COOPERATIVES, MARKETING ORDERS AND BALANCING SUPPLY AND DEMAND IN THREE PERENNIAL CROP COMMODITY SUBSECTORS

By

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ABSTRACT

COOPERATIVES, MARKETING ORDERS AND BALANCING SUPPLY AND DEMAND IN THREE PERENNIAL CROP COMMODITY SUBSECTORS

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Perennial crop industries have tried different approaches and have had different experiences in attempting to balance supply and demand. Three crops (tart cherries, almonds, and raisins) were selected for comparative analysis of actual and potential roles of various vertical market coordination institutions in improving subsector supply-demand balance.

Two significant problems complicate the coordination of supplies with demand in perennial crop subsectors: 1) short-run problems due to annual fluctuations in supplies and 2) long-run challenges relating to substantial overplanting that can result in persistent overproduction. The combination of inelastic demand and annual supply fluctuations results in wide price fluctuations for some commodities.

Types of cooperatives and alternative marketing strategies employed by cooperatives were investigated. Committed integrated marketing cooperatives (CIMCs) in the almond and raisin subsectors market a significant portion of member production through strong national branded consumer products. In their roles as food manufacturers, these CIMCs work through their brand position to influence consumer demand and retailer merchandising. They have the ability to significantly influence the demand side in order to help balance subsector supply and demand. A committed commodity marketing cooperative (CCMC) lacks a strong national brand franchise, but focuses on selling large volumes of processed products to food manufacturers and the food service industry along with retaining a commitment to being a reliable supplier of a commodity such as tart cherries.

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Long run supply-demand balancing approaches that were investigated included approaches to reduce acreage when overplanting had occurred and to avoid overplanting. Raisin acreage reduction has been accomplished to some degree through the Raisin Diversion Program (RDP) as part of the raisin marketing order. An orchard removal incentive program for tart cherries was proposed but never implemented.

Supply management programs were analyzed, with emphasis on federal marketing orders. Three main types of supply management provisions of federal marketing orders are commonly implemented to mitigate the consequences of annual supply fluctuations. Reserve pools address the problem of annual supply fluctuation through storing a portion of grower deliveries in large-crop years and releasing some or all of the storage reserve in short-crop years. Market allocation provides another stabilization approach by removing excess product in large crop years from the designated major markets. The third set of provisions, non-production or non-harvest diversion, provides additional flexibility in managing excess supplies. A major contribution has been to alleviate some of the negative consequences of supply instability by helping to promote increased sales and to prevent erosion of demand through more stable commodity supplies.

Supply management provisions of the federal marketing orders have also helped dampen price declines in large crop years, thus mitigating the negative impact on growers. Econometric models of the tart cherry and almond industries were developed to estimate the impact on grower prices of implementing a federal marketing order in each of those two subsectors. Estimated price impacts were substantial in some years of marketing order implementation (up to a 20% difference in grower prices for tart cherries), but impacts were moderate in other years.

To my mother, Jean S. Hinman

ACKNOWLEDGMENTS

I owe a significant debt of gratitude to two people who contributed greatly to the completion of this research. Dr. James Shaffer, my major professor, suggested the general topic, provided overall guidance and was instrumental in obtaining the funding that made this project possible. Dr. Donald Ricks, my research supervisor, provided valuable insights into the workings of perennial crop subsectors and spent countless hours of his time to give me guidance, recommendations, and encouragement. Both of them read several drafts and offered comments that continually improved the dissertation.

The thoroughness which Dr. John Staatz brought to the task of reading and editing the dissertation was both a blessing and a curse. His numerous incisive comments and suggestions greatly improved the final document. Dr. Christopher Peterson and Dr. Thomas Pierson also served on my dissertation committee and provided helpful insights. Thanks to each of you.

The patient support offered by my wife, Susan Allen, was another necessary ingredient of my success. Nor will I forget the gentle needling and words of encouragement coming from my two stepchildren, Glenn and Virginia. I look forward to spending more time with you all.

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CHAPTER 1: INTRODUCTION

The uncertainty facing participants in the food marketing system contributes to mismatches between supply and demand for various agricultural commodities. Both climatic and human factors contribute to this uncertainty. The weather is frequently a major cause of substantial annual supply fluctuations. Human factors are also important in that mistakes are made in agricultural production and investment decisions because of a number of reasons including the difficulty of accurately predicting important economic variables.

These factors contribute to problems of economic coordination in commodity markets. Shaffer distinguishes four kinds of coordination.[1] Micro-micro coordination takes place within an individual firm. Micro coordination refers to coordination between firms, such as between firms operating at two adjacent stages of a subsector. Macro coordination is the overall balancing of supply and demand in a commodity subsector in terms of quantities and qualities. Macro-macro coordination refers to the supply and demand of goods and services at the level of the national economy. This research focuses on macro coordination and hereafter all references to coordination mean macro coordination in terms of this classification.

The framework used in this research for examining the issues related to matching supply and demand is a subsector approach, which views the flow of an agricultural commodity from grower to consumer through various marketing channels as a vertical system consisting of several stages. Matching supply and demand in terms of both quantities and characteristics of commodities at each stage of the vertical system is part of the process of vertical coordination. There are complex interactions between these stages. Decisions

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[1]James D. Shaffer, "Thinking About Farmers' Cooperatives, Contracts, and Economic Coordination," in Cooperative Theory: New Approaches, ed. Jeffrey S. Royer, Washington DC: USDA, ACS Service Report 18, July 1987, 61-62.

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made at various points in the marketing channels for a commodity may help or hinder the match of supply and demand.

Mighell and Jones define vertical coordination as "all the ways of harmonizing.... at each stage in the vertical production-distribution system."[2] The research reported here takes only a slice of that broad concept by focusing on certain means to harmonize the system, specifically, improving the match of quantities supplied and demanded both on an annual basis and over the longer run, and the matching of the characteristics of commodity-based food products with consumer preferences. It also compares the processes of vertical coordination in subsectors with various types of cooperatives, marketing orders, and other coordinating mechanisms. The research gives primary emphasis to certain stages of the vertical market system. Much of the analysis focuses on grower-first handler transactions, which corresponds to stages two and three of the five stages of a subsector as presented in Chapter 2.

The analysis concentrates on selected perennial crop commodities. These commodities have significant problems in coordinating supplies with demand. Analysis of those problems provides an opportunity to examine a variety of institutions which have evolved (or have been proposed) to respond to these problems.

The study focuses on two supply conditions common to a number of perennial crop subsectors: (1) annual supply fluctuations which are primarily related to weather conditions and (2) long-term changes in acreage and productive capacity that may lead to periods of over-production and under-production relative to typical levels of quantity demanded. The long-run supply-demand balance for many perennial crops is a cyclical type of phenomenon in which periodic overplanting can lead to persistent commodity industry overcapacity

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[2]Ronald Mighell and Lawrence Jones, Vertical Coordination in U.S. Agriculture, USDA, Economic Research Service, Farm Economics Division, Agricultural Economics Report No. 19, February 1963.

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Demand conditions are also significant. Farm-level demand for a number of perennial crops is typically price inelastic. The combination of inelastic demand and annual supply fluctuations results in wide price fluctuations for some commodities. Changes in consumer preferences on product characteristics, such as the trend toward less consumption per capita of sweetened desserts, have also had considerable impact on demand for certain commodity-based processed food products.

Perennial crop industries have tried different approaches and have had different experiences in attempting to balance supply and demand. Three perennial crops were selected to be the focus of this analysis: tart cherries, almonds, and raisins. These three crops were selected for comparative analysis because each of them has: (a) faced problems of overproduction at one time or another, (b) developed broad-based programs involving joint industry decision-making to address collective problems, including federal marketing orders, and (c) had large marketing cooperatives playing significant marketing and vertical market coordination roles.

1.1 Research Objectives

The first objective of this research is the description and diagnosis of the instability and coordination problems that characterize the markets for each of the three perennial crop commodities. This objective is addressed in chapters two and three. Chapter two examines and compares supply-demand balancing problems for tart cherries, almonds, and raisins. Chapter three introduces the subsector framework and then presents, both conceptually and with examples, problems related to the interaction between subsector stages that hinder effective coordination.

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The second objective is to compare the role of various marketing organizations in the three commodity subsectors. To accomplish this, chapter three introduces a system of categorizing market coordination arrangements and their roles in coordinating supply and demand.

The third objective is to examine a variety of coordination approaches used to influence demand and supply in the three subsectors. Chapter four focuses on demand-related issues and coordination. Chapter five examines supply management roles and institutions, with particular emphasis on cooperatives and federal marketing orders.

Chapter six deals with the fourth objective, which is to assess the impact on grower prices of supply management that has been undertaken through the use of federal marketing orders. Econometric models are developed to analyze the magnitude of the impact of federal marketing orders on tart cherry and almond prices. Comparisons are made with the results of a study of the raisin marketing order.

Chapter seven presents a summary and overview of this research, including some perspective on the impact on the commodity subsectors of various market coordination arrangements.

1.2. Research Methods

Interviews with a number of participants in the three perennial crop commodity industries provided valuable information on conditions in the three subsectors and approaches used by various firms and organizations to address supply-demand balancing problems. People from cooperatives, the staff of marketing order administrative boards, universities, and government were interviewed. A review of past research, trade publications, as well as cooperative bulletins and newsletters also provided key information. Data on production, sales and prices were collected from a number of published sources, both government and private.

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Some written portions of this research were reviewed by certain key informants who had previously been interviewed to verify information and obtain additional perspectives on the analysis and issues addressed. This iterative process improved the accuracy of the research results presented herein and also widened the author's understanding of market coordination arrangements in the three subsectors.

Marketing order price and revenue impacts were analyzed by developing econometric models of the tart cherry and almond subsectors. Comparisons were made of the results of these models with previously published research on the economic impact of the raisin federal marketing order.

To set the stage for the following chapters, chapter two presents an overview of the supply-demand balancing problems in each of the three perennial crop subsectors.

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CHAPTER 2: SUPPLY-DEMAND BALANCING PROBLEMS IN PERENNIAL CROP SUBSECTORS

Two significant problems complicate the coordination of supplies with demand in perennial crop subsectors: 1) short-run problems due to annual fluctuations in supplies and 2) long-run challenges regarding the need to avoid serious overplantings that can result in persistent overproduction. Equilibrium conditions of supply and demand for a number of perennial crops tend to occur infrequently and can be transitory due to the combination of substantial crop fluctuations and long-term trends in orchard or vine capacity which may or may not match demand trends.

Supply and demand are in approximate balance when average market prices for a commodity approximate average cost per unit plus a normal return on investment for typical growers. In contrast to the situation of approximate balance, when supplies are excessive grower prices are frequently well below cost of production because total supply is not well coordinated with demand. This chapter examines and compares the supply-demand balancing problems that face each of the three commodities.

2.1. A Short-run Supply Issue: Challenges to Coordinating Supply and Demand Because of Annual Supply Fluctuations

Major coordination challenges arise because while supplies of perennial crops can fluctuate widely from year to year largely because of the impact of weather conditions, demand tends to change in a relatively gradual trending pattern over a period of several years. This situation can cause substantial problems for growers and firms at various subsector stages.

Although annual supply fluctuations for a number of perennial crops are due primarily to fluctuating yields resulting from variable weather conditions, for a few perennial

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Figure 3.

Figure 1. U.S. Tart Cherry Production and Bearing Acreage, 1950-1991

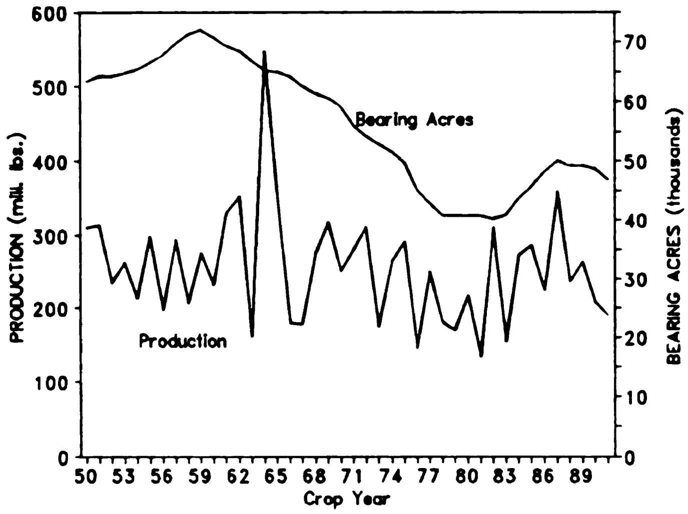


Figure 2. U.S. Almond Production and Bearing Acreage, 1950-1991

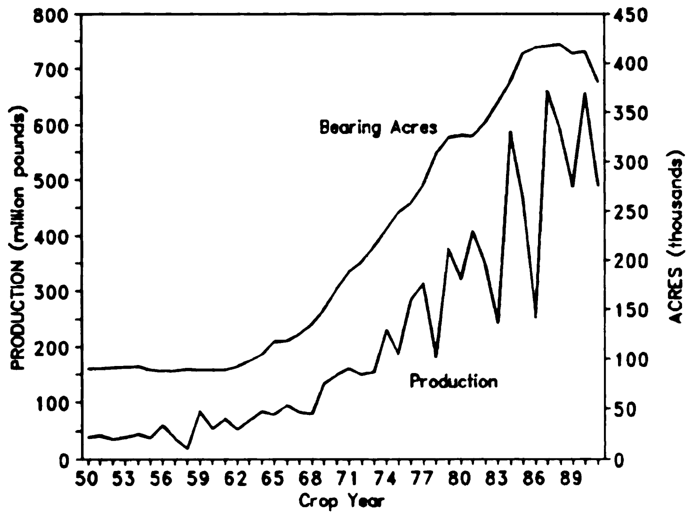
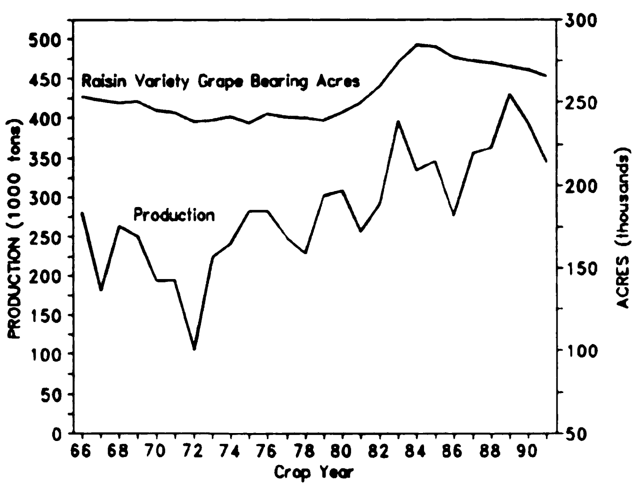


Figure 3. U.S. Raisin Production and Raisin Variety Grape Acreage, 1966-1991



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crops such as raisins, year-to-year changes in market utilization decisions by growers also contribute to annual supply fluctuations. There have been a few weather-induced short raisin crops in the last 25 years (1972, 1976, 1978). In addition, year-to-year shifts in utilization of raisin-type grapes have also had a significant impact on the quantity of raisins produced in some years. Raisin producers can respond to alternative market opportunities for raisin-type grapes by choosing between selling for crush (wine-making) and drying for raisins. This accounts for some of the year-to-year changes in raisin production shown in Figure 3. In addition, a relatively steady 12-15% are sold for fresh market and for canning. The overall level of raisin-type grape bearing acreage has primarily followed gradual trends during the last 25 years. The reasons for the rise and subsequent decline in the 1970s and 1980s are explored below.

Figure 1 and Figure 2 show substantial year to year changes in the level of production of tart cherries and almonds even though the number of bearing hectares changes gradually. Note that in these figures, production level is indicated on the left vertical axis and bearing acreage on the right vertical axis. The magnitude of annual tart cherry supply fluctuations is one of the most pronounced for any U.S. agricultural commodity. Tart cherry supplies are often double or half the level of the previous year. Annual supply fluctuations for almonds increased to some degree in the 1980s as the overall level of supply rose substantially.

Perennial crop production variability can be characterized by considering the range of annual change (highest and lowest magnitude) and the number of short crops and large crops that occur in a given time period. Some of this data is summarized in Table 1. Tart cherry annual change in production compared to average shipments of the previous four years ranged between 58% and 180%. Almonds had a similar range (68%-194%), but raisins are somewhat less variable by this measure. However, the number of short crops (10) was significantly greater for tart cherries than for the other crops.

Table 1. Production Changes in Four Perennial Crops, 1967-1992

Production as a Percentage of Previous Four Years Average Shipments[1]			Number of Short and Large Crops[2]	
	Smallest Percent	Largest Percent	No. of Short Crops	No. of Large Crops
Tart Cherries	58	180	10	10
Almonds	68	194	3	14
Raisins	46	152	4	12

[1]Based on Table 2, Table 3, and Table 4. The first year of comparative data is 1967 because the earliest year for which there is complete raisin data is 1963.
[2] See text for definition of short and large crops.

The terms "large crop" and "short crop" require clarification. In this analysis, a large crop year is defined as a level of production of 120% or more of the average of the previous four years' shipments. A short crop year is a level of production that is 85% or less of the average of shipments of the previous four years. Table 2 (tart cherries), Table 3 (raisins), and Table 4 (almonds) indicate the general magnitudes of what constitutes large and small crops both in terms of quantity differences and percentage differences between: (a) production in a given year and (b) a four-year moving average of past shipments.

The "large crop year" threshold figure of 120% or more for tart cherries is appropriate because during the operation of the federal marketing order, the administrative board that acted in an administrative and oversight capacity (known as the Cherry Administrative Board) proposed that one or more supply management provisions be implemented, or have issued documents stating that such would be their policy, if crops were of that general magnitude or greater.

For raisins, large crops, defined as deliveries by raisin growers of 120% or more of average shipments for the previous four years, generally yield negative net revenue, as

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Table 2. Short Versus Large Tart Cherry Crops and Comparison of Revenue and Price

Year	Crop Size[a] (mil. lbs.)	Short versus Large Crop	Diff. Between Prod. and Previous 4 Yrs. Avg.Shipments (mil. lbs.)	Prod. as Pct. of Previous 4 Years Average Shipments	Total Revenue (mil. $)	Average Annual Grower Price (¢/lb.)	Annual Price as a Pct. of Previous 4 Years Avg. Price	Net Revenue[b] (cents per lb.)
1965	354	large	59	120	16.1	5.0	73	
1966	180	short	-130	58	24.3	13.8	228	
1967	178	short	-104	63	30.6	17.5	210	
1968	276		-2	99	41.5	15.2	147	
1969	317	large	71	129	23.3	7.8	61	
1970	251		22	109	17.9	7.6	56	
1971	280		41	117	27.7	10.0	83	-0.4
1972	312	large	55	121	22.3	8.3	82	-2.0
1973	175	short	-96	65	33.1	18.9	224	+2.7
1974	265		18	107	48.9	18.5	165	+6.2
1975	291	large	52	122	25.1	10.2	73	-4.1
1976	147	short	-93	61	36.8	25.1	180	2.1
1977	211		44	121	61.9	29.4	162	+13.6
1978	181	short	-31	85	79.3	43.8	211	+25.3
1979	170	short	-31	85	80.5	47.2	174	+23.5
1980	218	large	39	122	43.3	20.2	56	-3.1
1981	135	short	-55	71	59.1	44.5	127	6.8
1982	311	large	138	180	34.6	14.1	36	-9.8
1983	155	short	-31	83	71.5	46.6	148	-4.0
1984	255	large	86	147	64.0	25.0	80	-5.6
1985	286	large	103	156	62.8	22.4	69	-5.9
1986	224		22	111	44.3	20.3	75	-14.2
1987	359	large	154	175	22.4	7.8	27	-16.9
1988	236		2	101	43.8	18.7	99	-7.7
1989	264		13	109	35.3	14.5	84	-11.9
1990	209	short	-48	81	36.6	18.1	118	-8.4
1991	190	short	-64	75	88.1	46.4	313	8.9
1992	335	large	101	143	55.2	17.6	72	-2.5

[a]Crop size, total revenue and price data from Noncitrus Fruits and Nuts (NASS, USDA). Total revenue is farm value.
[b]Average annual U.S. tart cherry grower price minus grower costs per lb.("Cost of Producing Cherries," Mich. St. Univ.)

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1990	[illegible]
1991	[illegible]
1992	[illegible]

[a]Crop size, s…
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Table 3. Short Versus Large Raisin Crops and Comparison of Revenue and Price

Year	Crop Size[a] (1000 tons)	Short versus Large Crop	Difference Between Prod. and Previous 4 Years Average Shipments	Prod. as Pct. of Previous 4 Years Average Shipments (mil.lbs.)	Total Revenue (mil. $)	Avg. Annual Price ($ per ton)	Annual Price as a Pct. of Previous 4 Yrs. Avg. Price	Net Revenue[b] ($ per ton)
1965	241.4				54.0	200		-3
1966	258.2				57.7	206		-9
1967	161.3	short	-29	85	53.8	297		1
1968	240.5	large	49	126	70.0	265	113	2
1969	229.8	large	38	120	66.8	266	110	-2
1970	176.3		-17	91	54.6	283	109	-3
1971	174.5		-18	91	63.8	329	118	-6
1972	90.2	short	-104	47	58.8	560	196	17
1973	200.7		29	117	168.9	754	210	24
1974	213.1	large	45	127	145.4	602	125	-1
1975	252.6	large	83	149	188.2	665	118	-8
1976	134	short	-40	77	199.8	706	109	45
1977	220.3		32	117	208.6	840	123	25
1978	86.5	short	-104	46	243.8	1067	152	108
1979	261.7	large	90	152	347.9	1151	140	37
1980	250.6	large	83	149	372.3	1205	128	27
1981	224.4	large	43	124	336.6	1315	123	12
1982	206.2		17	109	336.7	1153	97	-50
1983	336.2	large	125	159	232.5	587	49	-50
1984	295	large	78	136	212.4	635	60	-163
1985	303.6	large	74	132	211.8	612	66	-135
1986	244.5		-4	98	209.7	757	101	
1987	323.1	large	54	120	290.9	817	126	
1988	324.1		32	111	326.0	898	127	
1989	393.3	large	87	128	420.1	977	127	
1990	354.9		39	112	354.5	903	105	
1991	314.0		25	108	332.2	963	105	
1992	353.1		n/a	n/a	329.4	849	91	

[a]Crop size, shipments--Thompson seedless only.Total revenue (farm value), price (all raisins):Noncitrus Fruits & Nuts.
bWeighted grower price for grapes dried for raisins and for crush, minus grower costs per lb. Cost data available through 1985 only (French and Nuckton, An Econometric Analysis of the California Raisin Industry).

Table 4. Short Versus Large Almond Crops and Comparison of Revenue and Price

Year	Crop Size[a] (mil. lbs.)	Short versus Large Crop	Difference Between Prod. and Previous 4 Years Average Shipments	Prod. as Pct. of Previous 4 Years Average Shipments (mil.lbs.)	Total Revenue (mil. $)	Average Annual Grower Price ($/lb.)	Annual Price as a Percentage of Previous 4 Years Average Price
1965	79.1				45.0	0.57	
1966	95.0				51.9	0.54	
1967	82.2				44.6	0.54	
1968	80.6		<1	100	44.5	0.55	
1969	132.8	large	50	160	73.9	0.56	102
1970	148.4	large	55	159	80.1	0.54	98
1971	160.7	large	54	151	87.1	0.54	98
1972	150.1		23	118	98.1	0.65	119
1973	154.7		13	109	200.0	1.29	226
1974	229.3	large	85	158	170.1	0.74	98
1975	185.6		35	123	128.0	0.68	80
1976	283.8	large	125	179	184.0	0.65	78
1977	313.1	large	130	171	264.5	0.84	102
1978	181.0	short	-36	83	262.5	1.45	202
1979	376.0	large	144	162	579.0	1.54	171
1980	321.8		62	124	473.3	1.47	131
1981	407.4	large	138	151	299.5	0.78	59
1982	346.7	large	62	122	311.1	0.94	72
1983	241.9	short	-64	79	231.9	1.04	88
1984	586.9	large	284	194	446.1	0.77	73
1985	464.7	large	133	140	360.6	0.8	91
1986	251.6	short	-120	68	461.6	1.92	216
1987	659.7	large	289	178	648.0	1.00	88
1988	590.0	large	173	142	600.1	1.05	94
1989	488.5		40	109	480.9	1.02	86
1990	656.2	large	198	143	598.0	0.93	75
1991	485.9		-30	94	564.2	1.19	114
1992	545.9		-12	102	670.1	1.26	120

[a]Crop size, total revenue and price data from "Almond Statistics" (Almond Board of California) and Noncitrus Fruits and Nuts (NASS, USDA). Total revenue is farm value. Net revenue is not computed due to lack of cost data.

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indicated in the last column of Table 3. Large almond crops are defined by the same criterion, ranged from 122% to 190% of prior four-year average shipments, during the period 1965-1992. During the 1980s, crops of that magnitude were associated with price levels that ranged between 59% and 98% of prior four-year average prices.

These criteria, based on comparisons of production to prior average shipments, represent only an approximate means to define large and short crops, because there are exceptions in each case. For example, 1977 tart cherry production was 121% of shipments for the previous four years, but should not characterized as a large crop year because prices were high enough to yield positive net revenue for typical growers. The previous year's crop had been quite short (61% of the previous four years' shipments). The percentage comparison also needs to be viewed with caution for raisins. The late 1970s was a period of strong raisin export demand, so that prices were 123%-140% of prior four-year averages even in large crop years (as defined by the 120% of prior four year shipments criterion) and were even higher in short crop years. With almonds, large crops by the 140% definition prior to the 1980s were not associated with low prices (e.g., price levels substantially below price levels in the prior four years). Thus the percentage comparisons provide one useful general indication of what represents large and short crops, but the comparisons should be made with caution. It would have been preferable to establish net revenue as the main criterion for assessing what are large and small crops, but sufficient data were not available to do so.

Crop size has a significant impact on price fluctuation. When large tart cherry crops occurred, prices in those years were 83% or less of the average prices for the previous four years. Prices ranged as low as 36% (1982) and 27% (1987) of the previous four-year average, as shown in the second to the last column of Table 2. Also, in most large crop years, prices ranged from under one cent to seventeen cents below estimated average cost of production, as shown in the last column in Table 2.

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Large crops have not had as strong a downward price effect with almonds and raisins as they have had with tart cherries. For raisins, the magnitude of the supply fluctuations have been proportionally smaller than for cherries. The magnitude of year-to-year supply swings have in a number of cases been larger than for almonds than for cherries, so the explanation of less price variability lies both in the fact that almonds are not as price inelastic and because certain marketing institutions (federal marketing orders) provide greater means to mitigate the impact of large supplies.

Tart cherries have had more severe annual supply fluctuations during the last 25 years than have almonds or raisins. Average annual percentage changes in production were 17% for tart cherries, 15% for almonds, and 10% for raisins for the period 1965-1992. Production variability for these three crops is compared to other perennial crops in Table 5.

Additional measures of variability include INS and the coefficient of variation.[3] Tart cherries rank as the most variable perennial crop by two of the three measures for the period 1965-1992. The high CV for almonds for 1965-1992 (0.59) is because mean production in the denominator of the CV calculation was low.

Considering the more recent period 1981-1990, it is evident that almond production variability has increased substantially and appears to have become more variable than tart cherries when measured by INS or CV. However, the figures in Table 1 indicate that tart cherries have a more serious production variability problem in terms of frequency of short crops when considering the period 1967-1990. On the other hand, there has been only one short tart cherry crop since 1983 because tart cherries have been in a period of excessive plantings.

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[3]INS is an index measure of variability or instability known as the variance of annual percentage change. See Ian Dalziell, "Sources of Agricultural Marketing Instability," Unpublished Ph.D. dissertation, Michigan State University, 1985. The coefficient of variation is the standard deviation divided by the mean.

Table 5. Production Variability Measures For Selected Perennial Crops

	1965-1992			1981-1992		
	Average Annual Percentage Change[1]	Coefficient of Variation[2]	INS[3]	Average Annual Percentage Change	Coefficient of Variation	INS
Tart Cherries	16.6	0.26	1674	19.4	0.26	2123
Almonds	14.3	0.59	1442	18.0	0.29	2144
Hazelnuts	15.2	0.42	1420	17.6	0.31	1764
Raisins	9.3	0.25	664	7.6	0.14	292
Plums	6.7	0.20	287	8.6	0.14	435
Sweet Cherries	8.5	0.21	476	7.5	0.15	412
Freestone Peaches	6.8	0.15	312	7.8	0.13	375
Blueberries[4]	8.1	0.34	386	4.1	0.15	72
Apples	3.9	0.20	104	3.9	0.12	128
Nectarines	4.7	0.41	133	3.8	0.10	90

[1]Average annual percentage change is the average of year-to-year percentage changes, which are measured as a percentage of the average production for each pair of adjacent years.

[2]Coefficient of variation is the standard deviation of production divided by the mean.

[3]INS is the variance of annual percentage change. This index of variability effectively detrends a data series. If production increased by a constant proportion each year (e.g., 10% per year), there would be zero variance and consequently INS would equal zero.

[4]Blueberry data are through 1990 only.

Of the three industries, the tart cherry industry has experienced the largest annual price swings; the coefficient of variation for cherry prices for the period 1964-1989 was .65. The comparable figures for raisin and almond prices were .50 and .41, respectively. The higher price variability for tart cherries was due mainly to the larger relative swings in tart cherry production combined with price inelastic demand. All three commodities exhibit price inelastic demand, as evidenced through price flexibilities (approximately the inverse of demand elasticities).

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Analysis in Chapter 6 indicates that grower price flexibilities are approximately -2.0 for tart cherries and -1.4 for almonds. Nuckton and others computed price elasticity of bulk raisins as -0.2, approximately equivalent to a price flexibility of -5.0.[4] Although the evidence suggests that raisin price flexibilities are higher, tart cherries have higher price variability due to larger swings in production.

2.2. Long-Term Supply Trends and Overproduction

Periods of overproduction occur in various agricultural subsectors. If overplanting occurs with perennial crops, those subsectors may experience excess production capacity, overproduction and prices below typical grower costs for a number of years. Individual growers make acreage expansion decisions that in the aggregate may result in considerable overproduction capacity for the subsector when the new acreage reaches bearing age. This is a consequence of secondary uncertainty, which arises because growers are often unable to take account of the aggregate consequences of their planting decisions. Growers have limited knowledge of the planting intentions of other growers and of the consequences of the total impact of those planting decisions on future supply and prices. Also, growers generally make planting decisions in the belief that their individual decisions will not affect the aggregate supply. When many growers plant at the same time, as is often the case, the net impact on total productive capacity can be large. Primary uncertainty is due chiefly to supply variability attributable to climatic and biological factors such as those discussed above.

For a number of crops the result is similar: periods of high prices typically lead growers to form overly optimistic expectations regarding future profit levels and to plant

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[4]C.F. Nuckton, B.C. French, and G.C. King, An Econometric Analysis of the California Raisin Industry, Gianninni Foundation Research Report No. 339, University of California, December 1988, 30. The point of means elasticity was computed at the 1983 values.

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new acreage to the point where productive capacity is significantly expanded. If demand cannot be expanded by a commensurate amount, these expansionary plantings sometimes result in a level of supply which leads to economic losses by growers for a number of years after the new acreage begins bearing. For example, expansionary tart cherry plantings in the late 1970s resulted in a period of large supplies and low prices beginning in the mid-1980s.

As shown in Figure 1 at the beginning of this chapter, tart cherry bearing acres declined steadily after 1964 and leveled out around 1978. Largely in response to high prices in the late 1970s, growers made substantial new plantings in the late 1970s and early 1980s. Bearing acreage began to rise significantly around 1983, and in the second half of the 1980s serious overproduction problems became evident. (A tart cherry tree is defined as "bearing" in the sixth year after planting.)

Though many perennial crops exhibit some type of long-term cycle, it is more pronounced in some crops, such as tart cherries, than in others. The longer-term cyclical production pattern for cherries contrasts with the almond market, which has seen fairly steady long-term growth in both demand and supply (despite large year to year variation). Almond demand expansion has been more effective in keeping up with large increases in production than has tart cherry demand expansion.

Almond demand expansion has been facilitated in part by the fact that almonds are relatively inexpensive to store. Due to significant almond production variability, large inventories are sometimes carried over into a subsequent marketing year. The combination of collective storage through a federal marketing order (examined in Chapter 5) and storage by the almond marketing cooperative and other firms helps reduce the likelihood that shortages of supply will subsequently affect demand or that higher prices from short-run fluctuations will send false signals to producers about future price prospects.

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Table 6. Number of Years from Planting on Bearing and Typical Life Span for Three Perennial Crops

	Years from Planting to Bearing	Typical Economic Life for Tree/Vine
Tart Cherries	6	20-35
Almonds	5	20-35
Raisin-type Grapes	3	several decades

Supply-demand balance problems for perennial crops differ considerably from the typical situation with annual crops, and the typical supply-demand coordination mechanisms are also different for perennials than for annual crops. Markets for annual processing vegetables are coordinated to a large extent by preplanting contracts with prices specified. This coordinating mechanism is rarely used with perennial crops. Annual preplanting contracts for annual vegetables facilitate rapid adjustments to supply-demand imbalances, and the processing firms that provide the contracts with growers typically use market analyses and predictions of market conditions for the upcoming year in determining contracted quantities. If excess production of a certain annual vegetable occurs in a given year, for example, the contracted acreage can be reduced in the following year.

In contrast to annual crops, adjustment periods for perennial crop acreage usually last a number of years because of the large fixed investments in bearing acreage, the time lag between planting and bearing, and the long life span of perennial crops. The typical life span for an almond or tart cherry orchard is 20 to 35 years, and for raisin-type grapes, several decades. Downward adjustments made by growers in removing orchards or vineyards in response to low returns due to excess capacity are usually slow. However, when returns have been low for a number of years, substantial acreage may be removed in a relativel

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relatively short period of time.[5] The pattern for cherries illustrates a common occurrence of cycles in production.

An optimizing rule in economic theory recommends that an economic decision to remove trees or vines be based on a grower's estimate that the net present value of a stream of income from a particular block is less than the sum of (a) the net present value of the income that could be obtained from an alternative use of that land minus (b) the cost of removing the trees and the loss in value of assets that cannot be redeployed into alternative enterprises. Knowledgeable extension agents with experience in fruit industries indicate, however, that growers generally do not make such explicit calculations but instead make general judgments using approximate figures. The agents have observed that growers commonly compare current or recent prices to variable and perhaps fixed and total costs with some vague thoughts about the future. The predictions are understandably vague because of the uncertainty that growers face, especially uncertainty relating to the actions of other growers of the same crop. A common result is periods of grower overinvestment in orchards or vines (as well as the associated equipment) and slow downward adjustment in acreage once the excess plantings have occurred.

Another factor contributing to long-term oversupply problems is that even if some growers exit from production, their orchards or vines often stay in production, in some cases operated by a new owner who may have purchased the orchard at a loss to the original owner.[6] Overcapacity problems can thus plague a perennial crop industry for many years.

Examination of tart cherry acreage trends over the last 40 years (Figure 1) indicates that bearing acreage has risen and fallen two times, suggesting a cyclical pattern. In

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[5]Larry Hamm, "Food Distributor Procurement Practices: Their Implications for Food System Structure and Coordination," Unpublished Ph.D. dissertation, Department of Agricultural Economics, Michigan State University, 1981.

[6]Dr. Donald Ricks, Dept. of Agricultural Economics, Michigan State University, Personal communication.

contrast, a fairly steady and pronounced long-term upward trend is evident for almonds since the 1960s (Figure 2) with a leveling off since the mid-1980s and a slight downturn in the 1990s. Figure 3 indicates that Thompson seedless grape bearing acreage, after remaining fairly steady for many years, rose sharply in the late 1970s and early 1980s and then began to decline in the mid-1980s. Thompson seedless grape production represents approximately 90% of all raisin-type grape production. Raisins produced from Thompson seedless grapes are called Natural Thompson Seedless raisins (NTS).

The preceding pages have provided a general overview and comparison on the short -run and long-run supply-demand balancing problems for the three commodities. Now the supply-demand balancing problems for each of the three commodities are examined in more detail.

2.3. Tart Cherry Supply-Demand Balancing Problems

This section examines both short-run and long-run supply demand balancing problems in the tart cherry subsector. The effect on production and market supplies from the combination of weather-induced annual fluctuations in yields and the longer-run cyclical nature of bearing acreage often sends confusing market signals to growers and processors. For example, it is difficult to determine to what extent high or low cherry prices in a given year are the result of short-run annual supply fluctuations and to what extent the prices reflect the longer-run supply-demand balance related to the cyclical phenomenon. It is especially difficult for growers to interpret where the industry is in terms of productive capacity when the industry is near a turning point in the long-term cycle and then has an unusually short or unusually large crop. Acreage figures which might help growers interpret these trends are published too late and too infrequently (every four years) to serve as an effective guide to decision making. Thus although it is clear that short tart cherry crops in 1990 and 1991 were partially due to weather-induced short-run fluctuations, opinions differed

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differed among growers, processors, and other industry participants on whether or not these short crops represent a turning point in the long-run cycle of productive capacity.[7]

In the long-run cyclical pattern of tart cherry bearing acreage, periods of industry over-capacity and under-capacity are interspersed with periods of approximate balance of productive capacity with demand. The impact on supply and demand, prices and costs of some different periods of the production cycle in the most recent twenty-year period can be analyzed using Figure 4 and Figure 5.

The years 1972-1975 were a period of approximate balance between supply and demand at a remunerative price. Price P_a, resulting from the intersection of demand D_a with supply S_a in Figure 4, represents a price level that is consistent with generally moderate levels of supply.

Extending that price level on a dotted line over to Figure 5 is intended to show that the 1972-1975 period was a period in which grower prices approximated average total cost of production (ATC) for typical well-managed grower firms, represented by the flat portion of the ATC curve.

The next period in the tart cherry cycle, 1976-1981, can be characterized as a period of general under-capacity of production in relation to potential demand, with frequent short crops and unusually high prices received for cherries. This is shown graphically by the shift from S_a to S_b and the rise in the price level to P_b, which is considerably above typical grower cost of production in Figure 5. Growers responded to high prices during this short supply period with substantially increased plantings, resulting first in a transitional period of approximate balance of supply and demand from 1982 to 1984 and then a period of chronic over-capacity during the period 1985-1989. Over-capacity is shown graphically by the supply

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[7]Dr. Donald J. Ricks, personal communication.

1972–1975: Period of approximate balance.

1976–81: Reduction in productive capacity, period of frequent shortages and high prices (shift from Sa to Sb). Demand is reduced in part due supply fluctuations and perceptions by some retailers [illegible]

1972–1975: Period of approximate balance.

1976–81: Reduction in productive capacity, period of freqeuent shortages and high prices (shift from Sa to Sb). Demand is reduced in part due supply fluctuations and perceptions by some retailers and manufacturers of high prices and unreliable supply (shift from Da to Db).

1982–1984: Period of approximate balance.

1985–1990: Due to heavy plantings, supply shifts to Sc. Demand growth is sluggish in part due to a continued perception of cherries as "high priced", despite a number of low–price years.

Figure 5. Illustration of Tart Cherry Grower Price Level Changes Due to Changing Long-Term Supply Conditions, 1972-1989

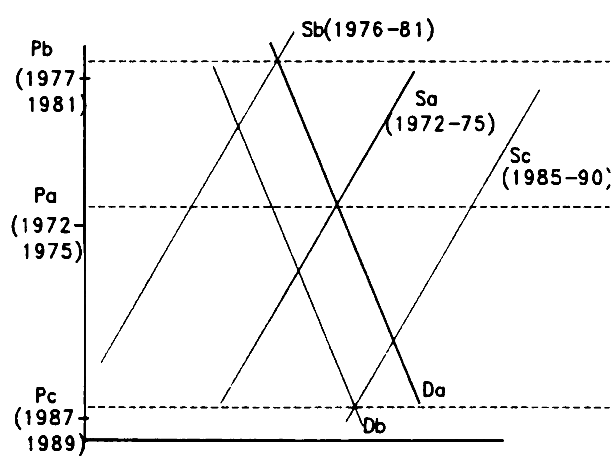
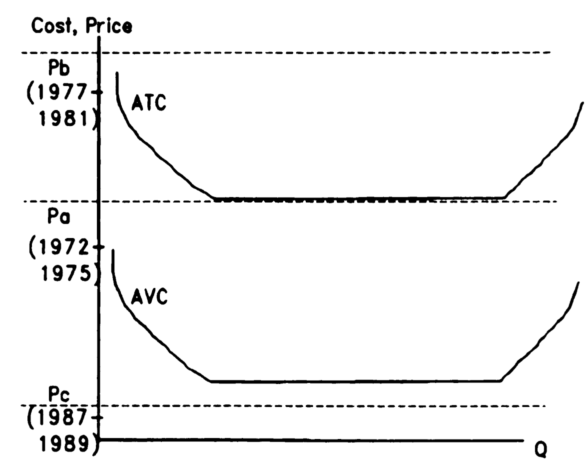


Figure 6. Relationship of Average Grower Cost to Tart Cherry Price Levels, 1972-1989



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The preceding graphs illustrate the meaning of long-term imbalance between supply and demand of perennial crops by showing the effects on grower price levels of changes in tart cherry productive capacity at different periods of the production cycle. During the period of declining tart cherry acreage, frequent shortages led to price levels well above grower costs in most years. Subsequent heavy plantings resulted in grower price levels below typical grower costs.

It is important to put more precise meaning into this discussion of excess production and shortages with actual price and cost figures. Graphical comparisons of tart cherry prices with cost of production in Figure 6, Figure 7, and Figure 8 help to do this. Michigan tart cherry cost of production data was obtained from cost estimates carried out in 1971, 1979, 1984, and 1989. Total and variable production cost figures at an average yield of 2.6 tons per acre for the four survey years are plotted in Figure 6 with connecting lines to illustrate the cost trends (2.6 tons per acre was the approximate statewide average in recent years). Costs beyond 1989 were increased at a constant rate of 2% per year. The sharp increase in average total cost (ATC) between 1979 and 1984 and the decline between 1984 and 1989 were due largely to changes in the cost of land and orchards, which represents in part the capitalization into land and orchards of the higher expected stream of income resulting from high tart cherry prices in the late 1970s and early 1980s. Since ATC is itself influenced by grower prices for tart cherries, comparisons of price and ATC as a measure of imbalance and supply and demand should be done with caution, and greater reliance should be placed on comparing price and variable cost.

A production cost time series for the entire period was constructed by interpolating between survey years using the assumption that both variable and total costs changed by equal increments each year. The original cost survey figures were presented as costs per

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Figure 6. Michigan Tart Cherry Grower Total and Variable Cost with Yield of 2.6 Tons/Acre

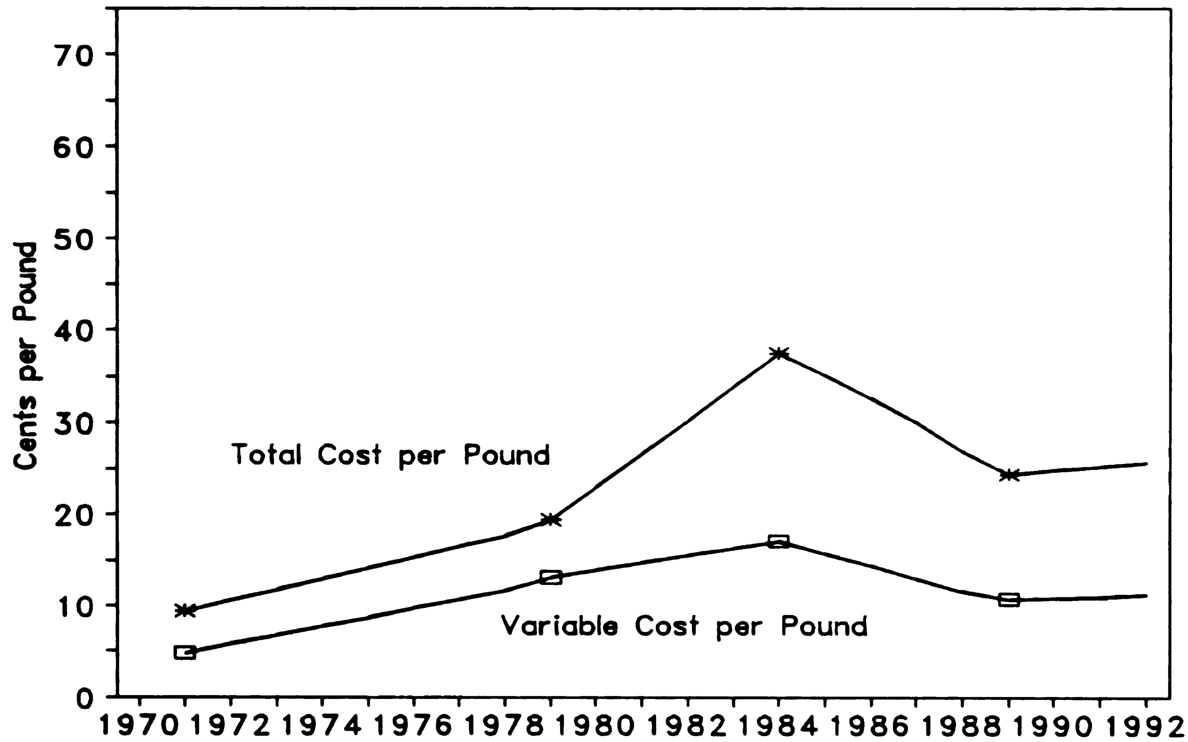
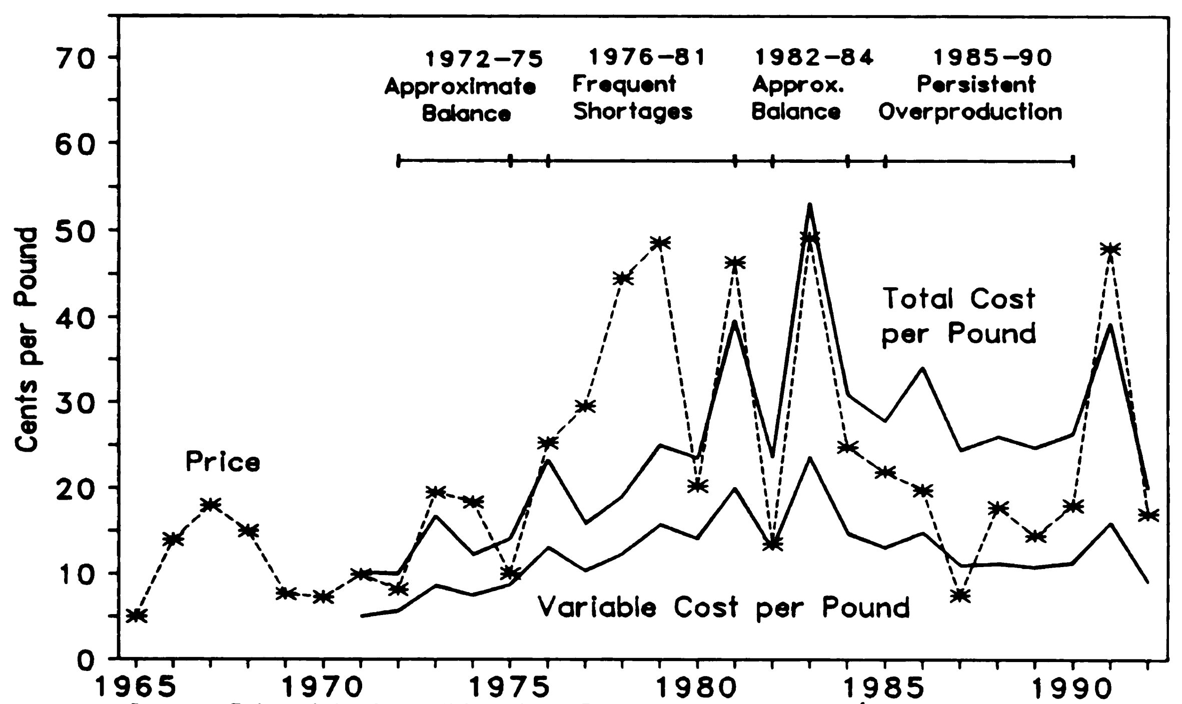


Figure 7. Michigan Tart Cherry Grower Prices Compared to Variable and Total Cost at Average Yield Each Year



Source: Price data from "Noncitrus Fruits and Nuts, ' ERS/USDA, annual summaries, various years. Cost data: see previous figure.

