price (Appendix Table A.25) converted to the respective country currency and expressed in 1970 $/M.T. deflated by the respective country consumer price index.

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.27 Private Final Consumption, 1950-1982 (in billions) a/

YEAR	EU	EC	EJ	EWG	EF	EUK	EN	ESWE
1950	192.0	12.7	3235	63.6	67.5	9.46	12.86	21.2
1951	207.1	14.2	3758	76.5	78.9	10.39	13.68	23.4
1952	217.1	14.6	4263	83.8	90.4	10.69	14.04	25.9
1953	229.7	16.5	4656	89.7	101.8	11.42	14.76	27.7
1954	235.8	17.2	4708	98.4	108.5	12.24	16.41	29.5
1955	253.7	18.2	5206	108.6	115.2	12.94	18.08	31.2
1956	266.0	19.5	5687	119.4	131.2	13.72	19.63	32.9
1957	280.4	21.1	6300	127.4	144.1	14.50	20.64	35.1
1958	289.5	22.8	7028	136.3	161.5	15.26	21.18	37.8
1959	310.8	24.0	7247	145.6	173.0	15.90	22.11	40.3
1960	324.9	25.2	8844	172.4	183.9	16.75	24.14	44.0
1961	335.0	26.4	9632	176.9	200.9	17.38	25.74	46.6
1962	355.2	27.8	10068	202.4	229.8	18.32	27.58	50.1
1963	374.6	28.8	12050	219.3	255.1	19.89	31.86	54.3
1964	400.5	32.1	12983	231.5	276.4	21.35	35.26	58.5
1965	430.4	34.8	17047	255.8	295.3	22.63	39.82	64.6
1966	465.1	38.2	19301	272.6	320.3	24.07	43.58	68.9
1967	490.3	41.1	23306	280.7	355.8	25.36	46.89	73.2
1968	536.9	42.5	26639	302.7	383.9	27.06	50.24	80.5
1969	581.8	46.7	30636	332.1	440.0	28.45	57.92	85.8
1970	621.7	49.3	36295	371.6	474.2	30.92	64.70	93.8
1971	672.2	53.7	41299	410.1	527.5	34.44	72.83	99.0
1972	737.1	59.4	47152	447.9	588.3	39.10	82.02	107.4
1973	812.0	67.1	56626	492.6	665.2	44.40	92.61	116.8
1974	888.1	78.9	69859	532.9	788.9	51.50	104.14	132.0
1975	976.4	95.9	69975	574.6	890.5	51.64	120.74	132.0
1976	1084.3	109.4	82486	617.5	1023.4	63.10	136.78	150.0
1977	1205.5	120.7	93449	665.1	1144.2	73.10	152.36	172.0
1978	1348.7	133.6	105789	713.1	1326.7	98.21	179.17	198.0
1979	1510.9	149.0	115910	766.4	1516.6	115.97	191.23	217.0
1980	1672.8	166.5	127319	821.6	1745.1	134.50	202.50	240.8
1981	1873.0	191.5	137458	873.6	2008.4	151.24	211.08	301.0
1982	2008.0	207.8	144845	899.4	2302.4	165.92	221.83	336.6

a/ Notation: Expenditures (Ej) in U.S. (US$), Canada (Can$), Japan (yen), West Germany (D.M.) France (francs), United Kingdom (pounds), Netherlands (guilder), and Sweden (krona).

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.28 Population, 1950-1983 (millions) a/ b/

YEAR	POPU	POPC	POPJ	POPWG	POPF	POPUK	POPN	POPSWE	POPS	POPI	POPNE	POPSC
1950	151.7	13.8	82.9	47.7	41.9	50.6	10.1	7.02	27.9	46.3	23.3	14.98
1951	154.4	14.0	84.3	48.1	42.2	50.6	10.3	7.07	28.1	46.6	23.6	15.12
1952	157.0	14.4	85.5	48.5	42.6	50.4	10.4	7.13	28.3	46.9	23.7	15.27
1953	160.0	14.8	86.7	48.9	42.9	50.9	10.5	7.17	28.5	47.0	24.0	15.41
1954	162.4	15.2	88.2	51.7	43.0	51.1	10.6	7.21	28.8	47.7	24.1	15.53
1955	165.3	15.6	89.1	52.2	43.3	51.2	10.8	7.26	29.0	48.0	24.4	15.66
1956	168.2	16.1	90.0	53.0	43.6	51.4	10.9	7.32	29.2	48.3	24.6	15.82
1957	171.2	16.6	90.9	53.7	44.1	51.7	11.0	7.32	29.4	48.5	24.7	15.93
1958	174.8	17.1	91.8	54.4	44.6	51.9	11.2	7.41	29.7	48.7	25.1	16.13
1959	177.7	17.4	92.7	54.9	45.1	52.2	11.4	7.45	29.9	49.1	25.3	16.25
1960	180.7	17.8	93.2	55.6	45.5	52.5	11.5	7.48	30.1	49.4	25.5	16.42
1961	183.7	18.3	94.1	56.2	45.9	52.9	11.6	7.52	30.6	49.5	25.7	16.63
1962	186.6	18.6	94.9	56.9	46.9	53.4	11.8	7.56	30.8	50.2	26.0	16.86
1963	189.2	18.9	95.9	57.6	47.8	53.6	12.0	7.60	31.1	51.2	26.3	17.04
1964	192.1	19.3	96.9	58.3	48.4	54.2	12.1	7.66	31.3	51.1	26.5	17.23
1965	194.6	19.6	97.9	59.0	48.9	54.6	12.3	7.73	31.6	51.6	26.9	17.40
1966	196.9	20.1	98.9	59.7	49.4	54.7	12.5	7.81	31.9	51.9	27.1	17.56
1967	199.1	20.4	99.9	59.9	49.9	55.1	12.6	7.87	32.1	52.4	27.3	17.72
1968	201.2	20.8	101.1	60.2	49.9	55.3	12.7	7.91	32.6	52.8	27.5	17.87
1969	203.2	21.0	102.3	60.8	50.3	55.5	12.9	7.98	32.9	53.2	27.7	18.05
1970	204.9	21.3	104.3	60.7	50.8	55.4	13.0	8.04	33.8	53.7	27.9	18.20
1971	208.0	21.6	104.7	61.3	51.3	55.6	13.2	8.10	34.1	54.1	28.2	18.33
1972	209.0	21.8	107.0	61.7	51.7	55.8	13.3	8.12	34.5	54.3	28.3	18.48
1973	211.0	22.1	108.3	62.0	52.1	55.9	13.4	8.14	34.9	54.9	28.6	18.53
1974	213.8	22.5	109.6	62.0	52.5	56.0	13.5	8.16	35.2	55.4	28.6	18.59
1975	216.0	22.8	111.0	61.8	52.8	56.0	13.7	8.20	35.5	55.8	28.9	18.61
1976	218.0	23.1	112.8	61.5	52.9	56.0	13.8	8.22	35.9	56.7	29.1	18.59
1977	220.2	23.3	113.9	61.4	53.0	55.9	13.9	8.25	36.6	56.4	29.2	18.62
1978	222.6	23.5	114.9	61.3	53.3	55.8	14.0	8.27	36.8	56.7	29.3	18.66
1979	225.1	23.7	115.9	61.4	53.5	55.9	14.0	8.29	37.2	56.9	29.3	18.72
1980	227.8	23.9	116.8	61.6	53.7	56.0	14.1	8.31	37.4	57.0	29.4	18.77
1981	229.8	24.3	117.6	61.7	54.0	56.3	14.2	8.32	37.6	56.5	29.6	18.85
1982	232.1	24.6	118.4	61.6	54.2	56.3	14.3	8.33	37.9	56.7	29.6	18.78
1983	233.7	24.9	119.3	61.4	54.6	55.8	14.4	8.33	38.2	56.6	29.7	18.97

a/ Population as of mid-year.
b/ Notation for population (POP) in country (j) is as follows: U = U.S.; C = Canada; J = Japan; WG = West Germany; F = France; UK = United Kingdom; N = Netherlands; SWE = Sweden; S = Spain; I = Italy; NE = Belguim, Denmark, Luxemburg and the Netherlands; and SC = Norway, Sweden and Switzerland.

Source: United Nations (1985)

APPENDIX TABLE A.29 Per Capita PCE deflated by CPI and expressed in 1970 U.S. dollars, 1950-1980 a/

YEAR	DEU	DEC	DEJ	DEWG	DEF	DEUK	DEN	DESWE
1950	1.95	1.39	0.26	0.56	0.68	0.96	0.70	1.24
1951	2.03	1.43	0.27	0.64	0.69	0.95	0.69	1.23
1952	2.06	1.41	0.28	0.70	0.75	0.93	0.70	1.28
1953	2.08	1.55	0.29	0.75	0.84	0.96	0.71	1.36
1954	2.10	1.57	0.28	0.77	0.90	0.99	0.76	1.41
1955	2.19	1.62	0.31	0.81	0.93	1.00	0.80	1.43
1957	2.21	1.69	0.35	0.89	1.02	1.04	0.83	1.47
1959	2.30	1.79	0.38	0.96	1.04	1.09	0.83	1.56
1960	2.34	1.81	0.45	1.10	1.06	1.13	0.89	1.65
1961	2.34	1.82	0.46	1.09	1.10	1.11	0.92	1.66
1962	2.41	1.86	0.44	1.19	1.18	1.13	0.93	1.73
1963	2.47	1.88	0.49	1.24	1.24	1.19	1.01	1.81
1964	2.57	2.00	0.50	1.25	1.29	1.21	1.05	1.87
1965	2.66	2.06	0.62	1.32	1.33	1.22	1.11	1.94
1966	2.78	2.13	0.66	1.36	1.40	1.26	1.14	1.94
1967	2.80	2.18	0.76	1.38	1.49	1.27	1.18	2.00
1968	2.90	2.12	0.81	1.45	1.52	1.28	1.19	2.14
1969	2.95	2.21	0.86	1.53	1.62	1.27	1.28	2.14
1970	2.97	2.24	0.94	1.65	1.64	1.28	1.33	2.17
1971	3.05	2.31	1.01	1.72	1.71	1.32	1.37	2.12
1972	3.18	2.40	1.04	1.75	1.78	1.37	1.42	2.16
1973	3.18	2.45	1.06	1.79	1.79	1.39	1.47	2.18
1974	3.15	2.56	1.08	1.82	1.88	1.35	1.49	2.23
1975	3.19	2.78	0.98	1.87	1.91	1.10	1.55	2.01
1976	3.34	2.93	1.04	1.94	2.00	1.16	1.62	2.07
1977	3.45	2.95	1.10	2.03	2.05	1.21	1.71	2.11
1978	3.52	2.98	1.20	2.11	2.16	1.50	1.91	2.27
1979	3.43	3.01	1.23	2.17	2.21	1.49	1.94	2.24
1980	3.29	2.98	1.25	2.19	2.21	1.51	1.91	2.18

a/ Calculated by dividing expenditures (Appendix Table A.27) by population (Appendix Table A.28) and converting currencies to 1970 U.S. dollars.