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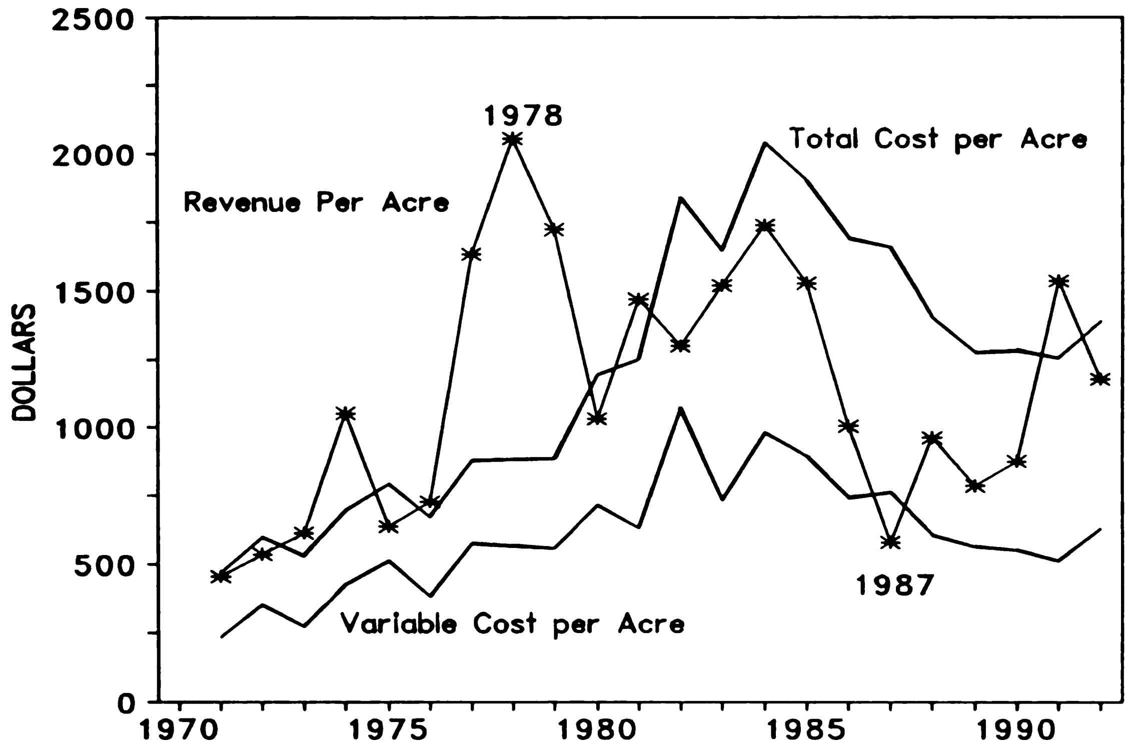
Figure 8. Michigan Tart Cherry Grower Total and Variable Cost and Revenue Per Acre



acre. The time series per-acre cost figures were then divided by actual annual average yields per acre to give the total and variable costs per pound at average seasonal yields. Harvesting costs were included as the number of cents per pound. The resulting cost figures were plotted with bold lines to form the "cost band" in Figure 7.

Figure 7 compares grower prices to grower cost per pound. Annual average Michigan grower prices for processing were plotted on the same graph with each year's price appearing as an asterisk. Michigan prices are typically about equal to U.S. prices since Michigan produces over 70% of U.S. tart cherries. Thus comparison of Michigan price and cost of production is a reasonable approximation for the entire U.S.

Figure 8 compares grower returns per acre (gross revenue) to cost per acre. Costs per acre are computed by taking the cost survey figures (which were per-acre figures) and adding costs that were given in cents per pound (multiplied by average yields per acre).

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Both Figure 7 and Figure 8 indicate that when short crops occur, prices are high relative to preceding or succeeding years and are often well above total cost of production, such as in 1977-1979. In large crop years such as 1975 and 1980, prices tend to drop below total cost of production of a typical grower. When prices are consistently below total cost of production, such as from 1985 through 1989, this provides evidence of persistent overproduction. In the very large crop year of 1987, gross revenue per acre was below variable cost of production.

Comparisons of production and sales forecasts showed that estimated average production (based on a 1990 orchard survey) is likely to exceed projected processed tart cherry sales well into the 1990s.[8] The orchard survey and related analysis provided some evidence of excess tart cherry productive capacity upon which plans for an orchard removal incentive program were developed. Orchard removal issues are examined in Chapter 5.

Comparing average tart cherry production with average quantity sold in Figure 9 helps illustrate the problem that supply shortages tend to constrain long-run demand growth. Average production (plotted as bars in Figure 9) is computed by multiplying bearing acreage by a 4-year moving average of yields. Potential average annual sales are computed as the average of the two highest years out of the previous four, based on the assumption that annual sales could have stayed at the highest levels attained in recent years had sufficient quantities of tart cherries been produced to meet that demand. Four year periods were selected as the most accurate means of estimating averages due to the improved averaging effect of having two high production and two low production years. Tart cherry sales are defined as equivalent to processed movement, which is computed as beginning inventory plus pack minus ending inventory. The tart cherry pack is the quantity processed as frozen, pie filling, and canned.

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[8]Cherry Marketing Institute, "Report on Michigan Tart Cherry Survey," Okemos, Michigan, 18 January 1991.

Figure

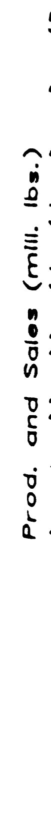

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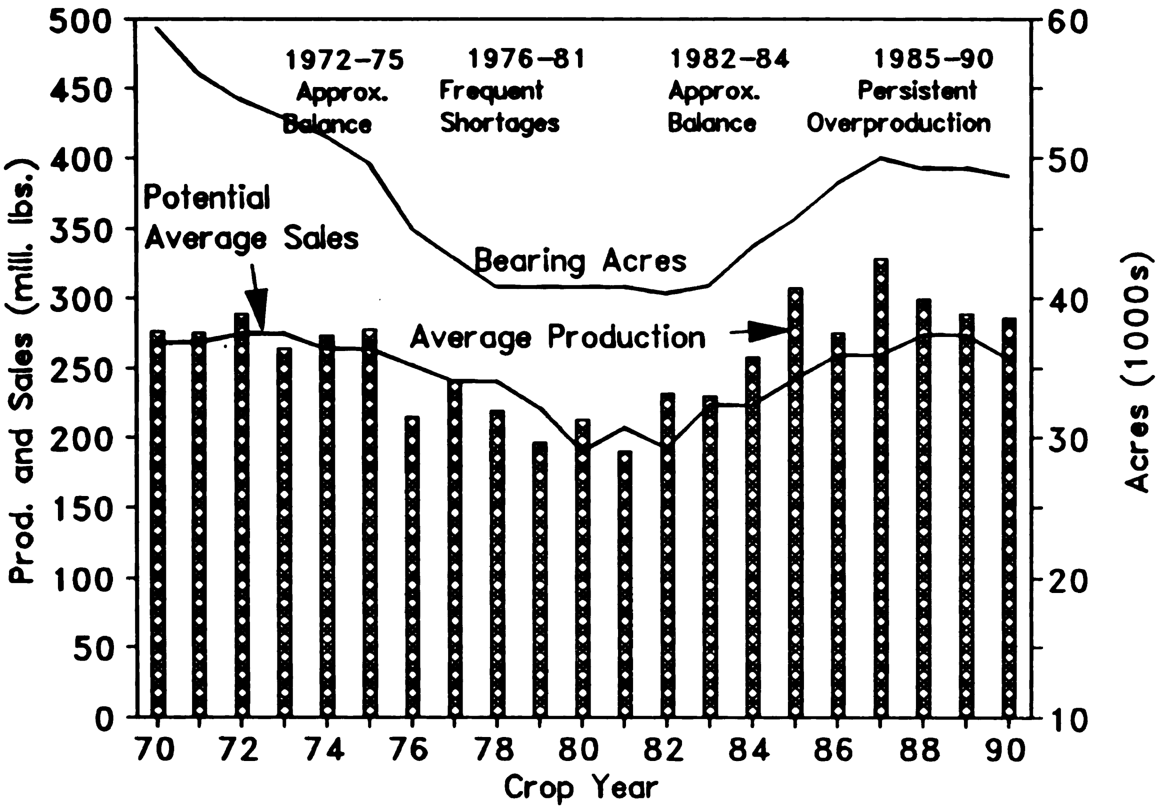
Figure 9. Average U.S. Tart Cherry Production, Average Sales, and Bearing Acreage

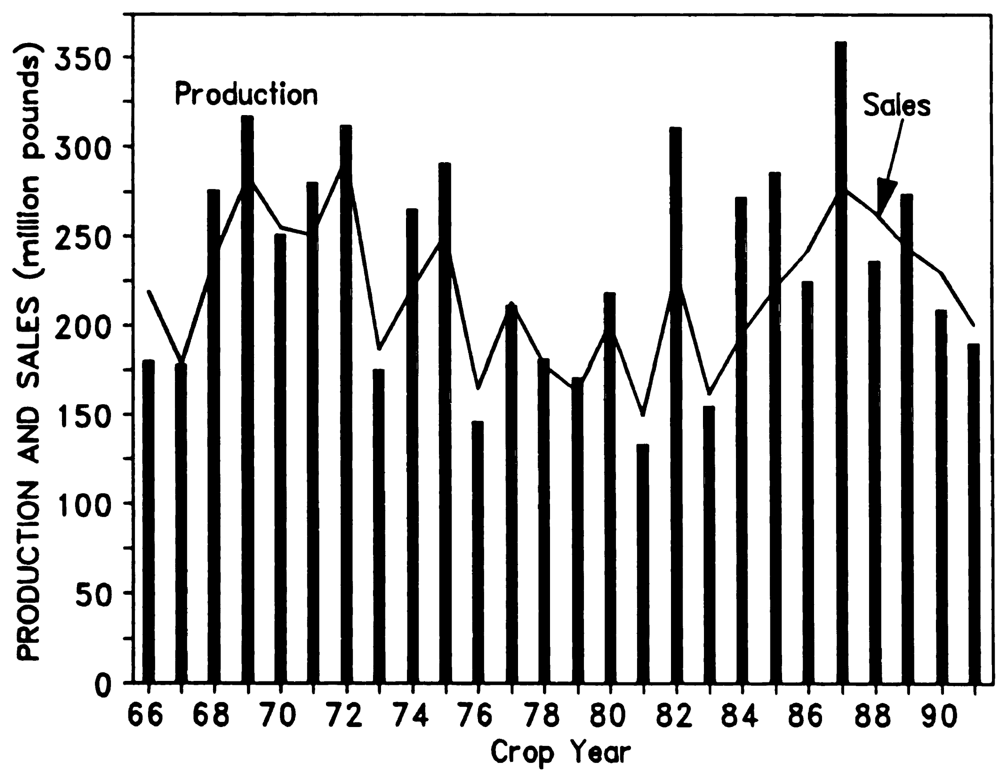


The resulting graph in Figure 9 is consistent with Figure 7 in that the same cyclical periods are also evident though less pronounced. One can observe during the period 1976-81 that the reduced productive capacity from declining acreage resulted in average production generally below potential demand (average annual sales). Although average production is equal to average sales in 1977, one should note the pattern over several years rather than in one particular year. The general downward trend of average annual sales from 1976 to 1980 provides some evidence that one key impact of shortages during that period was dampened demand. When acreage and production began to rise around 1982, demand growth lagged behind.

The preceding discussion focused on the long-run cyclical aspect of tart cherry supply instability. The focus now turns to annual supply fluctuations. Supply instability combined with inadequate storage is a major aspect of the problem of balancing subsector supply and demand on an annual basis. Figure 10 illustrates the annual supply fluctuation problem by presenting actual sales and actual production rather than moving averages as in Figure 9. The problem of frequent shortages is evident. There were ten years with short crops between 1966 and 1991 as defined by the criterion in Table 2. The short crop years were: 1966, 1967, 1973, 1976, 1978, 1979, 1981, 1983, 1990, and 1991. A key occurrence in each of these short crop years was that total sales dropped off sharply due to the reduced supplies. Another key factor is that because of the risks associated with storage by individual firms, during most years there is generally little processed product stored to meet the short crop possibilities. Some alternative coordination mechanisms for dealing with this problem are examined in Chapter 5.

However, some stabilization through storage did occur during the years of general excess capacity in the late 1980s. Although tart cherry processors have generally tried to

Figure 10. U.S. Total Tart Cherry Production and Total Sales, 1950-1991



have as little carryover as possible, the prevalence of large crops during that period meant that some processed product was stored because of the difficulty of selling the larger quantities in commercial channels. Note that the graph in Figure 10 shows that production levels in 1986 and 1988 were well below sales. Although at first glance those graphs appear to indicate that shortages could have a negative impact on demand (because of the gap between production and sales) this was not the case. In both of those years, there were large carryin stocks due to heavy production in 1985 and 1987. In addition, production levels were approximately 111% and 101%, respectively, of the average of prior years' shipments. Thus sales did not decline, largely due to the stabilizing effect of stored cherries. However, tart cherry industry observers have noted that although large stocks in those years did have a stabilizing effect, most interseasonal storage is unplanned storage. The large size of cherry carryover stocks in those years was largely due to handler inability to sell large additional quantities. Industry observers caution that storage by processing firms will generally not be adequate to mitigate the problems caused by supply volatility, including the lack of product in short crop years.

Further evidence that 1986 and 1988 did not represent shortage years is that in 1986 and 1988 average grower prices were on average about 14¢ per pound and 7¢ per pound lower than total grower costs (see Figure 7).

Although bearing acreage changes little from one year to the next, production continues to be subject to wide annual fluctuations throughout various phases of the tart cherry production cycle. Wide fluctuations in prices were especially noteworthy during certain time periods such as the 1970s and early 1980s, when large year-to-year changes in production were particularly frequent.

Large production in a given year can push grower prices below annual variable costs, causing severe economic hardships. The 1987 national tart cherry crop was very large and Michigan grower prices averaged approximately 8¢ per pound, which was 3¢ less than annual variab

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variable costs of growing and harvesting for a typical grower and 17¢ less than total cost per pound (see Figure 7).

Since cherry demand is price inelastic, especially at the farm level, even large decreases in grower price result in only small increases in the quantities of cherries sold in a large crop year. Significant demand expansion is not easily achieved within a period as short as one year.

Due in part to the problems encountered in trying to stabilize markets through storage by individual firms, a tart cherry federal marketing order supply management program was established to facilitate storage on a collective basis. The coordination role played by marketing orders is examined in Chapter 5.

2.4. Almond Supply-Demand Balancing Problems

In contrast to tart cherries during the last 25 years, the longer-run almond situation regarding acreage and production has not been cyclical but rather has shown a sustaining pattern of long-term expansion. Production rose from an average of less than 100 million pounds annually during the mid-1960s to an average in the 500-600 million pound range by the early 1990s. Bearing acreage reached a peak in the early 1990s and then continued on a high plateau with a slight decline.

The question of whether periods of overcapacity occur in the almond subsector is illustrated graphically by comparing average production and average annual sales in Figure 11.[9] It is useful to compare 1972-1979 with the period beginning in 1980. The period 1972-1979 was selected for comparison because the seventies were years of strong almond demand in which the almond marketing order was not used. Prior to 1972 and after 1980 the almond marketing order was regularly used in large crop years.

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[9]Average production (plotted as bars) is calculated by multiplying the three year moving average of yields by bearing acreage. A three-year moving average of delivered sales is plotted on the same graph.

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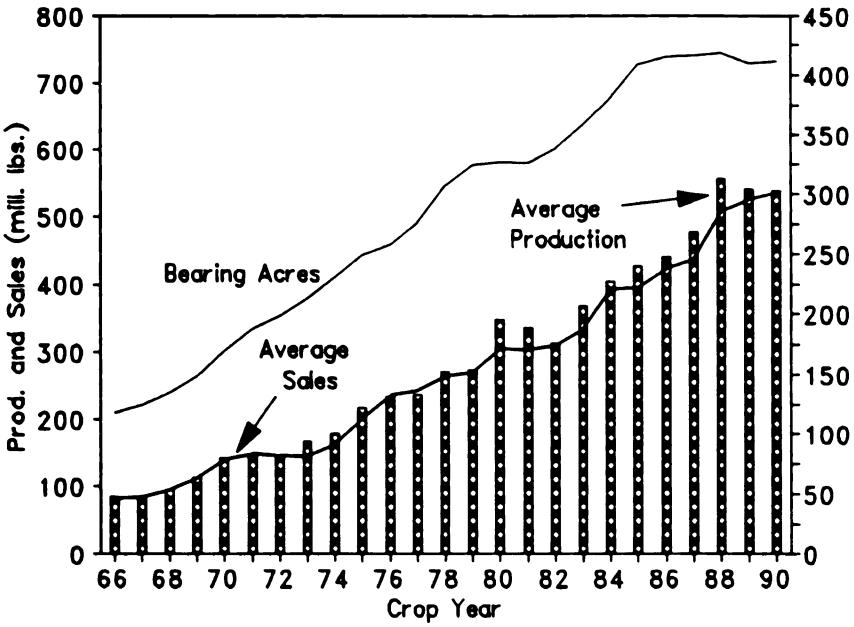
Figure 11. U.S. Average Almond Production and Average Sales



During the period 1972-1979, the bar graph representing average production in Figure 11 and the line graph representing average sales are about the same height, indicating approximate equality of production and sales and thus an approximate balance of supply (productive capacity) and demand. Even though bearing acreage was increasing steadily, oversupply in the U.S. market was not a big problem because increasing quantities of almonds were exported as can be seen in Figure 12. U.S. sales rose and fell and then rose again during that period, but the overall sales had a gradual upward trend. The situation changed in the early 1980s, however, when production capacity began to rise sharply due to improved yields and rising acreage.[10] Generally weaker economic conditions in much of the world led to faltering export sales in the early 1980s. Almond exports began to rise again in the mid-1980s, but a very short crop in 1986 substantially disrupted the pattern of increasing export sales (this is examined in more detail below).

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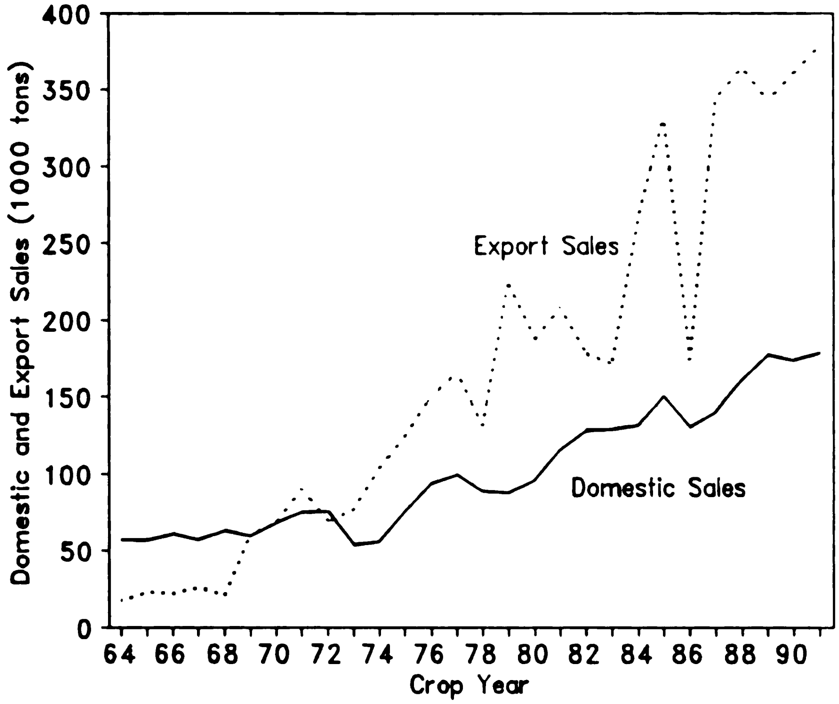
[10]Average yields rose from 850-880 pounds per acre in the late 1970s to over 1000 pounds in the early 1980s (measured as three year annual averages).

Figure 12. Domestic and Export Almond Sales, 1964-1991



The net result of these factors was a period of overcapacity in the 1980s. From 1980 on, the bar graphs in Figure 11 representing production are generally above the line representing average sales, providing one indication of general overcapacity. Production above sales levels was either stored as carryover stocks or disposed of in alternative sales outlets that did not compete with sales in the primary commercial channels. In some years this was accomplished through the operation of the federal marketing order reserve, which is explained in Chapter 5.

The fact that there were many years of large supplies is also evident from examining the graph in Figure 13 which compares <u>actual</u> annual delivered sales (versus a moving average of sales in the previous graph) and total U.S. production of almonds. Production levels in 1984, 1987, 1988 and 1990 were particularly large relative to sales and production and levels in prior years.

One would expect large crops such as these to result in prices below cost of production, as was shown to be the case with tart cherries. However, because of a lack of

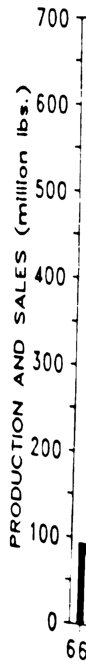


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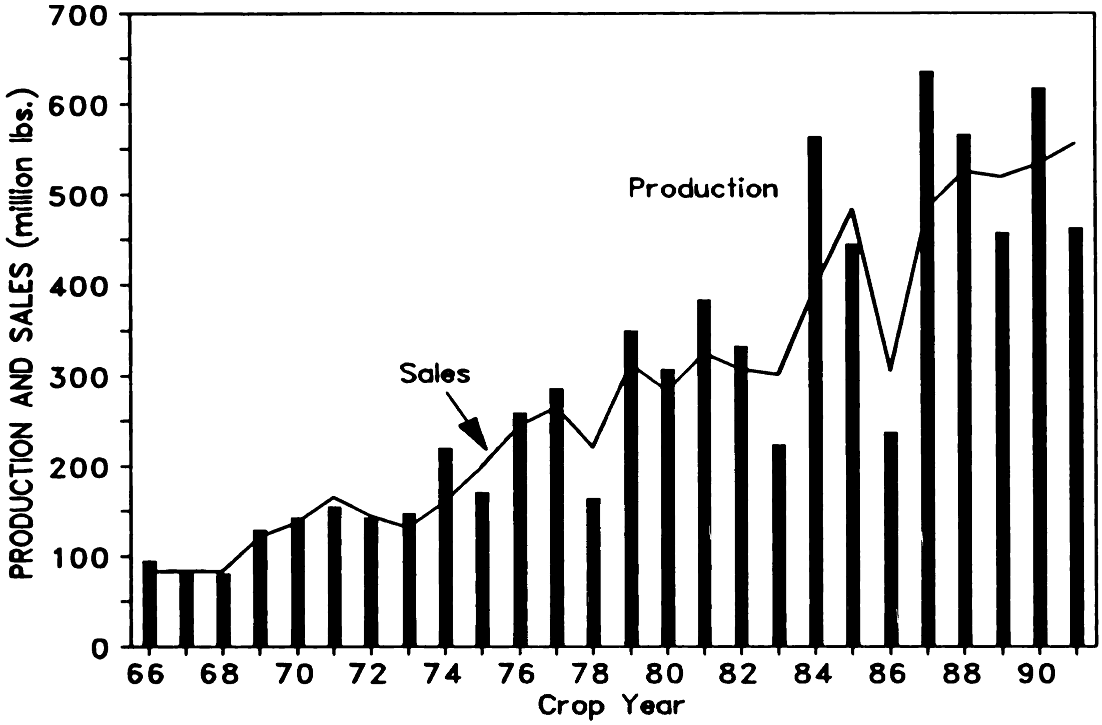
Figure 13. U.S. Almond Production and Total Sales



data, a meaningful price-cost comparison across time could not be made for almonds. Part of the difficulty in developing time series data for costs is that production costs are highly variable across production zones because of differing land ownership or tenancy relationships among growers and because of other factors.

The magnitude of annual swings in almond production has increased along with the average level of production. Table 5 in section 2.1 shows that average annual percentage change for almonds was 14.3% for the period 1965-1992, but had increased to 18.0% for the period 1981-1992.

Figure 13 also shows that short crops (well below sales) were particularly evident in 1978, 1983, and 1986.[11] The situation was somewhat different for 1989 and 1991, as will be discussed below. In 1986, the general unavailability of almonds and record high almond

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[11]Production in those years was 83%, 79%, and 68%, of average sales for the previous four years.

prices ($1.92 per pound versus prices ranging from $0.77 to $1.04 for the three preceding years) resulted in a loss of sales outlets that hampered subsequent demand growth when production levels later rose to substantially higher levels.[12]

The question arises as to whether the shifts in quantities sold from year to year with the variation in supplies represent shifts in demand or movement along a fixed demand curve. The evidence suggests both. The graphs indicate that when production increases in year after a short crop, sales generally recover to levels somewhere near previous years of comparable production levels, which suggest that only movement along a demand curve has taken place. The evidence that the demand curve has also shifted in more anecdotal. Interviews with handlers revealed that sales of certain types of manufacturer buyers will cease buying in response to the unavailability, at least for several years, suggesting that preferences have changed--the manufacturers change their product offering to consumers to food products with a more reliable supply.

This situation is similar to the dampening of demand associated with the tart cherry shortage period in the 1970s and in 1981 and 1983, in which the reduced supply and higher prices contributed to a decline in demand. The juxtaposition of the very short crop year in 1986 and two large crop years (1987 and 1988) led to a significant policy change regarding the operation of the almond reserve under the federal marketing order. Subsequent to 1986, almond reserves were used increasingly as a means for collective industrywide storage to reduce the likelihood of shortages as occurred in 1986. Referring again to Figure 13, it is evident that a stabilizing effect did occur in 1989 and 1991 since sales did not drop off as had occurred during previous short crops. This was due to storage of almonds both through the almond marketing order reserve and through storage by individual handlers. Supply management through federal marketing orders and other means is covered in Chapter 5.

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[12]Blue Diamond Growers, Inc., "Annual Report 1987-1988." Price data from "Statistical Tables," Almond Board of California, various years.

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2.5. Raisin Supply-Demand Balancing Problems

A key factor that differentiates the raisin supply situation from that of the other two commodities is that shifts in market utilization of grapes in a given year affect the raisin supply. The raisin supply depends not only on the amount of raisin variety grape bearing acreage and yields but also on market utilization decisions by growers. Growers decide whether to dry the grapes for raisins or to sell them in one of three alternative market outlets: (a) crush (winemaking), (b) fresh (table grapes), or (c) canning. Since the proportion of the crop used fresh and for canning has remained relatively constant at 12-15%, the grower decision that has the greatest effect on the annual raisin supply is between drying grapes for raisins or selling them for crushing into grape juice for wine-making. Growers switch back and forth between the crush market and the raisin market based on expected relative returns and the availability of the crush market in a given year.

Figure 14 shows that although the overall level of raisin-type grape acreage has been steady for many years (up until the early 1980s), grower decisions to shift between the raisin and wine markets has caused acreage harvested for raisins to vary considerably.[13] This additional factor of uncertainty and supply volatility contributed to the difficulty of balancing subsector supply and demand.

Weather has also played a role in raisin production variability. Frost damage in 1972 and post-harvest rain damage in 1976 and 1978 affected the crop on a substantial proportion of the Thompson grape acreage as shown by the decline in acreage for those years in Figure 15 for "NTS Raisin Harvested Acres." The reason that acreage declines in years of

[13]The data series for the graph of "Acres Harvested for Raisins" in Figure 14 was computed by multiplying total raisin-type grape bearing acreage time the percentage of grapes dried into raisins. The graph is intended only to demonstrate that changes in market utilization have a considerable impact on raisin production (the line representing production in the graph is raisin production, not production of raisin-type grapes). It should be viewed only as an illustration of utilization changes from year to year over the time period shown and not as a precise measure of acreage harvested for raisins in any given year.

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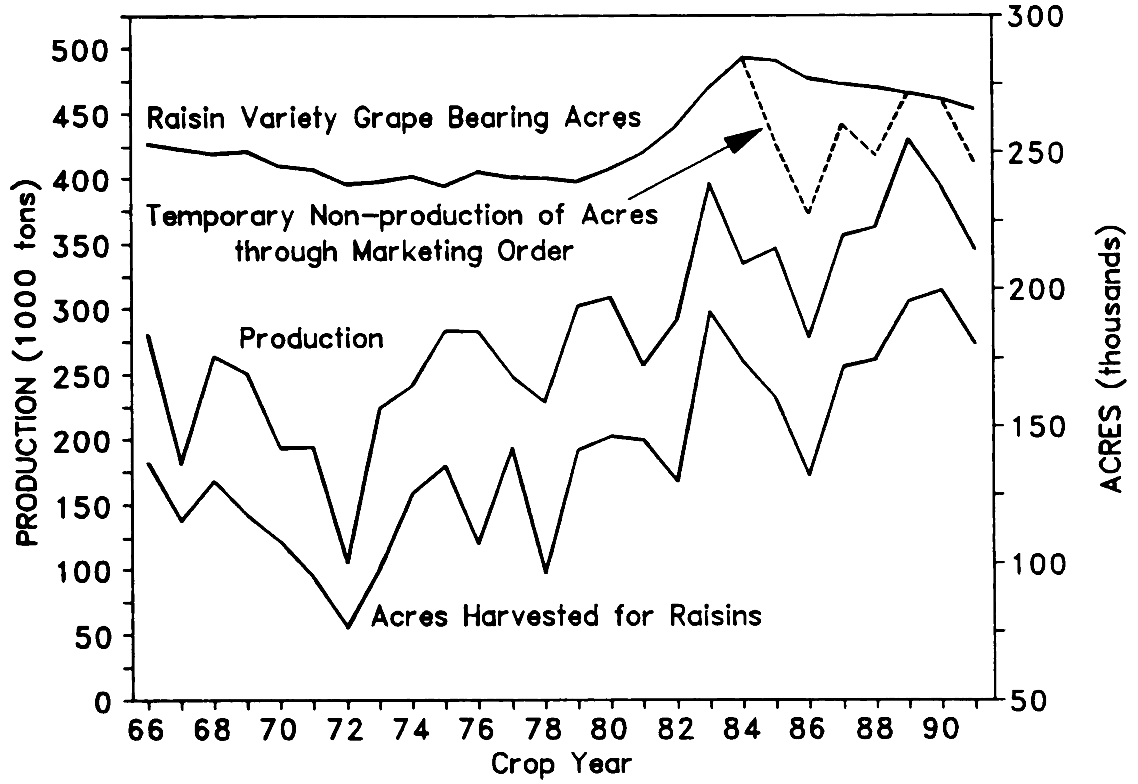
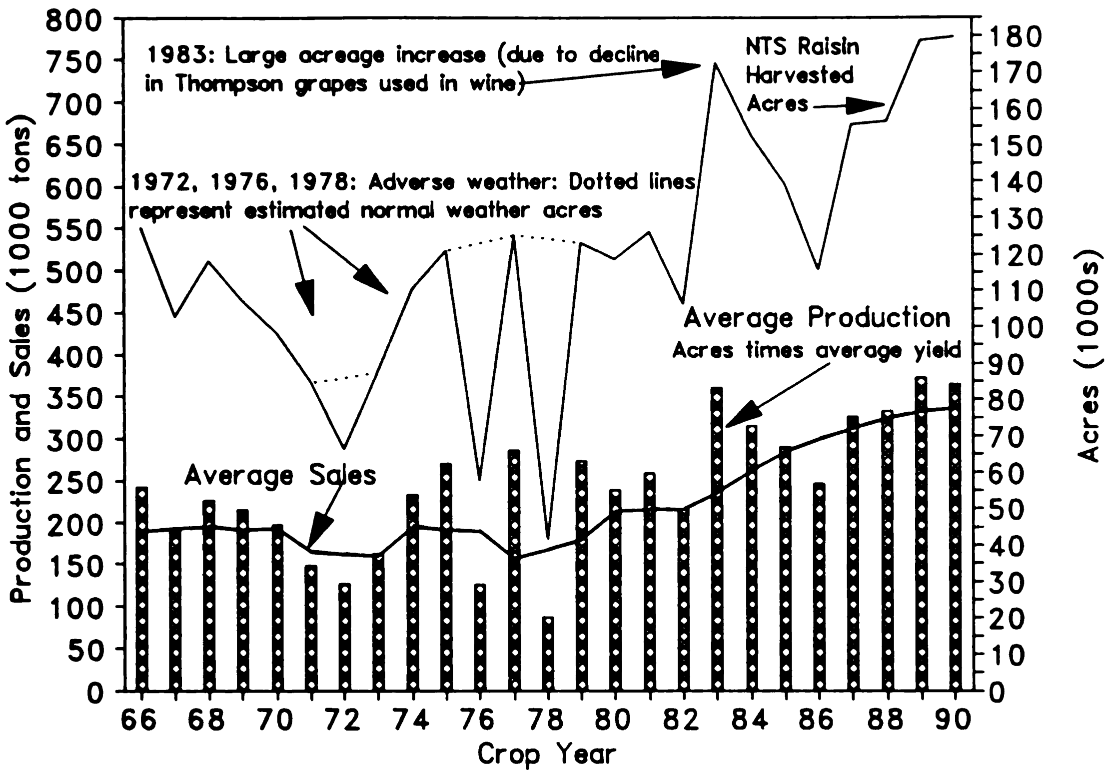
Figure 14. Raisin Type Grape Bearing Acreage and Acreage Harvested for Raisins



extreme weather is that significant portions of grape acreage typically destined for the raisin market are diverted to other uses (such as alcohol distillation) during those years because the grapes on those acres are damaged.

However, it is evident that even without weather extremes in those three years, raisin grape acreage varied considerably from year to year. The "normal weather acres" represented by the dotted lines in Figure 15 are an estimate of what acreage would have been had there been normal weather conditions in 1972, 1976, and 1978. The "normal weather" acreage data points for those three years were computed by averaging the bearing acres before and after the low production years in question. The purpose of doing this is to show that considering the whole period from 1966 to 1991, acres harvested for raisins varied considerably from year to year even without weather extremes.

Figure 15. Harvested Acres, Average Production and Average Sales for NTS Raisins



2.5.1. Long-Run Raisin Supply-Demand Balance Issues

Turning to long-run issues, the first step is examining trends in overall productive capacity for raisins. Figure 14 indicates that for a number of years from the 1960s until around 1980, raisin variety grape bearing acreage remained relatively steady. However, in the early 1980s the rise in raisin-type grape bearing acreage was due in part to grape grower expectations that they could take advantage of the strong wine market to sell greater quantities of raisin-type grapes for crush.[14] Thompson seedless grape juice had traditionally been an important ingredient in California wines. However, various factors altered the situation to the detriment of raisin growers. The booming California wine business in the late 1970s also brought about substantial planting of varietal wine grapes, much of which directly competed with Thompson grapes for blending in generic wines. San

[14]Nuckton and others, An Econometric Analysis of the California Raisin Industry.

Joaquin Valley bearing wine grape acreage doubled during the 1970s. Also, a California law was passed in 1983 increasing the proportion of juice from varietal grapes in each bottle labeled with a particular variety, thereby reducing the proportion of Thompson grape juice. California wine sales began to slacken in the 1980s and the high value of the dollar in relation to a number of other currencies encouraged wine imports. Due to the sharp reduction in the quantities of grapes accepted into the traditional crush market outlet, Thompson seedless grape growers substantially increased raisin production in the early 1980s.[15]

This turn of events is depicted graphically in Figure 16, which compares the tonnage of Thompson seedless grapes dried for raisins and tonnage used in other outlets. In the years just prior to 1983, the percentage dried for raisins was 50-60%, with about 30% of the grape tonnage crushed for wine. However, in 1984 the percentage used for wine dropped to 14% and the percentage dried for raisins jumped to 74%.

Figure 15 helps to clarify further the issue of overproduction and shortages by comparing average raisin production with average sales (a three year moving average). Average production is computed by multiplying bearing acres times a three year moving average of yields. The graph indicates that a significant amount of acreage did not produce raisins due to weather factors in 1972, 1976, and 1978. These weather-induced short crops appear to have somewhat offset a general trend to overproduction beginning in the mid-1970s. The graph also shows that grape acreage harvested for raisins increased sharply in 1983 (148% of the previous year's acreage) due to the aforementioned large-scale shift from crush to raisins by many grape growers.

This sharp increase in raisin supply meant a sudden severe imbalance between supply and demand, resulting in a large drop in average grower price from $1153/ton in 1982 to

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[15]Nuckton and others, An Econometric Analysis of the California Raisin Industry, 1-2.

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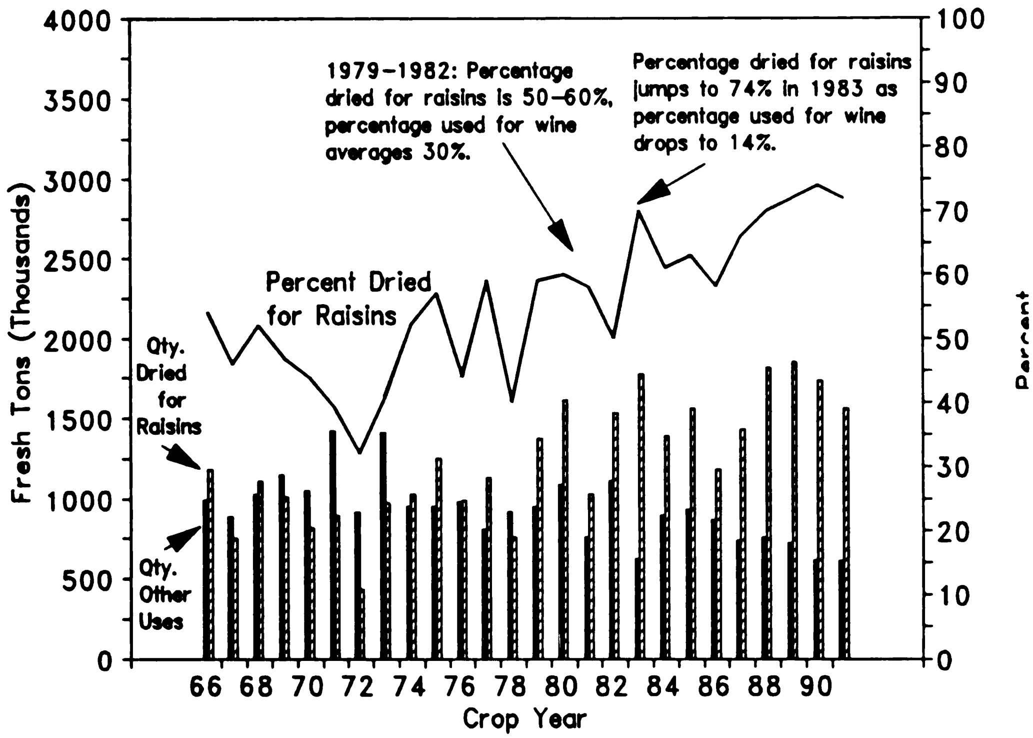
Figure 16. Percentage of Raisin Type Grapes Dried for Raisins and Comparison of Quantity of Grapes Dried for Raisins versus Quantity in All Other Uses, 1966-91

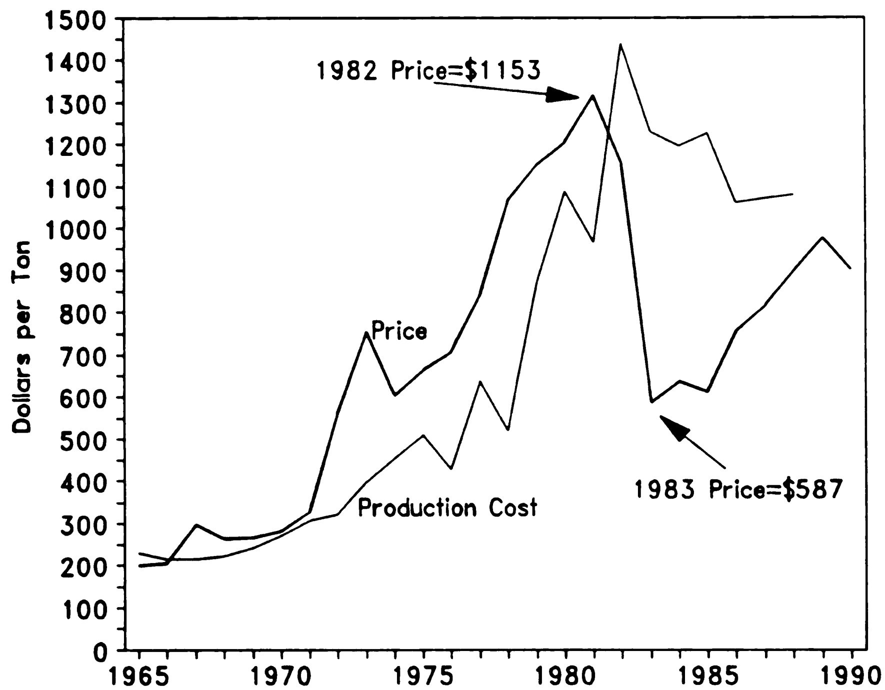


$587/ton in 1983. This was the beginning of a period of over-capacity, as evidenced by the comparison of price and average cost of production in Figure 17.[16] Thus interdependence with the wine market was a major factor contributing to raisin oversupply problems in the 1980s.

The downturn in the wine market resulted in sharp increases in raisin market supplies beginning in 1983. This was because a number of growers who had historically sold grapes for crushing shifted more heavily into raisin production. These circumstances brought about several responses by raisin industry organizations, one of which involved

[16]The price series used was the average annual price for all raisin varieties (Noncitrus Fruits and Nuts, NASS, USDA). Production cost for NTS raisins is based on multiplying wine varietal grape cost of production by 1.09 (to account for extra costs of drying and handling) and converting to nominal terms by multiplying by the GNP price deflator and the drying ratio to make grape costs equivalent to dried raisin costs. Comparing the price of all raisin varieties to the cost of a single variety (NTS) is a reasonable approximation since NTS production represents 90% of all raisin production. Cost figures were obtained from Nuckton and French, An Econometric Analysis of the California Raisin Industry, 73.

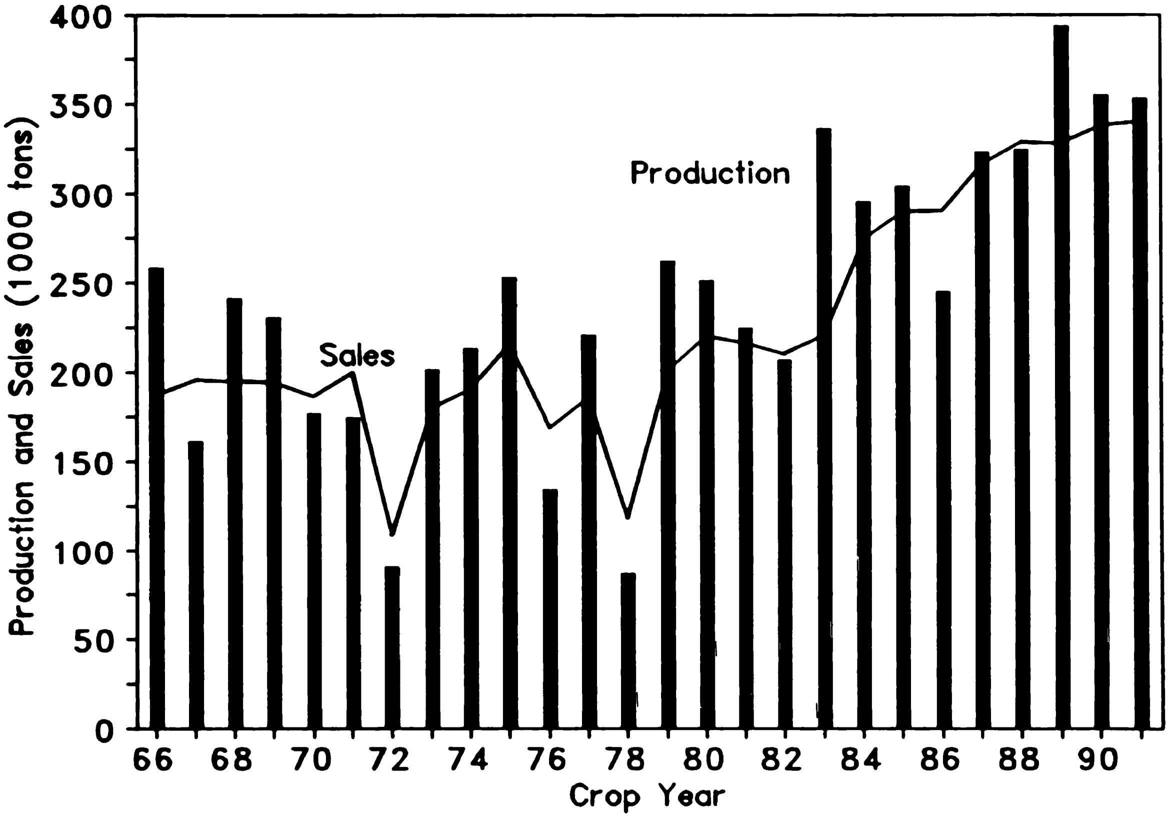
Figure 17. Comparison of California Raisin Grower Price and Production Cost



establishing a program to encourage growers to discontinue production temporarily by trimming vines or to remove acreage from production permanently under the Raisin Diversion Program (RDP). The sharp shifts in bearing acreage beginning in 1984 shown by the dotted lines in Figure 14 are due to implementation of the RDP through the federal marketing order. Producing acreage declined for three successive years, although most of that acreage was removed from production only temporarily. The dotted lines in Figure 14 indicate the number of acres that were removed from production in specific years. Fewer acres were removed under the RDP after 1986 because the supply-demand balance began improving. The RDP is explained in more detail in Chapter 5.