Source: See text, section 4; also see Appendix B for details on calculation of prices.

APPENDIX TABLE A.30 U.S. Almond Supply and Disposition, 1950-1984 (metric tons of kernal weight) a/

YEAR	PRODU	CLU b/	MPU b/	SBU	DSU	QUU	QUXP	SEU	QTIU	DSIU	QUUEX	QUUIM
1950	17107	785	17892	2994	20886	17282	0	3605	6009	26895	17282	23291
1951	18546	308	18854	3605	22459	15332	1905	5191	1881	24340	17237	17212
1952	16177	-209	15968	5191	21159	14742	2404	4039	3299	24458	17146	18040
1953	17310	509	17819	4039	21858	14969	2676	4235	3399	25257	17645	18368
1954	19721	367	20088	4235	24323	17418	3220	3672	755	25078	9361	18173
1955	17382	37	17419	3672	21091	16647	2359	2095	242	21333	19006	16889
1956	26649	653	27302	2095	29397	15241	6396	8113	46	29443	21637	16693
1957	16400	-10	16390	8113	24503	15419	4309	4847	2321	26824	19728	17740
1958	8624	104	8728	4847	13575	10822	635	2742	5738	19313	11457	16560
1959	37901	302	38203	2742	40945	21146	8210	10243	980	41925	29356	22126
1960	23851	418	24269	10243	34512	24107	3939	6466	441	34953	28046	24548
1961	31233	1110	32343	6466	38809	24898	4894	9306	342	39151	29792	25240
1962	23756	223	23979	9306	33285	24540	3749	4621	116	33401	28289	24656
1963	31291	-695	30596	4621	35217	22745	7097	5382	159	35376	29842	22903
1964	38287	-765	37522	5382	42904	25915	7986	8999	199	43103	33901	26114
1965	35959	-241	35718	8999	44717	25815	10400	7894	200	44917	36215	26014
1966	43193	-200	42993	7894	50887	27825	10149	11720	237	51124	37974	28062
1967	37348	-70	37278	11720	48998	26182	11926	10507	254	49252	38108	26436
1968	36612	-190	36422	10507	46929	28770	9518	8228	534	47463	38288	29304
1969	60299	-2016	58283	8228	66511	27288	27592	11577	129	66640	54880	27417
1970	67299	-2941	64358	11577	75935	31185	30960	13709	129	76064	62145	31314
1971	72904	-3063	69841	13709	83550	34234	40839	8500	115	83665	75073	34349
1972	68070	-3643	64427	8500	72927	34245	31409	7259	124	73051	65654	34370
1973	70186	-3765	66421	7259	73680	24590	35132	13661	53	73733	59672	24643
1974	103998	-5273	98725	13661	112386	25505	47149	39733	28	112414	72654	25533
1975	84164	-6972	77192	39733	116925	34027	55996	26904	29	116954	90022	34056
1976	128706	-11645	117061	26774	143835	42395	68306	33673	69	143904	110701	42464
1977	142014	-12827	129187	33674	162861	44797	75254	42728	58	162919	120051	44855
1978	82113	-8436	73677	42728	116405	40073	59470	17129	239	116644	99542	40312
1979	170565	-12483	158082	17129	175211	39811	101705	35811	106	175317	141516	39917
1980	145966	-7554	138412	35811	174223	43308	84793	46122	34	174257	128101	43342
1981	184817	-11027	173790	46111	219901	52564	94301	73036	19	219920	146865	52583
1982	157276	-7243	150033	73036	220069 c/	58188	80732	81149	257	220326	138920	58445
1983	109722	-9118	100604	80264	177850 c/	58327	77883	41640	79	177929	136210	58406
1984	266222	-10556	255666	41107	283990 c/	59584	121003	103402	107	284097	180588	59691

a/ Notation: PRODU = Producer deliveries, California
CLU = Computed losses
MPU = Redetermined marketable
SBU = July 1 stocks
DSU = Domestic supply
QUU = Delivered domestic sales
QUXP = Delivered export sales
SEU = Ending stocks, June 30
QTIU = Imports
DSIU = Domestic supply plus imports
QUUEX = Delivered sales, total
QUUIM = Domestic disappearance

b/ There are some statistical discrepancies in these data prior to 1963.

c/ Excludes market development reserve of 3,000 M.T. in 1982; 3,018 M.T. in 1983; 12,783 M.T. in 1984.