Figure 18 also shows year to year variations in the difference between production and sales, with results similar to tart cherries and almonds. The graph shows that there were five years between 1964 and 1990 with production well below the level of sales of previous years, but in only three of those years did sales decrease significantly due to the shortages:

Figure 18. U.S. Total Raisin Production and Total Sales, 1964-1991



1972, 1976, 1978. Thus, one factor that the raisin market has in common with the markets for almonds and tart cherries is the potential for reduced demand due to shortages. As with almonds, the changes in sales levels appear to reflect both movement along the demand curve and a shift in demand. In the years following shortages, raisin sales recover to levels somewhere near where they were in years prior to the shortage. However, it takes several years to recover to levels fully consistent with prior sales trends, indicating that an inward shift in the demand curve has taken place, followed in many instances by renewed promotional efforts to shift the demand curve outward. However, of the three commodities, the problems of potential shortages are the least serious with raisins.

As with the other crops, the question should be posed as to whether interseasonal storage by raisin firms could mitigate the potential problem of annual supply variability. The answer appears to be no, since the irregular pattern of shortages makes it unlikely that individual firms could anticipate the changes in production well enough to store sufficient quantities to avoid a shortage. To deal with this problem, an industry-wide storage program has been organized through a federal marketing order. The industry as a whole is not necessarily any better at forecasting shortages than are individual entrepreneurs. However, collective storage through a marketing order facilitates sharing the costs of storing sufficient quantities to mitigate the problems caused by shortages. Federal marketing order supply management programs are examined in Chapter 5.

2.6. Concluding Comments

In summary, the three perennial crop industries examined in this research face some common problems, including annual supply fluctuations and the long-term challenge of balancing industry productive capacity with potential demand. Of the three crops, cherries and almonds have experienced the largest year-to-year variations in production and raisins the least variation over the period of study (1965-1992). The three industries also differ in the degree of price variability, with cherry prices being the most variable. The raisin industry faces a challenge which has no parallel in the other two industries: volatility in raisin production partially due to multiple uses for raisin variety grapes and the resulting interdependence with the wine industry.

CHAPTER 3: THE SUBSECTOR FRAMEWORK AND A CLASSIFICATION OF ORGANIZATIONAL RESPONSES TO COORDINATION PROBLEMS FOR THE THREE PERENNIAL CROPS

This chapter introduces the subsector framework used to examine the means to respond to the supply-demand balancing problems introduced in the previous chapter. The subsector framework is used to examine marketing problems related to vertical coordination performance.

In addition, a major purpose of this chapter is to introduce a system of classifying certain key coordination actions that have been adopted or considered in perennial crop subsectors. To accomplish this, a means of classifying cooperatives is introduced to help explain potential differences in the contribution that types of cooperatives can make to balancing supply and demand for a commodity.

3.1 The Subsector Framework

A useful component in examining the problems of supply-demand balancing is to view an agricultural commodity production and marketing system as a commodity subsector. A subsector consists of a series of stages from the grower to the final consumer stage.[17]

Table 7. Vertical Stages in Agricultural Subsectors

Stage 1. Growers

Stage 2. Initial Processors/Handlers

Stage 3. Food Manufacturers

Stage 4. Retailer-Wholesalers

Stage 5. Consumers

[17] Bruce Marion. The Organization and Performance of the U.S. Food System, Lexington: D.C. Heath and Company, 1986. Input supply is also generally considered to be a stage in the subsector, but is not included here because input supply is beyond the scope of this analysis.

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An example of an agricultural subsector with five vertically linked stages is presented in Table 7. The stages are linked by a number of vertical coordination mechanisms including prices, contracts, verbal agreements, and various institutional arrangements, including marketing cooperatives, marketing orders, and generic commodity promotional organizations.

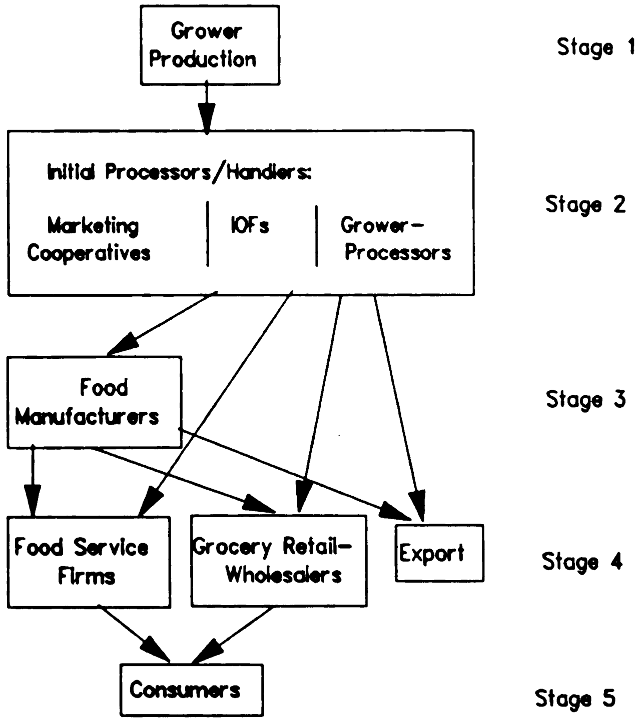
This analysis focuses largely on the grower and initial processor/handler stages (stages 1 and 2 in Table 7) and their approaches to supply-demand balancing within the vertically linked marketing system. Growers and initial processors/handlers (cooperative or IOFs[18]) are collectively referred to as the "industry." The vertical stages from grower to consumer for each commodity are hereafter referred to as the almond, raisin, and tart cherry subsectors.

Figure 19 shows typical major marketing channels through which perennial crop commodities flow. For a processed commodity, marketing alternatives for growers selling raw product to firms in the initial processor/handler level (stage 2) include: (a) selling through a cooperative, (b) vertically integrating downstream as an individual firm by becoming a grower-processor, or (c) selling to investor-owned firms that engage in processing or handling. This research is primarily concerned with first of these three, that is, the role of marketing cooperatives in the vertical system.

Some Stage 2 firms are primarily commodity processors and typically sell a portion of their processed tonnage to food manufacturers for industrial use as an ingredient. Other cooperatives and IOFs process and sell a significant portion of grower deliveries as branded retail food products. In such cases where a firm is both initial processor and manufacturer, two or more subsector stages are vertically integrated within the firm. For example, a large cooperative that markets a portion of its tonnage as brand-name manufactured products to

[18]IOF = investor-owned firm, as distinguished from a cooperative, which is a patron-owned firm.

Figure 19. Simplified Overview of Main Marketing Channels in Processed Perennial Crop Subsectors



retailers can be characterized as vertically integrated between the initial processing and food manufacturing stages for the branded portion of its total tonnage marketed.

Food manufacturers and initial processors/handlers may sell in one or more of three main market channels (Stage 4 of Figure 19): (1) food service wholesalers and retailers, (2) grocery retailer-wholesalers, and (3) export. Brokers and other specialized marketing firms can play major roles at various stages of distribution, but such firms were excluded from Figure 19 to simplify the presentation.

This framework provides a means to examine problems related to pricing and vertical coordination focusing on the standard operating procedures of retailers and food manufacturers.

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3.2. The Price System and Vertical Coordination

Much of the value of the coordination mechanisms that are the focus of this research is their role in facilitating and complementing the coordinating role of prices. The effect on coordination of the standard operating procedures (SOPs) of retailers and food manufacturers, particularly as they relate to pricing, is explained in this section through the example of a representative commodity-based consumer food product, canned tart cherry pie filling. The purpose will be to show that certain pricing SOPs can hinder the flow of supply and demand information through the vertical marketing system.

Why is there in some cases incomplete coordination of supply changes at the farm level with the manufacturer stage and retailer stage? Coordinating supply and demand for a commodity and its various related retail products is complicated by the fact that firms in the downstream stages of a commodity subsector, including food manufacturers and retailers, do not have a crop-commodity focus. Retailers have little incentive to be concerned about conditions in a particular subsector. In deciding whether to provide shelf space for a particular product, retailers compare the potential profitability of carrying a particular food product with a set of alternative products. Raw product supply changes generally have generally little impact on key retail decisions. Manufacturers focus on producing food products lines targeted at various market segments, and their chief concern regarding the commodity is to have a reliable supply. In the view of manufacturers, providing a reliable supply is the function of growers and initial processors.

The business practices and strategies of retail and manufacturing firms can frequently hinder the transmission of market information on supply and demand in a commodity subsector. An example of this problem is related to the common retail practice of "pricing on the nines," in which typical prices charged per pound or per item are, for example, \$1.19, \$1.29, \$1.39 and so on. This practice is based on the observation that for certain grocery products, consumers tend not to appreciably alter purchased amounts over a range of p

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[a]Larry G. Ham
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a range of price changes, up to nine cents per pound or per item. Because of this behavioral tendency on the part of consumers not to respond to price changes in this range, grocery retailers tend not to change retail prices on these individual grocery items even if the cost of food ingredients may have dropped by as much as nine cents. When this practice is applied to commodity-based processed food products, this hinders the flow of information on supply conditions from grower to consumer, since significant increases in supply may not be reflected at the retail level.[19]

3.2.1. Example of Vertical Coordination Problems: The Behavior of Food Retailers and Manufacturers

This illustrative example relates to the above-mentioned grocery retailer SOP of pricing on the nines. Retailers observe that consumers respond very little to price differences between, for example, \$1.30 and \$1.39 for a consumer-sized can of tart cherry pie filling. Thus demand is highly inelastic and can be represented by a demand schedule that is nearly vertical in that range, as shown in Figure 20. Although the intersection of supply schedule S_a with the demand schedule indicates that a price of \$1.37 would be charged, this is not what is commonly practiced by retailers for many products. Instead, if the wholesale price per can plus a standard retail margin is anywhere in that ten-cent range, the retailer's SOP is to round up the price charged consumers to \$1.39. Only if the wholesale price plus the standard margin is above \$1.39 or below \$1.30 will the grocer change the retail price per can, and the price will be increased or decreased by 10 cents to continue pricing on the nines. Thus the demand schedule becomes more elastic at a point just above \$1.29, \$1.39, etc. Since demand is similarly inelastic for each segment of the demand schedule, retailers will tend to price on the nines in a number of different price ranges.

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[19]Larry G. Hamm, "Food Distribution Procurement Practices: Their Implications for Food System Structure and Coordination," unpublished Ph.D. dissertation, Department of Agricultural Economics, Michigan State University, East Lansing, 1981.

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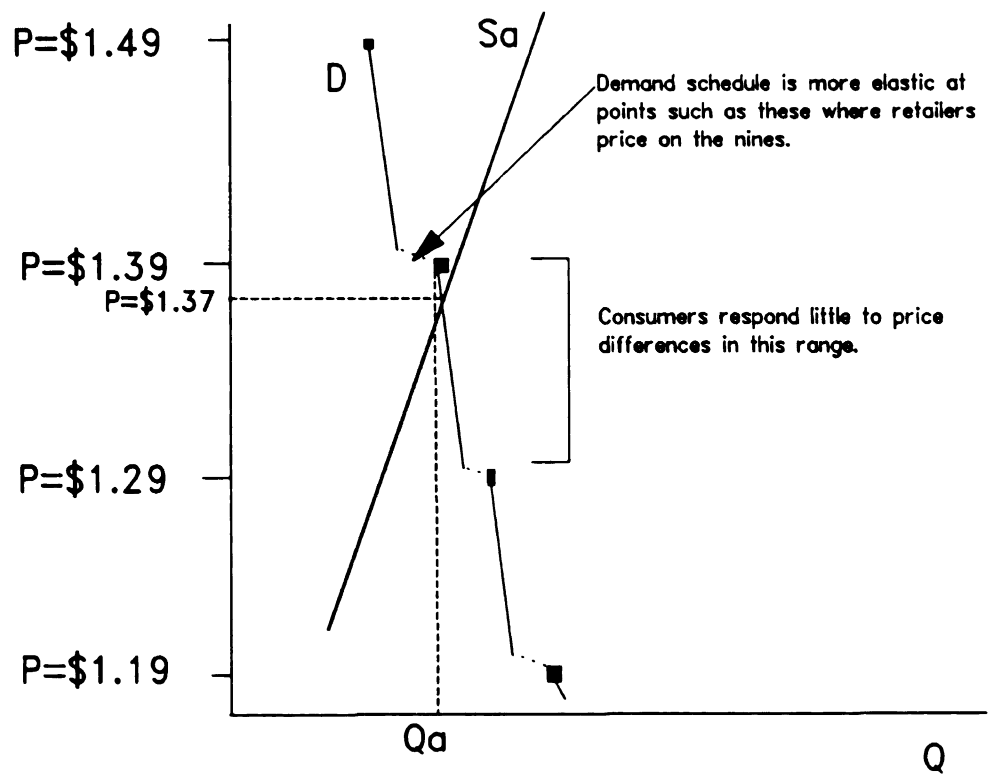
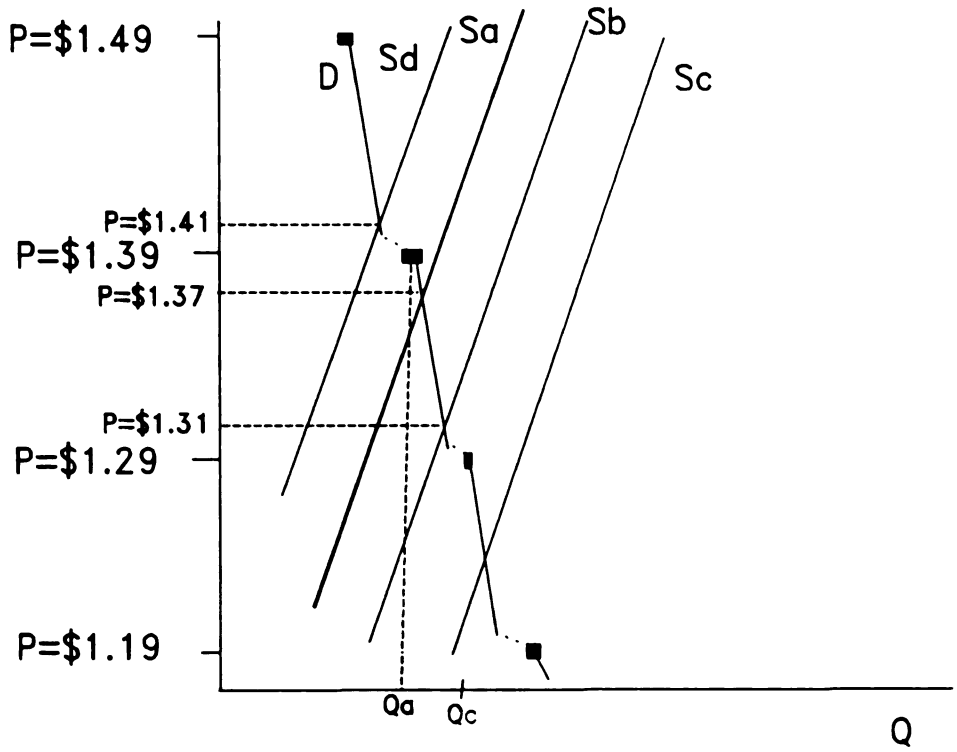
Figure 20. Demand Schedule with Pricing on the Nines by Grocery Retailer



The discussion above appears to imply that the segments in the demand schedule are vertical, representing infinitely inelastic demand. However, the segments are drawn to represent highly inelastic demand, but not infinite. What this means is that if pricing on the nines is commonly practiced for canned cherries, then quantity adjustments are taking place in other parts of the tart cherry market. Other tart cherry products are accumulating as inventories or having prices reduced. However, it is assumed for purposes of this analysis that this effect is not large, and that the impacts of retail price non-responsiveness to supply changes represent a significant problem in vertical coordination as described below.

Assuming supply schedule S_a as the point of comparison from which to continue the analysis, the next step in the example is to examine what happens with a supply increase or decrease. A larger crop is represented by a supply shift to S_b in Figure 21, where standard supply-demand analysis would indicate a price of \$1.31 would prevail. However, since S_b intersects the same segment of the demand schedule as S_a, retailers tend to charge the same

Figure 21. Retail Price and Product Movement for Supply Increase or Decrease



retail price as before ($1.39) due to pricing on the nines. Due to the ability of the retailer to charge a price of $1.39 despite the higher level of supplies of that commodity, the quantity demanded at retail stays at the same level (Q_a), that would be expected if the supply schedule intersected the demand schedule at the point where price equals $1.39. If, however, an even larger crop causes a shift in supply to S_c, supply intersects demand in the next lower segment, and the retailer will round the price charged per can to $1.29.

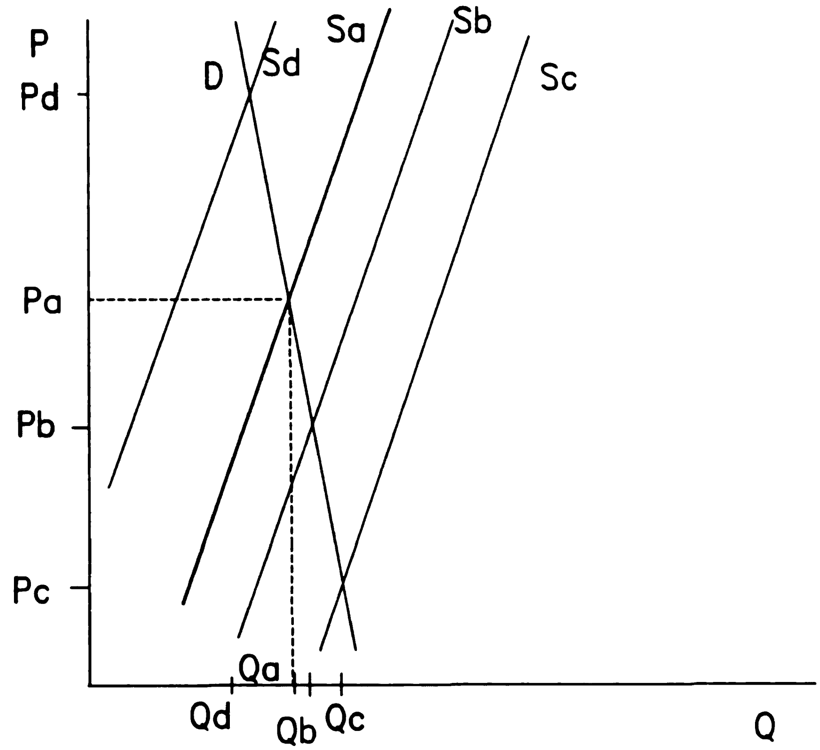
A smaller crop is represented by a supply shift in the opposite direction, from S_a to S_d. In this case, supply intersects the next higher segment of the demand schedule and a price of $1.49 is charged. Even though in this example the magnitude of the shift would suggest that a price of $1.41 be charged, the retailer charges $1.49 due to pricing on the nines. Although the supply shifts to S_b and S_d are of about the same magnitude, the supply increase to S_b results in no change in price while the supply decrease to S_d results in a price change of ten cents. This provides a partial explanation for the common experience of food manufacturers that retailers will readily increase price in response to a shortage, but resist lowering price in response to increased supplies and lower grower and wholesale prices. This is a key aspect of the lack of effective vertical coordination that can occur in perennial crop subsectors due to retailer SOPs.

It should be noted that farm level demand does not exhibit the stepped character of the retail demand function. This partly because only a portion of farm sales are destined for a single retail consumer product such as pie filling. The remainder of the crop is sold for industrial use in food service and as ingredients in the manufacture of other food products where the demand is somewhat more price elastic. Retailer behavior and consumer demand for retail processed products nevertheless exert a strong influence on farm level demand. In addition, SOPs relating to raw product pricing at the grower-first handler stage do not suggest a stepped demand function, so the grower level demand function is represented by a straight line.

Because of inelastic demand at the farm level, large crops represented by S_b and S_c in Figure 22 bring about steep price declines from P_a to P_b and P_c but only small increases in quantity demanded from Q_a to Q_b and Q_c. A short crop represented by a supply shift to S_d induces a substantial farm-level price increase from P_a to P_d.

Further insight is gained by examining pricing at several subsector stages as shown in the following graphs (Figure 23, Figure 24, and Figure 25). Since the price impact at the initial processor stage is similar to that of the grower, the processor stage is not presented separately. The key here is the effect on pricing behavior resulting from the manufacturer's awareness of the retailer tendency to price on the nines. The manufacturer in this example (Figure 24) has a stepped demand function similar to that of the retailer, and the manufacturer's sales prices range from \$1.15 to \$0.91. These representative price levels were determined from a retailer price of \$1.49 per can including a 30% gross margin.

Figure 22. Farm Level Demand



Representative manufacturer price levels were determined by declining from $1.49 in eight cent increments, representing approximately a 30% margin at each retail price level.

If supply shifts from S_a to S_b, the manufacturer keeps the price at $1.07 based on the observation that retailers will generally not change the price per can for a supply shift of that magnitude. Thus, typical consumer behavior of being unresponsive to price changes of less than ten cents, if it is combined with the ability of retailers and manufacturers to hold prices at the upper end of a ten-cent range, results in no increase in sales of consumer-sized cans of pie filling despite a nine cent decrease in grower price due to the large crop (Figure 23).

The quantity represented by Q_a minus Q_c is surplus and may become unsold carryover stocks at the processor level. Other possibilities are that the surplus will not move beyond the grower level and will either not be harvested or if the cherries are harvested they will not be sold. Thus price declines may occur in this situation at the processor and grower

Figure 23. Effect of Supply Increase on Tart Cherry Grower Price per Pound

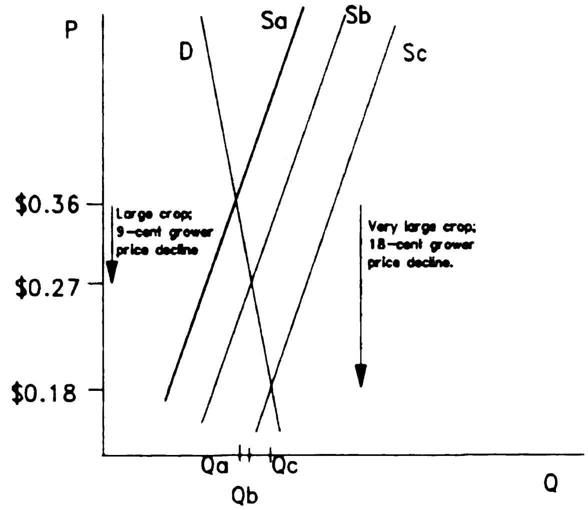


Figure 24 Effect of Supply Increase on Manufacturer Price per Can, Tart Cherry Pie Filling

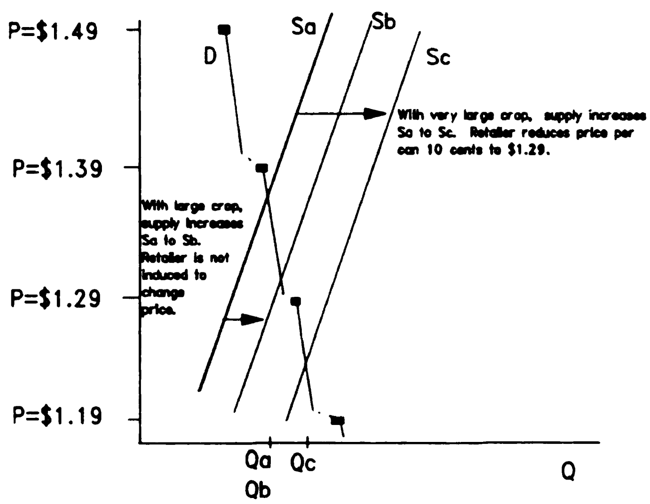
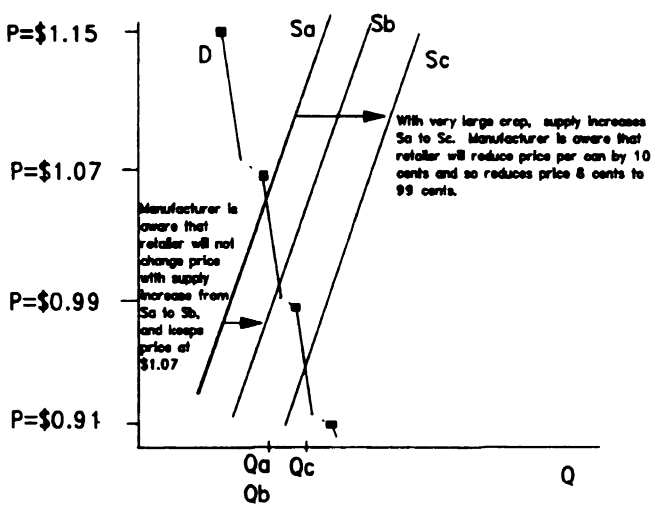


Figure 25. Effect of Supply Increase on Retail Price Per Can of Tart Cherry Pie Filling



levels, but not at the manufacturer and retailer level, indicating ineffective coordination between subsector stages.

In the event of a very large crop (a shift from S_a to S_c), the retailer will price on the nines and drop the price per can ten cents from \$1.39 to \$1.29 (Figure 25). The manufacturer reduces price by the same amount to 99¢. However, the impact is larger at the grower level (Figure 23). Grower price drops by 18¢, but there is little additional increase in sales. When this occurs, the limited effectiveness of passing market signals relating to supply conditions downstream to consumers indicates that there are problems of coordinating supply and demand for commodity-based processed products. Large crops can thus bring about sharp price declines to growers, yet even significant declines in grower prices frequently result in only small increases in quantity demanded at retail. Note that up to this point, the analysis assumes that there are no promotions, coupons, or "two for \$2.79" specials that alter these relationships. The effects of merchandising and promotion are introduced later.

3.2.1.1. Other Factors Affecting Price Transmission in the Subsector

Other retailer SOPs such as product-line pricing can also hinder transmission of price signals in a subsector. Cherry pies provide a useful example. Suppose that a large crop brings about a nine cent decline in the price of raw cherries and a ten cent decline in the price per pound of frozen cherries. The frozen cherry price change is lower since there are 1.11 pounds of raw cherries in a pound of frozen cherries.[20] If one pie uses one pound of cherries, ingredient cost declines by 10¢. In our example, a grocery store carries a line of frozen fruit pies (cherries, apples, and blueberries) all priced originally at \$3.79. The 10¢

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[20]Substantial weight is lost through pitting and sorting cherries, and some of the juice is lost. After adding back sugar and freezing the cherries in the form known as "five plus one", one pound of the frozen product contains the equivalent of 1.11 pounds of the original raw product.

decline in ingredient cost is not likely to induce substantially increased sales because the retailer prefers to maintain the same price for the entire line. One reason is that the retailer is aware that a price change of less than ten cents is not likely to induce many consumers to purchase additional cherry pies. Since the retailer does not change consumer prices in this example, the manufacturer tends to adopt a parallel pricing structure involving ranges within which changes in raw product price changes will not induce any price changes at the manufacturer level.

An additional factor is that the raw product cost of processed food products is often a small part of total cost. Therefore in many instances changes in raw product cost due to shifts in production levels from year to year have little impact on the manufacturer's pricing decisions for particular food products.

Manufacturers also have long planning horizons for making pricing and promotion decisions. By the time supply changes become evident in a given year, a manufacturer may already have pricing and promotion decisions in place for the year, and if so, will see little advantage in changing those decisions because tart cherry supplies have increased in that particular year. In this example, lower grower and processor price by themselves are again unable to provide adequate subsector coordination to signal consumers of increased supplies. Supplemental mechanisms such as promotion and merchandising of commodity-based products can improve coordination in this situation.

3.2.2. The Impact of Annual Supply Variation

Annual supply variation in perennial crops contributes to vertical coordination problems in part because of problems relating to transmission of price signals vertically through the subsector stages. In this section, vertical coordination problems are illustrated through a series of supply-demand diagrams that represent vertically linked subsector stages. The diagrams show the impact on prices of annual supply fluctuations at several subsector stages. The "stepped" character of the demand curves in the previous set of diagrams is also applicable to the demand curves shown below. However, to make the diagrams more readable, the demand curves below are not represented with separate segmented steps, but with a straight line. The first set of diagrams appear in Figure 26 through Figure 29, illustrating the impact of a short tart cherry crop (a decrease in annual supply). Interpretation of the graphs begins by looking first at Figure 26, the grower level (stage one of the subsector) and then moving sequentially through Figure 27 (processors), Figure 28 (manufacturers) and Figure 29 (retailers).

The supply-demand graphs represent exchange between subsector stages. The intersection of supply and demand at the grower level (stage one, Figure 26) indicates the grower price and a quantity of raw cherries which is exchanged between the grower stage and the initial processing stage. Figure 27 (stage two) represents exchange between the initial processor and the food manufacturer. Quantities in Figure 27 are processed cherries sold at f.o.b. processor prices. Figure 28 (stage three) represents exchange between the food manufacturer and the grocery retailer, with the quantity and price of canned tart cherries on the horizontal and vertical axes. Exchange between retailers and consumers is shown in Figure 29 (stage 4), with price representing the retail price charged in grocery stores, and quantity is the amount of canned tart cherries sold by grocery stores to consumers.

Given that overview of what the graphs represent, the next step is a more detailed analysis. Tart cherry industry observers indicate that supply decreases are reflected more effectively through the vertical system than are supply increases, and this is what is shown in the graphical analysis. Returning to Figure 26 (stage one), an initial equilibrium is represented by the intersection of S_a and D_a, with price P_a and quantity Q_a. With a short crop in a particular year, raw product supply shifts from S_a to S_b. Linking this graph by dotted lines with graphs representing downstream stages is a means to illustrate a key aspect of vertical coordination -- the means by which the supply decrease is reflected vertically through the subsector stages.

ANNUAL SUPPLY DECREASE: FOUR SUBSECTOR STAGES

Figure 26. Impact of Supply Decrease on Growers (Stage One)

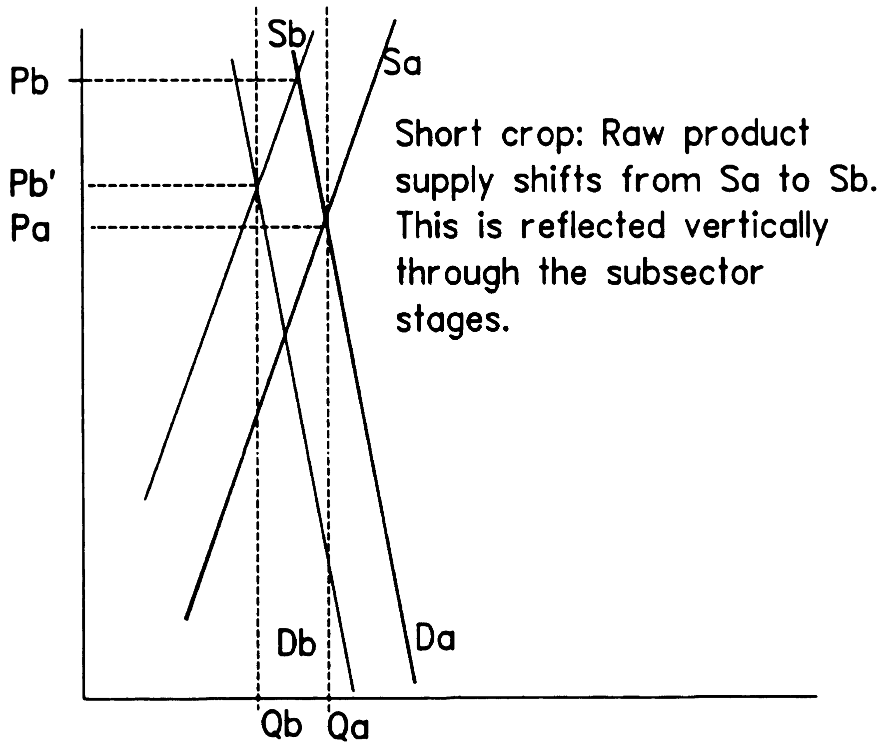


Figure 27. Impact of Supply Decrease on Processors (Stage Two)

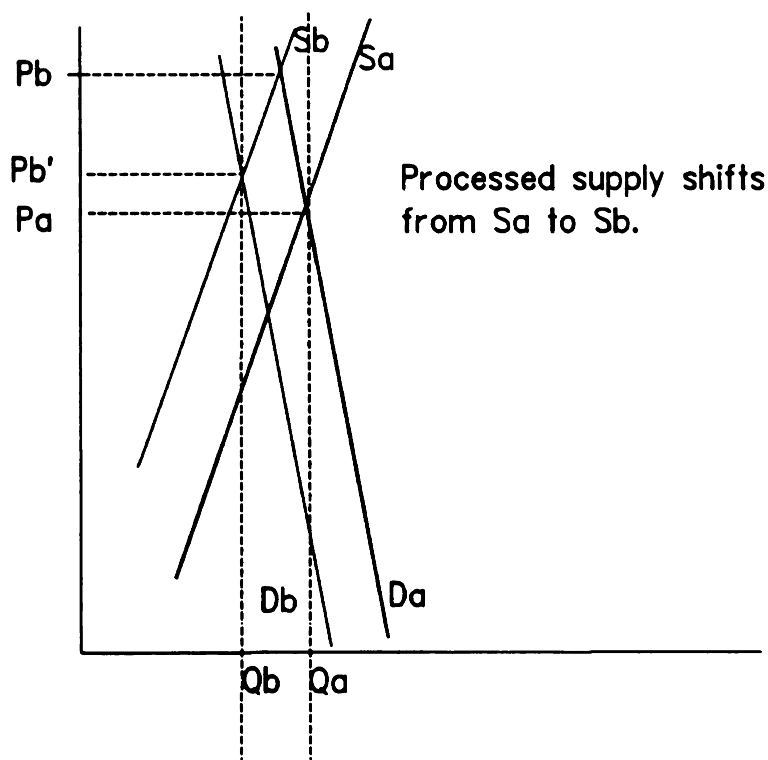


Figure 28. Impact of Supply Decrease on Manufacturers (Stage Three)

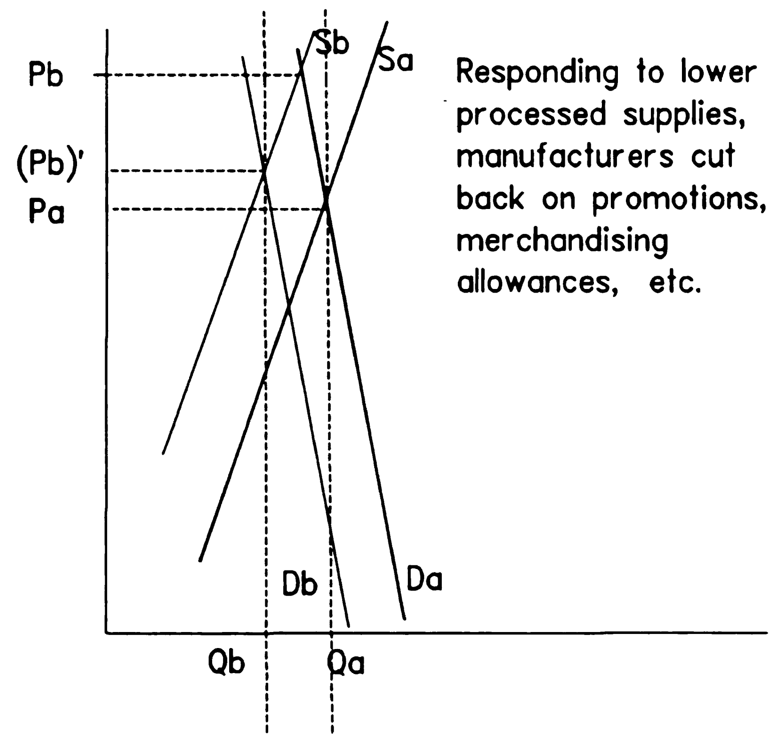
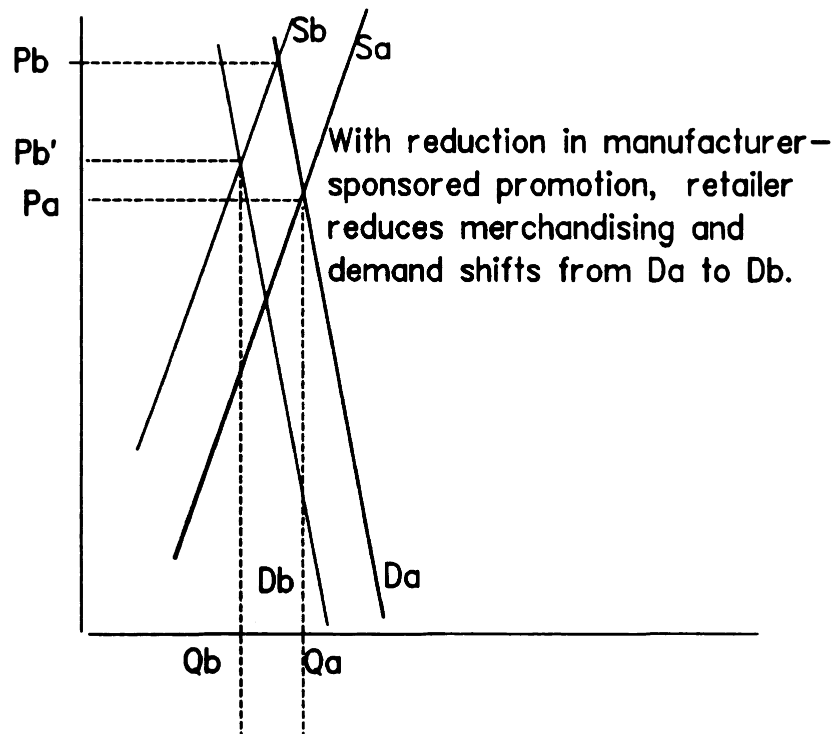


Figure 29. Impact of Supply Decrease on Retailers (Stage Four)



In Figure 27 (stage two), the impact of the smaller crop is to shift processed cherry supply from S_a to S_b. Responding to lower levels of processed supplies coming from processors, manufacturers in Figure 28 (stage three) cut back on merchandising allowances and other forms of promotion. With the reduction in manufacturer-sponsored promotion, the retailer (Figure 29, stage 4) responds by reducing merchandising activity, which has the effect of reducing demand, shifting D_a to D_b. Although the supply decrease by itself would have meant an increase in price from P_a to P_b, due to the dampened demand from reduced promotion, the price increase is smaller, rising from P_a to P_b'. This price change is reflected upstream in the vertical system to manufacturers, processors and growers with prices differing at successive stages by the amount of the retail, manufacturer and processor margins.[21] Thus the vertical transmission of price changes due to moderate supply decreases in this example is accomplished reasonably effectively.

The same is often not true, however, for supply increases. Beginning with Figure 30 (stage one), the intersection of S_a and D represent an initial equilibrium. A large crop is represented by a shift in raw product supply from S_a to S_c in Figure 30 and correspondingly processed supply in Figure 31 shifts from S_a to S_c. However, the supply increase may not be effectively vertically coordinated beyond the manufacturer stage to the retailer stage (Figure 33).

Returning to the graphical analysis, Figure 30 shows that if supply changes originating at the farm level indicate a price change of up to 9¢ at retail, price may remain at P_a and not decline to P_c, which would have been consistent with the shift in supply from S_a to S_c. The lack of a price decline in this example is attributed to the above mentioned retailer standard operating procedure of "pricing on the nines." Manufacturers (Figure 32) respond to this retailer practice by holding their price at P_a, despite the supply increase.

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[21]These margins may vary from time to time depending on market conditions and the strategies of different firms.

ANNUAL SUPPLY INCREASE: FOUR SUBSECTOR STAGES

Figure 30. Impact of Supply Increase on Growers (Stage One)

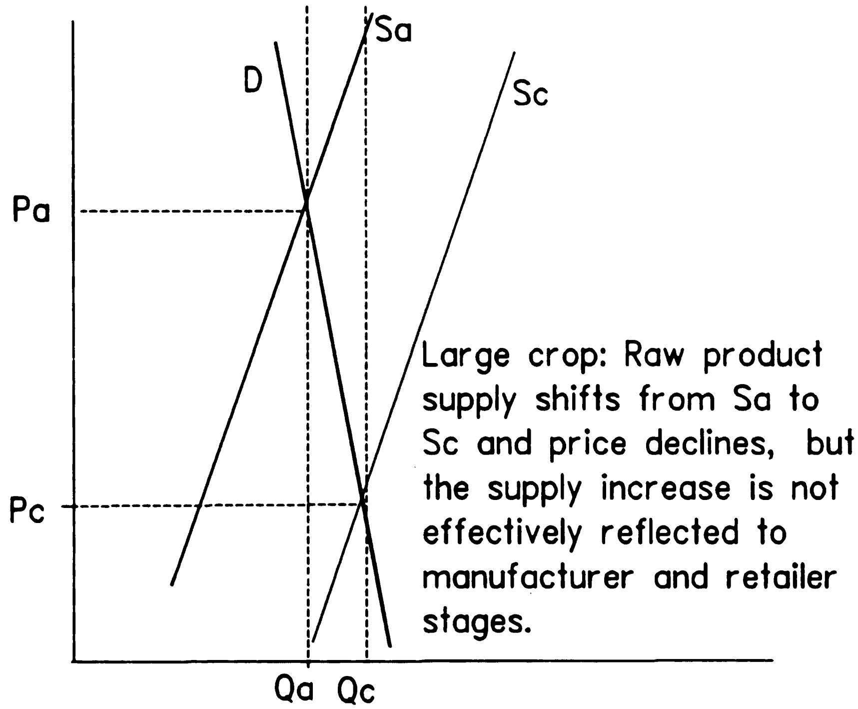


Figure 31. Impact of Supply Increase on Processors (Stage Two)

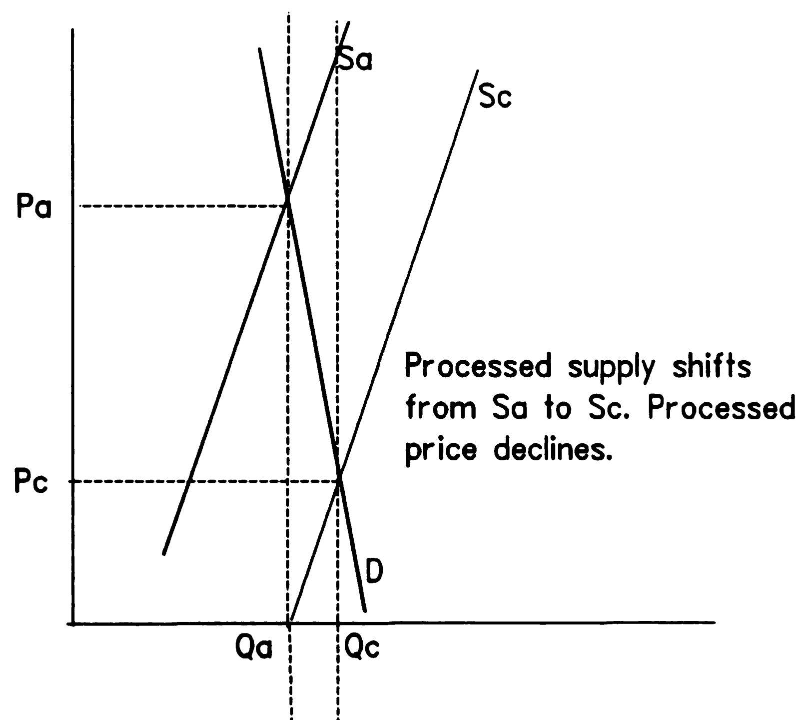


Figure 32. Impact of Supply Increase on Manufacturers (Stage Three)

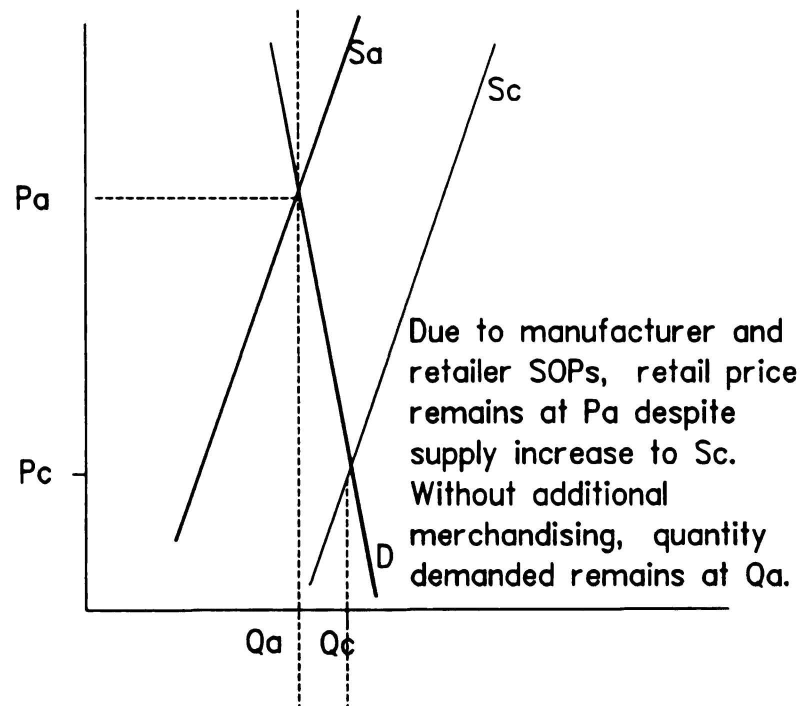
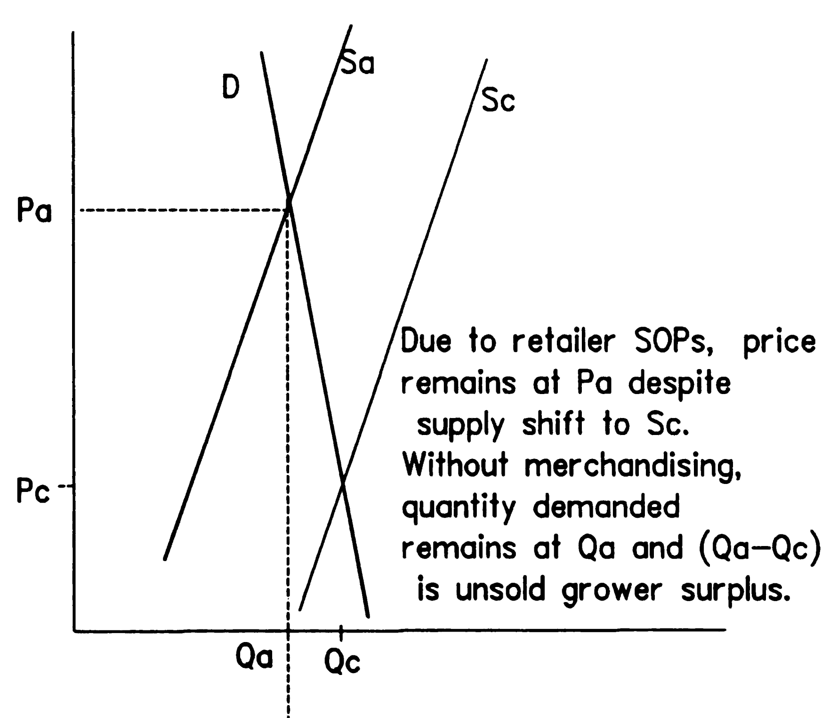


Figure 33. Impact of Supply Increase on Retailers (Stage Four)



Without additional merchandising, quantity demanded remains at Q_a. As discussed above, the quantity represented by Q_a minus Q_c is surplus and may become unsold carryover stocks at the processor level or unharvested cherries at the grower level.