Source: Almond Board of California (1985)

APPENDIX B

Calculation of Landed U.S. Almond Prices

Prices were unavailable for U.S. almonds landed in the different export markets and so these were calculated from the known f.o.b. U.S. export price in the following manner.

$$PU_{jt} = (PUX_t + TU_{jt})DU_{jt} \bullet ER_jU_t$$

where

PU_{jt} : duty paid c&f price in k-th country currency

PUX_t : United States f.o.b. (or f.a.s.) export price in U.S. dollars

TU_{jt} : transfer cost from United States in country k

DU_{jt} : ad valorum duty on U.S. almonds entering country k (7% duty is written as 1.07)

ER_jU_t : exchange rate between United States dollars and k country currency. In units of j currency/$US.

If a specific duty were to be levied then the transfer costs would include that duty. The transfer costs used were the freight rates.

The model was estimated in a common currency (U.S. dollars), and following the arguments of Bjarnason, McGarry and Schmitz a base year (1970) exchange rate was used.

$$PU_{jt}(\$70) = PU_{jt} \div ER_jU_t(1970)$$

A final transformation used was to deflate this price by the (current) consumer price index.

$$DPU_{jt}(\$70) = PU_{jt}(\$70) \div CPI_{jt}$$

$$DP_{ukt}(\$70) = \frac{PU_{ukt}(\$70)}{CPI_{kt}}$$

In the text the notation ($70) is normally suppressed, except in situations where to do so might cause ambiguity.

APPENDIX C

Conversion of Per Capita Demand Coefficients to Total Shipment Demand Time-Varying Coefficients

The statistical demand analysis was in terms of per capita shipments for U.S. demand and import demand functions for seven countries (or groups of countries). For purposes of analysis, it was necessary to convert the import equations to derived export demand equations. Due to nonlinear terms, the total shipment demand coefficients differ for each year. This appendix provides the methods used in these calculations.

An example of the conversion is given for the West German price coefficient. The per capita consumption (QCUWG) was expressed as a function of the landed price of U.S. almonds in West Germany (DPUWGt) and other variables, where

$$(1)\ DPUWGt = \frac{(PXU_t + TUWG_t)\, DUW_t \bullet ERUWG_t \bullet 100}{ERWGU_{1970} \bullet CPIWG_t}$$

We now wish to express total shipments in terms of *nominal* U.S. prices (PAU_t) and other variables. The original coefficient associated with $DPUWG_t$ is $b_{4,4}$ shown schematically in Appendix Table C-1. We desire to use coefficient $\beta_{4,1}$ associated with PAU in Appendix Table C-2.

First, the export price can be expressed as the domestic price less the price difference between the domestic price and the export price [PXU ≡ PAU -(PAU -PXU)]. Second, the additive transportation cost (TUWG) can be expressed as a separate variable. The remaining terms in equation (1) are then multiplied by the coefficient $b_{4,4}$ and by population ($POPWG_t$) to obtain the time-varying coefficient $\beta_{4,1}$. This calculation is shown in Appendix Table C-3. This coefficient $\beta_{4,1}$ then applies equally to PAU, to the price difference, and to transportation costs in estimating total shipments. As a check on these calculations, per capita estimated shipments multiplied by the population for a particular year gives identical values as obtained by using the derived coefficients (β_{ij}) and relevant exogenous variables given in Appendix Table C-2.

Appendix Table C-3

Equations for Converting Per Capita Demand Coefficients of Appendix Table C-1 to the Total Shipment Demand Time-Varying Coefficients of Appendix Table C-2.

United States

$$\beta_{1,1} = b_{1,1}\,[(POPU_t \bullet 100) \div CPIU_t]$$

$$\beta_{1,3} = b_{1,9}$$

$$\beta_{2,1} = 0$$

$$\beta_{1,11} = b_{1,17}[(POPU_t \bullet ERUUK) \div (CPIU_t \bullet 10)]$$

$$\beta_{1,12} = b_{1,25}\,[100 \div CPIU_t]$$

$$\beta_{1,20} = b_{1,33}\,[POPU_t \div POPU_{t-1}]$$

$$\beta_{1,28} = 0$$

$$\alpha_{1,39} = \alpha_{1,41}\,[POPU_t]$$

Appendix Table C-1

Per Capita Demand Equations[a]