3.2.2.1. Analysis of the Effects of Merchandising

This outcome of unsold stocks or unharvested cherries can be altered somewhat with effective merchandising by manufacturers and retailers. Figure 34 through Figure 37 represent the same situation with a supply increase depicted in Figure 30 through Figure 33. The difference is that merchandising by manufacturers or retailers stimulates increased demand at the retail level as shown by the shift from D_a to D_c in Figure 37. Price remains at P_a due to pricing on the nines by the retailer, but quantity demanded at P_a increases from Q_a to Q_m. This has the effect of improving coordination, since the quantity sold (Q_m) more nearly matches the quantity produced by growers (Q_c). There is improved vertical coordination through the subsector stages since the increase in demand due to increased retailer merchandising increases the quantity of raw product demanded at the grower level (stage one).

The purpose of this graphical analysis has been to show that pricing SOPs can hinder the flow of supply and demand information through the vertical marketing system, and that effective merchandising can improve the situation. The next section deals with some of the specific means by which merchandising accomplishes this.

3.2.2.2. The Impact of Merchandising

Because of these problems in coordinating demand with short-run shifts in supply, manufacturers and generic promotion organizations rely partly on various non-price methods such as couponing to reflect supply changes to consumers and to increase sales. Table 8 and Figure 38 show the effects of various alternative merchandising techniques on product movement.

ANNUAL SUPPLY INCREASE WITH MERCHANDISING: 4 SUBSECTOR STAGES

Figure 34. Impact of Supply Increase on Growers (Stage One)

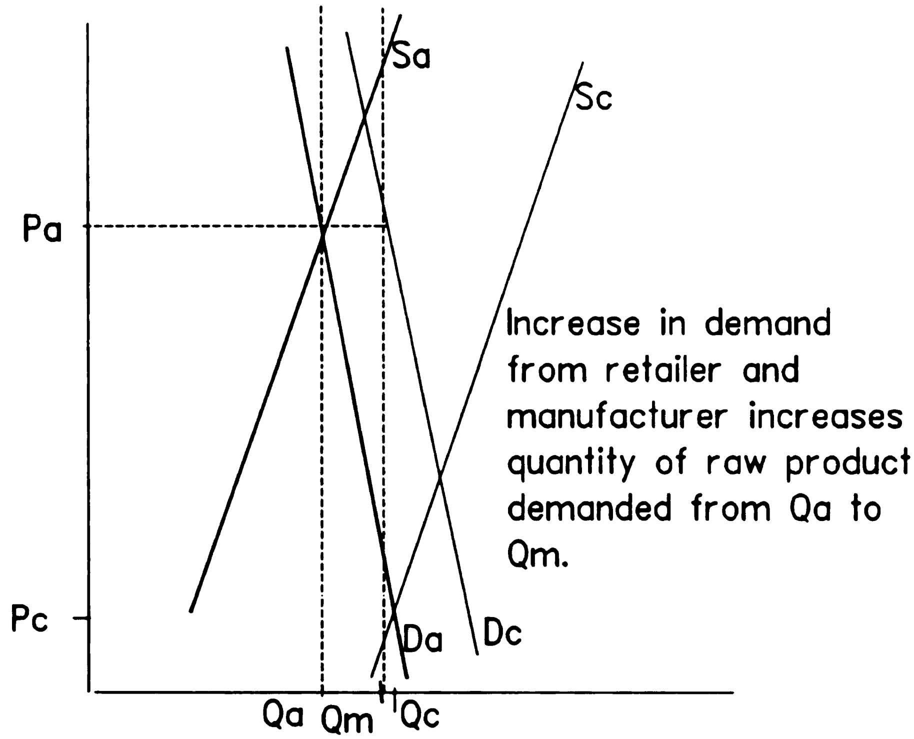


Figure 35. Impact of Supply Increase on Processors (Stage Two)

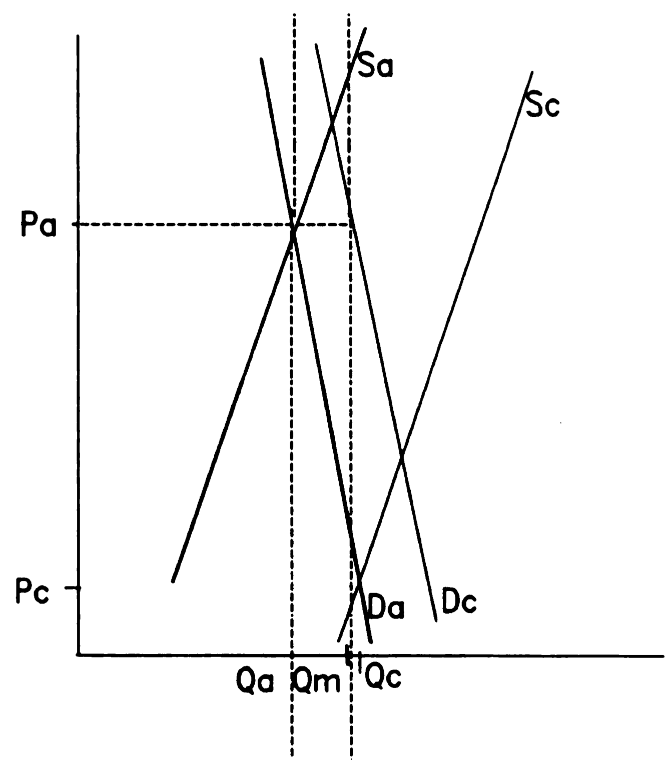


Figure 36. Impact of Supply Increase on Manufacturers (Stage Three)

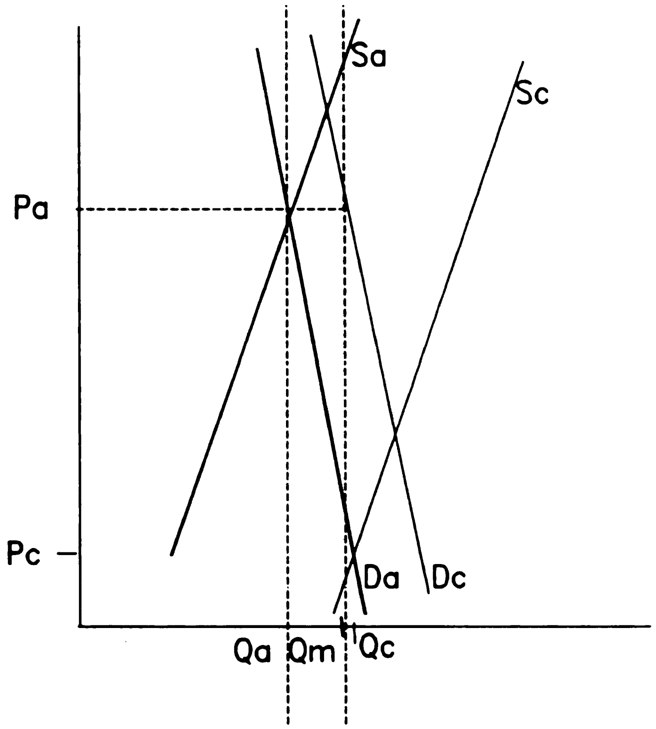


Figure 37. Impact of Supply Increase on Retailers (Stage Four)

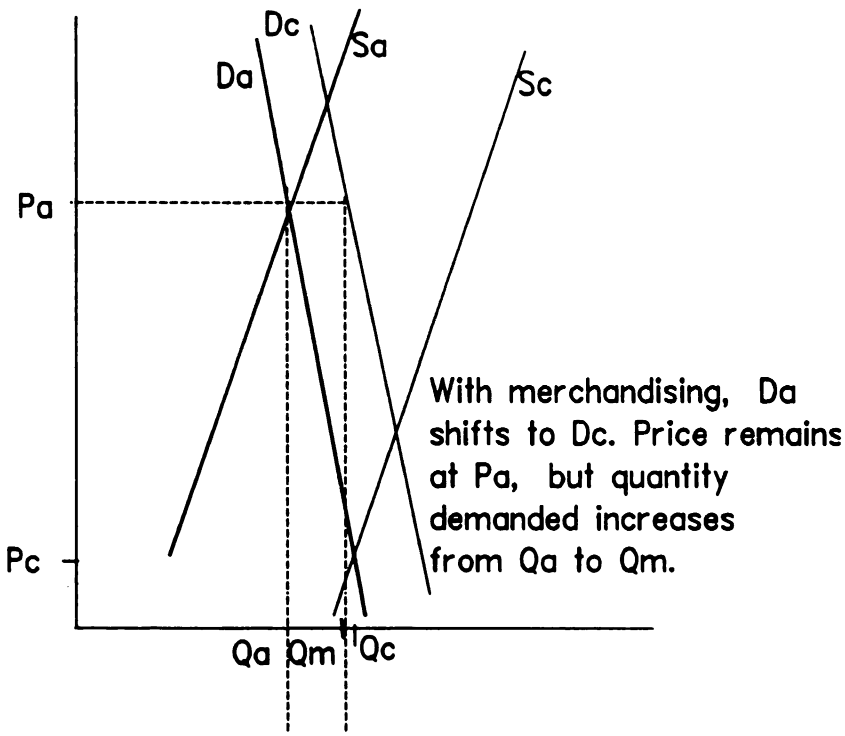


Table 8 shows a number of merchandising actions that can be taken in retail stores to increase sales temporarily. The techniques in the first and second categories in Table 8 are all non-price methods to communicate with consumers about specific products. The third category indicates that combinations of several techniques plus price changes have the strongest impact. Merchandising with methods such as these can contribute to improved vertical coordination when they are implemented to increase sales in response to increased supplies due, for example, to a large crop. Since normal pricing SOPs are often not adequate in adjusting retail sales to changing supply conditions in the subsector, the merchandising can provide very important supplemental coordination roles.

However, retailers rarely undertake merchandising efforts on behalf of specific products on their own. They must be induced to undertake specific promotions by manufacturers, other suppliers, or generic commodity promotion organizations. For example, a manufacturer may offer a promotional allowance of five cents per can, provide in-store display materials, and induce an agreement from the retailer to run a newspaper advertisement. In some cases the manufacturers will pay an advertising allowance for a local advertisement and possibly offer coupons.

Figure 38 shows that one effect of the merchandising is to temporarily shift the demand schedule to the right so that the supply schedule representing the large crop (S_b) intersects the D_{merch} demand schedule (which reflects the impact of merchandising) at a point that will bring forth increased sales. The sales increase is the difference between Q_a and Q_{merch}. Price is not changed, so this represents the application of non-price coordination methods. Within a week to possibly a few weeks after the end of a promotion, the merchandising effect wears off, demand shifts back to the left, and sales return to their pre-promotion level. If only a single promotion is undertaken, this promotional impact is particularly likely to be short-lived for commodity-based products considered to be of minor importance from the retailer's point of view, including tart cherry products. For this reason,

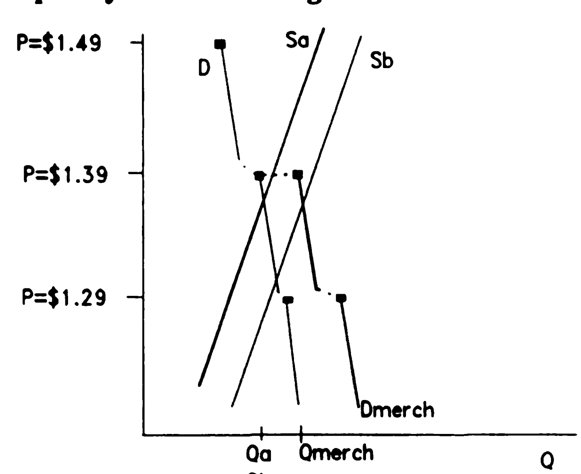
Table 8. Effects of Temporary Merchandising Techniques on Product Movement

Technique	Description	Impact on Sales[1]
1. Use of off-shelf (special) displays	a. End-aisle display with special price compared to shelf location with same special price. No advertising. b. Same as 1a. but with the addition of more colorful, elaborate signs	+420% +542%
2. Use of shelf signs with no price reduction	a. Use of simple sign with no advertising and no product name identification b. Use of sign with product name identification and price specified but no advertising c. Use of simple "as advertised" sign to point out advertised product on shelf compared to same product without a sign.	+5% +39% +124%
3. Combinations of various techniques	a. Product advertised in newspaper with special price combined with a simple shelf sign "as advertised at xx¢" b. Same as 1a. above with the addition of end-aisle display c. Same as 1b. but with manufacturer "theme sale" making use of store-wide banners, point-of-purchase materials, etc.	+194% +629% +782%

[1]Impact of a specific promotion may last for up to several weeks after the promotion takes place, after which product sales will generally return to the pre-promotion level.

The results reported above are from a special study conducted by Progressive Grocer in 1970. The numbers are intended only to provide a general picture of the impact of alternative merchandising techniques, and reliance should not be placed on specific percentages. Percentage changes in sales in response to promotions vary greatly by commodity, market and time period. These figures represent averages of several products over several time periods. The study consisted of testing various merchandising techniques in sets of one company's stores matched for volume, design, size, and demographics. Reported in: Larry G. Hamm, "Food Distributor Procurement Practices: Their Implications for Food System Structure and Coordination." Unpublished Ph.D. Dissertation, Dept. of Agricultural Economics, Michigan State University, East Lansing, 1981, 416-17.

Figure 38. Effect of Temporary Merchandising on Retail Demand With Supply Increase



to have a significant impact on increasing sales as a means to respond to increases in supply at the farm and processor level, there needs to be several related promotions timed sequentially throughout the year.

It should be acknowledged that promotions including coupon offerings generally reduce the price of a food product, e.g. a price of 59¢ is reduced to two for 99¢. Coupon promotions are frequently targeted to the more price responsive buyers. Increases in sales that result from the coupon promotion are therefore represented in economic analysis both in terms of moving along the demand curve as well as shifting the curve. Nevertheless, the analysis about the role of merchandising and promotion in coordinating demand with variable supply still holds.

Hamm offers useful observations that help to put the foregoing analysis into perspective. Writing in 1981, he pointed out that brand manufacturers were getting out of the commodity business, largely because returns were higher with more highly processed foods and because of the additional cost incurred by marketing commodity-based products with variable supplies. Some IOF branded food product manufacturers that continued to market commodity products have tended to rely on processors to supply product for the manufacturer label. The processor then bore the risk and cost of supply variability. Hamm pointed out that manufacturers thus avoided the need to bear coordination costs by shifting the coordination role to upstream stages in the subsector (processors and growers). As the brand manufacturers have reduced some aspects of their vertical coordination role, private label processors have had to increasingly bid against each other for retail buyer attention. A frequent result is that is insufficient merchandising and increased reliance on price as the main coordination mechanism. In large crop years inventory backs up and the private label suppliers bear the cost. In short crop years, supplies are depleted quickly and retail prices may be higher than economically necessary.[22]

Thus many manufacturers no longer perform the role of inducing retailers to undertake merchandising to increase sales of commodity-based food products. Alternative coordination mechanisms that fill the supply-demand balancing roles as IOF food manufacturers have shifted away from those roles are introduced in Section 3.3 below.

3.2.3. Consumer Demand: Matching Product Attributes to Consumer Preferences

Another dimension of coordination addressed in this research is that of matching product attributes, grades, qualities, and varieties with consumer preferences. Table 9 provides an illustrative list of key product attributes. The linkage between food product attributes and the vertical production-distribution system is illustrated below in Figure 39 using a concept map which combines Table 9 and the subsector stages in Table 7.[23]

As shown in the diagram, consumers have buying strategies which are based on tastes and preferences for perceived specific attributes of food products. Firms at various stages of a particular subsector attempt to use various coordination mechanisms to determine the product attributes and appropriate quantities desired by participants in downstream stages. Price is a primary coordination mechanism, and other ones include contractual arrangements, grades and quality specifications and other forms of market information. Firms adapt production, handling, processing, and distribution methods to produce food with the attributes that they perceive are preferred by consumers and to provide the necessary services to intermediate customers who are in downstream stages in

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[22]Hamm, "Food Distributor Procurement Practices."

[23]Adaptation of diagram from Deborah H. Streeter and others, "Information Technology, Coordination, and Competitiveness in the Food and Agribusiness Sector," American Journal of Agricultural Economics, December 1991, 1467.

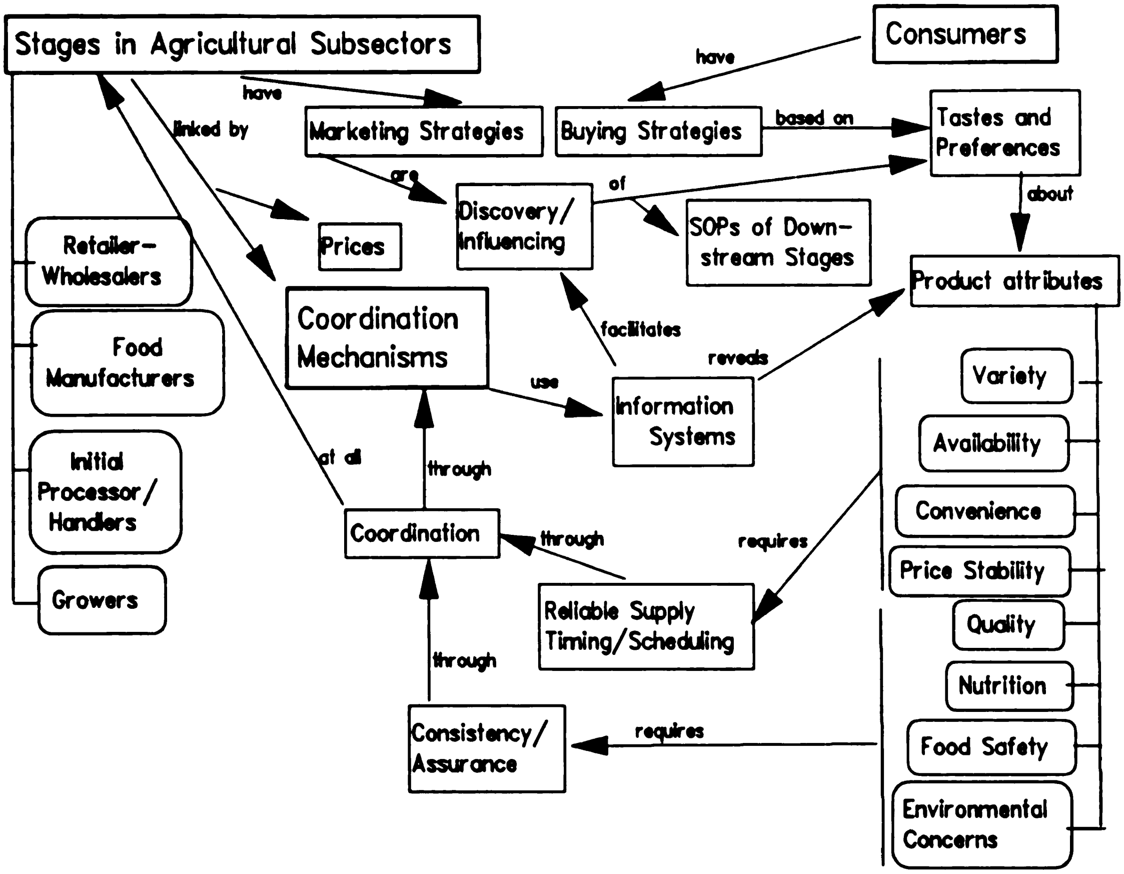
Table 9. Food Product Attributes

Variety
Availability (e.g., seasonal versus year-round)
Convenience
Price Stability
Taste
Color
Quality
Nutrition
Food Safety
Environmental Impacts

the subsector. Firms also develop marketing strategies which are based on attempts to discover consumer tastes and preferences and/or to influence them. For branded food product manufacturers (cooperatives or IOFs) as well as commodity-oriented firms and organizations, marketing strategies are directed at discovering and influencing the merchandising SOPs of retail food distributors. This elicitation of preferences and development of strategies to provide products and services to match those preferences is part of the process of coordination.

Large food retail firms are in some respects more able to identify key characteristics and potential demand for food products than are commodity processors or growers. However, Hamm points out that retail food distributors have little incentive to transmit that demand information to firms upstream in the vertical system. Instead, the characteristics and variety of food products offered to consumers are largely determined by the standard operating procedures of, and interactions between, purchasing agents and merchandisers of large retail chains on the one hand, and marketing agents of food manufacturers on the

Figure 39. Coordination Linkages of Subsector Stages with Consumer Demand



other. The outcomes of these interactions severely limit the effective access of new products and products from new and small firms.[24]

A key part of the interaction between retailer and manufacturer is that retailers need to be convinced by manufacturers that a particular new food product will be accepted by consumers. Retailers generally expect manufacturers to carry out market research to determine consumer preferences and the means by which product characteristics can be designed and promoted to appeal to those preferences. The market research, test marketing and promotion are costly undertakings often beyond the reach of small firms.

Growers, processors, manufacturers and others in the production-distribution system need detailed information about product demand, including preferences for specific product

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[24]Hamm, "Food Distributor Procurement Practices."

attributes, in successive steps of the vertical chain. Food manufacturers generally invest significant resources in market research on consumer preferences. Large brand manufacturers generally have quite effective market research and new product development. However, such research is generally not oriented toward increasing sales for food products from a particular commodity. For this reason growers of a specific commodity whose production is increasing, or is highly variable, have incentives to take collective action in the form of supporting commodity-oriented organizations that carry out market research and generic commodity promotion that can contribute to subsector coordination. How that is carried out is examined in Chapter 4.

In markets coordinated primarily by prices, demand is articulated primarily through decisions to buy or to refrain from such actions. However, food products have a number of actual and potential attributes, and sales data in such markets provide very limited information about consumer preferences. Since it is costly for consumers to express their preferences directly to commodity processors, manufacturers, other suppliers, and growers, the most likely consumer reaction to dissatisfaction with any particular attribute is not to buy the product.[25] Thus there are difficulties in transmitting information on consumer preferences for product attributes to firms in successive stages of a commodity subsector. This contributes to problems of balancing supply and demand.

Thus there is a role for supplemental coordinating mechanisms which address the problems and shortcomings of relying primarily on market prices to balance supply and demand for perennial crop commodities. The graphical examples above illustrated the problems of vertical transmission of pricing signals through states of a perennial crop subsectors. Part of the function of cooperatives, marketing orders, commodity promotion

[25] A. O. Hirschman, Exit, Voice and Loyalty, Cambridge: Harvard University Press, 1970.

commissions and other marketing institutions is to facilitate the price system in the task of vertical coordination. The nature of those coordination mechanisms is examined next.

3.3. Market Coordination Mechanisms and Balancing Subsector Supply and Demand

Coordination mechanisms for market exchange between growers and IOF handlers/ processors take a variety of forms, a few examples of which include open price contracts, contracts in which prices or price formulas are specified, non-contractual and verbal agreements and so on. Another alternative that may facilitate subsector coordination is vertical integration through combined ownership of farms, initial processing and food manufacturing (combining subsector stages one, two and three from Figure 19 in section 3.1). Vertical integration could help gain market access for growers, and problems of short-run supply variability could be addressed through large scale storage. However, vertical integration through combined ownership of farms and processing facilities adjacent vertical stages such as processing and is not the dominant pattern observed in perennial crop subsectors. Although grower-processors operate in both the tart cherry and almond subsectors, they do not play a significant market coordination role.

Given the conditions described in Chapter 2 and the coordination problems introduced in this chapter, a key question is what market coordination mechanisms are best suited to helping to improve the balance of supply and demand in a subsector? The prevalence of cooperatives and the existence of certain types of government-facilitated coordination in the raisin, almond, and tart cherry subsectors suggests that other types of grower-IOF coordination mechanisms are often inadequate for addressing supply-demand balancing problems in certain subsectors.

The foregoing graphical and discussion of the consequences of supply variability show that grower-IOF coordination mechanisms can and do fail to address supply-demand balancing problems in certain subsectors. Chapter 4 and Chapter 5 explore in detail the ways in which cooperative coordination and government-facilitated coordination offer alternatives.

This last term requires some clarification. In a broad sense, numerous aspects of coordination across markets are facilitated by government. Market exchange is facilitated by performance of such functions as contract enforcement, establishing standards, and determining which individuals have which specific rights when interests conflict. There also appears to be some overlap between cooperative coordination and government-facilitated coordination in that the very existence of cooperatives depends on enabling legislation such as the Capper-Volstead Act. However, in this research the term government-facilitated coordination is used more narrowly to apply to some specific instances where government action is initiated to address a specific set of market coordination problems. These government actions include the creation of federal marketing orders and financing of generic commodity demand expansion organizations if these are supported by a state or federal marketing order.

In the second category in Table 1 (government-facilitated coordination mechanisms) are two supply-demand balancing mechanisms: federal marketing order supply management and generic commodity demand expansion. Federal and state marketing orders are a form of collective action by growers (and in some cases processors) that can facilitate some forms of industry-wide cooperation in managing subsector supply or demand-related problems. Growers can vote to establish a marketing order for improved industry marketing performance based on legal guidelines established by the federal government or by some individual state governments, with mandatory provisions that generally apply to all growers and handlers in a market. The almond and raisin federal marketing orders have both been in effect for over 40 years. The tart cherry federal marketing order was in effect from 1972 to 1986. Marketing order supply management issues are examined in Chapter 5.

Table 10. Examples of Coordinating Mechanisms in Three Perennial Crop Subsectors

Coordinating Mechanism	Commodity: Almonds	Commodity: Raisins	Commodity: Tart Cherries
COOPERATIVE COORDINATION			
#1 Committed Commodity Marketing Cooperative			X
#2 Committed Integrated Marketing Cooperative	X	X	
#3 Cooperative/Corporation Joint Venture			X
#4 Bargaining Cooperative		X	X
GOVERNMENT-FACILITATED COORDINATION			
Federal Marketing Order Supply Management			
A. Reserve Pool Storage	X	X	X
B. Market Allocation	X	X	X
C. Nonharvest or Non-production Diversion		X[b]	X
D. Acreage Removal		X[b]	
Generic Commodity Demand Expansion[c]			
A. Research and Development	F	S	F,S
B. Advertising and Promotion	F	S	S,N
C. Export Promotion	F,OF	F,OF,S	F,OF,S,N
D. Allocation to New Product Development Through Federal Marketing Order	F	F	F

[a]IOF = Investor-owned firm, as distinguished from a cooperative, which is patron-owned firm
[b]The Raisin Diversion Program reduces raisin grape acreage temporarily (through spur pruning) or permanently (through vine removal).
[c]F = federal marketing order; OF = other federal government programs; S = state marketing order; N = nongovernmental organization

An important issue related to generic commodity demand expansion is how the programs are funded. Raisin and tart cherry promotion programs are funded by mandatory grower assessments arranged through state marketing orders in some states. Major organizations for carrying out these programs are the California Raisin Advisory Board (CALRAB) and the Cherry Marketing Institute (CMI). Almond generic promotion is funded and carried out through the federal marketing order administrative board, the Almond Board of California (ABC). The role of government-facilitated coordination is examined in more detail in Chapter 5.

The discussion above suggested that since retailers and non-grower-owned food manufacturers are not commodity-oriented, coordinating supplies from agricultural production with consumer demand is generally left to firms that <u>are</u> commodity-oriented, including agricultural marketing cooperatives. But what specific advantages do cooperatives have in addressing commodity supply-demand balancing problems?

3.4. Advantages of Cooperatives

Cooperatives do not play these coordination roles in certain commodity subsectors by accident, but rather because they have some advantages in organizing certain marketing functions for their members that are growers of the commodity in question. This section presents briefly a few of the key arguments in the agricultural economics literature regarding these advantages. The arguments do not pertain to marketing of any specific crop. Staatz points out some of the reasons why cooperatives in some cases are the preferable means to organize transactions between growers and downstream stages in a subsector[26].

> "A farmer cooperative firm...represents a looser form of vertical integration than a vertically integrated IOF...Stockholders in the cooperative firm agree to eschew competition among themselves in their marketing and input supply activities but continue to make the rest of their decisions independently. Cooperative firms therefore allow their members to capture many of the advantages of large-scale marketing, input production, and strategic planning while still permitting farmers to make most of their farm-level decisions themselves. Thus while there are often strong reasons for vertically integrating between farming and certain marketing and input supply activities, the decentralized nature of cooperatives make them a more efficient way of carrying out that integration than an IOF."

Another reason for the existence of agricultural cooperative firms is the preservation of grower market options. Growers facing the prospect of large capital losses on farm assets if they have no market because of the closing of an investor-owned processing plant are often motivated to purchase the processing facilities to convert them into processing-marketing cooperatives. Growers organized into cooperatives are likely to be willing in many cases to operate market facilities that IOFs have abandoned because cooperatives take into account the joint profitability of farming and marketing, not simply the profitability of

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[26]John Staatz, "Farmers' Incentives to Take Collective Action Via Cooperatives: A Transactions Cost Approach," in Cooperative Theory: New Approaches, Jeffrey S. Royer, ed., Service Report 18, Agricultural Cooperative Service, USDA, July 1987, 98.

marketing functions alone. Peterson addresses this issue in his classification of cooperative strategies. He developed a taxonomy of six returns strategies and six risk management strategies followed by cooperatives. Peterson refers to the strategy of producing returns for growers in times when non-cooperative firms would abandon a market as a "maintain the market" strategy.[27]

However, the joint profitability argument alone is not sufficient to explain why cooperatives exist, since growers could renegotiate contracts with IOF marketing firms to make the latter more profitable and thus preserve their market options. There must be reasons why this renegotiation of contracts sometimes does not take place. One reason is that if growers bargain collectively, they may choose not to make price concessions due to grower uncertainty as to the IOF processor's true financial situation. If supplies and prices are volatile, IOFs can incur heavy losses if they have to commit to a raw product price before they know what prices they will receive for their processed products. In a cooperative, there can be a somewhat more open flow of financial information among system participants, and farmers can have more confidence that a reduction in prices is not due to opportunistic behavior.[28]

This brief discussion of coordination roles leads us to a related question: Since there are many types of cooperatives, which ones are most suited to deal with the above-mentioned supply-demand balancing problems? The following section presents four types of cooperatives.

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[27]Christopher J. Peterson, The Economic Role of Agricultural Cooperatives: Returns and Security Strategies, Unpublished Ph.D. dissertation, Cornell University, 1992.

[28]Staatz, "Farmers' Incentives to Take Collections Via Cooperatives," 92-93.

3.5. Types of Cooperatives and Balancing Supply and Demand

Two particular types of cooperatives have the greatest potential to contribute to an improved balance of supply and demand in a subsector: (1) committed integrated marketing cooperatives and (2) committed commodity marketing cooperatives.[29] A key aspect of both types of committed marketing cooperatives is that although their priority commitment is to their members, they are large enough to be committed to influencing markets and marketing of the commodity as a whole through various means. New product development and market development achieved by these types of cooperatives results in greater overall sales of the commodity. The cooperatives also engage in other activities beneficial to other marketing firms such as dealing with legislative and regulatory matters and seeking to reduce foreign trade barriers. Examples of the cooperatives appear in Table 11. As shown in Table 11, additional types of cooperatives that have important roles in the three subsectors include bargaining cooperatives and cooperative-corporation joint ventures.

This section briefly presents and defines several types of cooperatives and is intended only to set the context. Analysis on the role of cooperatives in coordinating supply and demand appear in Chapters 4 and 5. A key question is how one distinguishes CIMCs, CCMCs, and other types of cooperatives.

1. Committed Commodity Marketing Cooperative (CCMC). CCMCs have a goal of influencing demand and prices as well as maintaining strong marketing programs for a particular commodity. The CCMC may also at times attempt to influence market supplies through storage or other means. These cooperatives do not have a strong brand position, in contrast to committed integrated marketing cooperatives (#2 below). CCMC members typically make up a large proportion of the total number of producers of the commodity, and the cooperative is usually the largest marketing firm in a commodity subsector, or is

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[29]The terms committed commodity marketing cooperative and committed integrated marketing cooperative are adapted from work by Ronald A. Knutson.

Table 11. Types of Cooperatives in Fruit, Nut, and Vegetable Industries

Type of Cooperative	Examples from California and Florida	Examples from Michigan and other states
1. Committed Commodity Marketing Cooperative (CCMC)	Citrus Central[a] (Florida)	1. Cherry Central Cooperative 2. MBG Marketing
2. Committed Integrated Marketing Cooperative (CIMC)	1. Blue Diamond 2. Sun Maid 3. Sunkist	1. National Grape Cooperative (Welch) 2. Ocean Spray (MA)
3. Cooperative/Corporation Joint Venture		Curtice-Burns Profac (NY, MI)
4. Bargaining Cooperative	1. Raisin Bargaining Assn. 2. Calif. Canning Peach Assn. 3. Calif. Canning Pear Assn.	1. MACMA-AAMA(MI) 2. Hazelnut Growers Barg. Assn. (OR)

[a]No longer in business

among the largest. An example of a CCMC in Florida was Citrus Central, which has now gone out of business. Although no longer in business, the quantity of citrus fruit marketed through the cooperatives represented a significant proportion of total Florida citrus production. Unlike Sunkist, Citrus Central did not market member production under a brand name.

Michigan-based examples of CCMCs include Cherry Central Cooperative (CCC), a federated cooperative in the tart cherry industry, and MBG Marketing, a centralized cooperative in the blueberry industry. Cherry Central was formed to strengthen marketing, and to a lesser extent pricing, in cherry commodity markets. Influencing cherry prices has not been a major goal in recent years. Today CCC markets a variety of processed and fresh fruits and vegetables. It is one of the largest marketers in the U.S. of processed cherries, blueberries, and apples. Cherry Central currently has 17 processor members in Michigan, Utah, and Wisconsin. Most of the members are cherry processing cooperatives, although several are grower-processors. MBG Marketing is a member of CCC and is the sole supplier of blueberries to Cherry Central.

The goals and achievements of Cherry Central include influencing demand, maintaining strong marketing, and advancing grower and industry interests. However, because it is mainly involved in commodity marketing and does not directly market consumer branded products, it can be categorized as a committed commodity marketing cooperative rather than as a committed integrated marketing cooperative. Sales of consumer retail products, which provides the means for vertical coordination with downstream market levels, are achieved in part through membership in Profac cooperative, which has a joint venture arrangement with Curtice-Burns, an IOF food manufacturer. Cherry Central also markets some products under consumer brands, (through Curtice-Burns/Profac), but these are not strong national brands such as Sun-Maid or Blue Diamond.

2. Committed Integrated Marketing Cooperative (CIMC). CIMCs are more completely integrated than CCMCs in that they market a significant portion of their commodity as strongly branded consumer products. CIMCs thus provide an additional dimension beyond the CCMC by providing more direct access to retail consumer markets. An advantage that CIMCs have over CCMCs and other types of cooperatives is that prices are generally more stable at retail market levels and the benefits of this increased stability can be passed upstream to the growers.[30] In Peterson's taxonomy, pursuit of this risk management strategy of integrating into a more stable final market, is referred to as "selective vertical integration."

Examples of such cooperatives based in California with strong national brands are Sun Maid (raisins), Blue Diamond (almonds) and Sunkist (fresh citrus). Additional examples from other states include National Grape Cooperative (which markets processed

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[30]Ronald A. Knutson, "The Impact of Cooperatives on Market Performance, Subsector Coordination, and the Organization of Agriculture," in Agricultural Cooperatives and the Public Interest: Proceedings of a North Central Regional Research Committee Sponsored Workshop, St. Louis, MO, June 6-8, 1977, N.C. Project 117 Monograph 4, Research Division, College of Agricultural and Life Sciences, University of Wisconsin, Madison, September 1978, 306.

grape products under the Welch's brand) and Ocean Spray (cranberries). This research for focused on Sun-Maid and Blue Diamond because it emphasized the almond and raisin subsectors.

Peterson's classification of cooperative strategies provides insights on how to distinguish types of cooperatives. Peterson classified twelve cooperative strategies: six strategies that are designed to improve member returns and six strategies that intended to reduce grower risk.[31] Two of Peterson's twelve strategies help define a CIMC: 1) the risk strategy of integrating into a stable final market and 2) the return strategy of serving a "missing" final consumer market. A missing consumer market in the context of this research means the potential additional sales of commodity-based retail food products that could occur if new food products were developed or if sales were expanded into new geographic locations. Both Sun-Maid and Blue Diamond are able to reduce risk to their members through returns that are steadier due to more stable prices on their sales of branded retail products than are obtainable from bulk commodity sales of raisins or almonds. In addition, by development and promotion of new products and seeking additional market niches, both cooperatives are expanding sales for their members by serving "missing" final consumer markets. In so doing, they also serve a key supply-demand balancing role by increasing demand for products for which supply has been increasing. The means by which the cooperatives accomplished this task are the subject of Chapter 4.

Sun-Maid Growers of California was created during the 1930s to provide additional market outlets for growers of raisin-type grapes. The cooperative markets a variety of retail package sizes and types under its brand name and it currently holds about a 50% share of the U.S. retail market for packaged raisins. The cooperative also markets significant quantities as industrial ingredients to food manufacturers. Sun Maid membership

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[31]Peterson, The Economic Role of Agricultural Cooperatives.

represented between 25-30% of total raisin production during the second half of the 1980s. Sun Maid currently has approximately 1300 members.

The California Almond Growers Exchange was formed in 1910, but was renamed Blue Diamond Growers of California in 1987. Rapid growth of California almonds since the late 1960s propelled Blue Diamond into becoming the world's largest almond marketing firm. The cooperative's share of total California almond production has fluctuated around 50% in recent years. Historically its share has been as high as 60%. Blue Diamond membership was approximately 4500 members in 1992. Although branded retail sales are important, a large proportion of the cooperative's tonnage is sold in raw bulk form or as value-added ingredients for food manufacturers and food service customers. During the late 1980s and early 1990s, Blue Diamond was also selling 60-70% of its member's production into the export market.

3. Cooperative/Corporation Joint Venture. This arrangement combines a food manufacturing firm with a more commodity-oriented cooperative. An example is the long-term joint venture agreement between Profac Cooperative, the members of which supply a number of fruits and vegetables, and Curtice-Burns, Inc., which markets a number of branded food products. In the past, several joint ventures in the Florida citrus industry have also operated under somewhat similar joint venture arrangements.

The joint venture approach represents another example of a more flexible approach to vertical coordination than is likely with ownership integration of vertical stages in a subsector. One major contribution of such an arrangement is to balance supply and demand for cherries, which may involve the cooperative's use of stock tonnage as a means to limit the quantities that the cooperative will accept in surplus periods. However, stock tonnage is not used by some joint ventures. This approach is discussed in more detail in Chapter 5.

4. Bargaining Cooperative. Bargaining cooperatives typically negotiate prices and sometimes other terms of trade with processors. A major contribution to vertical

coordination and balancing supply and demand is that the bargaining process provides a means to bring a great deal of supply and demand information to bear on the raw product pricing process. Bargaining cooperatives are also frequently influential in the support and maintenance of supply management programs through federal marketing orders and are generally supportive of demand expansion programs through generic commodity demand expansion organizations.

California examples include the Raisin Bargaining Association, California Canning Peach Association and California Canning Pear Association. In Michigan, MACMA-AAMA bargains on behalf of producers in various Michigan commodity industries, including apples, asparagus, and tart cherries. MACMA-AAMA is the Michigan Agricultural Cooperative Marketing Association, which has historically been affiliated with American Agricultural Marketing Association (AAMA).

3.6. Summary

A goal of this chapter was to make the case that a perennial crop subsector that relies primarily on market prices and exchange arrangements between growers and IOF handlers can experience significant coordination problems. The analysis of supply variability leads to several observations about perennial crop subsector impacts and actions to improve coordination. The foregoing pages described several factors that make sales of commodity-based food products relatively unresponsive to price declines that are unpublicized or otherwise unaccompanied by additional promotion. Food manufacturers and retailers recognize that the purchasing behavior of many consumers regarding certain processed food products is not very price responsive. As a result, SOPs of manufacturers and retailers include not changing certain retail food product prices despite changes that may have occurred in the cost of raw product due to volatility in agricultural production. Specific SOPs that were examined were pricing on the nines and product line pricing. In both cases, raw product costs can vary over a substantial range before any retail price changes are made. When price changes are made, they tend to move in substantial increments such as ten cents per unit.

An additional reason for the lack of price responsiveness is that the raw product cost of processed food products is often a small part of total cost. This reduces the pressure to adjust the selling price of the product in response to changes in the raw product cost.

Also important is the competitive environment facing manufacturers and retailers. Retail stores carry thousands of products and decisions relating to pricing and price changes of individual food products depend on strategies developed to draw customers into retail grocery stores. These retailer strategies are in turn affected by the competitive actions of other retailers in the market area. Changes in raw product cost of food products from a particular commodity generally have very little impact on these decisions. Food manufacturers also have long planning horizons, and this is an additional reason that and their promotional and pricing decisions are not likely to be significantly altered in response to raw product supply fluctuations and changes in raw product cost.

However, even if sales of certain processed food products are not generally responsive to price changes alone, food product sales often <u>are</u> responsive to a large number of promotion and merchandising efforts. Retailers can be influenced to undertake merchandising actions to increase sales of particular food products. Such efforts to influence retailer merchandising generally come from food manufacturers. However, large branded food product manufacturers promote their own products and have no incentive to undertake such efforts for food products from a particular commodity in response to problems of supply variability.

The graphical analysis showed that this lack of price responsiveness can result in big price and revenue declines at the grower level in large crop years. These problems of subsector coordination can be addressed by collective action by growers. Although firms at various subsector stages feel the consequences of the coordination problems, growers have the greatest incentive to undertake such action due to the severity of the negative impacts of supply volatility.

At the grower level is the issue of individual versus collective benefit of taking action in response to supply variability. There are benefits to all growers if total demand for a commodity expands. However, for individual growers and individual IOF processors and manufacturers, the benefits of promoting food products as a "commodity" are not likely to exceed the costs. However, if funds can be collected to undertake promotional campaigns of sufficient size, there is often a benefit from generic commodity promotion. A greater payoff to promotion comes from successful differentiation of commodity-based food products through developing a brand franchise.

Growers can express their collective interest in market expansion for commodity-based food products through the coordination mechanisms introduced in the previous section. Cooperative coordination mechanisms included CIMCs and CCMCs. Committed integrated marketing cooperatives can expand demand by developing and promoting food products with a cooperative brand franchise. Committed commodity marketing cooperatives generally command a sufficiently large proportion of total supply to enable them to influence manufacturers to undertake new product development and promotion. Government-facilitated coordination mechanisms make up another major category. Growers can support generic commodity demand expansion programs by assessing money from growers (and sometimes handlers) and allocating that money to promotional programs.

Reliable supplies of raw product and predictable prices are key factors in getting an adequate payoff from investment in promotion and in achieving effective product differentiation and new product development. The reliability factor is a key aspect of persuading IOF food manufacturers to undertake food product promotion involving a perennial crop commodity. The coordination mechanisms developed to address this issue, particularly federal marketing orders, are the subject of Chapter Five.

Another goal of this chapter was to develop the framework to gain a general understanding of how cooperatives, and in particular committed marketing cooperatives, can address the coordination problems posed by the supply volatility described in Chapter Two. This framework is used in the next chapter to examine specific demand expansion efforts of CIMCs and CCMCs in the tart cherry, almond and raisin subsectors.

CHAPTER 4: DEMAND ISSUES AND COORDINATION

The previous chapters presented some of the problems associated with balancing supply and demand in perennial crop subsectors. The next step is to look at how certain roles played by committed marketing cooperatives and generic commodity promotion organizations address the problems of balancing supply and demand for perennial crops. This chapter examines both short-run demand issues relating to annual supply fluctuations and also long-run demand issues relating to the need to expand demand to balance supplies during periods of overproduction.

4.1. Demand Expansion and Cooperatives

Contributing to the ability of CIMCs and CCMCs to perform vertical market coordinating roles such as demand expansion are: (1) cooperative membership that includes a large proportion of producers of a commodity and (2) a brand position through successful product differentiation of commodity-based retail products, and in some cases substantial financial resources that the cooperative can apply to developing and marketing new products. The strong brand position and new product development abilities of large cooperatives in both the almond and raisin subsectors have enabled them to expand demand for member tonnage and indirectly influence overall demand for those commodities.