	DPU_j	QCE_j	DRF_j	DE_j	QCU_{jL}	Constant α_j	Vector of Predetermined Variables and Constants	
							1. DPUU	25. DEU
QCUU	$b_{1,1}$	$b_{1,9}$	$b_{1,17}$	$b_{1,25}$	$b_{1,33}$	$\alpha_{1,41}$	2. DPUC	26. DEC
QCUC	$b_{2,2}$	$b_{2,10}$	$b_{2,18}$	$b_{2,26}$	$b_{2,34}$	$\alpha_{2,42}$	3. DPUJ	27. DEJ
QCUJ	$b_{3,3}$	$b_{3,11}$	$b_{3,19}$	$b_{3,27}$	$b_{3,35}$	$\alpha_{3,43}$	4. DPUWG	28. DEWG
QCUWG	$b_{4,4}$	$b_{4,12}$	$b_{4,20}$	$b_{4,28}$	$b_{4,36}$	$\alpha_{4,44}$	5. DPUF	29. DEF
							6. DPUUK	30. DEUK
=							7. DPUNE	31. DEN
QCUF	$b_{5,5}$	$b_{5,13}$	$b_{5,21}$	$b_{5,29}$	$b_{5,37}$	$\alpha_{5,45}$	8. DPUSC	32. DESWE
							9. QCEU	33. $QCUU_L$
QCUUK	$b_{6,6}$	$b_{6,14}$	$b_{6,22}$	$b_{6,30}$	$b_{6,38}$	$\alpha_{6,46}$	10. QCEC	34. $QCUC_L$
							11. QCEJ	35. $QCUJ_L$
QCUNE	$b_{7,7}$	$b_{7,15}$	$b_{7,23}$	$b_{7,31}$	$b_{7,39}$	$\alpha_{7,47}$	12. QCEWG	36. $QCUWG_L$
							13. QCEF	37. $QCUF_L$
QCUSC	$b_{8,8}$	$b_{8,16}$	$b_{8,24}$	$b_{8,32}$	$b_{8,40}$	$\alpha_{8,48}$	14. QCEUK	38. $QCUUK_L$
							15. QCENE	39. $TCUNE_L$
							16. QCESC	40. $QCUSC_L$
							17. DRFU	41. 1
							18. DRFC	42. 1
							19. DRFJ	43. 1
							20. DRFWG	44. 1
							21. DRFF	45. 1
							22. DRFUK	46. 1
							23. DRFNE	47. 1
							24. DRFSC	48. 1

[a]Estimated values of the b_{ij} are given in Table 14. Values are zero for $b_{1,17}$, $b_{3,11}$, $b_{3,19}$, and $b_{6,22}$.

Appendix Table C-2

Total U.S. Shipment Matrix of Time-Varying Demand Coefficients

		PAU	PAU-PAX	QE_j	RF	E_j	QU_{jL}	TU_j	MPU	SBU	Constant
QUU		$\beta_{1,1}$	$\beta_{2,1}$	$\beta_{1,3}$	$\beta_{1,11}$	$\beta_{1,12}$	$\beta_{1,20}$	$\beta_{1,28}$			$\alpha_{1,39}$
QUC		$\beta_{2,1}$	$\beta_{2,2}$	$\beta_{2,4}$	$\beta_{2,11}$	$\beta_{2,13}$	$\beta_{2,21}$	$\beta_{2,29}$			$\alpha_{2,40}$
QUJ		$\beta_{3,1}$	$\beta_{3,2}$	$\beta_{3,5}$	$\beta_{3,11}$	$\beta_{3,14}$	$\beta_{3,22}$	$\beta_{3,30}$			$\alpha_{3,41}$
QUWG		$\beta_{4,1}$	$\beta_{4,2}$	$\beta_{4,6}$	$\beta_{4,11}$	$\beta_{4,15}$	$\beta_{4,23}$	$\beta_{4,31}$			$\alpha_{4,42}$
WUF	=	$\beta_{5,1}$	$\beta_{5,2}$	$\beta_{5,7}$	$\beta_{5,11}$	$\beta_{5,16}$	$\beta_{5,24}$	$\beta_{5,32}$			$\alpha_{5,43}$
QUUK		$\beta_{6,1}$	$\beta_{6,2}$	$\beta_{6,8}$	$\beta_{6,11}$	$\beta_{6,17}$	$\beta_{6,25}$	$\beta_{6,33}$			$\alpha_{6,44}$
QUNE		$\beta_{7,1}$	$\beta_{7,2}$	$\beta_{7,9}$	$\beta_{7,11}$	$\beta_{7,18}$	$\beta_{7,26}$	$\beta_{7,34}$			$\alpha_{7,45}$
QUSC		$\beta_{8,1}$	$\beta_{8,2}$	$\beta_{8,10}$	$\beta_{8,11}$	$\beta_{8,19}$	$\beta_{8,27}$	$\beta_{8,35}$			$\alpha_{8,46}$
SEU									$\beta_{9,37}$	$\beta_{9,38}$	

Vector of Predetermined Variables and Constants

1. PAU	28. TUU
2. PAU-PAX	29. TUC
3. QEU	30. TUJ
4. QEC	31. TUWG
5. QEJ	32. TUF
6. QEWG	33. TUUK
7. QEF	34. TUN
8. QEUK	35. TUD
9. QENE	36. QUROW
10. QESC	37. MPU
11. RFUK	38. SBU
12. EU	39. 1
13. EC	40. 1
14. EJ	41. 1
15. EWG	42. 1
16. EF	43. 1
17. EUK	44. 1
18. EN	44. 1
19. ESWE	45. 1
20. QUU_L	46. 1
21. QUC_L	
22. QUJ_L	
23. $QUWG_L$	
24. QUF_L	
25. $QUUK_L$	
26. $QUNE_L$	
27. $QUKSC_L$	

Canada

$\beta_{2,1} = b_{2,2}[(POPC_t \bullet ERCU_t \bullet 100) \div (ERCU_{1970} \bullet CPIC_t)]$
where $ERCU_{1970} = 1.0152$

$\beta_{2,2} = -\beta_{2,1}$

$\beta_{2,4} = b_{2,10}$

$\beta_{2,11} = b_{2,18}[(POPC_t \bullet ERUUK_t \bullet ERCU_t) \div (ERCU_{1970} \bullet CPIC_t \bullet 10)]$