Depending on cooperative market position and resources, cooperative demand expansion efforts tend to involve one or both of two main strategies: a commodity marketing strategy or a brand/value-added marketing strategy. Table 12 presents some of the key differences between the strategies. A commodity marketing strategy for a cooperative involves selling member production as a relatively undifferentiated commodity. Cooperatives that emphasize a commodity strategy over a brand/value-added strategy usually have little capacity to develop new retail products for consumers.

Table 12. Alternative Marketing Strategies in Perennial Crop Subsectors

Commodity Marketing Strategy	Brand/Value-added Marketing Strategy
-Sell undifferentiated commodity	-Have strong retail brands and market a variety of value-added food products designed to meet consumer preferences
-Emphasize sales of members production primarily with existing products to benefit producers	-Focus on meeting consumer desires with a wide variety of products & services based on consumer wants & preferences
-Usually have little capacity to develop new products for different types of consumers	-Have ability to develop a series of new products for different types of consumers preferences

4.2. Commodity Marketing

A large proportion of almonds, raisins, and tart cherries are sold as relatively undifferentiated commodities by both investor-owned processors/handlers and cooperatives, including those cooperatives that have strong consumer brands. Because of the strong price competition and little product differentiation in commodity marketing, there are usually lower margins for the firm with this strategy than in the branded and value-added categories.

However, the almond cooperative and some competing commodity marketing firms have some impact on their sales volumes in the commodity portion of the market by emphasizing high quality and guarantees of more reliable supply to attract the "quality buyers" while leaving "price buyers" to be supplied by other handlers.[32] Thus even within the relatively undifferentiated commodity market, there are degrees of product differentiation. The same is true to varying degrees in the other two subsectors.

For example, in the commodity-oriented "brown almond" market, the almond cooperative will emphasize quality factors such an unusually low incidence of "foreign

[32] Almond Facts, Blue Diamond Growers, Inc., July 1986, 39.

material." The cooperative also has "self-certification" arrangements, in which buyers will accept deliveries without inspection because of the buyer's confidence in the cooperative's quality.[33] These cooperative approaches reduce transactions costs and facilitate coordination in regard to quality characteristics.

4.2.1. Undifferentiated Commodity Markets and Annual Supply Fluctuations

Expanding or contracting demand as annual supplies fluctuate has been attempted to the extent possible in undifferentiated commodity markets. In a large-crop year, major attempts are usually made to sell larger quantities into the commodity markets, primarily through lower commodity prices, and prices to processors and growers may fall to very low levels. A short crop will usually cause commodity prices to rise, perhaps substantially. Cooperatives may need to ration the short supplies to key industrial and food service customers to whom they sell their commodity as ingredients. Both of these instances represent movement along a demand curve, which should be distinguished from shifting of the demand curve resulting from demand expansion programs. Demand expansion efforts in times of large supplies may include increased food service promotions and extra efforts to induce industrial food manufacturer customers to expand use of existing products and if possible to introduce new products.

This relatively undifferentiated commodity market plays a key role in almond supply-demand coordination particularly in regard to the substantial annual supply fluctuations. A key part of Blue Diamond's strategy involves remaining a reliable supplier not only to branded product markets but also to the major customers to whom they sell almonds as an industrial ingredient. To carry out this strategy in an environment of fluctuating supplies, the cooperative uses the commodity market as the place to make adjustments in quantities

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[33] Interviews with cooperative representatives.

marketed in accordance with the size of a crop in a particular year. In a large crop year, increased quantities will be sold into the commodity market by the cooperative as well as by other firms. In short crop years, the almond cooperative will cut back sales to the undifferentiated commodity market to safeguard supplies to brand markets and key industrial and food service customers. The raisin cooperative uses a similar strategy to act as a reliable supplier to key customers in branded and value-added ingredient markets.[34]

4.3. Brand/Value-Added Marketing

In contrast to commodity marketing, cooperatives that use a brand/value-added strategy focus on maintaining a strong brand position and meeting consumer preferences with a variety of established products and new products. Sun Maid and Blue Diamond have had the ability to employ brand/value-added demand growth strategies to varying degrees in the raisin and almond subsectors. They also use commodity marketing strategies for a substantial proportion of their tonnage. If a cooperative has a substantial market share of the subsector as a whole and is successful in expanding demand for its members' products, the cooperative's efforts are likely to have a significant impact on overall commodity demand in that subsector.

Key elements of brand/value-added strategies to expand demand for member tonnage include: (1) advertising, promotion, and merchandising, (2) development of new markets, (3) market research and product development. These types of activities are likely to be especially emphasized by large cooperatives with strong brands. Cooperatives that are also food manufacturing firms (including Sun Maid and Blue Diamond) differ from typical large investor-owned food manufacturing firms in that cooperatives often undertake these steps specifically to sell profitably quantities of a commodity grown by their grower members

[34] Interviews with cooperative representatives.

rather than just attempting to expand volume and profits without regard to a commodity, which tends to be more common with IOFs.

The first of these elements (advertising, promotion and merchandising) addresses in part the short-run problems relating to the lack of effective vertical coordination in some perennial crop subsectors. Chapter 3 illustrated how some retailer practices and the lack of a commodity orientation at the retailer level can contribute to supply/demand imbalances resulting from annual supply fluctuations. Chapter 3 also discussed conceptually how advertising, merchandising and promotion can improve the vertical transmission of information in a subsector so that changes in supply are reflected to consumers. What follows now is a discussion of some specific means by which advertising, promotion and merchandising are carried out. Subsequent sections present how cooperatives implement the other above mentioned elements of brand/value-added strategies.

4.3.1. Elements of Brand/Value-Added Strategies: Advertising, Promotion, and Merchandising Activities

Before going into the details of what specific actions are undertaken by cooperatives, it is useful to set the stage with some general points about advertising, promotion, and merchandising activities. Hamm points out that brand manufacturer strategies for advertising, promotion, and merchandising include three main components: (1) retail trade oriented promotions, (2) consumer-directed advertising, (3) a sales force of either brokers or the manufacturing firm's own employees.[35] These strategy components are in part oriented toward eliciting certain merchandising responses from food distributors such as grocery chains.

Branded food manufacturers (both cooperatives and IOFs) use a wide variety of retail trade promotions, including paying various types of allowances to retailers (e.g.,

[35] Hamm, "Food Distributor Procurement Practices, 435.

advertising and merchandising allowances), point-of-purchase display materials, distribution of coupons redeemable through purchase of specific products by consumers, and a number of other merchandising techniques. In addition to media advertising to achieve product differentiation and to build consumer brand loyalty, consumer-directed promotion focuses promotional allowances for retailer advertising in local newspapers and other media as a means to increase the likelihood that retailers will accept and follow through with the retail trade promotions offered by the manufacturer. The manufacturer's field force (sales staff or brokers) carries out a variety of field tasks for the manufacturer sometimes including labor support in those retail stores which are using manufacturer promotions and monitoring compliance by retailers with manufacturer's stipulated conditions.[36]

In the retail consumer product market, actions and strategies of cooperatives with strong brands resemble to a degree those of IOF branded food manufacturers. These actions taken by committed marketing cooperatives such as those that are the subject of this research are intended to create awareness of their commodity-based products on the part of consumers and to induce merchandising responses on the part of retailers so as to coordinate demand with supply levels. This is a major aspect of balancing supply and demand that is undertaken by committed marketing cooperatives.

The raisin and almond cooperatives use all three above-mentioned components typical of brand manufacturer strategies in marketing their branded retail products. The specific timing of promotions, intensity of media and print advertising, and other strategic decisions are made with the goal of maximizing sales with the promotional resources they have available.

The raisin cooperative has advertised its branded consumer products in the broadcast and print media, frequently in coordination with point-of-sale promotions. They

36 Hamm, "Food Distributor Procurement Practices," 432.

have also used a multi-brand approach in which they advertise jointly with branded products with which raisins are frequently consumed, including ready-to-eat breakfast cereals and hot cereals.[37] Raisin marketers, including Sun-Maid, have used clay animation advertising featuring the "dancing raisins" as a successful part of their advertising. This award-winning advertising campaign was pioneered by a California-based generic promotion organization supported by raisin growers and packers known as the California Raisin Advisory Board (CALRAB).

Methods used by the almond cooperative to appeal to consumers include advertising in magazines, newspapers, radio, and television as well as in-store displays and consumer couponing. They also advertise in trade publications to reach wholesalers and retailers in both the retail grocery business and in food service.[38] In addition, the almond cooperative also uses national tie-in advertising with other branded products.

Thus the CIMCs in the almond and raisin subsectors undertake a number of actions in the arena of advertising and promotion related to their brand retail products designed to elicit merchandising responses from retail food distributors which will in turn bring about increased consumer purchases. This plays an important role in balancing of supply and demand by improving the coordination of consumer demand for commodity-based processed food products with member supplies that represent a large proportion of total annual supplies.

4.3.1.1. Demand Expansion and Contraction in Response to Annual Supply Fluctuations

As the size of the crop varies from year to year, commodity subsector participants attempt to vary the quantities demanded for the commodity as much as possible. In a large-

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[37] Sun Diamond Grower, Spring 1982, 21.

[38] Annual Report 1981-82, California Almond Growers Exchange, 7-8.

crop year, brand marketers and generic commodity promotion commissions may expand advertising, promotion, and other demand expansion efforts. Among these activities oriented toward grocery retailers and wholesalers are expanded trade advertising, promotional allowances, and encouragement of more in-store displays and special merchandising. For marketers with strong brands, and for commodity promotion commissions with sufficient funding, consumer advertising may also be increased in the large-crop years. Many of these kinds of demand expansion activities are commonly scaled back temporarily in years of short-crop supplies. By varying the magnitude of their promotional, advertising, and demand expansion programs, these subsector participants attempt to alter demand to more closely conform with the supply for a given year.

Despite efforts by firms and organizations within the commodity subsector to expand and contract demand to conform with annual supply fluctuations, the degree to which this can be quickly accomplished is often quite limited. Market demand expansion for branded products is expensive and to be very effective needs to be accomplished over a period of several years through consistent, concerted efforts that are planned well in advance. Since the planning horizon for effective demand expansion for branded products is multi-year, relatively stable annual supplies and prices are important for successful implementation of demand expansion efforts. Programs that address supply stability are the subject of Chapter 5.

Large annual fluctuations in supplies thus tend to conflict with the standard operating procedures of most major brand marketers. The limited ability to modify demand quantities is especially noteworthy when an unusually large crop occurs and a large increase in demand would be desirable to balance the large supply.

Demand expansion is especially limited for tart cherries by the variability and uncertainty in price and supply. National brand food manufacturers are reluctant to invest in expanding demand for cherry products because of this high degree of uncertainty.

An example of the limited ability to modify demand quantities in the short run is illustrated by the tart cherry situation in 1987, a year with a very large cherry crop. National crop size increased by 136 million pounds from the previous year to approximately 358 million pounds, which was 61% larger than the previous year's moderately sized crop. Even though supply had increased by 136 million pounds over the previous year, there was only a much smaller increase in sales of 35 million pounds made up of: (a) an additional 15 million pounds sold in commercial markets (11% of the increase in supply) plus (b) 20 million pounds purchased by the U.S. Department of Agriculture (USDA) for government feeding programs. Even the small increase in quantities sold was achieved only with a very low grower price, which approximated 36% of typical grower unit costs. This 1987 example from the tart cherry subsector, while perhaps an example of extreme circumstances, illustrates forcefully the difficulty in expanding demand substantially from one year to the next to conform with annual supply fluctuations. This example also illustrates again that farm-level demand is often highly inelastic, which is characteristic of a number of perennial crops.

In a short-crop year, a combination of higher prices and a decline in promotion and advertising activity reduces quantity sold. However, the reduction in consumer and manufacturer purchases that occurs may not be easily reversed when demand expansion efforts are re-emphasized in a subsequent large-crop year.

4.3.2. Elements of Brand/Value-Added Strategies: Market Development

Market development includes increasing sales by opening up new markets in foreign countries or in the U.S. Strategies for development of new markets in all three subsectors have involved export market development, domestic market expansion and increased sales to the national school lunch program and other commodity feeding programs of the U.S. Department of Agriculture. Export markets have grown dramatically for almonds and raisins to the point where up to two thirds of almond production and about one third of raisin production is now exported.[39]

Partially in response to expected large increases in supply, Blue Diamond has played a large role in export development through opening up various countries to California almonds, carrying out promotional activities, developing distributor networks and encouraging reduction of trade barriers. Up until the mid-1970s this effort was facilitated by a policy of pricing marketing order reserve almonds for export below U.S. prices through the market allocation provisions of the almond federal marketing order (the marketing order is examined in more detail in section 5.2.7 of Chapter 5).

As the export market became a large part of total almond sales, it came to be considered a primary market and no longer a residual market into which excess supplies could be shifted in large crop years. Secondary markets are residual markets into which excess supplies can be shifted without affecting sales in regular commercial channels, which are the primary markets.

Raisin export market development also involved market allocation through the federal marketing order. As with the almond marketing order, market allocation involved pricing reserve raisins for export below domestic U.S. prices. Since the mid-1970s, the specific pricing mechanism for raisin exports has been altered and has become the Export Incentive Program, which is explained in Chapter 5.

4.3.3. Elements of Brand/Value-Added Strategies: Market Research and Product Development

Market research is undertaken to determine consumer preferences and market segmentation trends as they relate to food products, and how to fill specific market niches

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39"Statistical Tables, California Almonds," Almond Board of California, Sacramento CA, various years. "Marketing Policy," Raisin Administrative Committee, Fresno CA, various years.

by developing food products that appeal to different types of consumers using almonds, raisins, or tart cherries. When applied to specific commodities, market research can be a means to help adapt products from that commodity to consumer preferences and hence to aid in effective demand expansion. The effective demand expansion can, in turn, help marketing firms such as cooperatives to coordinate demand and supply better. As indicated in Figure 39 (section 3.2.3 of Chapter 3), committed marketing cooperatives can develop marketing strategies based on consumer buying strategies which are in turn based on consumer preferences for specific product attributes.

Product development provides specific ways to exploit the demand potential, taking account of supply conditions in a commodity subsector. The information derived from market research is used to develop products, initiate different packaging methods, or determine which special services can fill specific market niches. If supplies are expected to continue steady or to grow, new product development is a key part of a strategy fulfilling consumer preferences and eliciting specific behavior from retail food distributors intended to maintain or increase sales of commodity-based products.

That strategy includes developing new food products, sizes, and packaging as a means to help maintain or expand the number of facings on supermarket shelves. Facings are the number of containers of a particular brand of food product that are juxtaposed on supermarket shelves. Expanding the number of facings increases the visibility of the food product and the brand name and helps to ensure continued or increased sales. Failure to persuade retailers to keep a certain number of facings for a set of products can be detrimental to sales. One study showed that reducing facings from four units to two units, with no change in the price or shelf location, can reduce sales by 48%. Similarly, reducing facings from three units to one can reduce sales by 58%.[40] Means such as those to

[40]Source: Progressive Grocer. See footnote to Table 8 in section 3.2.3., Chapter 3.

maintain consumer exposure to commodity-based retail food products are particularly important in light of the limited coordinating role played by prices of processed commodity-based products as discussed in Chapter 3.

New product development is focused both on developing branded retail products and on increasing uses of the commodity as a value-added ingredient. Licensing the use of the cooperative's brand name with branded food products manufactured by other firms is another way to increase marketplace exposure and sales.

What follows now is a more in-depth look at the brand/value-added strategies followed by cooperatives in each of the three subsectors. Strategies related to branded consumer products are examined first, followed by use of the three commodities as value-added ingredients.

4.3.3.1. Product Development: Branded Consumer Products

Cooperatives and other firms and organizations that are oriented towards the interests of growers and handlers of a specific commodity can enhance subsector coordination by exploiting consumer preference trends to develop products to appeal to those consumers as a means to maintain sales when supply and demand are in an approximate balance and to increase sales when supplies are expanding.

An additional strategy firms use for expanding branded product sales is providing services that meet the needs of intermediate customers such as retailer-wholesalers and brokers. For example, the almond cooperative has for a number of years purchased other tree nuts for resale, thus allowing the cooperative and its brand brokers to offer an array of nuts to their customers. Another example of providing services is the joint selling arrangement Sun- Maid raisin cooperative made with several other cooperatives. The joint sales agency (Sun-Diamond) facilitates the ability of the sales staff and brokers to offer an array of products to retailer-wholesalers. Offering an array of products increases the ability of the cooperative (operating in its role as a food manufacturer) to influence retail food distributors to carry more products and to engage in merchandising activity that increases sales and thus helps create the capacity to more effectively coordinate demand with changing supply levels.

In all three perennial crop subsectors, a significant proportion of the tonnage is marketed as consumer retail products. Approximate percentages are 40% for tart cherries and raisins.[41] Figures on the proportion of the almond market in retail products were not available. Demand expansion through the branded consumer product approach is accomplished by developing products for sale on supermarket shelves with attributes that appeal to a consumer population that is becoming increasingly segmented and whose preferences are changing over time. The connection between food product attributes and subsector stages was illustrated in Figure 39 (section 3.2.3. of Chapter 3). In recent decades, consumers have demanded increased convenience in food preparation, and have shown increasing preference for foods compatible with a healthy lifestyle, including lower calorie "light" foods. For example, to appeal to health-conscious consumers concerned with salt and fat, Blue Diamond introduced salt-free and dry roasted almonds.

Sun-Maid has had strong national consumer brand name recognition for several decades for raisins as a snack food and as an ingredient for home baking. Beginning in the late 1970s, the cooperative introduced several new consumer products which involved combining raisins with other dried fruits and nuts to increase sales for both snacking and home baking. Improved packaging materials and different retail sizes were also introduced

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[41] Marketing Policy reports from the Raisin Administrative Committee in recent years indicate that approximately 40% of raisins marketed are in packaged form for retail markets and about 60% are sold in bulk. Tart cherry statistics from recent years indicate that pie filling represents about 17% of total sales and that the amount of frozen cherries that is remanufactured as pie filling represents another 20-23%. Source: Red Tart Cherries: Crop Statistics and Market Analysis, (Michigan Agricultural Cooperative Marketing Association--Red Tart Cherry Growers Marketing Committee; American Agricultural Marketing Association--Cherry Advisory Committee), Lansing, Michigan, various years.

to spur consumer sales. Since the cooperative has a large proportion of the branded retail raisin market (50%[42]), such actions contribute to subsector coordination by maintaining or expanding the facings on supermarket shelves, and thus retail sales, in the face of steady and increasing production in recent years. Data presented earlier indicated that reducing facings has a significant impact on reducing sales of processed food products.

Certain actions by a cooperative with a large retail market share contribute to balancing supply and demand by attracting environmentally conscious consumers and/or other segments of consumers and thus enhancing demand for a commodity-based product with excess capacity. For example, to address consumer concerns over natural resource conservation issues, Sun-Maid in 1992 announced its intention to pursue a policy of searching for means to make its packaging recyclable and to use fewer resources where possible. The cooperative also noted the importance of informing consumers of these "environmentally friendly" actions.[43]

The almond marketing cooperative has moved over the years in the direction of increasing emphasis on branded consumer products as a prime demand expansion strategy. Due to Blue Diamond's very large branded retail market share of almonds (over 90%[44]), these actions represent an important part of long-term subsector coordination due to the large increases in almond production that were projected when these initiatives were begun. In the 1950s Blue Diamond launched its original flavored almond snack products, and subsequently expanded into a large product line with a number of flavors by the 1980s. The cooperative moved from a position of being mostly an industrial almond supplier well into the 1970s to the point where by the mid-1980s "the largest single specialty segment is

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[42]Peter Penner, President of Sun-Maid Growers, Inc., personal communication.

[43]Sun Diamond Grower, Sun Diamond Growers, Inc., Spring 1992, 14 and 21.

[44]Steve Easter, Blue Diamond Growers, personal communication.

consumer products," representing about 30% of Blue Diamond sales.[45] Blue Diamond has steadily increased the variety of almond-based consumer products and package sizes sold on supermarket shelves. To further increase the exposure of almond products to consumers, Blue Diamond developed other products designed to be sold in the supermarket produce section.[46] All of these actions contributed to increased almond sales by appealing to different types of consumers, by placing products in different sections of retail grocery stores and through maintaining product exposure and facings on retail shelves. These actions represent an important set of marketing strategies including some forms of non-price coordination that take account of retailer SOPs.

The tart cherry subsector also provides an example of this approach. Certain tart cherry processing cooperatives sought commodity demand expansion opportunities in branded retail product marketing by purchasing the pie filling divisions of some major brand manufacturers that were interested in divesting themselves of these divisions.[47] Consumer-sized canned pie filling showed a trend toward replacing canned cherries in the 1960s and 1970s as consumers were attracted to the increased convenience of pie filling. Pie filling was marketed under a few strong regional brands. To tap into this trend and as a means to get into branded product marketing, Cherry Central Cooperative acquired a pie filling division.

By acquiring a brand, Cherry Central became a committed integrated marketing cooperative for a period of time. Advertising and promotion and other demand expansion activities undertaken for their branded retail products were a means to improve supply-

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[45]Almond Facts, Blue Diamond Growers, Inc. May/June 1985, 3.

[46]Annual Report 1979-80, California Almond Growers, Exchange, Inc., 8.

[47]Donald J. Ricks and others, The Tart Cherry Subsector of U.S. Agriculture: A Review of Organization and Performance, N.C. Project 117, Monograph 12, Research Division, College of Agriculture and Life Sciences, University of Wisconsin - Madison, July 1987, 26.

demand balancing. The promotional efforts of the cooperative were undertaken to elicit merchandising responses by retailers to maintain and increase sales of various cherry-based retail food products partly in response to changing tart cherry supply levels.

The pie filling division of Cherry Central was sold after several years to a food manufacturer-cooperative (Curtice-Burns/Pro-Fac). In so doing, Cherry Central's brand acquisition strategy was replaced by a re-emphasis on working with existing food manufacturers to expand tart cherry usage. Without a direct ownership link to retail markets through a brand franchise, Cherry Central became once again a committed commodity marketing cooperative, and supply-demand balancing actions were pursued by working with other food manufacturers. Curtice-Burns/Pro-Fac carries a full line of fruit pie filling which includes tart cherry pie filling; they have several regional brands of pie filling. Having other types of pie filling in addition to cherries enhances that firm's ability to influence food distributors to carry tart cherry pie filling and perhaps at times to engage effectively in merchandising activities. More recent tart cherry demand expansion efforts have involved developing branded fruit snack products and "light" pie filling to appeal to the more nutrition-conscious and healthy lifestyle consumer segments.

4.3.3.2. Product Development: Value-Added Ingredients

An additional strategy pursued by cooperatives in each of the three subsectors is selling their commodity as ingredients to food manufacturers and to the food service business. Their value-added ingredient strategies enable growers to sell into a more diverse set of markets. Providing value-added ingredients involves considerably more than just supplying bulk quantities of almonds, raisins, or tart cherries. Cooperative efforts are directed toward filling increasingly specialized manufacturing niches with products tailored to specific manufacturers' or food service distributors' needs in terms of quantity, quality, special handling, and packaging. Key national trends to which each of the cooperatives have addressed their strategies are the increasing preference for convenient, healthy foods and the substantial growth in food service. Some efforts are also made to promote nontraditional and nonfood uses of the products.

Since the cooperatives represent a significant portion of total U.S. production in each of the three subsectors, these marketing efforts and innovations contribute to supply-demand coordination by expanding demand. Food service and manufactured products such as breakfast cereals, in which almonds and raisins are key ingredients, represent significant areas of growth in the U.S. food system into which growers can market increased levels of production.

Blue Diamond's strategy for meeting the demand for more specialized ingredients and exact specifications for ingredients has been to work closely with the manufacturers to determine their needs and to supply the specific cuts, type of packaging, and services required. Cooperative personnel spend months or years working jointly with a manufacturer to develop a product with an exclusive niche in terms of variety and quality of almonds that their members can fill.[48] Ready-to-eat breakfast cereals have been a major area of sales growth in the area of value-added ingredients. Beginning around 1980-81, new product development with almonds as key ingredients increased significantly in such diverse areas as dry mixes, liquor, diet foods, condiments, frostings, and nonfood uses (shampoos and cosmetics).

Around the same time, the almond cooperative significantly increased its involvement in the food service market by signing an agreement with a major national food service distributor.[49] The cooperative developed special cuts and packaging to meet the special needs of different parts of the highly segmented food service industry.

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[48] Annual Report 1988-89, Blue Diamond Growers, Inc., 8.

[49] Annual Report 1981-82, California Almond Grower's Exchange, 6.

Blue Diamond also developed separate strategies to deal with the specific needs of new categories of customers that were becoming increasingly important, including the military and organizations that sell snack food products such as small packets or cans of nuts for fund raising purposes.[50]

Bakery products (bread, cakes, cookies) have traditionally been a major outlet for raisin use as an ingredient, but additional products and uses are needed, for example, to market the increased levels of raisin production that have been rising since the early 1980s. Cooperative research and development staff work closely with marketing personnel to develop alternate uses for raisins and derivatives (raisin paste and juice concentrate). Nonfood uses include alcohol and processing of tobacco products. Ready-to-eat breakfast cereals with raisins as ingredients has been an important part of demand growth through the 1980s and up to the present.

A statement issued by Sun-Maid expresses that an important part of value-added ingredient strategy is that the cooperative puts considerable effort into delivering "what industrial customers demand, on time, in affordable quantities."[51] To be capable carrying out the strategy, Sun-Maid must control reliable supplies and have prices stable and predictable enough to encourage food manufacturers to adopt product development strategies using raisins. This is a key coordination role played by a CIMC. Details on how supply management is accomplished to provide more reliable supplies is examined in Chapter 5.

An additional method for expanding sales of both raisins and almonds is licensing other manufacturing firms to produce food products with ingredients supplied by the cooperative and bearing the cooperative brand label. For example, the raisin cooperative

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[50]Annual Report 1983-84, California Growers Almond Exchange, 11.

[51]Sun Diamond Grower, Fall 1987, 32.

licensed other firms to produce raisin bread, English muffins and other bakery products and to sell the products with the Sun-Maid brand name. The almond cooperative increased almond sales by licensing the production of various products with their brand name, including ice cream, frosting, and a cream cheese and nut product.

Tart cherry cooperative strategies for value-added ingredient demand growth have involved increasing the number of products in its traditional sweetened dessert category and also seeking more nondessert uses. The cooperative, other processors and the generic demand expansion organization work with manufacturers to maintain the tart cherry position as part of the frozen pie market and to expand the use of cherries in a number of other desserts, baked goods, and new products such as cheesecake, turnovers, and strudel, fruit snacks, cookies, muffins, and yogurt.[52]

Thus product development for commodities as value-added ingredients in manufactured food products and food service is a major growth area due to changing demographics and consumer preferences. The exploitation of these areas for demand expansion by cooperatives whose membership constitutes a significant proportion of U.S. production represents an important aspect of coordinating demand with expanding supplies.

4.4. Demand Expansion Responses for Extended Periods of Overproduction

During periods when supply and demand are in approximate balance, most firms, including cooperatives, maintain substantial interest in demand expansion programs for the purpose of industry and firm growth both for the handler firms and the growers of the commodity. At other times if the subsector is faced with overproduction so that prices are below the most typical range of grower costs, demand expansion is likely to be accentuated

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[52]Ricks, The Tart Cherry Subsector, 34.

as an important way to help achieve a supply-demand balance which results in grower prices that more nearly cover their costs.[53]

4.4.1. Response to Overproduction by the Almond Marketing Cooperative

Beginning in the 1980s, almond subsector participants became concerned over expected large increases in almond production due to continual expansion of plantings. A major response of the cooperative was to emphasize new product development as a means to expand demand. One of the key new products was almond butter which was in some respects an alternative product to peanut butter. Among the cooperative successes in terms of increased sales was convincing a confectionery food manufacturer to use almond butter in a new candy bar. Generic demand promotion involving all almond handlers through the federal marketing order also played a role in expanding almond butter sales. The Almond Board of California established a market development reserve of between 2% to 10% of salable crop from 1981 through 1985 so that food manufacturing firms would have a guaranteed supply for this new product and its markets.[54]

Although a major goal for domestic market development was to persuade at least one peanut butter manufacturer to introduce almond butter into its product line, this goal has not yet been achieved. However, several new products that include almond butter as an ingredient have been introduced into European markets. Thus to date there has been a moderate degree of success with this new product development strategy in increasing almond sales. To the extent that new product strategies facilitated by a marketing order program are successful in expanding demand, they help to balance large increases in

[53]Based on interviews with representatives of commodity promotion commissions and Dr. Donald J. Ricks.

[54]Almond Board of California, "Almond Statistics," various years.

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almond production capacity such as the substantial expansion that occurred in the 1970s and 1980s.

The response by the almond marketing cooperative to an overproduction problem in the late 1950s provides another useful example of how cooperative sales strategies and contracting methods can contribute to an improved supply-demand balance when faced with a situation of excess supplies. In this example a key factor was lengthening the duration of the contract to periods longer than one year for cooperative supply arrangements with downstream firms that manufacture almond products. The purpose was to encourage introduction of new almond products. The cooperative marketing strategy led to substantially increased sales and reduction of large carryover stocks that had accumulated as a result of the large crop.

The year 1959 brought very large almond production (211% above the average of the previous four years' shipments), and very strong marketing efforts were needed for the cooperative to move large additional quantities into commercial channels. The cooperative had typically offered their customers one-year contracts, but their response to the oversupply was to offer their main customers two-year contracts with a price in the second year only slightly above the first year price, which was itself low relative to previous years. The cooperative strategy was aimed at convincing confectioners and other almond users to introduce new almond products and guaranteeing the price for two years was intended to be a significant incentive. Firms are usually reluctant to undertake new food product introductions, especially ones requiring significant advertising expenditures, without a reliable supply of the ingredients at a predictable cost.

The result of the cooperative's marketing strategy was that a number of firms substantially increased their almond utilization and the cooperative was able to eliminate a huge carryover. Almond shipments stayed at a permanently higher level from this point on, demonstrating a key supply-demand balancing role played by the cooperative in response to incr

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to increased production. In some subsequent years contracts of varying length longer than one year were used to induce additional almond purchases to move large supplies.[55]

4.4.2. Example of Raisin Generic Promotion as a Response to Overproduction

The raisin subsector has also been faced with the prospect of substantial supply increases at various times in which the response by raisin marketing organizations played a key role in attempts to restore an improved balance of supply and demand. A sharp increase in raisin production in the early 1980s brought about increased generic demand expansion efforts in an attempt to help correct the significant over-supply situation that developed by that time. CALRAB developed an advertising program beginning in 1986 that focused on promoting raisin consumption by overcoming the unexciting image of raisins that market researchers determined was the perception that held by many American consumers.[56] CALRAB's widely acclaimed advertisements featured images of dancing raisins on television and in print and was successful in improving the image of raisins. Although it is difficult to attribute increases in demand to specific commodity promotion efforts, this promotional campaign and other CALRAB efforts appear to have contributed to expanding raisin demand over a period of several years, and in conjunction with a number of other initiatives, probably helped to reduce the previous supply-demand imbalance.

Raisin promotion in foreign markets was also increased substantially with the assistance of foreign market development funds from the U.S. government (the Market Promotion Program and its predecessor programs of the Foreign Agricultural Service of the U.S. Department of Agriculture). Although different strategies are developed for each

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[55]Steven Easter, Blue Diamond Growers, personal communication.

[56]Olan D. Forker and Ronald W. Ward, Commodity Advertising: Economics and Measurement of Generic Programs, New York: Lexington Books, 1993.

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country, in general the focus has been on the raisin as a nutritious and natural food and on the value of the raisin for fitness and as a snack.[57] These collective efforts by raisin market participants have helped to significantly expand raisin demand and were in part a response to the earlier large increase in supplies. Almond and tart cherry export market development efforts have also been assisted with the U.S. government's Market Promotion Program.

4.5. Generic Demand Expansion: Interrelationships with Other Marketing Efforts

Kinnucan and others point out that "the interplay of generic and brand promotion is a vital issue for industries in which both types of promotion are common." This is true for all three subsectors that are the subject of this research, but especially almonds and raisins, since significant proportions of the total tonnage of those two commodities are sold through major national brands. Opportunities may arise in which "a collaborative relationship between private firms and the relevant generic promotion entity makes economic sense. Scale efficiencies can be realized, advertising costs reduced and coordination with other marketing tools (e.g., price specials) accomplished."[58] This applies to cooperatives as well as IOFs. Some of the efforts by commodity promotion organizations in all three subsectors are oriented towards convincing IOF food manufacturers to use almond, raisins, or tart cherries as ingredients in various food products and to advertise that fact.

Committed marketing cooperatives have an interest in generic promotion in two respects. First, there are likely to be opportunities for collaboration between cooperative brand promotion and generic promotion. A prime example mentioned above is that Sun-

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[57]Forker and Ward, Commodity Advertising.

[58]H.W. Kinnucan and others, "Research and Marketing Issues Facing Commodity Promotion Programs," in D.I. Padberg, ed., Food and Agricultural Marketing Issues for the 21st Century, FAMC 93-1, Food and Agricultural Marketing Consortium, Texas A&M Univ., 1993, 135.

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Maid designed advertising that combined its brand with the dancing raising promotion from CALRAB's generic advertising program. Second, since CIMCs and CCMCs also sell significant proportions of member deliveries as an undifferentiated commodity, the goals of the boards and management of the cooperative and the generic promotion entity are quite similar. Kinnucan and others point out that "[m]arketing cooperatives that pursue an aggressive market-development program may build upon the generic efforts of commodity check-off programs."[59] Due to this convergence of goals, cooperative support is often a pivotal factor in the start-up or continuation of a commodity promotion program, either through bloc voting or through efforts by cooperative boards and management to convince members to support the generic program in referenda.

Committed marketing cooperatives in the almond, raisin and tart cherry subsectors have all made efforts to convince members to support their respective generic promotion programs. Through cooperative newsletters and annual meetings members are frequently urged to vote in favor of generic promotion in referenda on marketing orders that fund the generic promotion programs. Raisin and tart cherry growers pay mandatory assessments for generic promotion through state marketing orders. Almond grower assessments for generic promotion are arranged through the federal marketing order.

Cooperative and generic demand expansion efforts and the use of marketing orders have been interrelated in both the almond and raisin subsectors. For example, the market development reserve for almonds created through the federal marketing order facilitated cooperative efforts to increase almond sales by providing a guaranteed supply that could be sold at a lower price to firms engaging in new product development efforts without affecting other almond marketing channels. Almonds set aside in a reserve in certain large crop years through implementation of the almond federal marketing order can be supplied at

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[59]Kinnucan and others, "Research and Marketing Issues," 134.

prices below prevailing prices in regular commercial channels to certain firms engaging in new product development. The sales are for limited quantities and are arranged in ways to prevent any resale into other almond marketing channels. Blue Diamond and other marketing firms have taken advantage of this marketing order provision to promote new product development as a means to sell additional almonds during periods of increasing production and thus to improve the supply-demand balance in the subsector.

Another example of the interrelationship between cooperative and generic demand expansion is the use of promotional assessments collected from growers through the almond marketing order to fund both branded product advertising and generic advertising and promotion. An additional example is the advertising designed by the raisin cooperative that combined its brand with the dancing raisin theme from CALRAB's generic advertising program. These are examples of joint or interrelated efforts by both cooperatives and the commodity marketing orders to expand demand and thus to reduce an oversupply problem.

4.6. Cooperative Efforts to Reflect Demand Expansion Results to Grower Members

Up to this point the focus has been on the demand side of the cooperative role in supply-demand balancing for a perennial crop. The purpose of this section is to examine approaches by which cooperatives in general can expand supply to keep in balance with demand when demand is growing. Examples are provided related to various perennial crop subsectors.

With a perennial crop, there is a time lag of several years between the grower's decision to plant more acreage and the resulting increase in supplies. If demand is expanding faster than supply in the interim, the cooperative may adopt supplemental strategies to obtain the needed additional supplies. These strategies include: (a) taking in new grower members, (b) encouraging current members to rent or buy more producing acres, and (c) supplementing cooperative member supplies with some non-member tonnage.

Cooperatives in the three subsectors discussed here have used varying combinations of these strategies when the cooperative's sales expanded more rapidly than did overall commodity sales. The tart cherry cooperatives have emphasized new membership at certain times, and have purchased non-member tonnage to supplement member supplies, but have not encouraged expansion by current members.

Taking in new grower members can be an important way for certain cooperatives to grow over the years and can influence the cooperative's market share. Cooperatives in two of the subsectors have at various times made special efforts to increase membership and/or to encourage current members to rent or buy more acreage to meet actual or anticipated increased sales commitments. Both the raisin and almond cooperatives have take action from time to time to facilitate orchard or vineyard acquisition by members. These actions are generally taken during times of substantial demand expansion over several years. They provide another example of cooperative responses that facilitate coordination of member supply with demand growth trends.

A major reason why a cooperative uses non-member tonnage to supplement member grower supplies is uncertainty over whether demand growth or supply shortages are temporary. Using non-member tonnage to provide a portion of the needed additional supplies allows the cooperative the flexibility of later eliminating non-member purchases if demand growth diminishes or demand declines or member supplies increase.

For example, the raisin cooperative initiated a new policy in 1990 of acquiring non-member tonnage on a regular basis and paying cash at harvest for this tonnage. Prior to this change, the raisin cooperative relied for many years on obtaining raisins to meet additional customer supply needs from the marketing order reserve pool (see discussion of reserve pools beginning in section 5.2.2 of Chapter 5). However, by the late 1980s the cooperative found that the reserve had become an insufficient source of supply for that purpose and began in 1990 to purchase a significant portion of its supply from nonmen

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members. With the uncertainty of future demand trends, this approach of obtaining extra supplies from nonmembers also provided a degree of flexibility. The almond cooperative also supplements supplies with non-member tonnage.

For both the raisin and almond cooperatives, using non-member tonnage to supply specific additional needs has served as a useful coordination method to deal with fluctuating supplies or with an uncertain international trading environment. Purchasing non-member tonnage as needed provides the flexibility to expand raisin or almonds sales in both foreign and domestic markets, yet cut back non-cooperative supplies quickly if sales slacken or if member supplies increase. If, for example, export demand falls off due to unfavorable exchange rates or other factors, the cooperative can reduce non-member cash purchases.

The role of the almond cooperative in overall supply-demand balancing appears to be declining. In 1991, the almond cooperative announced its intention to aim for an optimum quantity in terms of tonnage handled per year and to close its membership within a few years after signing up sufficient members to provide that quantity. Extra tonnage required to meet customer needs would henceforth be obtained by cash purchase from non-members. Blue Diamond undertook this change in policy based on some strategic analysis of the cooperative's position in the almond industry. With the rise in the number of handlers (mostly small ones) in recent years, the Board of Directors apparently decided that cooperative membership would be unlikely in the future to represent as dominant a proportion of total California almond production as in the past. The cooperative would therefore accept its reduced share of the market and aim for a quantity of supplies from members which it could market most effectively and meet all contingencies from nonmember supplies.[60]

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[60]Almond Facts, May/June 1991.

Another aspect of balancing supply and demand relates to differences in varieties and quality of perennial crops. Demand for certain qualities and uses for specific market segments tends to expand more rapidly at certain times than demand for the commodity in general. Some varieties may meet market preferences better than other varieties. The cooperative can encourage the desired varieties and qualities by offering higher price premiums for these. For example, if a cooperative markets a crop with multiple uses (e.g., processed and fresh) it may desire to adjust grower returns to favor the market utilization with the greatest expected demand growth. MBG Marketing, Inc. has encouraged growers to incur the additional expenses of harvesting blueberries for the fresh market by offering higher returns for blueberries picked for the fresh market rather than for processing.[61] The cooperative board and management in this situation play a coordinating role by analyzing subsector demand trends and adjusting cooperative payment policies to elicit supply responses from growers consistent with the changing trends.

National Grape Cooperative has played a key coordination role in this regard in the grape juice subsector. National Grape members grow both white and Concord grapes which are marketed as branded juice products under the Welch's label. The cooperative has a dominant share of the branded grape juice market and balances cooperative grape supplies with demand through acreage contracts with members. In recent years they have considerably expanded acreage contracts of white grapes in response to expected continued growth in sale of white grape juice products. This provides an additional example of a cooperative coordination role in response to demand trends.

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[61]John Shelford, Manager of MBG Marketing, personal communication.

In both the blueberry and grape examples, cooperatives will not necessarily do a better job of reflecting premia for more highly desired varieties or packs than would market prices through grower-IOF coordination. These examples were presented to show where cooperatives can and have played effective coordination functions.

4.7. Summary

Chapter 2 provided evidence that all three subsectors are subject to considerable annual supply and price variability and periods of overproduction. Chapter 3 put forth the argument that the SOPs of retailer food distributors and IOF food manufacturers do not adequately address the supply-demand balance problems brought about by the supply variability described in Chapter 2. A major factor affecting growers is the lack of retail price responsiveness to changes in crop production, which leads to large price and revenue declines in some large crop years. These problems of subsector coordination can be addressed in part by grower collective action. One manifestation of grower collective action presented in this chapter was the means by which committed marketing cooperatives (CIMCs and CCMCs) can improve coordination in the short run by influencing the merchandising behavior of retailers. Committed marketing cooperatives provide growers a means to deal with changes in supply conditions by advertising and merchandising strategies, including effective access to retail food distributor merchandising through retail brand franchises of commodity-based food products. Through CIMCs, a significant proportion of total production of almonds and raisins have been sold as branded retail products, and the CIMCs in those two subsectors have the resources to expand demand through advertising, promotion, and merchandising, and to influence retailers to undertake merchandising to increase sales in response to large crops.

The CCMC in the tart cherry subsector had a brand franchise only for a short period and has otherwise made efforts to influence other food manufacturers to manufacture and market cherry-based products. In all three subsectors, generic commodity promotion provided an additional means to influence sales.

Long-run demand issues were also examined. For almonds and raisins, extended periods of heavy production have posed dilemmas from time to time, requiring efforts to expand demand. For tart cherries, shortages in the late 1970s reduced demand as some consumers shifted away from tart cherry products due to several years with high prices and low supplies. This period of frequent shortages was followed by a period of overproduction in the mid to late 1980s.

Shifting consumer preferences also affected the food product categories into which the three commodities are sold. Key trends have included a continuing shift towards more convenient foods, and more nutritious snacks consistent with a healthy lifestyle (e.g., products that are low in fat, salt, sugar, and calories). Those trends have helped sales of raisins and almonds. Marketing of almonds and raisins has been adapted to shifting consumer preferences through new product development, merchandising and promotion efforts.

A significant aspect of evolving consumer tastes and preferences has been a shift away from sweetened desserts. These trends have contributed to difficulties in increasing sales of tart cherry products. Tart cherry marketing in the past has focused largely on final use in sweetened desserts.

Another aspect of demand management has been access to industrial and food service markets--sales of the commodity as value-added ingredients. The almond and raisin cooperatives have been heavily involved in industrial new product development as well as other approaches such as developing joint promotions in conjunction with other branded food product manufacturers such as breakfast cereal firms.

There is also continuing growth in consumption of food away from the home. The food service market is becoming increasingly segmented. Considerable efforts of committed marketing cooperatives have gone into increasing sales of the commodities as ingredients to food service firms. The experience of the almond cooperative has led them to the conclusion that their retail brand recognition facilitates industrial and food service sales. Major brand manufacturers of food products such as breakfast cereals will often give the cooperative preference as a supplier because of the prominence of the branded retail products.[62]

The almond subsector has been able to achieve reasonably good coordination performance in part through the efforts of Blue Diamond. The means to adapt to consumer preferences have included developing a number of new branded products and as well as expanding the value-added ingredient category. Blue Diamond, along with other firms and organizations in the almond subsector, has been able to assess the magnitude of the supply increase and to design strategies to sell the increasing quantities of almonds.

The raisin subsector has faced a different situation. Prior to the mid-1980s, the trend for both raisin production and raisin sales was rather flat. The sharp increase in grape utilization for raisins beginning in the mid-1980s spurred several actions to increase sales. Sun-Maid developed a few new products (mainly new sizes and packages) and increased raisin usage as a value-added ingredient. Both Sun-Maid and the Raisin Bargaining Association supported a substantially increased role for generic promotion, which helped to increase sales.

In the tart cherry subsector there is no processor that has a strong national brand position similar Blue Diamond and Sun-Maid. Cooperative processors have four regional pie filling brands. These cooperative processors employ some of the brand marketing strategies used by Blue Diamond and Sun-Maid, but they have less ability to obtain and maintain continual exposure on supermarket shelves. The pie manufacturers that have

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[62]Interviews with cooperative officials.

strong brands are not cooperatives and thus do not have the orientation of serving the interests of the growers of the commodity. Strong brand marketing is thus less predominant for tart cherries than it is for almonds and raisins. Tart cherry subsector participants must use marketing strategies that rely little on strong consumer brands, but instead focus heavily on serving the other market segments, including food service, selling industrial ingredients to pie manufacturers.

Due to the very volatile nature of tart cherry supplies, efforts to maintain stable supplies and prices through supply management programs have been a key component of supply-demand coordination. That is the subject of the next chapter.

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CHAPTER 5: USES OF SUPPLY-DEMAND BALANCING APPROACHES IN THREE PERENNIAL CROP SUBSECTORS

Chapter 2 introduced the supply-demand balancing problems associated with production fluctuations. This chapter addresses the subject of how supply management programs have been used to respond to these problems. Short-run supply issues are addressed first, and the use of federal marketing orders in each of the three commodity subsectors is examined in detail. In the case of tart cherries, other programs that were proposed, but not implemented, are also explored. Then the focus turns to long-run supply issues: reducing acreage through orchard or vine removal and approaches to avoid overplanting.

5.1. A Short-run Supply Issue: Problems in Coordinating Supply and Demand Because of Annual Supply Fluctuations

Since substantial supply variability occurs in all three subsectors, it is important to ask: What is the value of greater stability? A major value of stability is the collective benefit, especially to growers and processors, from maintaining demand due to more reliable supply. From the point of view of commodity industry participants, demand expansion efforts can be severely hampered if a short crop occurs, resulting in inadequate supplies for the expanding markets and/or causing substantial temporary price increases. Lack of supplies, high prices, and prices that fluctuate widely can constrain demand expansion because these conditions are detrimental to the needs and requirements of large food manufacturers and food retailers. Therefore a coordination challenge facing commodity industry participants, including cooperatives and other processing-marketing firms, is to provide adequate, dependable supplies and relatively steady prices each year, despite the possibility of a short crop due to unfavorable weather conditions or other factors.