$\beta_{2,13} = b_{2,26}[100 \div (ERCU_{1970} \bullet CPIC_t)]$

$\beta_{2,21} = b_{2,34}[POPC_t \div POPC_{t-1}]$

$\beta_{2,29} = 0$

$\alpha_{2,44} = \alpha_1 [POPC_t]$

Japan

$\beta_{3,1} = b_{3,3}[(POPJ_t \bullet DUJ_t \bullet ERJU_t \bullet 100) \div (ERJU_{1970} \bullet CPIJ_t)]$
where $ERJU_{1970} = 357.575$

$\beta_{3,2} = -\beta_{3,1}$

$\beta_{3,30} = \beta_{3,1}$

$\beta_{3,5} = 0$

$\beta_{3,11} = 0$

$\beta_{3,14} = b_{3,27}[(100) \bullet (ERJU_{1970} \bullet CPIJ_t)]$

$\beta_{3,22} = b_{3,35}[POPJ_t \div POPJ_{t-1}]$

$\alpha_{3,41} = \alpha_{3,43}[POPJ_t]$

West Germany

$\beta_{4,1} = b_{4,4}[(POPWG_t \bullet DUWG_t \bullet ERWGU_t \bullet 100) \div (ERWGU_{1970} \bullet CPIWG_t)]$
where $ERWGU_{1970} = 3.60$

$\beta_{4,2} = -\beta_{4,1}$

$\beta_{4,31} = \beta_{4,1}$

$\beta_{4,6} = b_{4,12}$

$\beta_{4,11} = b_{4,20}[(POPWG_t \bullet ERUUK_t \bullet ERWGU) \div (ERWGU_{1970} \bullet CPIWG_t \bullet 10)]$

$\beta_{4,15} = b_{4,28}[(100) \div (ERWGU_{1970} \bullet CPIWG_t)]$

$\beta_{4,23} = b_{4,36}[POPWG_t \div POPWG_{t-1}]$

$\alpha_{4,42} = \alpha_{4,44}[POPWG_t]$

France

$\beta_{5,1} = b_{5,5}[(POPF_t \bullet DUF_t \bullet ERFU_t \bullet 100) \div (ERFU_{1970} \bullet CPIF_t)]$
where $ERFU_{1970} = 5.5175$

$\beta_{5,2} = -\beta_{5,1}$

$\beta_{5,32} = \beta_{5,1}$

$\beta_{5,7} = b_{5,13}$

$\beta_{5,11} = b_{5,21}[(POPF_t \bullet ERUUK_t \bullet ERUF_t) \div (ERFU_{1970} \bullet CPIF_t \bullet 10)]$

$\beta_{5,16} = b_{5,29}[(100) \div (ERFU_{1970} \bullet CPIF_t)]$

$\beta_{5,24} = b_{5,37}[POPF_t \div POPF_{t-1}]$

$\alpha_{5,43} = \alpha_{5,45}[POPF_t]$

United Kingdom

$\beta_{6,1} = b_{6,6}[(POPUK_t \bullet DUUK_t \bullet ERUKU_t \bullet 100) \div (ERUKU_{1970} \bullet CPIUK)]$
where $ERUUK_{1970} = 0.4159$

$\beta_{6,2} = -\beta_{6,1}$

$\beta_{6,33} = \beta_{6,1}$

$\beta_{6,8} = b_{6,14}$

$\beta_{6,11} = b_{6,22}[(POPUK_t) \div (ERUKU_{1970} \bullet CPIUK_T \bullet 10)]$

$\beta_{6,17} = b_{6,30}[(100) \div (ERUKU_{1970} \bullet CPIUK_t)]$

$\beta_{6,25} = b_{6,38}[POPUK_t \div POPUK_{t-1}]$

$\alpha_{6,44} = \alpha_{6,46}[POPUK_t]$

Northern Europe

$\beta_{7,1} = b_{7,7}[(POPNE_t \bullet DUN_t \bullet ERNU_t \bullet 100) \div (ERNU_{1970} \bullet CPIN_t)]$
where $ERNU_{1970} = 3.5890$

$\beta_{7,2} = -\beta_{7,1}$

$\beta_{7,34} = \beta_{7,1}$

$\beta_{7,9} = b_{7,15}$

$\beta_{7,11} = b_{7,23}[(POPNE_t \bullet ERUUK_t \bullet ERNU_t) \div ERNU_{1970} \bullet CPIN_t \bullet 10)]$

$\beta_{7,18} = b_{7,31}[(POPNE_t \bullet 100) \div (ERNU_{1970} \bullet CPIN_t \bullet POPN_t)]$

$\beta_{7,26} = b_{7,39}[POPNE_t \div POPNE_{t-1}]$

$\alpha_{7,45} = \alpha_{7,47}[POPNE_t]$

Norway, Sweden and Switzerland

$\beta_{8,1} = \beta_{8,8}[(POPSC_t \bullet ERSWEU_t \bullet 100) \div (ERSWEU_{1970} \bullet CPISWE_t)]$
where $ERSWEU_{1970} = 5.1788$

$\beta_{8,2} = -\beta_{8,1}$

$\beta_{8,35} = \beta_{8,1}$

$\beta_{8,10} = b_{8,16}$

$\beta_{8,11} = b_{8,24}[(POPSC_t \bullet ERUUK_t \bullet ERUSWE_t) \div (ERSWEU_{1970} \bullet CPISWE \bullet 10)]$