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Consumers also benefit from greater stability. A more reliable supply is more consistent with consumer preferences since consumers are afforded a greater variety of products.

The tart cherry situation is illustrative of the problems caused by supply instability. As discussed in Chapter 3, manufacturers, food service operators, and grocery retailers tend to respond to the problem of possible shortages by reducing use or exposure of products which use cherries or other products that are subject to widely fluctuating supplies and prices. Advertising and promotion activities of branded manufacturers generally decline with a short crop and some firms may completely drop cherry products from their line. Even with low prices and more plentiful supplies in subsequent years, some food manufacturers are reluctant to re-introduce cherries.[63]

Market introductions of new products require substantial development and advertising expenditures over a period of several years. Manufacturing firms incur substantial risks because these market development costs may not be recovered if a short crop results in supply shortages and considerably higher prices for a key ingredient like cherries. Although these problems are more pronounced in the tart cherry subsector, similar problems can also affect efforts to maintain or increase sales of almonds and raisins as value-added ingredients in various food products.

Thus some of the benefits of stability for perennial crop commodities like these result from preventing a decline in demand that could occur due to sharply fluctuating supplies, and thereby contributing to improved balance between supply and demand in the subsectors. Given this collective benefit to growers and processors, as well as consumers, a key question is why the potential benefits to individual firms of carrying inventories may

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[63]D.J. Ricks, L.G. Hamm and W.C. Chase-Lansdale, The Tart Cherry Subsector of U.S. Agriculture: A Review of Organization and Performance, N.C. Project 117 Monograph 12, College of Agriculture and Life Sciences, University of Wisconsin-Madison, July 1982, 13.

not provide sufficient incentives for substantial planned storage from year to year to balance subsector supply and demand. The tart cherry subsector provides an illustration of problems related to storage by processor firms. The common pattern of large crops tending to alternate with short crops appears to provide opportunities for processor storage as a means to balance interseasonal supplies. However, the fact that there are substantial exceptions to the large-crop/short-crop pattern induces most firms to store very little from year to year. There is considerable risk from having two or more large crop years in succession.[64] Processors indicate that even a single major mistake in year-to-year storage, such as carrying a large inventory when the following year does not bring a short crop, can severely weaken or possibly bankrupt a processing firm. Lenders may also refuse to loan to tart cherry processors for the purpose of storing processed cherries from year to year because of the risks involved. In addition, due largely to these risks, other firms have not become involved in a speculative role by storing and subsequently selling these commodities.

There have been substantial risks from storage by processor firms in the almond subsector as well. The mid-1980s provides an example of the difficulties that can arise in the almond subsector from pursuing certain pricing strategies to benefit member growers that involve carrying substantial inventories from year to year. A large almond crop occurred in 1984 and the almond cooperative ended up carrying a substantial inventory as one result of their strategy of "holding the market," that is, attempting to prevent the steep price decline that would otherwise probably result from a large crop. The subsequent crop in 1985, instead of providing an opportunity to release most of the stored extra supplies, turned out to be another large-crop year. Blue Diamond again carried a large inventory into the next year, which was costly. This illustrates some of the problems relating to

[64]Donald Ricks and Larry Hamm, "Tart Cherry Subsector," in Bruce Marion, The Organization and Performance of the U.S. Food System, Lexington, MA: Lexington Books, 1986, 178-186.

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storage by individual cooperatives. There are many small almond marketing firms that compete with Blue Diamond but buy only for their immediate market needs and do not contribute to year-to-year stability in supplies by maintaining inventories. Under continued surplus conditions, such firms may gain a cost advantage over large committed marketing cooperatives that practice an inventory holding policy. Having extra supplies in short crop years could give a committed marketing cooperative the ability to recoup some of the competitive advantage that it loses in successive years of large crops. However, short crops occur relatively infrequently with almonds and raisins.

Raisin production variability has been fairly difficult to predict due to the combination of occasional weather-induced shortages and variation due to decisions by grape growers to switch between the raisin and crush (wine) markets. As with tart cherries, the changing raisin and almond situations have made it difficult to form accurate expectations for profitable storage.

Due in part to the problems encountered in trying to stabilize markets through storage by individual firms, federal marketing order supply management programs have been used in all three subsectors to facilitate storage on a collective basis. The frequency of short crops is a key issue in determining which type of supply management program is most appropriate for a particular commodity. In the tart cherry subsector, short tart cherry crops occurred 10 times between 1966 and 1991 (Figure 10 in section 2.3 of Chapter 2). In each of those years, supplies dipped well below the level of sales in previous years. This tends to result in a negative impact on demand in subsequent years. Raisins and almonds each had five short crops between 1966 and 1991, as shown in Figure 18 and Figure 13. However, in the almond and raisin subsectors, crops that were so short that the shortages significantly reduced sales compared to previous years occurred only three times each during that time period, significantly less frequently than with tart cherries. The difference in the frequency of short crops for tart cherries relative to almonds and raisins has led to somewhat different supply management strategies in the subsectors for dealing with the annual supply fluctuations, which is discussed next.

5.2. Federal Marketing Order Supply Management Programs

Supply management programs have been implemented in all three subsectors through federal marketing orders. Federal marketing orders are administered by boards made up of grower and/or handler representatives, and by the staff hired by the boards. The administrative bodies in the three subsectors with marketing orders that are the focus of this research are the Almond Board of California, the Raisin Administrative Committee and the Cherry Administrative Board.

This section examines the purposes for which marketing orders were established and then looks at several of the key operational provisions for almonds, raisins, and tart cherries. Comparisons of marketing order implementation in the three subsectors are made, followed by more detailed examination of each.

5.2.1. Goals of Federal Marketing Order Programs

The reasons for establishing the federal marketing orders differed somewhat between the tart cherry marketing order on the one hand and the almond and raisin marketing orders on the other. The tart cherry marketing order program had three main goals: (a) reduction in annual supply fluctuations, (b) more stable prices, and (c) somewhat higher prices to growers, especially in large crop years. Tart cherry marketing order reserve pool provisions were used primarily to address the annual supply volatility problem, that is, frequent occurrences of years with quite short supplies following years with temporary large excessive supplies.

In contrast, the almond and raisin marketing orders were established primarily for dealing with periods of persistent overproduction and resulting low grower prices. A 1986

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statement from the almond marketing cooperative presents their viewpoint as to why the almond marketing order was created:[65]

> "The Almond Marketing Order was put into effect in 1950 amid conditions of near chaos in the almond industry. U.S. production was excessive, and at the same time inexpensive imports were being delivered to our markets from such places as Italy and Spain. Growers were suffering. Many were on the verge of going out of business. Thus the primary purpose for instituting the order was to provide for volume controls that would allow diversion from the domestic market in oversupply years."

The almond marketing order has been used primarily to reduce temporarily excessive supplies. The supply management provisions have been used mainly to divert excess production to secondary markets that do not compete with the primary market. During its early years of operation the almond marketing order was used extensively to expand exports of U.S. almonds. This was accomplished through use of the market allocation provisions which are explained below. In recent years the almond marketing order has also been used to provide some reserves to supplement short supplies in certain short-crop years.

As with almonds, the serious problems associated with large raisin crops have been recognized for a long time. Studies as far back as the 1930s indicated that due to the inelastic nature of raisin demand, large crops frequently resulted in burdensome levels of carryover stocks. Various market control schemes were developed to deal with these problems. A strong impetus for the creation of the federal marketing order in 1949 was the serious state of overproduction after the end of World War II due to curtailment of the wartime raisin-buying program, through which large quantities of raisins had been sold.[66]

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[65]California Almond Growers Exchange, Statement by CAGE presented to the Study Team on Performance Criteria for Federal Marketing Orders, 1986. The study team of Leo C. Polopolus, Hoy F. Carman, Edward V. Jesse, and James D. Shaffer issued a report entitled "Criteria for Evaluating Marketing Orders: Fruits, Vegetables, Nuts, and Specialty Crops," (National Technical Information Service, 1986).

[66]C.F. Nuckton, B.C. French, and G.A. King. <u>An Econometric Analysis of the California Raisin Industry</u>, Gianninni Foundation Research Report No. 339, University of California, December 1988, 6.

In all three subsectors the marketing order programs have included one or both of two main supply management provisions which may be implemented in large crop years. These are: (1) a reserve pool storage program and a (2) market allocation (diversion of excess production to secondary market outlets that do not compete with the main commodity markets). In the tart cherry and raisin orders a third provision is non-harvest or non-production diversion. Each of these provisions is now considered.

5.2.2. Reserve Pool Storage with Federal Marketing Orders

With a reserve pool storage program, a portion of the crop is stored in large-crop years and can be released for sale in a subsequent short-crop year to supplement supplies so that shortages are reduced. Storage for release in a subsequent short crop period addresses one of the main supply-demand coordination problems resulting from surpluses followed by shortages. Since weather-induced shortages can: (1) substantially affect product availability and prices, (2) hamper the marketing, merchandising and new product development programs of food manufacturers and (3) reduce shelf space and product exposure in retail grocery stores, a reserve pool program can reduce the impact of shortages and help maintain commodity sales by supplementing supplies in short-crop years. Use of the reserve pool and other marketing order supply management provisions contributes to supply stability and helps to dampen the decline in grower prices that generally occurs in large crop years.

Econometric analysis of the tart cherry reserve pool in Chapter 6 indicates that reserve pool implementation on five occasions between 1972 and 1986 dampened price declines that occurred in large crop years. Price impacts estimated with the econometric model varied between two cents (8% higher than the price would have been without the marketing order) and five cents (35% higher). A raisin market analysis indicated that raisin prices would have been more variable without use of the supply management provisions of the marketing order.[67] The French-Nuckton study also estimated that average grower net revenue would have been lower without the order. Those results are discussed further in Chapter 6.

Since large tart cherry crops and shortages in the subsequent year occurred several times each during the 1970s, reserve pool storage was the provision that was emphasized. For three of the years in which the marketing order was implemented (1972, 1975 and 1980), quantities were stored in a reserve pool and released during the following short crop

Table 13. Tart Cherry Marketing Order Effect on Supplies

	Year of Marketing Order Use		
	1972	1975	1980
	-Mill. lbs. (raw prod. equiv.)-		
Market Supply w/o Marketing Order	340.2	287.7	238.1
- Following Year Supply w/o M.O.	190.9	175.0	143.3
= Two-Yr. Annual Fluct. w/o M.O.	149.3	112.7	94.8
Market Supply with Market. Order	313.4	282.7	210.3
- Following Year Supply with M.O.	182.5	175.0	147.6
= Two-Yr. Annual Fluct. with M.O.	130.9	107.7	62.7
Two-Yr. Annual Fluct. w/o M.O.	149.3	112.7	94.8
- Two-Yr. Annual Fluct. with M.O.	130.9	107.7	62.7
= Reduction in fluctuation with M.O.	18.4	5.0	32.1
Source: Table 36 and Table 37.			

[67] B.C. French and C.F. Nuckton, "An Empirical Analysis of Economic Performance Under the Marketing Order for Raisins," American Journal of Agricultural Economics (73:3), August 1991.

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years, somewhat stabilizing supplies over each two year period. Table 13 indicates that two year reductions in supply fluctuation from use of the marketing order ranged from 5 to 32 million pounds, representing between 2% and 18% of two-year average supply. This illustrates how reserve pools can be one method of improving the balance of supply and demand in the short run.

Use of reserve pools is most effective in stabilizing supplies during periods when very short crops are a frequent occurrence, which was the cherry industry pattern between 1972 and 1983. When large crops do not alternate with small crops on a regular basis, there may be difficulty in making effective use of reserve pools for commercial markets as supply management tools. For example, the use of the cherry marketing order reserve pool was strained by the occurrence in two successive years of large crops in 1984 and 1985.

5.2.3. Market Allocation

With market allocation, supplies are managed for greater stability in primary markets, reducing the volatility in supplies that would occur without a program. Market allocation is the removal of excess supplies in large-crop years by diverting a portion of the excess from primary markets to secondary market uses. Market allocation is a form of price discrimination, and the usual conditions for price discrimination are applicable. For an effective market allocation program, a subsector needs to be able to develop significant secondary markets in which demand is relatively elastic. Program effectiveness is also enhanced if demand in secondary markets is fairly readily expandable. It must also be possible to maintain the primary and secondary markets separate from one another.

For almonds, secondary markets under the program have included exports, almond butter, almond oil, airline snack packets, an almond beverage and other new products. Tart cherry secondary markets have included juice, exports, puree and dried cherries. Additional secondary sales outlets common to the almond, raisin, and tart cherry orders over a number of

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of years have been U.S. Department of Agriculture feeding programs, including the school lunch program.

Market allocation can improve coordination by addressing both supply and demand problems. Diversion of excess supply helps dampen steep price declines in the primary markets which would otherwise occur in large-crop years. Use of secondary markets for supply diversion, while maintaining ample supplies for main markets, can help establish new markets and increase demand through new product development.

Under both the almond and raisin marketing orders through the 1950s and into the 1960s, export markets were relatively small but served as significant secondary markets for market allocation. Export sales steadily increased for both crops, due in part to the marketing order programs. Export markets have now become very important primary markets for both commodities.

Market allocation is especially relevant for a subsector which has an historic supply pattern of several excessive supply years in succession. In contrast to a reserve pool, market allocation does not by itself supplement supply shortages in short-crop years. This is a major reason why market allocation and reserve pool provisions are often used together within a marketing order -- as has been the case in almonds, raisins and tart cherries.

Market allocation is also commonly done to some degree by individual firms in each of the subsectors. As raw product supplies vary from year to year, processor firms, including cooperatives, typically make changes in the percentage of their tonnage which goes into different markets. For example, in a large crop year an IOF or cooperative processor engaging in both brand and commodity marketing would probably be able to sell only a limited additional quantity into its branded retail market, and thus may need to shift excessive supplies into bulk commodity sales, including exports, and into other industrial sales as ingredients for food manufacturers. Tart cherry marketers have on several occasions marketed some increased quantities into the juice market in large-crop years. The res

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results of these standard business practices in response to fluctuating farm supplies is somewhat similar to a market allocation program. Use of such a program under a marketing order increases the extent of these actions and the impacts for the subsector.

5.2.4. Non-harvest or Non-production Diversion

Both the tart cherry and raisin federal marketing order have had provisions that provide additional options for reducing the quantity of the crop entering the primary market. The tart cherry marketing order had a non-harvest option provision during the years that the order was in effect. The Raisin Diversion Program is a non-production diversion program that has operated as part of the raisin federal marketing order since 1985.

5.2.4.1. Non-harvest Diversion Under the Tart Cherry Marketing Order

To understand the non-harvest provision, a review of the mechanics of the tart cherry marketing order is helpful. In large crop years, the tart cherry marketing order administrative board established a "restricted percentage" based on an estimate of how much available cherry supplies exceeded the expected sales volume. If, for example, the restricted percentage were 15%, a processor could market as"free tonnage" 85% of the cherries received from growers, but had to place 15% of the cherries either in the storage reserve pool or market them into one of the approved secondary market uses, with non-harvest diversion as a third option for growers. If a grower chose to leave any portion of that grower's crop unharvested, that grower could receive non-harvest diversion credit and the processor could count as part of the "restricted" percentage an estimate of the quantity of cherries that were left unharvested. Growers could thus choose from among several options for their "restricted" tonnage: (a) the storage pool, (b) secondary market diversion options which were made available to them by their processors, (c) diversion credit for non-harvest,

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or (d) any combination of these. Growers who chose to participate in the storage reserve pool paid the costs for processing, storage and carrying of those pool cherries. Thus growers owned the reserve pool cherries, while processors were paid for their costs of processing when the pool was formed.

But why was the non-harvest provision included in the tart cherry marketing order? A common occurrence in large crop years when there is no marketing order is that substantial tart cherry tonnage was left unharvested because of lack of market outlets and/or prices so low that it is not remunerative for many growers to harvest. It was recognized in the design of the order that it would facilitate order operation to have a number of options by which growers could meet the requirement of diverting a specified percentage of the crop from the primary market. The non-harvest provision provided an additional option to reduce overall supplies under certain circumstances. This would contribute to improving the supply-demand balance in some years that the order was implemented but was used to a minor degree in most years. Except for the 22 million pounds in 1972 (54% of restricted tonnage), non-harvest diversion was quite small in most years that the order was used, but nevertheless helped to reduce supply fluctuations somewhat.

Had the order continued in operation past 1986, there would likely have been more use of both the market allocation and non-harvest provisions. Since the mid to late 1980s was a period with few short crops, the reserve pool would have become a low priority option. Using the reserve pool as a supply management tool to carry supplies until a subsequent year works well only if there are short crops in which to release stored cherries.

5.2.4.2. Non-production Diversion Under the Raisin Marketing Order

An important federal marketing order provision for addressing raisin overproduction problems known as the Raisin Diversion Program (RDP) was initiated in 1985 because of industry overcapacity in terms of raisin grape acreage. One reason for the increased raisin pr

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production was that a significant amount of grape acreage that had previously produced grapes for the wine market was suddenly shifted into raisin production because of reduced demand for raisin-type grapes in wine-making. Under the Raisin Diversion Program, growers were provided incentives to either remove some of their vineyards or to prune their vines in a way to produce no crop for a given year. This was done to help bring the surplus supply situation into balance. The sharp reduction in acres harvested for raisins beginning in 1985 shown in Figure 14 (section 2.5 of Chapter 2) was due largely to temporary non-production of vineyards from production for one or more years by growers who pruned their vines. Most of those growers subsequently resumed production of raisins after one or more years of participation in the program.

Figure 14 shows graphically that the main impact of the RDP has been temporary. While the upper solid line graph represents the actual acres capable of producing grapes, the dotted line graph represents net bearing acreage of raisin variety grapes after subtracting acres removed from production in a given year through the RDP. After reaching a peak of 284,000 acres in 1984, bearing acres dropped sharply with the implementation of the RDP in 1985 and 1986. However, most of the decrease in production was temporary (through pruning), and the number of bearing acres quickly regained earlier levels. Relatively few vines were actually taken out of the ground. Use of the RDP provision of the federal marketing order has thus helped mainly to alleviate temporary problems of overproduction. The RDP is explained more thoroughly below in the section on the raisin marketing order.

5.2.5. Tart Cherry Supply Management

Supply management programs have been discussed almost continuously within the tart cherry industry for the past 30 years. A federal marketing order was in effect from 1972 through 1986. This program included a reserve pool, market allocation and non-harvest diversion options as alternative provisions for managing temporary excess supplies.

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Most other supply management program proposals during the cherry industry's history have included some combination of these three alternative approaches.

After discussing the experience with the federal marketing order, some other supply management programs proposed after the termination of the order are examined. Those subsequent proposals were: 1) a new federal marketing order program and 2) a supply management program through a cooperative.

5.2.5.1. The Tart Cherry Federal Marketing Order

The marketing order program represented the culmination of many years of development and consensus-building in a major attempt to grapple with industry supply problems. It was the result of agreement among various segments of the industry, including growers and processors from various states. The marketing order covered Michigan, New York, Wisconsin and Pennsylvania, but did not include tart cherries produced in Utah, Oregon and Washington.

During most of the period in which the marketing order was used, the main supply problem in the tart cherry subsector was widely fluctuating annual supplies. From the time of initial implementation of the marketing order in 1972 until 1984, the industry progressed through phases of the long-term supply cycle in which there were frequent occurrences of years with a large crop followed by short crops (see ? in section 2.5 of Chapter 2). The primary operational provision of the marketing order was the storage reserve pool. The two other main provisions, market allocation and non-harvest diversion, were used in a secondary fashion. In 1972, 1975 and 1980 special emphasis was placed on the reserve pool as the primary option for intended use. In 1984 and 1985 somewhat more emphasis was given to secondary market allocation provisions.

In addition to the five implementations of the marketing order program, the industry planned to use the marketing order in 1982, another large crop year in which production was 180%

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was 180% above the average of the previous four years' shipments. This planned use of the marketing order in 1982 was, however, not permitted by a combination of OMB and USDA policies under the Reagan Administration. Subsequently, 1983 brought an extremely short crop with record high prices. Thus the very large supply fluctuations and market-price fluctuations of 1982-1983 provided a nearly ideal set of economic conditions for the intended operations of a cherry reserve pool.

The nature of the industry's supply problems changed substantially starting in the mid-1980s. Although the most significant supply-related challenge in the 1970s and early 1980s was wide annual fluctuations, by the mid to late 1980s the chief problem had become persistent oversupplies (Figure 7 in section 2.3 of Chapter 2). This was due to large new plantings by growers in response to high prices received during the late 1970s and the early 1980s. Since by the mid-1980s the industry was entering an over-capacity phase of the industry's long-term supply cycle, some changes in the marketing order program emphasis were needed. Tart cherry productive capacity had expanded to the point that substantially reduced the likelihood of very short crops with supplies much below potential demand quantities. Even years with relatively short crops produced quantities above long term average sales, with market clearing prices generally returning little to growers for their investments in time and orchards. One means to maintain grower prices in a range consistent with the cost of production during times when no short crops occur for several years is to market excess cherries into secondary markets rather than into main commercial markets.

During use of the marketing order in 1984 and 1985, the marketing order administrative board responded to the changing supply situation by shifting the emphasis of the program to rely somewhat more on market allocation and non-harvest and to reduce emphasis on the reserve pool. Despite this shift by the board, most growers continued to choose the reserve pool option, even in 1985 when there was a second successive year with

a restricted percentage. In such conditions, growers would be expected to emphasize options other than the reserve pool. Reserve pool cherries from both 1984 and 1985 were eventually sold to the USDA for school lunch and other government feeding programs as secondary market sales rather than being released into main commercial markets, which continued to be in surplus for several years.

The federal marketing order program might have been modified even further to adapt the program to changes in the predominant industry supply situation from earlier (before 1984) from being chiefly one of annual fluctuations to one of persistent oversupply (starting in 1984 and 1985). Had the marketing order continued to operate, Board policy making would probably have given even greater emphasis to the market allocation and non-harvest options of the program.[68]

This shift in program emphasis might have been carried still further had the industry been able to implement various proposals which had been considered at length. Among the industry proposals considered were amendments and modifications to the marketing order program to permit (1) orchard removal diversion credit, (2) bloom abortion, if technically feasible, and (3) at-plant diversion of some low quality cherries.

In 1986 the federal marketing order was discontinued by the Secretary of Agriculture following a continuance referendum. In the referendum, slightly fewer than 50% of the growers (representing, however, 55% of the tonnage) favored continuation. The decline in grower support for the marketing order mainly apparently reflected dissatisfaction with the size and timing of some of the storage and release decisions, rather than disenchantment with the concept of marketing order supply management. In the view of some growers,

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[68]Dr. Donald Ricks, Michigan State University, personal communication. Ricks was a member of the Cherry Administrative Board from 1979 to 1986.

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better management of the reserve pool would have resulted in better returns to growers from the sale of reserve pool cherries than was actually obtained.[69]

5.2.5.2. A Proposed New Federal Marketing Order Program

Low prices and reduced grower and processor incomes during the late 1980s spurred concern about the continuing tart cherry oversupply situation. Industry leaders devoted considerable time to analysis and discussion of alternative supply management program proposals, including a new federal marketing order. The proposed new marketing order was to be similar to the previous one but with more emphasis on market allocation provisions and reduced emphasis on the reserve pool. It was intended primarily to handle the persistent oversupply situation, but also to have substantial flexibility to adjust to some fluctuations in annual supplies. Inclusion of a reserve pool provision in a standby mode was advocated by some to be used when the long-term cycle returned to a phase when short tart cherry crops were again likely occurrences. Others opposed inclusion of a reserve pool because supply conditions at the time of proposed implementation were not conducive to its use for annual supply stabilization. Additional proposals included a diversion credit option for orchard removal to speed up downward adjustment in acreage and a national generic demand expansion program.[70]

Sufficient agreement among segments of the tart cherry industry on the proposed federal marketing order could not be reached and the USDA indicated an unwillingness to proceed with hearings without very strong evidence of widespread industry support. Industry leaders turned to other proposals for supply management including formation of a new cooperative for supply management.

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[69]Interviews with industry participants.

[70]Donald L. Hinman and Donald J. Ricks, "Supply Management Alternatives for the Tart Cherry Industry," Journal of Food Distribution Research, v. 23, no.1 (February 1992),57-68.

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5.2.5.3. A Proposed Supply Management Program Through a Cooperative

A special supply management cooperative called United Cherry Producers was formed in the winter of 1990. The original proposed program was focused on the problem of reducing tart cherry productive capacity through an orchard removal incentive program, which is examined below in section 5.3. However subsequent proposals for the cooperative focused on proposed provisions for managing temporary excess supplies in large crop years. Under the proposal, emphasis was to be placed on market allocation and non-harvest diversion. A marketing program board operated through the cooperative was to establish policies for managing supplies in large crop years. In years when supplies were expected to substantially exceed estimated sales, the board would recommend the percentage of the current years's crop to be diverted to secondary market uses or left unharvested. Each grower could choose whether to (1) deliver the restricted percentage of tonnage to a processor who made available approved secondary market uses, (2) leave some of the restricted portion in the orchard, or (3) possibly receive diversion credit for orchard removal. Another new ancillary cooperative was also proposed by processors to facilitate the processing and marketing of secondary market cherries that would have been encouraged or required by the proposed supply management program.

Subsequent proposals called for provisions that would allow the board to re-introduce a storage reserve pool if supply fluctuations were appropriate for this. The idea was that a storage reserve approach could again become a useful supply management tool when short crops again occur frequently, replacing the persistent oversupply situation which characterized the late 1980s.

Cherry industry leaders that proposed this program believed that a sufficient level of grower participation for an effective supply management program might be obtained through an organizational structure which called for use of a mandatory program or state marketing order in Michigan in combination with the supply management cooperative with membership in all cherry-producing states. Use of a state marketing order in Michigan required hearings and a grower referendum. Hearings were held in 1990 and 1991, but in neither case was a grower referendum authorized by state government. Obstacles to the proposed program included certain legal interpretations by the state of Michigan as well as less than full agreement within the industry regarding the desirability of the program. With the inability to obtain a mandatory program in Michigan, United Cherry Producers became inactive by spring 1991.

Short crops in 1990 and 1991, which raised prices and reduced industry inventories, dampened the enthusiasm among some elements of the tart cherry industry for any kind of supply management program. By early 1992, some industry discussions shifted to consideration of a voluntary association of processors to be organized as a new cooperative for supply management and pricing.

5.2.5.4. Summary of Tart Cherry Supply Management

The tart cherry subsector has seen a number of different proposals for supply management and a considerable amount of deliberation of different approaches. After bargaining association efforts to influence supplies through storage and other means in the 1960s, agreement was reached among various segments of the tart cherry industry to create a federal marketing order in 1972. Since the 1970s had a number of years with short crops, the primary supply management tool with the federal marketing order was a storage reserve pool program. The tart cherry federal marketing order improved the balance of supply and demand by reducing supply fluctuations somewhat, thus addressing the problem of temporary imbalances of supply and demand. Use of the order in large crop years also benefited growers by reducing the magnitude of price declines compared to normal supply years, though prices were generally below typical grower cost of production in large crop years.

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Since the mid-1980s brought a period of increased cherry industry productive capacity, market allocation would have become a more commonly used tool had the order not been terminated in 1986. Various proposals have been put before tart cherry growers and processors in the years since termination, with many of them bearing considerable resemblance to the supply management provisions of the federal marketing order. A supply management cooperative was one proposed form of organization, but agreement could not be reached, in part because short crops, lower inventories and higher prices were occurring during the period in which the supply management cooperative was being considered. During the 1990s, agreement may be reached among industry participants to establish a new program to improve the balance of supply and demand through supply management.

5.2.6. The Almond Federal Marketing Order

Almond bearing acreage has risen fairly steadily since the 1960s, and almond supplies did not exhibit anywhere near the volatility of tart cherry supplies until the 1980s. Thus throughout most of the history of the almond federal marketing order, it has been used to remove temporarily excess supplies from the primary market (thus reducing the magnitude of price declines compared to price levels in years with moderate sized crops) and using the market allocation provisions to increase demand through building new markets (e.g., export) and encouraging new product development. With the increased supply volatility of the 1980s, almond reserve policy changed to provide larger reserve carryover to be prepared for the problem of supply shortages in future short crop years. Reserve almonds can be (a) released later in the same marketing year for sales into primary markets, (b) sold into secondary markets such as for new product uses, or (c) released in a subsequent short-crop year for sale into primary markets.

Use of these three reserve alternatives has varied during the 41 years the almond marketing order has been in existence. In four of those years, the entire reserve was

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eventually released for primary market sales before the end of the same marketing year. In 25 of the 41 years a portion of the almonds in the reserve was sold into secondary markets to reduce large supplies in the primary markets; the remainder was released to the primary market or carried over into the following year. In two years (1987 and 1988), the entire reserve was carried over into the subsequent marketing year. There were 12 years in which the almond reserve was not implemented at all because supplies matched demand at remunerative prices.

Up until 1973, reserve almonds were mainly diverted to one secondary market outlet: exports. A minimum export price was established by the Board which was lower than the domestic f.o.b. price. However, the Board did not handle reserve sales for export; almond handlers acted as agents for the Board in selling reserve almonds at prices at or close to the minimum price.

Selling almonds at a price below the domestic price in the more elastic export market was an example of successful implementation of a price discrimination strategy by the California almond industry. The industry was able to keep the domestic and export markets segregated so that discounted-price almonds for export were not re-sold in the U.S. market. However, why a <u>minimum</u> export price? At first glance, it would appear that exports sales would be maximized with no minimum price. However, industry observers have noted that successful adherence to a minimum export price prevented handlers from unduly bidding against each other on the basis of lower price for sales to what was generally a limited number of foreign buyers in particular countries. The concern was that substantial price competition for foreign sales might actually reduce total sales in a given season, if foreign buyers held back on their purchases waiting for prices to decline further. If the buyers were convinced that the price would stay approximately the same, they would buy the sa

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same quantities and they would buy them earlier in the season.[71] The minimum export price was kept low enough to ensure the sale of the entire quantity of almonds diverted to the secondary market. However, since the lower export price was enforced collectively through the marketing order, it represented a form of export subsidy by the almond industry.

Officials of the almond marketing cooperative praise the reserve program for its contribution to expanding the California almond export market:[72]

> "Through differentiation of the domestic and export markets, the almond industry established a foothold in the export market in the 1950s. Export reserves were still in place through the 1960s, even though the industry exported over and above targeted levels. By the 1970s the export market was self-sufficient, and now accounts for over 60% of industry shipments."

Since 1973, no minimum export prices have been set by the marketing order board because export markets had become primary markets, meaning that almonds for export were henceforth sold without having price concessions arranged through the marketing order.

No marketing order reserves were established from 1973 to 1979 because the almond industry was able to move all almond production into domestic and export markets at satisfactory prices. Supply and demand were in closer balance than in previous years. Favorable exchange rates and increasingly strong demand in foreign markets resulted in substantial growth in overseas markets during the remainder of the 1970s.

Almond sales into export markets became more difficult with the advent of less favorable exchange rates in the 1980s. At the same time, almond industry production levels continued to increase substantially. Several record-breaking crops occurred in the 1980s -- 1981, 1984, and 1987 (the all-time high of 654 million pounds). Large crops also occurred

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[71]Interviews with California almond handlers and with Robert Boersma, economist with the Fruit and Vegetable Division, Marketing Order Branch, Agricultural Marketing Service, U.S. Department of Agriculture.

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in 1980, 1988, and 1990.[73] The Board responded to the oversupply situation of the 1980s by establishing an almond reserve in each of the large crop years.

To use the market allocation provision, new secondary market outlets were needed in which to divert excess product in large crop years, since the export market was no longer an outlet for secondary market diversion. Since the industry appeared to be heading into a period of persistent oversupply, demand expansion efforts would be needed to move the increased market supplies. The Board thus made the decision to combine the goals of managing annual supply fluctuation and stimulating market development by creation of a market development reserve.

How was the market development reserve implemented? When final decisions regarding reserve disposition were made each year, a portion of the reserve almonds were set aside in a market development reserve. In each of those years a portion of the almond reserve was diverted into these secondary market outlets and sold at prices below the prevailing f.o.b. handler price. The proportion of total marketable supply diverted to secondary markets ranged from 2% to 10%. Thus beginning in 1982 and continuing through the 1985 crop year, the almond industry was involved in collective efforts to increase almond demand through promoting new uses such as almond butter and selling to the USDA school lunch program. Additional diversion outlets used under the marketing order (generally for culls and low quality almonds), were almond oil and livestock feed. A very short crop in 1986 led to cessation of the market development reserve for several years. It was resumed in 1990, when 7% was allocated for market development.

It is difficult to judge quantitatively how much almond sales have increased due to these collective efforts to increase demand and to thus reach an improved balance between supply and demand in the face of very large almond production increases. Figures on the

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[73] See Table 4 on page 12 and Figure 13 on page 33.

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quantity of sales into new product markets are not available. However, several industry leaders have indicated that the efforts have probably brought about small to moderate increases in almonds sales.[74]

Thus the almond industry has used the order to coordinate supply and demand in several different ways. For the first two decades, excessive supplies were diverted to the export market. In the 1980s use was made of market development reserves and in two years reserve inventories were carried over to subsequent marketing years. Throughout the entire period, in large crop years in which reserves were used, the Board "metered out" supplies to some extent throughout the marketing year by lowering reserve percentages incrementally one or more times. As described earlier, intraseasonal price declines tends to cause buyers to delay purchases while waiting for further price declines, so releasing reserve almonds incrementally helps to ensure that the f.o.b. price would not decline during the season, thus facilitating steady sales by handlers.

5.2.7. The Raisin Federal Marketing Order

The raisin marketing order has been used to reduce persistent large supplies in large production years and to balance these supplies with demand levels in the primary domestic market. In most large crop years, the Raisin Administrative Committee has declared a reserve percentage which is generally in the range of 10-30% of the crop. Each handler places in storage a quantity of raisins equal to the specified reserve percentage.

Since short crop years tend to occur only every 2-5 years (see Figure 18 in section 2.5.1 of Chapter 2), in most years the reserve pool is sold for various secondary market uses including government school lunch and other feeding programs, P.L. 480 exports, sales to wineries for distilling purposes, and cattle feed. The marketing order also typically carries

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[74]Interviews with several almond handlers attending an Almond Board of California meeting, Modesto, California, June 1991.

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some reserve pool raisins into the subsequent crop year. If that year has a short crop, the raisins are released. If the crop is again large, then additional secondary markets are sought.

Each marketing year the Raisin Administrative Committee decides the proportion of the upcoming crop to set aside in a reserve after comparing expected levels of sales with the size of the new crop plus carryin stocks. If the RAC decides that 20% is the appropriate set-aside percentage, each raisin handler is required to store 20% of the raisins delivered to their packing house by growers. The remaining 80% that each handler is allowed to sell immediately is called "free tonnage." As the marketing year progresses, the RAC permits handlers to sell raisins from that reserve tonnage, and handlers may also buy additional reserve tonnage from other handlers. The release of reserve tonnage for free use in increments (that is, allowing some reserve tonnage to become free tonnage), is intended to even out raisin shipments over the course of the marketing year. Thus the raisin federal marketing order facilitates a steadier flow of raisins throughout the marketing year than would be the case without the order.

This "metering out" of the reserve through incremental releases is somewhat similar to the approach used with the almond marketing order and the reason for doing it is similar. The incremental release of the reserve has the effect of keeping f.o.b. raisin prices steadier than would likely be the case if the entire crop were available for sale at the beginning of the marketing season. Industry participants contend that if prices are steadier throughout the season, then buyers will make more purchases earlier in the season. This mainly has the effect of shifting who carries the inventory in the system--from the handler/processor to firms downstream in the subsector. On the assumption that downstream firms (food manufacturers and food service firms) are able to gauge effectively their level of sales, this represents good vertical coordination performance--coordination costs are borne by the firms most able to bear that cost.

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A key supply-demand balancing issue is how marketing institutions deal with the problems posed by substantial increases in supplies. As mentioned in Chapter 2, various circumstances led to a sharp increase in raisin production in the 1980s. Several measures were developed to deal with the large and rapid increase in supplies that occurred. Raisin marketing organizations were fairly responsive in dealing with industry supply problems such as occurred in the mid-1980s. One measure taken was a substantial reduction in the price to growers negotiated by the Raisin Bargaining Association (RBA).

However, the sharp reduction in the RBA-bargained grower price led to other problems. Many handlers were still holding high-cost carryover stocks from having paid the higher grower price the year before. Those high cost raisins could be sold by handlers only at a significant loss because the f.o.b. price had dropped significantly. In response to this problem, the RAC developed an Inventory Reduction Program (IRP), in which handlers could purchase lower-priced tonnage from the marketing order reserve. By combining the cheaper reserve raisins with the high-cost raisins, handlers could lower the average cost of their total raisin stocks. The lower costs enabled the handlers to sell their raisins at a price that substantially reduced the losses they would have incurred without the IRP.

Another response was the creation of the Export Incentive Program (EIP), which facilitated sales to packers of lower-priced reserve tonnage to reduce the net price of exported raisins to handlers engaging in export sales. This program is basically a market allocation to export secondary markets, similar in some respects to the minimum export price system operated through the marketing order up until the mid-1970s. Under the EIP, target prices vary by export destination. The cost of reserve tonnage to handlers who participate in the EIP is calculated in a manner designed to enable them to sell raisins at competitive prices in eight separate export markets. All packers thus end up with the same raw product cost for export sales to a specific country. The establishment of costs of reserve tonnage raisin for export is accomplished through joint industry decision making under the

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Raisin Administrative Committee.[75] Foreign buyers are more likely to make regular purchases of raisins if they realize that prices are not likely to decline throughout a particular marketing year since all of their potential suppliers face the same basic costs for raisins during the same time period. The argument is similar to the situation described above relative to "metering out" the domestic supplies. By facilitating regular purchasing and purchasing early in the marketing season, the storage risk is shifted downstream to foreign food manufacturers, distributors and other firms that are generally in a better position to estimate likely sales levels and therefore bear the cost of holding the inventory. Maintaining the export market as significant sales outlet in this manner is a key part of balancing supply and demand in the face of frequent large crops.

Another industry response to the problems posed by large supplies in the 1980s, the Raisin Diversion Program, was created in part to reduce production and to encourage reduction of raisin production capacity. Use of this marketing order provision to balance supply and demand is part of the same decision process as establishing the level of reserve tonnage. The RAC first estimates the proportion of raisin deliveries that will be placed in the reserve pool (recall the 20% reserve example above). A key factor in making that decision is estimating the quantity of raisins needed to maintain reserve tonnage at the desired level to meet domestic and export demand. They consider how much reserve inventory is needed to meet buyers' needs until the new crop comes in, that is, keeping the "pipeline" adequately filled. If a crop is so large that production will exceed normal commercial demand plus the pipeline requirements, the RAC has an additional tool to reduce supplies that year: the Raisin Diversion Program. Growers who elect to enter the program in a given year must agree to prune spurs on their grapevines (resulting in temporary non-production for one year) or to remove vines entirely from the blocks of land

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accepted for participation in the RDP. Supply is reduced by the amount that land selected for RDP participation would have produced. With a few exceptions, raisin yields do not vary greatly from an average of 2 tons per acre, which facilitates reasonably accurate estimates of raisin production from specific acreage.

Diversion levels under the RDP are based on acreage, and have ranged from a high of 50,000 acres in 1986 to as low as 15,000 acres in 1987. Diversion through the RDP is zero in some years; if the expected crop size plus existing stocks do not exceed estimated market needs, the RDP is not implemented. For example, since 1989 was a relatively short crop, the acreage diversion level for the RDP was set at zero for that year.[76]

The mechanics of implementation are as follows. Growers that enter the program are given certificates by the RAC representing the tonnage of raisins that their land would have produced. Handlers purchase the certificates from growers and the handlers use those certificates to obtain raisins from the reserve pool. Handlers can then sell those raisins as free tonnage in regular commercial channels.

Thus the value of the RDP is to provide an additional tool to reduce raisin supplies in large crop years. Also the size of the reserve pool is reduced by an amount equivalent to the certificates issued to growers. This means that the RAC does not have to seek secondary marketing outlets to dispose of that proportion of reserve tonnage that is reduced by the RDP.

However, the program is not without its problems. One problem in administration of the RDP may occur in the following manner. Recall that a number of Thompson grape growers sell their grapes for wine, fresh, or canned. A grower who produces Thompson grapes for these other markets, but has not historically produced raisins, could produce raisins for a single year and then get paid not to produce by participating in the RDP the

[76]Clyde Nef, Manager of the Raisin Administrative Committee, personal communication.

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following year. To the extent that Thompson grape growers who are not traditionally raisin producers take advantage of the program in this manner, the effectiveness of the RDP as a means to address supply fluctuation problems is diminished.

In summary, key raisin industry responses to the oversupply problems of the 1980s included the Inventory Reduction Program, the Export Incentive Program, and the Raisin Diversion Program. Collective action measures such as these help alleviate the effects of persistent oversupplies, thus improving the short-run supply-demand balance for raisins.

5.2.8. Comparison of Marketing Order Supply Management in the Tart Cherry, Almond, and Raisin Subsectors

The purpose of this section is to make general comparisons of marketing order supply management for the three selected crops and to raise some specific issues. Use of the tart cherry, almond and raisin marketing orders differed in the relative emphasis given to use of specific provisions to deal with supply management problems.

The tart cherry marketing order emphasized the reserve pool. Use of the reserve pool stabilized supplies by removing excess supplies from the market in large crop years and releasing them in subsequent short crop years. Reserve pool cherries were also sometimes released into the primary market in the same year in which the pool was formed, when market conditions warranted. Diversion to secondary market uses was done to a greater extent in the mid-1980s as the industry entered a period of oversupply. Because of continued large crop sizes beginning in the mid-1980s, there was less need to supplement supplies in the following year such as had been done in the 1970s when short crops followed large crops with greater regularity. Diversion to secondary market uses would probably have been used increasingly as a supply management tool for tart cherries had the order not been terminated in 1986. The non-harvest diversion option was used sparingly, except for the first

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year of marketing order use in 1972.[77] In other years of marketing order implementation, non-harvest tonnage ranged from 1 to 5 million pounds (between 3% and 13% of restricted tonnage).

The almond reserve has generally been used for market allocation. Up until 1973, excess supplies were diverted to the export market at prices below f.o.b. domestic almond prices. In the early 1980s and in 1990, a different method of market allocation involved setting aside specific percentages of quantities delivered by growers in a market development reserve, ranging from 2% to 10% of grower deliveries.

The almond marketing order has also been used as an interseasonal reserve pool in recent years. The year 1986 was a short crop year with record high almond prices and large crops occurred in each of the following two years.[78] The general unavailability of almonds and high prices had a negative impact on demand in 1986 and in subsequent years. The Almond Board concluded that almond reserve policy should be changed to facilitate having enough carryover stocks to avoid severe shortages such as occurred in 1986. By decision of the ABC, almond reserves in 1987 and 1988 were carried over into the next crop year, which represented a change from previous pool management policy in which the entire almond reserve quantity was diverted to secondary markets. This policy shift meant that the almond reserve would henceforth be managed in a way that would allow it to be used if necessary as an interseasonal reserve pool, similar to the use of the tart cherry marketing order.

A policy of supplementing short crops with reserve pools from previous large crops is facilitated by having reliable information on crop sizes on which to base release decisions. Incorrect supply estimates can lead to problems. In the view of a number of almond industry

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[77]Donald J. Ricks and others, The Tart Cherry Subsector, 1982.

[78]1986 almond production was just 68% of the previous 4 year's average shipments. 1987 and 1988 production figures represented 178% and 142%, respectively, of the prior average shipments.

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participants, release of the 1988 almond reserve in the early stages of the 1989 marketing year had a significant price-depressing effect. The problem, in their view, was that the release decision was based on an estimated new crop size that turned out to have been significantly underestimated.[79] This illustrates one of the uncertainties inherent in managing marketing order reserves. Supply-demand balancing, whether done by individual firms or with a marketing order, requires good information on which to base decisions to store and release crops.

Almond reserves have also been used for within-season supply management. For instance, the initial reserve level has been set at 25% in a number of years. In subsequent Almond Board decisions taken later in the marketing season, the reserve percentage was lowered in one or two increments to a final percentage (often 10% or less), if the Almond Board decides that demand conditions warrant within-season reserve releases.

Incremental within-season changes in the reserve percentage allow flexibility in supply management. As the marketing season progresses, it becomes clearer how well current supplies are matched with quantities sold. If the Board members judge that supplies continue to be excessive relative to likely sales, they can maintain the reserve percentage. If there are signs that the market is strong, then more almonds can be released by steadily lowering the reserve percentage, allowing handlers to sell more reserve almonds as the season progresses. If the reserve percentage is lowered too quickly, there is a chance that the f.o.b. price will start to decline unduly as the season progresses. This is a situation that the Board generally wants to avoid, because of the Board's experience that marketing almonds becomes more difficult if buyers perceive that prices may decline further later in

[79]Views expressed by several almond handlers at a public meeting of the Almond Board of California, June 1991.

the season.[80] This type of Almond Board decision-making can be compared to certain types of within-season decisions by the Cherry Administrative Board. The CAB made fall and spring release decisions for reserve pool tart cherries taking into account somewhat similar considerations, based on judgments about the strength of tart cherry prices and intraseasonal price patterns that would occur if cherries were released. The CAB sometimes also wanted to avoid the situation where release of cherries would contribute to a substantial decline in prices as the season progressed.

After several incremental changes, the reserve percentage may be reduced to zero and all reserve almonds can be sold. Alternatively, the ABC may decide on a season-end reserve percentage such as 10%. If a 10% reserve is the final Almond Board decision on disposition of the crop, then 10% of the marketable supply from a given crop year must be diverted to secondary markets or carried into a new crop year. The quantity carried into the new crop year can be released into primary markets if the subsequent crop is not large. If the subsequent crop is again large, reserve almonds can instead be diverted to secondary markets. The raisin marketing order follows a similar practice.

The almond reserve has generally been managed in a manner that facilitates demand expansion goals (such as increased export sales in the 1950s and 1960s). Overseas market development was given a big boost through almond reserve disposal with minimum prices and promotion for export markets. Exports now represent over 60% of California almond sales.

In the raisin industry, tonnage set aside in reserves has been used to pursue industry goals that contribute to improved vertical coordination through increased sales or reduced supply. For example, the Raisin Administrative Committee sells tonnage out of the reserve pool for two separate programs designed to mitigate the consequences of excess supplies.

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[80]Views expressed by several almond handlers at a public meeting of the Almond Board of California, June 1991.

In the Export Incentive Program, reserve tonnage is sold to handlers at reduced prices to enable them to sell at competitive price in overseas markets. In the Raisin Diversion Program, handlers receive reduced-price reserve tonnage and in turn compensate growers for removing or pruning vines to reduce raisin grape production.

The emphasis up to this point has been mainly on short-run supply management issues and has served to make some general comparisons of supply management in the three commodity subsectors. Now the focus turns to long-run issues.

5.3. A Long-Run Supply Issue: Reducing Acreage Through Orchard or Vine Removal

Collective action efforts have also been undertaken in two of the subsectors to address the long run aspect of supply and demand: the level of agricultural productive capacity. Market participants in both the raisin and tart cherry subsectors have made attempts to deal with this issue.

The Raisin Diversion Program operates under the federal marketing order. As mentioned previously, its main impact has been temporary since most grape growers cease raisin production for one year and subsequently resume production. However, since some participating growers have actually uprooted their vineyards, use of this raisin marketing order provision has helped the long-term supply-demand balance by facilitating a permanent reduction in the number of acres in production. Nevertheless, the impact remains small since the proportion of participating growers that uproot vineyards has generally represented less than 10% of total acreage involved in the Raisin Diversion Program in any given year. Some raisin industry participants contend that the RDP should put more emphasis on permanent rather than temporary removal, since the temporary removal approach does not adequately address the problem of overall excess capacity. One way to do this would be to provide incentives for vine removal every year. Currently the RDP is used only in certain high production years.

Reduction in productive capacity was also proposed in the tart cherry industry but was never implemented. Tart cherry industry leaders proposed including orchard removal diversion credit under the federal marketing order. Orchard removal would have been a fourth option for growers to participate in the operation of marketing order supply management in addition to the reserve pool, market allocation, and non-harvest options. Although this would have been a means to address overcapacity in the subsector, the USDA did not approve the inclusion of this option in the tart cherry federal marketing order. The USDA ruled that such a provision could only be implemented through formal amendment of the order. Since amending the order is generally a lengthy and difficult process, the order was terminated before amendments were accomplished.

The problem that orchard removal credits was intended to address was that acreage reduction in response to low prices generally takes place quite slowly, over a period of many years. Thus the rationale for orchard removal credits was that the balance of supply and demand during periods of large productive capacity could be improved by providing incentives to growers to reduce tart cherry acreage through orchard removal adjustment procedures.

There were other proposals which were discussed in the tart cherry industry to encourage acreage reduction. A proposal was developed in 1990 for an orchard removal incentive program that would compensate growers for removing acreage using a fund from voluntary grower assessments that was to be established for this purpose.

An industry-supported survey documented tart cherry acreage and age distribution of trees. In a report by the Cherry Marketing Institute, projected production levels were compared to likely demand growth trends. The CMI report suggested that removing sufficient acreage to reduce average production by 40 to 70 million pounds (15-20% of average production) could bring supply and demand into approximate balance after several years.[81] There was also widespread belief among industry leaders, based on past experience, that in the absence of an acreage adjustment program, lower price would not soon lead to adjustments in capacity.

The proposed orchard removal incentive plan involved accepting the lowest grower bids until the target level of orchard removal was achieved. Growers could choose to bid the amount of money that they would accept to remove certain orchard blocks, up to and including removal of the grower's entire tart cherry acreage.[82]

Implementation of the "cherry orchard buyout" was to be carried out by United Cherry Producers, a new supply management cooperative, which was discussed above in connection with short-run supply management issues. In implementing the program, the cooperative's board of directors would have determined the appropriate acreage for removal. A likely board policy would have been to emphasize removal of older orchards while leaving younger orchards to assure continued adequate supply capacity to meet future demand growth. There was some discussion of whether the program should emphasize buying out whole farms or paying for removal of individual orchard blocks. A consensus emerged emphasizing the latter, but permitting both. Bids would have been solicited from growers to remove "viable, productive" orchard blocks, and plans were included to assure that payment would be made only for removal of productive orchards (not abandoned blocks). Orchards that were bid for removal would have been inspected by industry representatives to assure compliance.[83]

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[81]Demand growth scenarios were projected as moderate increases from sales levels in recent years (up to 5%). Cherry Marketing Institute, "Report on Michigan Tart Cherry Survey," Okemos, Michigan, 18 January 1991.

[82]Donald Ricks, "Tart Cherry Orchard Buyout Bidding Approaches," Staff Paper 90-24, Department of Agricultural Economics, Michigan State University, March 1990.

[83]Donald Ricks, "Tart Cherry Orchard Buyout Bidding Approaches."

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The new cooperative and the orchard buyout proposal had strong initial support from many cherry growers and processors. A high level of grower enthusiasm for this proposal was evident from the fact that in spring 1990 growers representing 73% of national production and 83% of Michigan production signed up to participate and pay an assessment that was intended to generate the necessary funds. However, the industry had set a 90% participation threshold before they would implement the program. Since the 90% threshold was not reached in time for the 1990 growing season, the program was not implemented. This self-imposed threshold was based on the judgment of industry leaders regarding the extent of free riders they were willing to accept in financing the program. Subsequent proposals involved mandatory assessments through a Michigan state marketing order (rather than the voluntary assessments previously proposed) and combining orchard removal with supply management provisions to address annual supply fluctuations.

Various factors prevented implementation of the orchard removal program which had the potential to bring longer-run supply capacity and demand into closer balance. By reducing acreage, production in most years would have been closer to the quantities typically sold in commercial markets. There would still have been large crop years in which production would substantially exceed the quantities consumed in prior years, leading to downward pressure on grower prices. However, with reduced acreage the magnitude of the excess production would have been less, meaning an improved supply-demand balance.

5.4. A Long-Run Supply Issue: Approaches to Avoid Overplanting

A desirable coordinating mechanism to help avoid overplanting of a perennial crop is one that allows perennial crop supply expansion on a relatively steady and controlled basis that approximately matches the expansion in demand when demand increases, but also is effective in helping avoid excessive or unneeded plantings that can cause supplies to expand much more rapidly than demand. An effective coordinating mechanism also encourages reduced supplies when a market is faced with declining demand trends which cannot be reversed. Some examples of coordinating mechanisms that attempt to address the problem of overplanting are discussed below.

5.4.1. Market Information and Projections

One vertical coordination approach to help avoid overplanting that can be used by cooperatives is providing member growers with well-researched projections of likely future levels of aggregate quantities supplied and demanded for the subsector. Forward-looking market information helps growers make better informed planting and removal decisions and somewhat reduces the probability of overplanting. For example, projections may indicate that commodity supplies are expected to expand more rapidly than estimated demand growth, so that prices will likely decline, making many growers' operations unprofitable.

Although some cooperatives have tried the approach of providing long-run market projection information to growers for planting decisions, its effectiveness is not assured. For example, because projections in an earlier period indicated a likelihood of overplantings and future low prices, Blue Diamond at one point tried to discourage its member growers from planting much additional acreage. However, Blue Diamond found that this policy was ineffective since few growers heeded the advice. Growers generally have little incentive to restrict production since they are likely to feel that their individual decisions will have such a minor impact on total supplies that there would be no effect on prices. In addition, Blue Diamond was later able to expand demand by a considerably greater magnitude than had previously been expected. Therefore those growers who ignored the cooperative's advice reaped greater benefits from additional profitable sales. Since that time, the almond cooperative has generally adopted a policy of accepting whatever quantities their members

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produce and deliver in accordance with their membership agreements, and planning marketing programs to handle the supplies received as well as possible.[84]

5.4.2. Limiting Cooperative Membership

Limiting membership is another approach that a cooperative can use to discourage unneeded additional planting if supplies are projected to be adequate or excessive. This approach is likely to be most effective if a cooperative sells most of its output under strong brands and if the cooperative's share of total U.S. production of the particular commodity is high. In this case, new plantings might be curtailed somewhat since growers would have few good alternative market outlets.

Blue Diamond's experience provides an unsuccessful example of this approach. Grower membership was closed in 1984 with the intention of discouraging unneeded additional plantings, since plantings were rising rapidly and future almond supply increases were expected to be considerably greater than demand growth.[85] However, in subsequent years the number of acres in production continued to rise and some growers marketed expanding tonnage to an increasing number of small handlers. The cooperative's share of total subsector tonnage declined as nonmembers substantially expanded total acres in production and some members exited the cooperative. The policy of closed membership was ineffective in some respects and membership was reopened several years later to allow the cooperative to restore membership tonnage to its previous percentage of total production.[86]

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[84]Steve Easter, Blue Diamond Growers, Inc., personal communication.

[85]Almond Facts, (49:6) Nov/Dec 1984, 7.

[86]Almond Facts (52:5) Sep/Oct 1987, 38.

This illustrates a dilemma that cooperatives commonly encounter if they assume responsibilities for attempting to balance supplies with demand. Such attempts may cause the cooperative to lose market share of total production if the competition expands supplies more rapidly. Such an approach may also reduce the cooperative's overall efficiency because of reduced volume handled by the cooperative.

Another possibility is that limiting membership may bring supplies into balance with current sales levels within the cooperative. In that case, through product differentiation and niche marketing, the cooperative may be able to provide remunerative returns to members. But that may involve shifting the burden of excess supplies to nonmembers and thus the overall subsector supply-demand balance situation could be worsened.

5.4.3. Stock Tonnage Contracts

Another mechanism to coordinate grower supplies with a cooperative's demand is stock tonnage contracts with grower members. This has been used by some cooperatives in the tart cherry subsector. With this method each grower member purchases stock that includes the right to deliver specified quantities of raw product to a cooperative processor. The aggregate amount of stock tonnage for the cooperative is based upon the cooperative's demand projections for that commodity. Stock tonnage thus represents a share in the cooperative processor's expected market needs. Stock tonnage is used as a long-run supply-demand balancing tool by the cooperative/corporation joint venture between Pro-Fac Cooperative and the IOF food manufacturer, Curtice-Burns, with headquarters in western New York.

A part of the stock tonnage contract often stipulates that the cooperative is not obligated to take a greater quantity than the grower's stock tonnage if supplies are larger than needed by the firm. This provides a strong incentive for the grower to plant only sufficient acreage to produce a quantity equal to the stock tonnage, but no more, unless the grower has another market outlet.

The stock tonnage approach provides a potentially powerful mechanism for coordinating grower supplies with the demand for the cooperative's processed products. As the cooperative's demand increases, aggregate stock tonnage can be expanded by a comparable amount. If demand for the cooperative's products declines, the aggregate stock tonnage can be decreased, reducing the amount that members can market through the cooperative.

The supply-demand balancing impact for the subsector may be substantial if cooperatives that use stock tonnage market a large portion of total crop production. However, competitive actions by competitors who do not use the stock tonnage approach such as private label processors can reduce the effectiveness of the stock tonnage approach in balancing supply and demand. For example, private label processors that do not use stock tonnage may be able to purchase residual cherry tonnage from growers at prices considerably below the prices paid for cherries covered by stock tonnage. This could enable them to sell processed cherries at lower prices than the processors that are trying to balance supply and demand through the use of stock tonnage contracts. By placing stock tonnage processors at a competitive disadvantage in the sale of processed cherries, such actions by private label processors are disincentives to using stock tonnage, reducing the potential coordination impact. The impact of stock tonnage as a coordinating method can also be reduced if the firms that use it are not effective in expanding demand for the products marketed.

The stock tonnage approach is most appropriate for cooperatives which market most of their product through strong brands. Strong brands provide a market segment somewhat separate from the unbranded commodity portion of the market. There is less substitutability for commodity-based branded food products than for raw product sold in undifferentiated commodity markets. In other words, the demand for differentiated products in more inelastic because there are fewer close substitutes. If too much of a brand product is sold, the manufacturer will find it more difficult to maintain the price premium. Since supply requirements for a brand are more predictable than for a commodity, brand marketers can use stock tonnage to avoid oversupplying the branded market. This approach has been used for a number of years by the cooperative/corporation joint venture which has a strong brand position in pie filling.

There is generally less potential for the stock tonnage approach for perennial crop cooperatives which market much of their products in undifferentiated commodity markets and this approach has not been widely used by cooperatives which are primarily commodity processors. If a commodity processor used stock tonnage, other processors could easily expand output in large crop years to take away sales from the commodity processor attempting to limit supplies through stock tonnage.

5.4.4. Acreage Contracts

With acreage contracts the perennial crop grower agrees to deliver the production from specified acreage rather than marketing a specified tonnage through the cooperative. Acreage contracts are a predominant coordinating mechanism for annual processing vegetables, but this approach is less widespread within perennial crop subsectors.

As with the stock tonnage contract, acreage contracts have the potential to be a strong supply-demand coordinating mechanism for perennial crops. Under certain circumstances acreage contracts tend to work most effectively for a cooperative with a strong brand position for most of its output for reasons similar to the stock tonnage situation.

In the almond subsector, acreage contracts are the most common method for contracting between growers and handlers for delivery of almonds. However, acreage contracts have not been used for long-run supply demand balancing purposes in any of the three subsectors emphasized in this research. In contrast, acreage contracts have been used extensively to coordinate productive capacity with demand in the grape juice subsector. Along with the stock tonnage approach, acreage contracts may be used more extensively in the future by some cooperatives to coordinate grower supplies with its market demand.

5.5. Interrelationships Between Demand Expansion and Supply Management

Demand expansion and supply management approaches should not be viewed as separate. They are interrelated aspects of the vertical coordination functions. In a number of subsectors, cooperatives as well as other firms and organizations devote major efforts to developing strategies and programs for influencing both demand and supply -- often simultaneously. Effective supply management efforts are commonly used to expand demand. Important examples of this are storage reserve pools used to supplement supplies in situations when shortages in a particular year are likely to reduce demand for a period of several years.

The almond subsector provides an example of the interrelationship between demand expansion programs and supply management. As mentioned earlier, there has been complementarity in the goals of development of new products such as almond butter and the disposition of almond marketing order reserve tonnage into secondary markets that do not compete with the primary market. These goals were addressed by setting aside a portion of the almond marketing order reserve as a special market development reserve. The marketing cooperative was instrumental in encouraging almond butter as a new product development effort and as a secondary market outlet for the marketing order reserve. In addition, up until the early 1970s, long-range export market development efforts of the cooperative and of other almond handlers was facilitated by storage of almonds in the reserve to maintain reliable supplies for export. Thus programs on both the supply and the demand side were used in a number of ways to improve the supply-demand balance and economic viability of the subsector.

Use of market allocation to encourage new product development was also done through the tart cherry marketing order. A portion of the quantities of cherries diverted from the primary market in certain large crop years were channeled into relatively new uses including juice, puree and dried cherries.

The raisin subsector provides additional examples. Supply management through the raisin marketing order reserve has also contributed to raisin demand expansion goals. Although the raisin generic promotion program is a separate program, it is closely coordinated with the federal marketing order supply management program. In addition, the raisin reserve pool has contributed to stable supplies for export market development, similar to the almond situation. Raisin cooperative demand expansion goals are facilitated by regular purchase of large quantities of raisins from the marketing order reserve pool for sale in export and domestic markets when these reserve supplies are needed. The reserve thus helps to maintain steady, dependable supplies for effective demand expansion efforts by individual firms and for the subsector as a whole.

The interactions and interrelationships of supply and demand approaches and programs have thus had important impacts on all three subsectors.

5.6. Summary

Chapter 2 characterized the significant supply instability that affects the marketing of tart cherries, almonds, and tart cherries. Shortages reduce product availability in the year that the short crop occurs, but sales may also be reduced for succeeding years because manufacturers may drop certain products, retailers may not continue to carry a product, or consumers may shift buying preferences to other products. Storage from year to year by individual processor/handler firms could potentially help alleviate this problem, but there is often inadequate storage, partially due to the risks to individual firms. Chapter 3 pointed out that a lack of retail price responsiveness can result in big price and revenue declines for growers in large crop years. The negative impacts of supply volatility on growers provides significant incentives for grower collective action. This chapter examined some coordination mechanisms developed through grower collective action to address these problems. Supply management programs through federal marketing orders have been among the major approaches.

Price impacts from implementing marketing orders varies by subsector stage. Table 14 presents some of the key short-run impacts of marketing order supply management. Large crops tend to have substantial price-depressing effects with all three commodities, but use of marketing order supply management provisions can partially mitigate the impact. The f.o.b. price at the processor or handler level (stage 2) is the price that is most directly affected by the use of supply management provisions of marketing orders. When any of the three types of provisions are used in large crop years to reduce the supply of the commodity in primary markets, the f.o.b. price of almonds, raisins, or frozen tart cherries declines by less than would be the case if all of the grower deliveries were made available for sale. Processor/handler and grower prices are improved by the reduction of excess supplies in the primary markets through the use of the three types of provisions, either alone or in combination: storage reserve, market allocation, and non-harvest/non-production diversion. However, individual growers may be disadvantaged from not being able to sell all of the crop that they harvest. In addition, net revenue from the sale of stored or diverted cherries may be less than would have been the case had they been allowed unrestricted sale of cherries.

Reducing shortages in short crop years through release of marketing order reserves helps increase manufacturer sales (stage 3) and processor sales (stage 2). Certain manufacturer efforts to develop new products also benefit from secondary market diversion

Table 14. Short-run Impacts of Marketing Order Supply Management on Firms at Various Subsector Stages

Subsector Stage	Impacts of Marketing Order Supply Management
Stage 1: Grower	A. Grower prices improve through use of storage reserve, market allocation, and non-harvest or non-production diversion provisions. Non-harvest diversion gives cherry growers more options for meeting restricted tonnage requirement. Non-production diversion for raisins provides additional means to reduce supplies. B. When supply management provisions are used, growers are restricted from selling 100% of what they harvest. If they participate in secondary market diversion, their choices may be somewhat limited by the options available to the handler(s) to whom they typically sell their crop. For individual growers, net revenue from the sale of stored or diverted cherries may be less than might have been received had they been allowed unrestricted sales of cherries.
Stage 2: Handler/ Processor	A. Release of commodity stored in marketing order reserve helps increase processor sales and reduce shortages in short crop years. B. When supply management provisions are used, processors are restricted from selling 100% of grower deliveries.
Stage 3: Manufacturer	A. Reducing shortage in short crop years through release of stored crops helps increase manufacturer sales. Certain manufacturer efforts to develop new products benefit from secondary market diversion allocated to those uses. B. To the extent that supply management helps to increase f.o.b. prices and restrict quantities marketed, manufacturers may obtain less of the commodity at higher prices.
Stage 4: Retailer	Retailers reflect little or no price impact from marketing order operation, since raw product price changes due to the order are generally not large enough to bring about retail price changes.
Stage 5: Consumer	A. There is less likelihood that consumer demand will be reduced due to retail product unavailability in short crop years when the commodity is stored and released through reserve pool operations. Consumers benefit from greater product availability when market allocation is used for new product development. Raw product price changes from marketing order implementation is often not large enough to bring about retail price changes. B. In some instances, marketing order supply management could reduce product availability and raise consumer prices.

allocated to those uses. However, to the extent that supply management helps to increase f.o.b. prices and restrict quantities marketed, manufacturers may obtain less of the commodity at higher prices.

There may be little change in prices in the other stages. Raw product price changes due to the marketing orders are in many instances not large enough to bring about retail price changes. Reasons for this was explained in Chapter 3. Even if a cherry processor passes along a price change, a pie manufacturer that purchases processed cherries will in many instances not change the price of pies made from one particular commodity just because of a change in the price of that commodity. They will likely maintain their pricing structure for the whole line of pies by leaving the price of cherry pies unchanged. In general, if the f.o.b price at which manufacturers acquire the processed commodity drops (within a certain range), they generally do not reduce the manufactured sale price, but will instead increase their margin due to the lower cost of the commodity used as an ingredient in food manufacturing.

At the consumer stage (stage 5), one of the major impacts of implementing marketing orders is that there is less likelihood of unavailability of food products made from the perennial crop commodity when the commodity is stored in a large-crop year and subsequently released in a large-crop year through the operation of a storage reserve pool. Consumers also benefit from greater product availability when market allocation provisions are used for new product development. Marketing order supply management could in some instances, however, reduce product availability and raise consumer prices in some instances.

Several conclusions can be drawn from comparing the operation of the three marketing orders. The first is that different approaches are emphasized depending on the supply conditions facing the particular commodity. Market allocation has been the appropriate tool for much of the history of the almond and raisin marketing orders because the supply-related problem has generally been one of persistent overproduction rather than frequent shortages. Management of the tart cherry marketing order did not begin to make significant use of secondary market diversion until 1984 and 1985, which marked the beginning of a period of persistent overproduction in the tart cherry subsector.

A reserve pool storage program stabilizes supplies through storing and releasing the packed or processed commodity. The tart cherry industry used the reserve pool to store excess supplies in large crop years and to release it in subsequent short crop years. The almond industry did not begin to use the marketing order for this purpose until after a very short crop occurred in 1986. Short raisin crops do not occur frequently, so large reserve quantities are not typically carried over into a subsequent year.

The occurrence of two or more large crops in a row has posed reserve management problems for marketing orders in all three commodity industries, but especially for tart cherries and raisins. The juxtaposition of large tart cherry crops in 1984 and 1985 and the implementation of the marketing order in both of those years posed substantial challenges to the Cherry Administrative Board for the disposition of the reserve cherries. Similarly, the large raisin crops of the early 1980s led to substantial reserve management problems. The raisin industry responded with a series of measures to deal with the persistent large supplies, including the Inventory Reduction Program, the Export Incentive Program, and the Raisin Diversion Program. In combination with expanded promotional efforts, both branded and generic, these efforts have led to improvement in supply-demand balance conditions.

The almond and raisin marketing orders both used the export market for market allocation for the first two decades of the operation of those marketing orders. Both commodity industries pursued a strategy of using exports as the main outlet for secondary market diversion by maintaining a minimum export price below the f.o.b. domestic price. Both ceased that approach by the mid-1970s, by which time export volumes were becoming significant enough to be treated as primary markets, rather than residual outlets. Since that time, almond export strategies have been pursued independently by each almond handler

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firm, with most export expansion initiatives coming from Blue Diamond. Over 60% of California almonds are now exported. The raisin marketing order, however, continues to use the order to assist in export expansion, though not through minimum export prices. Instead, the Raisin Administrative Committee uses the sale of lower-priced reserve tonnage as a means to lower the cost of raisins to handlers engaged in exporting to selected foreign markets. In addition, CALRAB facilitates export expansion in selected markets such as Japan with a branded product supported jointly by the California raisin industry. This complements brand-oriented export expansion pursued by Sun-Maid and a few other handlers. Exports have played a major role in improving the supply-demand balance for both almond and raisins, but only a minor role for tart cherries.

Long run supply-demand balancing approaches considered in this chapter include measures to reduce acreage and measures to avoid overplanting. Overview comments and conclusions regarding these aspects appear in Chapter 7.

This chapter has shown that federal marketing orders have been a major factor in short-run supply-demand balancing in all three subsectors, and that one of the key impacts from the grower's viewpoint has been the ability to dampen steep price declines in large crop years. The next chapter looks more specifically at the price and grower revenue impacts in each of the three perennial crop subsectors of using federal marketing orders for supply management.

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CHAPTER 6: SIMULATION OF FEDERAL MARKETING ORDER PRICE IMPACTS

A number of supply management approaches were examined in Chapter 5, and federal marketing orders rank as one of the most important. A key performance issue relating to marketing orders is the magnitude of price impacts, especially grower prices, resulting from use of this supply management tool. That is the subject of this chapter.

Steep declines in prices commonly result from large crops in tart cherries, almonds, and raisins. Supply management provisions of federal marketing orders have been implemented in large crop years in these three subsectors in part to reduce the magnitude of the price decreases from unusually large supplies. Large crops frequently drive grower prices below the typical cost of production, and use of the marketing order permits management of a portion of market supplies that would otherwise drive grower returns further below costs. The effect of the supply management provisions is usually to raise prices somewhat. The analysis in Chapter 2 showed that tart cherry prices were generally still below grower cost of production in large crop years even when marketing order provisions were used. The use of supply management provisions of marketing orders with certain perennial crops that are subject to significant short-run supply variation facilitates subsector coordination by providing a more stable supply environment in which grower prices are also more stable and more closely aligned with grower cost of production.

Econometric models were used to analyze the impact on handler and grower prices of implementing supply management aspects of the federal marketing order for tart cherries and almonds. The tart cherry and almond models are similar in structure and both are based in part on a model of the asparagus industry developed by French and Willett[87] and

[87]Ben C. French and Lois Schertz Willett, "An Econometric Model of the U.S. Asparagus Industry," Gianninni Res. Rpt. No. 340, University of California, September 1989.

a model of the raisin industry developed by French and Nuckton.[88] Model development, solution method, and simulation results for both commodities are described in this chapter. Results from the tart cherry and almond models are compared to research results from the French and Nuckton study of the raisin marketing order. Estimated marketing order impacts for all three subsectors are examined in light of several performance criteria.

6.1. Tart Cherry Marketing Order Simulation

To analyze the performance of the tart cherry marketing order, price impacts of the marketing order were estimated by comparing actual season average prices with prices estimated in an econometric model that simulated prices and quantities over the period 1965-1989. Cherry prices were hypothesized to be higher with the establishment of a reserve pool and with the use of other provisions of the marketing order and lower in those years when reserve pools were released to supplement shortages, relative to the situation that would have existed without the marketing order. The purpose of this aspect of the research is to estimate the magnitude of the price effects. The model simulates the historical period assuming in a counterfactual alternative scenario that the reserve was not implemented in 1972, 1975, 1980, 1984 and 1985. The resulting simulated prices and quantities are estimates of what would have occurred without supply management operations of the tart cherry marketing order. The difference between the simulated price in the alternative scenario and the actual grower price is the estimated impact of not using the order, or conversely, the value in terms of increased grower prices of using the order for supply management in certain large crop years.

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[88]Ben C. French and Carole Frank Nuckton, "An Empirical Analysis of Economic Performance Under the Marketing Order for Raisins," American Journal of Agricultural Economics, August 1991.

Another simulation posed the same question in reverse: What would have been the price impact of using supply management provisions of the marketing order in certain other large crop years besides the five years in which the marketing order was used? A nearly ideal set of economic conditions for use of a reserve pool occurred with a very large crop in 1982. This was followed by a short crop in 1983, during which a reserve could have been released to supplement the short supplies. Since the marketing order was not used in 1982 and 1983, the circumstances in those years provide a useful opportunity to run a simulation to estimate the potential price impact of the marketing order.

Although the marketing order was discontinued in 1986, quite large crops occurred in 1987 and 1989, which again would have provided appropriate supply conditions for the use of the marketing order. Thus the second simulation focused on estimating the price impact had the marketing order been used in 1982, 1987, and 1989.

The model included ten econometrically estimated equations. A supply response equation predicted tart cherry bearing acreage. Other key behavioral relationships that were modeled included carryin stocks and pack, both frozen and canned. Domestic demand and allocation to the frozen and canned markets were modeled as a simultaneous system and estimated by three stage least squares. The ten equations and related identities were linked in a recursive model that made dynamic sequential predictions over the period 1965-1989 of (a) production, (b) carryin stocks, (c) frozen and canned pack, (d) frozen and canned movement, and (e) handler and grower prices.

6.1.1. The Tart Cherry Model

The variables in the model are presented in Table 15. Structural relationships among the variables are presented in Table 16. All data are annual. The time period for which all the relationships were modeled was 1964-1989. Making 1964 the initial year provided a sufficiently long time series to yield useful behavioral relationships, and data for

Table 15. Variable Identification, Tart Cherry Model

Variable	A. ENDOGENOUS VARIABLES (RPE = raw product equivalent)
AU	Bearing acres, thousands
DC	US canner total shipments of TC, million pounds RPE
DCD	US consumption of canned cherries (DCD = DC - EC), mill. lbs. RPE
DF	US freezer total shipments (movement) of TC (million. lbs. RPE)
DFD	US consumption of frozen cherries (DFD = DF - EF), million lbs. RPE
PGPU PGPUAV7	US season average grower price for TC, dollars per lb. Seven year moving average, grower prices lagged (T-6) to (T-12), dollars/lb.
PPCC	Representative f.o.b. canned price, 6/10, dollars per lb.
PPFC	Frozen TC f.o.b. price, 30-lb tins, $ per fresh lb., 1.11 lb. fresh to 1 lb. frozen
QCU;QCUSQ	US pack of canned TC, million pounds RPE; QCU squared
QFU;QFUSQ	US pack of frozen TC, million pounds RPE; QFU squared
QGU	US total production of TC, million pounds RPE
QSC	US seasonal supply of canned TC (pack plus carryin stocks), million lbs. RPE
QSF	US seasonal supply of frozen TC (pack plus carryin stocks), million lbs. RPE
SC	Carryin stocks of canned TC, million pounds RPE
SF	Carry-in stocks of frozen TC, million pounds RPE
	B. EXOGENOUS VARIABLES
EC, EF	Canned exports, frozen exports, million pounds, RPE
ID	Personal disposable income (billions of dollars)
IPC	Index of processing costs, 1967 = 1.0
QNHD	Quantity of TC diverted by non-harvest under federal marketing order
QOMA	Quantity of TC open-market abandonment
QSCI	U.S. domestic supply of canned TC (seasonal supply minus exports;QSC-EC)
QSFI	U.S. domestic supply of frozen TC (seasonal supply minus exports; QSF-EF)
RPSA RPR	Quantity of TC set aside in a reserve pool or allocated to secondary market Quantity of TC released from reserve pool in year following use of pool
T7601	Time shift (0 prior to 1976, 1 thereafter)
YU	US average total yield of TC, thousand pounds per acre

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Table 16. Structural Relationships of the Tart Cherry Model[1]

Bearing Acreage: (supply response)	Eq. #1	$AU_t = f(AUt\text{-}1, PGPUAV7_{t\text{-}6\text{ to }12}, \underline{T7601}$
Total Production:		$QGU_t = AU_t \text{ X } \underline{YU_t}$
Canned Carryin Stocks:	Eq. #2	$SC_t = f(SC_{t-1}, QCU_{t-1}, QCUSQ_{t-1}, QFU_{t-1})$
Frozen Carryin Stocks:	Eq. #3	$SF_t = f(SF_{t-1}, QFU_{t-1}, QFUSQ_{t-1})$
Canned Pack:	Eq. #4	$QCU_t = f(QGU_t, DC_{t-1}, SC_{t-1}, PPCC_{t-1}, \underline{IPC_t})$
Frozen Pack:	Eq. #5	$QFU_t = f(QGU_t, DF_{t-1}, SF_{t-1}, PPFC_{t-1})$
Canned F.O.B. Price: (canned demand)	Eq. #6	$PPCC_t = f(DCD_t, DFD_t, \underline{ID_t}, \underline{T7601})$
Frozen F.O.B. Price: (frozen demand)	Eq. #7	$PPFC_t = f(DFD_t, \underline{ID_t})$
Canned Domestic Movement:	Eq. #8	$DCD_t = f(QSCI_t, PPCC_t, PPCC_{t-1}, PGPU_t)$
Frozen Domestic Movement:	Eq. #9	$DFD_t = f(QSFI_t, PPFC_t, PPFC_{t-1}, PGPU_t)$
Grower Price: (farm-level demand)	Eq. #10	$PGPU_t = f(DFD_t, DCD_t, \underline{ID_t})$

[1]Underlined variables are exogenous.

all key variables were available for the entire time period. Since 1986 was the last year of the marketing order, a three-year period beyond 1986 (up to 1989) was judged to be sufficiently long to draw conclusions on the operation of the order. Also, another reason for not extending the data set beyond 1989 in this model was that the last year for which canned stock data was available was 1989. Although canning is no longer a major outlet for processed tart cherries, canning was important in the 1960s and early 1970s. Therefore, including equations related to canning provided the model with additional explanatory power.

6.1.1.1. Bearing Acreage and Production

Tart cherry grower supply response can be conceptualized in terms of acres planted and removed in response to the profitability of the cherry growing enterprise. Profitability can be measured by net returns to cherry growing, i.e., price minus cost in terms of return per unit of production or per acre. In the absence of adequate time series data on cost of production over a sufficiently long period, it was decided to use grower prices as a proxy for net returns. Since it takes approximately six years for a cherry tree to come into substantial production, prices must be lagged at least six years. The question then arises as to how many years prior to planting does the grower take into account in making planting decisions. Wu found that prices over the prior seven year period appeared to guide grower decision-making regarding planting.[89] In developing the acreage supply response equation for the marketing order simulation model, it was found that the simple average of price lagged from (t-6) to (t-12) provided better predictive power than shorter or longer periods, and was thus incorporated as one of the independent variables (LPGPUAV7). The L prefix in this equation and in subsequent equations indicates estimation in log form. One would normally expect more recent prices to be weighted more heavily in grower decision making than prices in more distant years, and that alternative lag structures could be developed to reflect grower planting behavior. Although several alternative specification were investigated, no model was found that predicted better than the simple average of (t-6) to (t-12).

Although it would be preferable to specify separate planting and removal equations, in the absence of annual planting and removal data, it was decided to make bearing acreage of tart cherries the dependent variable in a single supply response equation (Eq. #1 shown in Table 17). Growers are hypothesized to respond to past prices by planting only a portion

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[89]Ming-Wu Wu,"Supply and Demand Relationships for Tart Cherries in Michigan with Projections to 1990," Unpublished Ph.D. dissertation, Michigan State University, 1976.

Table 17. Bearing Acreage Equation Estimated by OLS

Independent Variable	Variable Label	Dependent Variable: LAU (Eq. # 1)	
	Constant	1.3673	(2.99)
Lagged acreage	LAU(T-1)	.5758	(4.80)
Lagged average grower price	LPGPUAV7	.0923	(2.55)
Dummy variable	T7601	-.0699	(-3.40)
	R^2 = .988 Adj. R^2 = .985		

[1]An L prefix indicates estimation in log form. T-statistics appear in parentheses beside each coefficient. OLS estimate was corrected for serial correlation with Cochrane-Orcutt autoregressive procedure.

of the desired new acreage. Thus a partial adjustment model is specified by including bearing acres lagged one year as an additional independent variable.

A significant structural change in acreage appears to have occurred around 1976, when a steady decline in acres over many years bottomed out, resulting in a plateau and an eventual rise in acreage beginning in the early 1980s (see Figure 1 in Chapter 2). Thus a time shift variable (T7601) is incorporated that takes a value of zero up through 1976 and one thereafter. This allows the intercept to shift on the supply response model. Although the structural change did not take necessarily place precisely in 1976, representing the change as a one-time shift through this dummy variable is a reasonable approximation of changes in acreage trends that may have occurred over a period of years prior to, and subsequent to 1976.

Yield per acre is considered exogenous to the model and would have been the same with or without the marketing order. Actual yields are used in both the base runs of the entire model and the alternative scenario runs. Production in the full model is identified as the product of predicted acres and actual yields.

6.1.1.2. Equations for Frozen and Canned Pack, Carryin Stocks, and Seasonal Supply

Frozen and canned pack. A key aspect of market behavior is how total production each year is allocated to various processing uses. The three largest uses of cherries in decreasing order of importance are frozen, pie filling, and canned. However, relatively complete data on pack, stocks, movement and prices were available only for frozen and canned cherries. Therefore the model focused on those two uses for cherries. The lack of sufficient pie filling data precluded developing equations to model pie filling utilization. Although canning is no longer an important processing outlet for tart cherries, it was important in the early period over which the equations are estimated and the simulations are carried out. Therefore equations for canned pack and canned carryin stocks are included in the model.

Equations #4 and #5 are a pair of equations that estimate how total cherry production was allocated between frozen pack and canned pack. Since the data are annual, the decision by processors to allocate tart cherries to frozen and canning uses is modeled as a simultaneous relationship and the equations are estimated as seemingly unrelated regressions (SUR). The empirical results appear in Table 18.

Frozen movement, stocks and f.o.b. price are used in the frozen pack equation; likewise, canned pack, stocks, and f.o.b. price are used in the canned pack equation. The logic of the estimated relationships is as follows: Decisions by processors to pack cherries (frozen and canned) are influenced positively by the current year's level of production, movement lagged one year (representing last year's sales), and f.o.b. price lagged one year.

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Table 18. Frozen and Canned Pack, Estimated by Seemingly Unrelated Regression

Independent Variable	Variable Label	Dependent Variable[1]	
		Canned Pack	Frozen Pack
		LQCU (Eq. # 4)	LQFU (Eq. # 5)
	Constant	-4.9503 (-2.97)	.1195 (0.12)
Production	LQGU	1.3912 (10.88)	.7118 (10.77)
Canned Movement	LDC(T-1)	.7396 (5.32)	
Frozen Movement	LDF(T-1)		.0769 (0.48)
Canned stocks	LSC	-.0429 (-1.31)	
Frozen Stocks	LSF		.0443 (1.18)
F.O.B. canned price	LPPCC(T-1)	.6371 (4.11)	
F.O.B. frozen price	LPPFC(T-1)		.1223 (3.03)
Processing Cost Index	LIPC	-.7832 (-5.71)	
	R^2 = Adj. R^2 =	.945 .931	.865 .838
	D.W.	2.41	1.94

[1]An L prefix indicates estimation in log form. T-statistics appear in parentheses beside each coefficient.

This last variable is intended to represent expected processor profitability. The index of processing costs (IPC) negatively affects processor expectations of profitability. IPC proved to be a strong explanatory variable for canned pack, but a very weak one for frozen pack, and with a theoretically unexpected sign (positive). IPC was thus excluded from the estimated frozen pack relationship. Finally, existing levels of stocks were expected to negatively influence quantities that processors will pack. This coefficients were in fact negative, although the relationship was rather weak for canned stocks and canned pack. The coefficient for frozen stocks had a theoretically unexpected positive sign, but the coefficient was not statistically significant different from zero. Since frozen stocks are likely to have an impact on the quantity packed, this variable was retained in the estimated equation, despite the lack of statisitical significance of the coefficient.

Frozen and canned stocks. Table 19 presents the estimated equations for modeling private stockholding behavior. Tart cherry industry observers note that most carryover stocks are not anticipated. Processors generally do not plan to carry stocks into the next year, except a small minimum needed to keep the marketing channels full until the new packing season is underway. Processors are often forced to carry stocks into the next year because of their inability to sell all of the processed supplies in a large crop year. The estimated relationships described below nevertheless capture in part some key influences on the levels of stocks.

The quantity of frozen tart cherries held as stocks at the end of a given marketing year is hypothesized to depend on the previous year's frozen stocks (SF_{t-1}) and the current year's frozen pack (QFU_t). The addition of a variable for the square of the quantity packed frozen (QFUSQ) improved the predictive power of equation #3 in Table 19. The inclusion of a squared term as an independent variable results in nonlinear variation in the dependent variable. Since stocks tend to be small relative to production, yet vary significantly from year to year, the nonlinearity of the equation provides a better estimate of year-to-year changes in stocks than would be the case without inclusion of the squared term. Similar reasoning is applied for the inclusion of squared canned pack (QCUSQ) in equation #2. Frozen cherries are considered to be the "barometer pack"; therefore frozen pack is hypothesized to affect canned pack and is included as an independent variable in the canned stock equation, but not vice versa.

A higher level of frozen pack was expected to have a negative impact on the quantity of frozen cherries stored over the range of pack levels generally observed in the 25-year period studied in this analysis. Higher levels of pack meant greater quantities sold. With the coefficients on QFU and QFUSQ in equation #3, the expected negative impact of

Table 19. Canned Carryin Stocks and Frozen Carryin Stocks Estimated by OLS

Variable	Variable Label	Dependent Variable[1]			
		Canned stocks		Frozen stocks	
		SC (Eq. # 2)		SF (Eq. # 3)	
	Constant	-2.1021	(-0.88)	44.39	(1.63)
Canned stocks	SC(T-1)	-.2957	(-2.31)		
Frozen stocks	SF(T-1)			.4041	(4.10)
Canned pack	QCU	-.0212	(-0.35)		
Canned pack squared	QCUSQ	.0004	(1.13)		
Frozen pack	QFU	.0309	(1.84)	-.8056	(-2.09)
Frozen pack squared	QFUSQ			.0042	(3.28)
	R^2 = Adj. R^2 =	.756 .692		.875 .850	

[1]T-statistics appear in parentheses beside each coefficient.

frozen pack on frozen stocks holds true, at least for small and moderate crop years. The coefficient of QFU in equation #3 (Table 19) is negative and this linear term dominates the squared term (QFUSQ) in most years, indicating that the relationship between pack levels and stocks is generally negative. However, in large crop years, processors had both large quantities packed and large quantities stored, so with the coefficients on QFU and QFUSQ, the relationship between frozen pack and frozen stocks is positive in large crop years. Thus, at higher pack levels (annual quantities approaching 200 million pounds of frozen pack), the squared term dominates, and the relationship between pack size and stocks becomes positive.

Frozen and canned seasonal supply. Seasonal frozen supply (QSF) and canned supply (QSC) are identified in the model by the sum of pack plus carryin stocks. Domestic frozen supply (QSFI) is identified as the remainder from subtracting frozen tart cherry exports (EF) from seasonal frozen supply. Domestic canned supply (QSCI) is identified in an analogous manner.

6.1.1.3. U.S. Domestic Demand and Market Allocation

This section presents a five-equation simultaneous demand system for frozen, canned and raw tart cherries. Given the values of predetermined variables, the equation system jointly solved for values of the f.o.b. prices for frozen and canned cherries as well as frozen and canned movement and grower price. The five equation demand system was estimated as a simultaneous system by three stage least squares. Reduced form parameters of the demand system were used for predicting values of the independent variables. Forecasting in the full dynamic model is described below. This section explains the five equations in the demand system.

Equations #6 and #7 in Table 20 represent canned and frozen U.S. domestic demand. The dependent variables are f.o.b. handler prices for tart cherries. Canned price is hypothesized to depend on frozen and canned consumption (domestic movement) and income. Income is exogenous, but frozen consumption is an endogenous variable that is determined simultaneously with frozen price in this demand system. Since frozen cherries are the "barometer pack", frozen movement is hypothesized to affect canned f.o.b. price, but not vice versa. Thus frozen domestic movement (DFD) appears in the equation for canned f.o.b. demand.

A structural downward change in canned f.o.b. demand appears to have taken place around 1976. Short crops and high prices began to appear in the late 1970s. Canned demand was already on a downward slide, but with the relative unavailability of tart cherries, processors cut back still further on the canned pack. Although supplies subsequently became more plentiful, canned demand never recovered to previous levels. Inclusion of the time shift dummy variable T7601 in the canned demand equation represents this shift in demand.

Table 20. Three Stage Least Squares Estimates of the U.S. Demand and Market Allocation System for Tart Cherries

	Explanatory Variables	Dependent Variable				
		LPPCC (Eq.#6)	LPPFC (Eq. #7)	LDCD (Eq.#8)	LDFD (Eq. #9)	LPGP Eq.#10
	Constant	4.7391 (5.22)	8.3981 (7.34)	-.2670 (-0.58)	2.2070 (6.08)	10.5201 (6.42)
Canned movement	LDCD	-.1158 (-1.23)				-.1100 (-.74)
Frozen movement	LDFD	-.9138 (-3.64)	-1.7268 (-7.97)			-1.9953 (-4.50)
Disposable income	LID	.5210 (5.74)	.4923 (7.72)			.3375 (2.21)
Dummy variable	T7601	.1414 (1.59)				
Domestic can. supply	LQSCI			1.0446 (15.08)		
Domestic frz. supply	LQSFI				.5806 (9.77)	
Can. price change	LRPPCC[1]			.1586 (2.68)		
Frz. price change	LRPPFC[2]				.0305 (0.99)	
Grower price	LPGPU			-.0002 (-0.003)	-.0965 (-3.42)	
	R^2 =	.903	.818	.987	.915	.723
	Adj. R^2 =	.883	.801	.985	.903	.683
	D.W.	1.66	1.55	2.10	1.57	2.16

[1]LRPPCC = LPPCC(T) - LPPCC(T-1)
[2]LRPPFC = LPPFC(T) - LPPFC(T-1)

Farm level demand (Eq. #10) is hypothesized to behave in a similar manner to f.o.b. demand. The independent variables in the farm level demand equation are frozen movement, canned movement, and income. The reduced form of this equation (not shown) is used to predict grower price in the dynamic model. Industry observers indicate that processors tend to pay growers whatever is left over after receiving f.o.b. prices and subtracting their margins. This would suggest that the index of processing costs (IPC) should be included in the grower price equation to represent the processor marketing margin. However, when the equation was estimated including IPC, the coefficient was not statistically significant. Therefore the IPC variable was not included.

Thus in reality grower prices are residual prices. However, since all data are annual in this model, grower price is assumed to be determined simultaneously with frozen and canned movement and f.o.b. prices.

Completing the five-equation demand system are market allocation equations #8 and #9. In equation #9, frozen domestic movement (DFD) is hypothesized to depend on (a) domestic seasonal supply (QSFI), (b) current and lagged frozen prices, and (c) raw product prices, which are the prices paid to growers. The market allocation equation included as an independent variable the difference between the current f.o.b. price and f.o.b. price lagged one year, expressed in log form (LRPPFC), rather than including current and lagged f.o.b. prices as two or more independent variables. The hypothesis is that frozen consumption (domestic movement) is determined in part by the price <u>change</u> between the past year and the current year rather than the absolute levels of prices. Handler decision-making regarding quantities of frozen and canned cherries are hypothesized to be influenced by these year-to-year price changes. If the frozen and canned prices increase from one year to the next, for example, handlers are expected to increase the allocation to frozen and canned cherries and to reduce the allocation to other cherry products, based in part on the magnitude of the price change. French and Willett used as a similar approach in their demand model for U.S. asparagus.[90] The market allocation equation for determining canned cherry consumption was specified in an analogous manner.

In the simulation model, operation of the marketing order is represented by adding and subtracting quantities of cherries from the domestic supply to represent the storage or diversion of cherries in certain large-crop years, and the release of cherries in subsequent years. The fact that there were only five observations for reserve pool operation precluded the possibility of developing an equation to model reserve pool operation explicitly.

6.1.1.4. The Full Model and Solution Process

This section presents the full model, which links all ten econometrically estimated equations and the identities. The model carries out dynamic sequential predictions of the endogenous variables. Below is an overview of how the blocks fit together to carry out the sequential computations.