$\beta_{8,19} = b_{8,32}[(POPSC_t \bullet 100) \div (ERSWEU_{1970} \bullet CPISWE_t \bullet POPSWE_t)]$

$\beta_{8,27} = b_{8,40}[POPSC_t \div POPSC_{t-1}]$

$\alpha_{8,46} = \alpha_{8,48}[POPSC_t]$

Appendix Table D

Almond Acreage in California: Reported and Revised, 1966-1983[a]

As of May 31	Age 0 (new plantings)	1	2	3	4	5	6
	16,850	11,370	8,602	5,897	5,292	5,678	4,996
1966	22,701	15,850	11,453	8,331	6,948	5,797	5,760
	(0)[d]	(0)	(0)	(0)	(0)	(0)	(0)
	16,195	19,015	13,461	9,833	7,227	6,517	5,795
1967	18,915	22,701	15,850	11,453	8,331	6,948	5,797
	(0)	(0)	(0)	(0)	(0)	(0)	(0)
	14,948	18,580	21,704	14,900	11,333	8,117	6,917
1968	•[e]	18,915	22,701	15,850	11,453	8,331	6,948
	(887)	(0)	(0)	(0)	(0)	(0)	(0)
	17,101	13,803	18,900	21,884	15,530	11,453	8,219
1969	18,535	14,061	18,915	22,701	15,850	•	8,331
	(0)	(0)	(0)	(0)	(0)	(25)	(0)
	16,009	16,888	13,646	18,915	22,076	15,522	11,363
1970	19,731	18,535	14,061	•	22,701	15,850	11,428
	(0)	(0)	(0)	(76)	(0)	(0)	(0)
	17,596	18,839	16,547	13,500	18,595	21,986	15,819
1971	18,436	19,731	18,535	14,061	18,839	22,701	15,850
	(0)	(0)	(0)	(0)	(0)	(0)	(0)
	14,955	18,436	18,796	16,825	13,391	18,457	22,301
1972	•	•	19,731	18,535	14,061	18,839	22,701
	(19)	(88)	(0)	(0)	(0)	(0)	(0)
	19,506	12,467	17,878	18,236	16,782	13,634	18,555
1973	24,154	14,936	18,348	19,731	18,535	14,061	18,839
	(0)	(0)	(0)	(0)	(0)	(0)	(0)
	24,129	19,951	12,485	17,730	18,556	16,903	13,497
1974	33,564	24,154	14,936	18,348	19,731	18,535	14,061
	(0)	(0)	(0)	(0)	(0)	(0)	(0)
	17,992	29,213	20,744	12,643	17,891	18,707	17,201
1975	23,419	33,564	24,154	14,936	18,348	19,731	18,535
	(0)	(0)	(0)	(0)	(0)	(0)	(0)
	10,247	19,805	28,534	20,719	11,959	17,816	19,168
1976	•	23,419	33,564	24,154	14,936	18,348	19,731
	(789)	(0)	(0)	(0)	(0)	(0)	(0)
	7,430	9,458	20,269	29,983	20,808	11,422	17,842
1977	•	•	23,419	33,564	24,154	14,936	18,348
	(971)	(2,323)	(0)	(0)	(0)	(0)	(0)
	7,963	6,046	6,837	21,357	30,604	22,031	12,878
1978	12,375	6,459	7,135	23,419	33,564	24,154	14,936
	(0)	(0)	(0)	(0)	(0)	(0)	(0)
	11,091	10,521	6,459	6,666	21,647	31,391	23,569
1979	23,618	12,375	•	7,135	23,419	33,564	24,154
	(0)	(0)	(353)	(0)	(0)	(0)	(0)
	14,163	17,988	11,161	6,106	6,649	22,332	31,540
1980	23,116	23,618	12,375	•	7,135	23,419	33,564
	(0)	(0)	(0)	(448)	(0)	(0)	(0)
	24,975	21,803	22,974	22,928	5,658	6,976	22,532
1981	29,322	23,116	23,618	12,375	•	7,135	23,419
	(0)	(0)	(0)	(0)	(215)	(0)	(0)
	11,293	27,998	22,562	23,618	11,884	5,269	6,876
1982	13,722	29,322	23,116	•	12,375	5,443	7,135
	(0)	(0)	(0)	(549)	(0)	(0)	(0)
	2,869	13,722	29,322	23,116	23,069	12,375	5,443
1983	4,881						
	2,107	4,881	15,183	32,465	24,405	24,600	12,729
1984							

Appendix Table D (continued)

As of May 31	Age 7	8	9	10	11	Other	Reported Bearing	Reported Non-bearing	Reported Total	Revised Bearing	Revised Non-bearing[b]	Revised Total
1966	(----------23,399[c]----------)					78,891 102,290 (2,438)	107,278	53,697	160,975	113,847	65,283	179,130 2,438[d]
1967	5,207 5,760 (0)	(---------23,053[c]---------)				76,799 99,852 (2,523)	117,371	65,731	183,102	118,357	77,250	195,607 2,523
1968	5,775 5,797 (0)	5,648 5,760 (0)	(---------23,096[c]---------)			74,233 97,329 (1,949)	123,786	81,465	205,251	(124,165) 126,456	(83,867) 81,576	208,032 208,032 2,836
1969	6,948 • (7)	5,769 5,797 (0)	5,726 5,760 (0)	(------22,985[c]-----)		72,395 95,380 (1,058)	133,495	87,218	220,713	(133,669) 140,009	(90,062) 83,722	223,731 223,731 1,090
1970	8,224 8,331 (0)	6,923 6,941 (0)	5,764 5,797 (0)	5,721 5,760 (0)	(22,853[c])	71,469 94,322 (1,368)	147,839	87,534	235,373	(148,429) 162,205	(93,943) 80,322	242,372 242,372 1,444
1971	11,428 •	8,331 •	6,940 •	5,797 •		92,955 98,715 (2,233)	169,016	85,077	254,093	(169,762) 184,833	(89,602) 74,531	259,364 259,364 2,233
1972	15,765 15,850 (0)	(----------38,001[c]----------)				90,977 128,978 2,977	198,912	69,012	267,924	200,429	71,657	272,086 3,084
1973	22,619 22,701 (0)	15,850 • (71)	(---------37,581[c]---------)			88,420 126,001 (1,397)	213,441	68,087	281,528	215,987	77,169	293,156 1,468
1974	18,542 18,839 (0)	22,487 22,701 (0)	15,670 15,779 (0)	(------37,451[c]-----)		87,153 124,604 (931)	230,259	74,295	304,554	234,250	91,002	325,252 931
1975	13,637 14,061 (0)	18,603 18,839 (0)	22,665 22,701 (0)	15,561 15,779 (0)	(37,560[c])	86,113 123,673 (3,365)	247,948	80,592	328,540	251,667	96,073	347,740 3,365
1976	16,746 18,535 (0)	13,555 14,061 (0)	18,709 18,839 (0)	22,701 • (45)	15,779	120,308 136,087 (4,683)	256,741	79,296	336,037	263,238	91,384	354,622 5,517
1977	19,731 • (1,150)	16,959 18,535 (0)	13,736 14,061 (0)	18,839 • (943)	22,656	131,404 154,060 (1,481)	273,417	67,140	340,557	282,664	73,871	356,535 6,868
1978	17,723 18,348 (0)	17,285 18,581 (0)	18,535 • (39)	14,061 • (80)	17,896	152,579 170,475 (6,610)	303,592	42,203	345,795	312,654	49,388	362,042 6,729
1979	13,594 14,936 (0)	18,273 18,348 (0)	17,784 13,581 (0)	18,496 • (267)	13,981	163,865 177,846 (5,903)	322,602	34,737	357,339	329,344	49,587	378,931 6,523
1980	23,977 24,154 (0)	14,279 14,936 (0)	18,348 • (526)	17,581 18,581 (0)	18,229	171,943 190,172 (4,608)	324,878	49,418	374,296	330,309	65,215	395,524 5,582
1981	31,209 33,564 (0)	24,154 • (124)	14,493 14,936 (0)	17,039 17,822 (0)	18,581	185,564 204,145 (2,752)	326,206	81,500	407,706	330,833	88,431	419,264 3,091
1982	22,372 23,419 (0)	30,983 33,564 (0)	24,030 • (314)	14,429 14,936 (0)	17,822	201,393 219,215 (6,649)	334,258	85,471	419,729	340,117	89,778	429,859 7,512
1983	7,135	23,419	33,564	23,716	14,936	212,566 227,502	356,223	69,029	425,252	356,223	69,029	425,252

[a]Reported acreage, given in the first row for each crop year, is from the California Crop and Livestock Reporting Service, California Fruit and Nut Acreage, various issues. The revised acreage data, given in the second row for each year, represents estimates of new plantings (age 0) and acreage by year of planting based on subsequent reports by the CC & LRS. For example, the 1983 report indicates 4-year old acreage of 23,069. The 1982 report gives 3-year old acreage of 23,618, indicating removals of 549 acres in 1983 (see third row for each year). The 1981 report, however, gives 2-year old acreage of 22,974, which is less than that reported for 3-year olds in 1982 of 23,618. Therefore, the revised figure of 23,618 is used for 1981 and it also carries back to 1-year old trees in 1980 and new plantings in 1979. Note that the major revisions are made in the nonbearing acreage, and by the time the trees reach bearing age, the acreage data revisions are a smaller percentage of reported acreage.

[b]The definition of nonbearing age was 4 years and older prior to 1972 and 3 years old and older thereafter, giving a sharp drop in nonbearing acreage in 1972. The series on bearing and nonbearing age were adjusted as follows: 1968 nonbearing acreage = age 0-3 acreage plus 80% of age 4 acreage; 1969 = age 0-3 acreage plus 60% of age 4 acreage; 1970 = age 0-3 acreage plus 40% of age 4 acreage; 1970 nonbearing acreage = age 0-3 acreage plus 20% of age 4 acreage; and 1971 = age 0-3 acreage plus 20% of age 4 acreage. The bearing acreage series equals the revised total acreage, less the adjusted nonbearing acreage.

[c]Reported total for 5-year cohort.

[d]Removals for period between May 31, 1966 and May 31, 1967, and similarly for subsequent years.

[e]Dot indicates no correction needed in reported acreage.

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