6.1.1.4.1. Overview of Tart Cherry Econometric Model

BLOCK I. BEARING ACREAGE AND PRODUCTION
[Supply response in terms of bearing acreage is based on a moving average of lagged prices, (T-6) through (T-12). Yield is exogenous, and acreage times yield equals production.]

BLOCK II. CARRYIN, PACK, SEASONAL SUPPLY, AND RESERVE POOL IMPLEMENTATION
[In those years in which the reserve pool is implemented, less than 100% of seasonal supply is marketed. The portion of the supply that is declared reserve is stored as frozen cherries. The reserve cherries are released to the market in subsequent years or are diverted to outlets that do not compete with the primary market. The quantity of frozen cherries that is set aside in the reserve pool (RPSA) and the quantity released in subsequent years (RPR) are exogenous variables.)

BLOCK III. U.S. DOMESTIC DEMAND AND MARKET ALLOCATION
[Allocation of seasonal supply to frozen and canned markets and estimation of domestic movement (consumption) in both markets. Estimation of grower prices and handler (f.o.b.) prices for frozen and canned cherries via reduced form equations from three stage least squares simultaneous solution].

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[90]French and Willett, "An Econometric Model of the U.S. Asparagus Industry," 19-20.

BLOCK IV. TOTAL SHIPMENTS BY CANNERS AND FREEZERS
[Estimation of canned and frozen shipments, which are the sum of domestic movement (consumption) plus exports.]

6.1.1.4.2. Model Structure Showing Equations and Solution Process

One loop of the model (Step A through Step R) calculates values for each variable for one year. A DO LOOP restarts the calculations for each succeeding year. The numbered equations are the econometrically estimated equations presented above. The coefficients are represented by the letter a_i. The remainder are computations (identities) based on the estimated variables. Verbal descriptions appear above the variable names for most equations.

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DO T = 1965 TO 1989

BLOCK I. BEARING ACREAGE AND PRODUCTION

A. Compute 7-year moving average of lagged grower prices =

PGPUAV7 = (PGPU(T-6) + PGPU(T-7) + PGPU(T-8) + PGPU(T-9) + PGPU(T-10) + (PGPU(T-11) + PGPU(T-12)) ÷ 7

B. Bearing = acreage	con- stant	+ a_1 lagged bearing acreage	+ a_2 average lagged price	+ a_3 dummy variable (O before 1976, 1 thereafter)
(#1) AU =	con- stant	+ a_1 AU(T-1)	+ a_2 PGPUAV7	+ a_3 T7601

C. Production =	bearing acreage X	yield
QGU =	AU X	YU

BLOCK II. CARRYIN, PACK, SEASONAL SUPPLY, AND RESERVE POOL IMPLEMENTATION

D. Canned carryin = stocks	con- stant +	a_1 lagged canned stocks +	a_2 lagged canned pack +	a_3 lagged canned pack squared +	a_4 lagged frozen pack
(#2) SC =	con- stant +	a_1 SC(T-2) +	a_2 QCU(T-1) +	a_3 QCUSQ(T-1) +	a_3 QFU(T-1)

E. Frozen carryin = stocks	constant +	lagged a_1 frozen stocks +	lagged a_2 frozen pack +	lagged frozen a_3 pack squared
(#3) SF =	constant +	a_1 SF(T-2) +	a_3QFU(T-1) +	a_3 QFUSQ(T-1)

F. Canned pack =	con-stant +	pro- a_1 duc-+ tion	lagged a_2 canned + pack	canned a_3 stocks +	lagged a_4 canned + price	proc. a_5 cost index
(#4)LQCU =	con-stant +	a^2LQGU +	a_2LDC(T-1) +	a_3 LSC +	a_4LPPCC (T-1) +	a_5LIPC

G. Frozen pack =	con-stant +	pro- a_1 duc-+ tion	lagged a_2 frozen + pack	frozen a_3 stocks +	lagged a_4 frozen price
(#4)LQFU =	con-stant +	a_1 LQGU +	a_2LDC(T-1) +	a_3 LSF +	a_4 LPPFC (T-1)

H. Canned seasonal supply =	canned pack +	canned carryin stocks
QSC =	QCU +	SC

I. Canned seasonal supply =	canned pack +	canned carryin stocks
QSC =	QCU +	SC

J.Frozen seasonal = supply	frozen pack +	frozen carryin- stocks	reserve pool + set aside	reserve pool _ release	secondary market - diversion	quantity non- harvested
QSF =	QFU +	SF -	RPSA +	RPR -	SMD -	QNHD

K. Frozen domestic supply =	frozen seasonal supply +	frozen exports
QSFI =	QSF +	EF

BLOCK III. U.S. DOMESTIC DEMAND AND MARKET ALLOCATION
(The following 5 structural equations make up a simultaneous system estimated by 3SLS. The sequential forecasts are made using reduced form equations)

L. Canned f.o.b. = price	con-stant +	canned a_1 domestic + consump-tion	frozen a_2 domestic + consump-tion	disposable a_3 personal + income	dummy a_4 variable
(#6)LPPCC =	con-stant +	a_1 LDCD +	a_2 LDFD +	a_3 LID +	a_4 T7601

M. Frozen f.o.b. price =	constant +	a_1 frozen domestic consumption +	a_2 disposable personal income	
(#7)LPPFC=	constant +	a_1 LDFD +	a_2 LID	

N. Canned domestic consumption =	constant +	a_1 canned domestic supply +	a_2 canned f.o.b. price change +	a_3 grower price
(#8)LDCD =	constant +	a_1 LQSCI +	a_2 LRPPCC +	a_2 LPGPU

O. Frozen domestic consumption =	con- stant +	a_1 frozen domestic supply +	a_2 frozen f.o.b. price change +	a_3 grower price
(#9) LDFD =	con- stant +	a_1LQSFI +	a_2LRPPCC +	a_3LPGPU

P. Grower price =	constant +	a_1 frozen domestic consumption +	a_2 personal income
(#10) LPGPU =	constant +	a_1LDFD +	a_2LID

BLOCK IV. TOTAL SHIPMENTS BY CANNERS AND FREEZERS

Q. Canned shipments =	canned domestic consumption +	canned exports
DC =	DCD +	EC
R. Frozen shipments =	frozen domestic consumption +	frozen exports
DF =	DFD +	EF

END DO T

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6.1.1.6. Model Performance

Two key aspects in evaluating the strengths and weaknesses of the results are to examine (a) the individual equations and estimated coefficients and (b) the predictive ability of the dynamic model as a whole. The adjusted R-squareds of the equations range from .90 and above to as low as .68. Most coefficients in the ten equations have theoretically expected signs, and many of them are large relative to their standard errors. However, some coefficients appear to have weak explanatory power (as evidenced by insignificant t-statistics) and a few have theoretically unexpected signs. Some variables were retained in the model to demonstrate that certain variables were considered during model development. Even though signs and/or levels of significance could in some instances be cause to exclude specific variables, certain independent variables were retained in those cases where inclusion of the variables was justified either from economic theory or from knowledge of how the commodity industry actually works.

A second key aspect of model performance is the predictive ability of the dynamic model as a whole. A within-sample forecast over the period 1965-1990 yields the results shown in Table 21. The average prediction error is 5% for total production, and around 7% for frozen consumption.

Table 21. Goodness-of-fit Measures of Dynamic Sequential Predictions of Key Endogenous Variables, 1965-1990

	Mean of variable (M)	Root Mean Square Error (RMSE)	Mean Absolute Error (MAE)	Mean Absolute Percentage Error (MAPE)
Bearing acres, thou. (AU)	50.3	2.8	2.5	4.9
Total production, mill. lbs. (QGU)	243.7	13.4	11.8	4.9
Canned pack, mill. lbs.(QCU)	35.2	7.7	5.7	18.4
Frozen pack, mill. lbs. (QFU)	144.9	18.4	13.4	8.8
Frozen stocks, mill. lbs. (SF)	35.8	13.2	9.0	35.1
Froz. seas. supp., mill. lbs. (QSF)	175.9	18.8	14.3	8.2
Canned movement,mill. lbs. (DCD)	26.6	7.7	5.3	21.5
Frozen movement,mill. lbs. (DFD)	137.9	11.7	9.4	6.9
Canned f.o.b. price (PPCC)	48.7	9.4	7.0	14.7
Frozen f.o.b. price (PPFC)	36.7	9.7	6.9	17.8
Grower price (PGPU)	20.9	8.0	5.7	27.6

The grower price and frozen cherry price are two of the key results from the analysis. The mean absolute error of the grower price from the baseline simulation was nearly six cents, which corresponded to a mean absolute percentage error of 28%. Grower price point estimates can therefore be considered to fall within a range of prices varying on either side of the price estimate by six cents (±6¢ or ±28%). Similarly, the range of possible error for frozen f.o.b. prices is approximately ±7¢ (±18%). These are large mean errors for key variables. Alternative specifications did not improve model performance, so the equations specified herein were used for the analysis. The model was judged to have sufficient explanatory power to be useful for historical simulation of marketing order impacts. However, because of the size of the mean errors, the simulation results should be viewed with caution.

6.1.2. Simulated Alternative Scenario: Non-implementation of Federal Marketing Order

The model carries out dynamic sequential predictions of handler and grower prices as well as quantities produced and sold by processors over the period 1965-1989. Price impacts of the tart cherry marketing order are measured by comparing actual historical prices to prices estimated in an alternative scenario in which the market order was assumed not to be implemented.

6.1.2.1. Method of Analysis

Two exogenous variables in the model represented the quantities of frozen cherries in reserve pool set-aside (RPSA) and reserve pool release (RPR). The latter variable is included to account for the fact that since a portion of the reserve pool is released within the same marketing year and the model uses annual data, using the full amount of the original reserve pool tonnage (RPSA) in estimating the price impact might overstate the amount actually removed and over-estimate the price impact. Additional variables that represent the quantities involved in marketing order supply management are secondary market diversion (SMD) and non-harvest diversion (QNHD). In the base run, RPSA and RPR were set equal to their actual values; see Step J. in Block II. of the model above in the section entitled "Model Structure Showing Equations and Solution Process." In the scenarios representing marketing order non-implementation, RPSA, RPR, SMD and QNHD were set equal to zero, resulting in a higher seasonal supply of cherries in the alternative scenario compared to the base run for those years in which the marketing order was used. The increased supply of cherries (relative to historical levels) in the "no reserve" scenario was hypothesized to result in lower simulated grower and handler prices than actually occurred with the use of the supply management provisions of the marketing order.

The previous chapter explained that the three main supply management provisions of the tart cherry marketing order were: (1) the reserve pool, (2) secondary market diversion (market allocation) and (3) non-harvest diversion. The bottom three rows of Table 22 indicate the tonnage in each of those three categories in each of the five years that the supply management provisions were used from 1972 to 1985. The sum of the tonnage in all of the restricted supply management categories appears in the row entitled "Sum of Marketing Order Uses." The model simulated the price impact of removing those quantities from the market in each of the five years that the marketing order supply management provisions were implemented.

The upper rows of Table 22 present the calculations that show how the total restricted tonnage figure was determined by the Cherry Administrative Board. The "New Crop for Processing" quantity was determined by subtracting from Total Production the quantities of cherries involved in Fresh Utilization and Non-market Order Abandonment (representing the amount of abandonment that took place that was not accounted for as part of non-harvest diversion under the marketing order). The next step was to calculate the percent of total U.S. tonnage that was covered under the marketing order's geographic

Table 22. Determination and Uses of Restricted Tonnage Under Tart Cherry Marketing Order

	1972	1975	1980	1984	1985
Total Production	311.7	290.5	218.1	271.6	286.2
- Fresh Utilization	7.0	7.2	6.3	8.0	7.6
- Non-market Order Abandonment	19.8	39.4	1.9	13.6	6.0
= New Crop for Processing	284.9	243.9	209.9	250.0	272.6
X Restricted Percentage	15%	15%	24%	15%	7%
= Restricted Tonnage Estimate	42.7	36.6	50.4	37.5	19.1
X Percentage of Production in Controlled Area	96.3	94.0	90.8	94.8	89.8
= Restricted Tonnage in Controlled Area	41.1	34.4	45.8	35.6	17.2
Sum of Marketing Order Uses =	41.1	32.0	44.4	34.4	16.5
Reserve Pool	19.1	27.0	42.5	31.6	12.5
+ Secondary Market Diversion	0	0	0	1.8	3.4
+ Non-harvest Diversion	22.0	5.0	1.9	1.0	0.6

boundaries. Four states in the Great Lakes region were included in the marketing order (Michigan, New York, Pennsylvania, and Wisconsin), but several western cherry-producing western states were excluded from the marketing order. The ratio of production in the regulated states to unregulated states is the Percentage of Production in the Controlled Area. These percentages must be multiplied by the New Crop for Processing figure to determine the regulated portion of the crop.

The Restricted Percentage is the key supply management decision made by the Cherry Administrative Board, based on their judgment on how much the estimated crop was likely to exceed the quantity that could be sold in the main commercial channels at prices approximating prices obtained in recent years with moderate crop sizes (neither short nor

Table 23. Tart Cherry Marketing Order Simulation: Quantities of Cherries Stored and Released

Year	Reserve Pool Tonnage RPSA	Actual M.O. Release	M.O. Release Figure Used RPR	Secondary Market Diversion SMD	Non-Harvest Diversion QNHD	Net Change in Supply due to M.O. in Simulation
	Millions of Pounds					
1972[2]	-19.1	+14.3	+4.3	0	-22.0	-36.8
1973[3]		+4.8	+4.8			+4.8
1974						0
1975[4]	-27.0	+27.0	+13.0	0	-5.0	-19.0
1976-1979						0
1980[5]	-42.6	+16.7	+5.7	0	-1.9	-38.8
1981[6]		+4.3	+1.8			+1.8
1982						0
1983						0
1984[7]	-31.6[7]	+8.3	+6.6	-1.8	-1.0	-28.6
1985[8]	-12.5			-3.4	-0.6	-16.5

[1]RPE = Raw Product Equivalent
[2]Spring 1973 release of 14.3 million pounds is considered to have an impact equal to one third of actual tonnage released (RPR=4.3)
[3]Fall 1973 release of 4.8 has price impact in 1973-74 crop year.
[4]Fall 1975 release of 6.0 reduces price impact of reserve, but spring 1976 release of 21.0 is considered to have an impact equal to one third of actual tonnage released, 7.0 mil. lbs. (RPR=6.0+7.0=13.0). Thus net removals are 19.0 (-27+13-5=-19.0)
[5]Fall 1980 release is 0.1. Spring 1981 release of 16.7 is considered to have an impact equal to one third of actual tonnage released, 5.6 mil. lbs. Therefore RPR=0.1+5.6=5.7.
[6]Fall 1981 release equals 0.6 out of a total of 4.3; the remainder to release in Spring 1982 equals 4.3-0.6=3.7 mil. lbs. (the remainder of the reserve was diverted to secondary markets). The spring 1982 release of 3.7 is judged to have an impact equal to one third of actual tonnage released (1.2 million pounds). Therefore RPR=1.8=0.6+1.8.
[7]Fall 1984 release of 5.8 reduces impact of 1984 reserve, but spring 1985 release of 2.5 has an impact equal to one third of the actual tonnage released (0.8 million pounds; therefore the release figure equals 5.8+0.8=6.6). Net M.O. removals in 1984 = -27.6 = -31.6 (reserve pool) + 6.6 (release) - 1.8 (secondary market)-1.0 (nonharvest diversion).
[8]Net M.O. removals in 1985 = -16.5 = -12.5 (reserve pool) - 3.4 (sec. market diversion) - 0.6 (non-harvest diversion).

excessively large). The final step is to multiply the Restricted Percentage by the result of the previous calculation to yield the Restricted Tonnage in the Controlled Area. The Restricted Tonnage should exactly equal the Sum of Marketing Order Restricted Uses. However, there are some discrepancies due to some difficulties in estimating the amounts used for marketing order diversion.

Table 23 takes the figures on marketing order uses (the bottom three rows from Table 22) and shows how those figures are actually used in the simulation. In each of the five years of marketing order implementation, the tonnage figures in Table 23 for the reserve pool (RPSA), secondary market diversion (SMD) and non-harvest diversion (QNHD) are the same as in Table 22. The second column of Table 23 shows the actual amount of reserve pool releases, some of which took place later in the same year in which the reserve pool was established, and some of which took place the following year; these release decisions were made by the Cherry Administrative Board.

One of the major purposes of the model was to measure the price impact from removing quantities from the market and subsequently releasing quantities that were stored in the reserve pool. Thus an important issue was to account correctly for releases from the reserve pool and to ensure that the impact of a given release was estimated in as realistic a manner as possible. A key challenge was to account for the phenomenon observed by CAB members and others in the industry that releases made in the spring following establishment of a reserve pool had a considerably smaller price impact than a release made in the fall, shortly after a reserve pool was established. The reason for this can be explained by comparing buyer attitudes in the fall and in the spring. In the fall of a year with a large crop, one of the chief risk-related factors is that manufacturer-buyers want to avoid purchasing quantities of cherries at higher prices than do their competitors and processor-sellers do not want to end up holding large inventories. Large supplies in large-crop years therefore have generally had a price-depressing effect since buyers observe the large quantities for sale and tend to bid prices downward during the first several months of the season. In contrast, in the spring of a given year, most of the crop from the previous fall has generally been sold. Since manufacturers and other buyers have filled most of their needs, their risk perceptions are different. An equivalent amount of cherries has less of a price-depressing impact with a spring release than a fall release from the reserve pool. The impact in economic terms is that cherry prices become less flexible in the spring (demand becomes more price-elastic).

The question thus arose in the course of this research as to how to model this phenomenon. The shift in price flexibilities (approximately the inverse of the price elasticity of demand), suggested that the coefficients in the demand equations should be altered to reflect the change. However, making such alterations in the coefficients was beyond the scope of this research. The decision was therefore made to approximate the reduced price impact of spring reserve pool releases by reducing the quantities of cherries released in the simulation runs. Since industry observers indicated that price impacts were generally about a third of what would be expected with fall pool releases, the magnitude of spring releases in the simulation was set equal to one third of the actual size of the releases. Taking this into account, the third column of Table 23 shows the figure actually used to represent pool releases in the simulation and the footnotes at the bottom explain the means by which the alternate release figures were arrived at. The final column presents the sum of all the previous columns; the Net Change in Supply is the change in the quantity of cherries used in the simulation to represent marketing order storage and release decisions.

Following the analytical method applied by French in his analysis of the raisin marketing order, the estimated disturbances of the econometrically estimated equations enter the equations as exogenous variables in the simulation runs.[91] Using this approach assumes that the unexplained variation in the dependent variables would be the same with or without supply management through the marketing order.

6.1.2.2. Tart Cherry Model Results

Model results are first presented for the "no marketing order" scenario for the five large crop years in which the marketing order was used, using the figures from the last column of Table 23. The subsequent section examines estimated impacts in other years in which the supply management provisions could have been used.

6.1.2.2.1. Estimated Marketing Order Supply Restriction Impacts for the Five Years of Implementation

Table 24 presents the simulation results that address the question, "What if the marketing order supply management provisions had not been used in 1972, 1975, 1980, 1984 or 1985?" The first column presents the tonnages from the last column of Table 23 -- quantities that were removed from the market (or subsequently released to the market after being stored in the reserve pool) through use of the three main supply management provisions, the reserve pool, market allocation, and non-harvest diversion (e.g., the net change in supply is 28.6 million pounds in 1984). The other three columns present the estimated f.o.b. and grower price impacts from those supply management actions. For example, removing the 28.6 million pounds from the primary market in 1984 had a grower

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[91]"To take account of the random fluctuations in supply and demand which motivated the establishment of the reserve pool program, the estimated disturbances of the stochastic equations and actual yield variations are retained as exogenous variables in the various simulation runs" (p.582)...."The estimated disturbances of the stochastic equations are entered as exogenous variables and remain the same with and without volume control in effect...Thus, the sequential solution of the historical model (volume control in effect) generates exact predictions of the endogenous variables with which to compare predictions of the no-volume-control scenarios. (p. 587). French and Nuckton, Econometric Model of the California Raisin Industry, 1991.

price impact of plus five cents. In other words, results from the simulation indicate that grower price would have been twenty cents without the marketing order instead of the actual twenty-five cents.

There are also estimated grower price impacts in years in which there was no storage or release through the marketing order; zeroes appear opposite those years in column 1 of Table 24. Price changes in those years are due to estimated changes in private stocks that

Table 24. Simulated Impact of Tart Cherry Marketing Order: Estimated Changes in Frozen f.o.b. and Grower Prices in Response to Quantities Stored and Released

Year	Net Change in Supply due to M.O. in Simulation[1]	Frozen f.o.b. price impact (frz. wt.)	Grower price impact	Price Change as a Percentage of Actual Grower Price
	mill. lbs.	cents per lb.		%
1972	-36.8	+2.5	+1.3	+15.8
1973	+4.8	-4.9	-3.0	-15.8
1974	0	+0.4	+1.2	+6.6
1975	-19.0	+2.8	+1.6	+15.6
1976	0	+0.7	+0.5	+1.9
1977	0	+0.3	+0.6	+2.0
1978	0	+0.7	+0.2	+0.6
1979	0	+0.2	+0.4	+0.8
1980	-38.8	+11.6	+6.4	+31.7
1981	+1.8	-3.1	-3.3	-7.4
1982	0	+0.9	+0.4	+2.8
1983	0	-1.5	-1.1	-2.5
1984	-28.6	+8.3	+4.9	+19.7
1985	-16.5	+2.7	+1.1	+7.3

[1]From last column of Table 23.

affect the total amount of supply on the market. For example, the estimated 1¢ decline in simulated grower price in 1983 relative to actual grower price was due to slightly higher overall supplies from higher private stocks in the "no marketing order" simulation.

As mentioned previously, these simulation results are indicative of price impacts but should be viewed with caution. The baseline runs indicated average estimation errors of six cents (28% of grower price), and the simulated price impacts are mostly small enough to fall within that range. Only the estimated grower price impact of 6.4 cents (32% change from actual grower price) is large enough to be outside the confidence interval, if only by a small amount. The estimates of price changes thus provide a preliminary indication of marketing order price impacts, but further research is warranted to reduce the size of the estimation error so that greater confidence can be placed in the estimated price impacts.

These estimated impacts of price and grower net revenue are shown graphically in Figure 40 and Figure 41 with the heavy solid lines representing actual prices and returns and the narrow line with symbols representing simulated prices and returns. Considering the whole period in which the federal marketing order was in effect (in which the supply management provisions were used five times), the price impact is moderate, with an estimated mean increase of less than one cent in terms of price or net return. Simulation results indicate that overall variability (measured by standard deviation in cents per pound) was slightly smaller with the marketing order (a standard deviation of 12.7¢ versus 13.8¢ per pound in terms of price and 8.3¢ versus 9.1¢ in terms of net revenue. Table 25 also shows that in each of the five years in which supply management provisions were used, growers still did not obtain average net returns higher than zero. The impact of the order was to improve net returns somewhat, but not to yield prices higher than average total costs. Figure 7 in Chapter 2 showed that prices were below total cost of production in each of the five years of marketing order implementation.

Figure 40. Comparison of Tart Cherry Grower Prices With and Without the Federal Marketing Order, 1972-1986, Based on Econometric Simulation

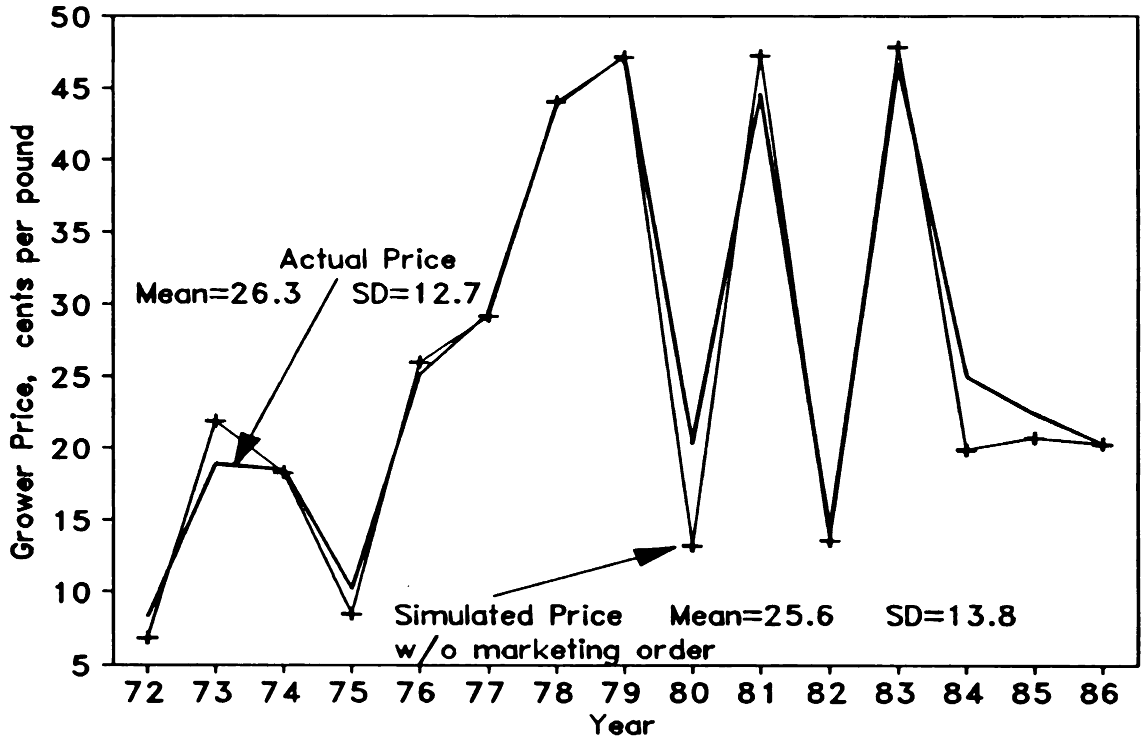
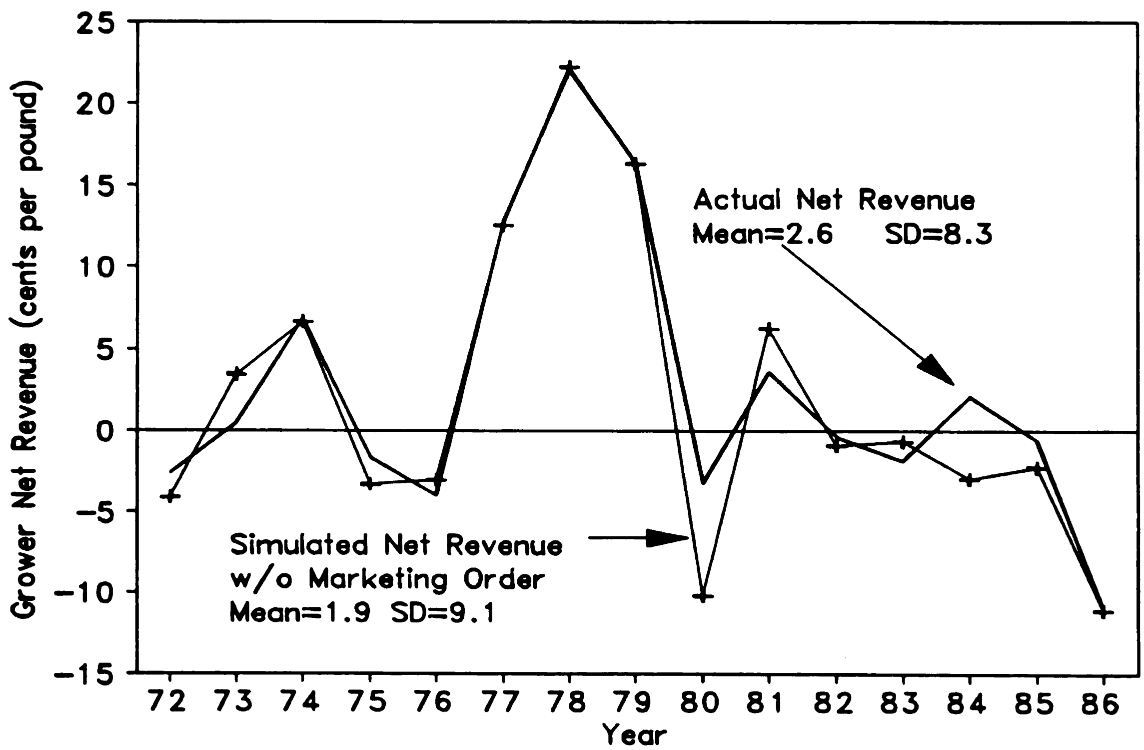


Figure 41. Comparison of Grower Net Return With and Without Tart Cherry Federal Marketing Order, 1972-1986, Based on Econometric Simulation



However, since the supply management provisions were used just five times in 15 years, it is more useful to examine impacts in terms of specific years than for the entire period. The simulation indicates that the largest price impacts occurred in 1980 and 1984. The simulation model results suggest that had the marketing order not been implemented in 1980, the f.o.b. price change for frozen cherries and canned cherries (not shown) would have been 12¢(frozen weight) and 10¢(expressed in RPE), respectively. These price differences were 28% and 16% of actual prices in 1980, respectively. Grower prices for raw processing cherries in 1980 would have been lower without the use of the marketing order by an estimated 6¢, which represents a 32% decrease from the actual 20¢ grower price.

Change in total grower revenue is another important factor to consider in examining marketing order impacts. Table 25 shows the estimated net change in revenue from using the supply management provisions. The second to the last column shows the net change in grower revenue implied by the changes in prices and quantities sold for frozen and canned cherries in the "no marketing order" scenario in the simulation. Since frozen and canned cherries represented on average about two thirds of all cherries sold (utilized production) in the period 1972-1986, the revenue figures were adjusted upward to approximate the changes in total revenue that growers would have received from the sale of all cherry products. The figures in the last column were computed by dividing the previous column (revenue from sales of frozen and canned cherries) by the percentage of total utilized production each year represented by U.S. sales of frozen and carried cherries.

The estimated total revenue effect from the simulation of removing tart cherries from the primary market either by reserve pool or secondary market diversion varies from a low of $700,000 in 1975 to a high of $8.2 million in 1980. Since releasing reserve pools into the primary market in years following establishment of reserve pools (and changes in private stocks and sales) generally have an opposite revenue impact from reserve pool storage, looking at pairs of years in terms of net revenue change is also useful. The

Table 25. Grower Revenue and Net Change in Revenue With and Without Tart Cherry Federal Marketing Order, Based on Simulation Model

	With Marketing Order				Without Marketing Order		Net Change	
Year	U.S. Sales of Frozen and Canned Cherries[1] (mil.lbs.)	Grower Price (cents per lb.)	Grower Revenue from Sales of Frozen and Canned Cherries (mil. $)	Net Change in Supply Due to M.O. Operations in Simulation[2] (mil.lbs.)	Grower Price (cents per lb.)	Grower Revenue from Sales of Frozen and Canned Cherries (mil. $)	Net Change in Grower Revenue (mil. $)	Net Change in Grower Revenue (adjusted for utilized production)[3]
1972	213.3	8.2	17.5	-36.8	6.9	16.0	+1.5	+1.8
1973	128.9	18.9	24.4	+4.8	21.9	26.5	-2.1	-2.8
1974	163.4	18.5	30.2	0	17.3	32.3	-2.1	-3.4
1975	159.1	10.2	16.2	-19.0	8.6	15.8	+0.5	+0.7
1976	108.8	25.1	27.3	0	24.6	27.2	+0.1	+0.2
1977	150.6	29.4	44.3	0	28.8	44.1	+0.2	+0.3
1978	135.2	43.8	59.2	0	43.6	59.3	-0.1	-0.2
1979	118.7	47.2	56	0	46.8	55.8	+0.2	+0.3
1980	118.5	20.2	23.9	-38.8	13.8	19.4	+4.5	+8.2
1981	96.5	44.5	42.9	+1.8	47.8	44.6	-1.7	-2.3
1982	164	14.1	23.1	0	13.7	22.7	+0.4	+0.6
1983	119.6	46.6	55.7	0	47.7	56.4	-0.7	-0.9
1984	119.7	25.0	29.9	-28.6	20.1	26.6	+3.4	+7.2
1985	164.7	22.4	36.9	-16.5	20.8	35.4	+1.5	+2.6
1986	181.6	20.3	36.9	0	20.2	36.7	+0.2	0.2

[1]Sales of frozen and canned cherries were chosen as the basis for comparing changes in grower revenue from marketing order implementation, since changes in total utilized farm production were not estimated in the model simulation.

[2]A negative sign indicates the net quantity removed from the primary markets through use of the federal marketing order. A positive sign indicates quantities released into the primary markets from reserve pool in the year following the establishment of the reserve pool.

[3]These figures are an approximation of what total revenue changes based on the value of utilized production. They were computed by dividing the previous column by the percentage of total utilized production represented by U.S. sales of frozen and canned cherries. Frozen and canned sales (shown in the first column) are on average approximately 68% of utilized production, ranging from 47% to 83%.

estimated marketing order revenue impact of $8.2 million in 1980 is partially offset by an estimated $2.3 million decrease in total revenue in 1981 compared to the situation that would have occurred without using supply management provisions of the marketing order.

6.1.2.2.2. Impact of Using the Tart Cherry Marketing Order in Other Large Crop Years

Several other years in the 1980s were potential candidates for supply management actions to mitigate the price-depressing consequences of large crops. Therefore another part of the research involved asking what would have been the price impact had the marketing order been used in those other large crop years of 1982, 1987, and 1989. The reasons for selecting those three years were described above and are briefly restated here. A very large crop and very low price in 1982 were followed by a very short crop and very high prices in 1983. This provided a nearly ideal set of circumstances for using the reserve pool. Although the order was terminated in 1986, it is also worth investigating the potential impact of using the marketing order in 1987 and 1989 had it continued to be a supply management tool available to tart cherry subsector participants. In those two years, supplies were in surplus and were large enough to have had a substantial price-depressing effect which use of the marketing order could have alleviated to a certain extent had the marketing order been available.

Table 26 presents hypothetical quantities in a manner analogous to the actual figures in Table 22. Total Production and Fresh Utilization in Table 26 are actual figures, and the Percentage of Production in Controlled Area represents the actual proportion of production in the states that were regulated by the marketing order prior to 1986. Computation of the remaining figures in Table 26 required some judgment as to what might have happened had the order been in effect. For example, an additional factor in these scenarios is the likelihood of reduced production abandonment if the marketing order had been used. With somewhat higher prices, growers would likely have been induced to harvest a larger proportion of their crops. Also, industry observers have noted that high processed prices and processor margins have tended to reduce processor perceptions of risk. The reduced perceived risk has encouraged processors to pack larger quantities of tart cherries. Adjustments in supply were therefore included in the simulation to provide a more realistic picture in terms of actual supply changes.

The likely reduction in production abandonment that would occur if the marketing order had been used was accounted for by reducing non-marketing order abandonment by 50% (1982--from 23.0 to 11.5; 1989--12.0 to 6.0). This is shown in the third row of Table 26. The difference between total abandonment and non-harvest diversion is called non-market order abandonment (or open market abandonment). Estimated non-harvest diversion figures, based on past experience with crops of comparable size, appear in the bottom row of Table 26. Concomitantly, estimated total production would have been higher by 11.5 and 6.0 million pounds in 1982 and 1989, respectively, due to less abandonment of the cherry crop. The estimated changes in production figures appear in column (6) of Table 27. These adjustments in figures make the simulation somewhat more realistic.

The next step in the computation was Subtracting Non-Marketing Order Abandonment and Fresh Utilization from Total Production yields New Crop for Processing, just as was done to compute the comparable figures in Table 22 for the simulation of the five actual marketing order implementations between 1972 and 1985. Computation of Restricted Tonnage was done in the same manner as in Table 22, and the Restricted Percentages used (20%, 25% and 10%) were based on the Recommended Marketing Policy of the Cherry Administrative Board. In 1986, the CAB agreed on target restricted percentages for crops of various sizes.[92] The estimated restricted tonnage figures for 1982, 1987, and 1989 were 55.7, 68.6 and 21.5 million pounds, respectively.

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[92]"Background Economic Analysis and 1986 Marketing Policy of Cherry Administrative Board," May 1986.

Table 26. Determination and Uses of Restricted Tonnage Under Simulation of Tart Cherry Federal Marketing Order

	1982	1987	1989
Total Production	310.9	358.5	264.1
- Fresh Utilization	7.4	9.0	6.7
- Non-market order abandonment	11.5	41.0	6.0
= New Crop for Processing	292.0	308.5	251.4
X Restricted Percentage	20%	25%	10%
= Restricted Tonnage Estimate	58.4	77.1	25.1
X Percentage of Production in Controlled Area	95.3	89.0	85.6
= Restricted Tonnage in Controlled Area	55.7	68.6	21.5
Sum of Marketing Order Uses =	55.7	68.6	21.5
Reserve Pool	42.7	0	0
+ Secondary Market Diversion	0	37.8	12.4
+ Non-harvest Diversion	13.0	30.8	9.1

The next step in the process of estimating the figures to use to represent marketing order supply management for 1982, 1987 and 1989 was to make judgments about how growers would have chosen to use various provisions of the tart cherry marketing order.[93] In the early 1980s, secondary market diversion provisions still had not been used, so the uses of restricted tonnage would likely have been the reserve pool and non-harvest diversion. The non-harvest diversion tonnage was estimated at 13.0 million pounds based on prior experience with a crop of that magnitude; the remaining 42.7 million pounds would have been put into the reserve pool. In 1987 and 1989, on the other hand, all of the tonnage that was not destined for non-harvest diversion would likely have ended up in secondary market

[93]Estimates were supplied by Dr. Donald J. Ricks, former chair and economic advisor to the CAB.

diversion. Since the late 1980s was a period of general overproduction, the reserve pool option was no longer viable.

Table 27 shows the estimated quantities that might have been removed from the market and subsequently released or diverted in the operation of the marketing order. The

Table 27. Simulation of Tart Cherry Federal Marketing Order Implementation in 1982, 1987, and 1989: Impact on Frozen f.o.b. and Grower Price

Year	Reserve Pool Tonnage RPSA (1)	M.O. Release Figure Used RPR (2)	Secondary Market Diversion (3)	Non-Harvest Diversion QNHD (4)	Net Change in Supply due to M.O. in Simulation (5)	Change in Prod. due to reduced Abandonment[2] (6)	Frozen f.o.b. price impact (froz. wt.) (8)	Grower price impact (9)
1982[1]	-42.7	+3.6		-13.0	-55.7	+11.5	+12.7	+6.3
1983[1]		+39.1			+39.1		-17.5	-12.9
1984					0		+1.8	+1.2
1985					0		-0.7	-0.4
1986					0		NC	NC
1987			-37.8	-30.8	-68.6	0	+7.2	+2.7
1988					0		+1.8	-1.0
1989			-12.4	-9.1	-21.5	+6.0	+2.3	+1.1

[1]This scenario assumes that 10.7 mill. pounds (25% of the 1982-83 pool) would be released in spring 1983, but would have an impact on prices equal to one third of the actual tonnage. The release variable RPR is therefore set equal to 3.6. 1983 reserve carryin thus equals 39.1. (-42.7+3.6=-39.1)

[2] The assumption is made that if the marketing order is used, open market abandonment would be half of what actually occurred without the marketing order in 1982 and 1989, but that in 1987 open market abandonment would have been the same without the order. Thus open market abandonment declines in this scenario by the following amounts: (a) 1982, 23.0 to 11.5, (b) 1989, 12.0 to 6.0. In the simulation, total production in 1982 and 1989 increases by 11.5 and 6.0 million pounds, respectively.

fifth column shows the tonnage used in the simulation to represent the net change in supply from the operation of the marketing order. As Table 27 indicates, the estimated price increases per pound from using the marketing order in 1982, 1987, and 1989 are approximately six cents, three cents and one cent, respectively, representing 40%, 35% and 5% increases over actual grower prices. Another notable result is that had the marketing order been used in 1982-83, the average grower price would have declined by an estimated 11¢ (25%) from the high 1983 price of 47¢ per pound due to release of the 1982 reserve to supplement the short supplies. The crop size in 1983 was 83% of average shipments for the previous four years.

The almond marketing order is examined next. The final section of this chapter applies various performance criteria to the tart cherry marketing order analysis and compares these results to almond and raisin marketing order analyses.

6.2. Almond Marketing Order Simulation

An additional goal of this research project was to analyze the impact (especially the impact on grower prices) of implementing the reserve provision of the federal marketing order for almonds. The modeling approach is similar to that used for simulating the tart cherry marketing order. The price impact is estimated by comparing actual season average prices with prices estimated in an econometric model that simulates prices and quantities over the period 1973-1989 if the marketing order had not been used. In the ten year period 1980-1989, the almond reserve was implemented seven times.

The main hypothesis of this analysis is that almond prices would have been lower than actual prices were with the use of the marketing order if the almond supply management program had not been implemented in certain high production years. The model simulates the historical period 1973-1989, assuming in an alternative scenario that the reserve was not implemented in any year during that period. The price difference between

Table 28. Variable Identification: Almond Model

Variable	Definition
	A. ENDOGENOUS VARIABLES
ACRES	Bearing acres (trees 4 years or older), thousands)
DOMSAL	U.S. domestic almond sales, millions of pounds
FOBPR	Handler f.o.b. price, dollars per pound (opening f.o.b. price of CAGE/Blue Diamond)
GRPR	Grower price, dollars per pound
PROD	Total U.S. almond production, millions of pounds
	B. COMPUTED VARIABLES
REDMARK	Quantity redetermined marketable (subtracting computed losses from total production), millions of pounds; estimated at fixed rate of 95% of total production
FREEQ	Free tonnage remaining after almond reserve implementation, millions of pounds (REDMARK - RESERVE)
PGAV3	Three year moving average of grower prices (GRPR) lagged 4, 5, and 6 years, dollars per pound
TOTSUP	Total salable supply, millions of pounds (CI + FREEQ + RELEASE)
	C. EXOGENOUS VARIABLES
CI	Carryin almond stocks, millions of pounds
CO	Carryout almond stocks, millions of pounds
ID	Personal disposable income, billions of dollars
RELEASE	Quantity released from almond reserve under federal marketing order, millions of pounds
RESERVE	Quantity set aside in almond reserve under federal marketing order, millions of pounds
TRND	Trend, 1973 = 73, etc.
T81	Dummy variable (equals 0 before 1981, 1 thereafter)
WPRIC	Farm price of walnuts, cents per pound
YIELD	Almond yield, pounds per acre

Note: In the tables showing estimated equations, variables with an L prefix were estimated in log form.

actual prices and the simulated "no reserve" prices is the estimated impact of using various supply management provisions of the marketing order.

6.2.1. The Almond Model

The econometric equations and related computations that make up the model are presented below. There are three equations estimated econometrically as single equations by OLS. Domestic almond demand is modeled as a simultaneous system and estimated by three stage least squares. Variables are identified in Table 28.

6.2.1.1. The Estimated Equations

The first step in modeling almond production was to estimate almond grower supply response. Similar to the approach taken for the tart cherry model, almond acreage supply response was based on a simple average of several years of lagged grower prices and bearing acres lagged one year. Since 1973 a bearing tree has been defined as four years or older;

Table 29. Bearing Acreage Equation Estimated by OLS

Variable label	Dependent Variable	
	ACRES (Eq. #1)	
Constant	29.0361	(4.29)
PGAV3	38.7000	(5.41)
ACRES(T-1)	.8434	(32.05)
R^2=.994 Adj. R^2=.983		

T-statistics appear in parentheses to the right of each coefficient. OLS estimate was corrected for serial correlation with Cochrane-Orcutt autoregressive procedure.

the independent variable for grower price (PGAV3) was therefore defined as the average of grower prices (T-4) through (T-6). The estimated coefficients are presented in Table 29. Yield was considered exogenous, and acreage times yield equals production.

The next step was to estimate almond demand equations. Similar to the situation in developing the tart cherry model, the assumption was made that since all data are annual, domestic demand could be most effectively modeled as a system in which domestic sales and domestic handler price are simultaneously determined. In the two-equation demand model, handler price was estimated as function of domestic sales (LDOMSAL), the price of a key substitute (walnuts--LWPRIC), and personal disposable income (LID). The L prefix

Table 30. Domestic Almond Demand Estimated by Three Stage Least Squares

Explanatory Variables	Dependent Variables			
	LDOMSAL (Eq. #2)		LFOBPR (Eq. #4)	
Constant	.4422	(-1.29)	-3.6213	(-2.71)
LFOBPR	.0117	(.09)		
LTOTSUP	.4687	(5.28)		
LDOMSAL(T-1)	.4993	(3.51)		
LDOMSAL			-1.4024	(-3.48)
LWPRIC			.3411	(2.65)
LID			1.4419	(4.39)
T81			-.2524	(-2.02)
R^2=	.945		.794	
Adj. R^2=	.910		.753	
D.W.=	1.75		2.20	

T-statistics appear in parentheses to the right of each estimated coefficient. An L prefix indicates estimation in log form.

indicates estimation in log form. An additional variable was added to capture the shift in the supply-demand balance in the early 1980s. After a period of strong demand expansion in the 1970s in which no reserves were implemented for eight years, reserves began to be implemented every year in the early 1980s. A time shift dummy variable (T81) was thus included in the demand equation. Domestic sales were modeled as a function of f.o.b. price, total supply, and lagged domestic sales. The f.o.b. price variable was not statistically significant, but was nevertheless retained because of the theoretical justification that price should influence quantity sold.

Interviews with almond handlers indicated that almond grower prices are a residual of f.o.b. handler prices after the processor margin has been subtracted. Grower prices were therefore modeled as a function only of handler prices.

Table 31. Almond Grower Price Equation Estimated by OLS

Explanatory Variables	Dependent Variable	
	GRPR (Eq. #4)	
Constant	-.1519	(-3.46)
FOBPR	.9929	(11.84)
R^2=.936 Adj. R^2=.936	D.W. = 2.67	

T-statistics appear in parentheses to the right of each coefficient.

The final equation needed to complete the system is an equation to predict export sales. A demand model incorporating elements of foreign demand for California almonds, and accounting for exchange rates in various foreign markets was beyond the scope of this research. Since this model was for historical simulation purposes only with emphasis on changes in the domestic market, a simpler export sales equation was developed.

Table 32. Export Sales Equation Estimated by OLS

Explanatory Variables	Dependent Variable LEXPSAL (Eq. #5)	
Constant	-3.2180	(-3.86)
LPROD	.6443	(6.76)
LCI	.1076	(1.84)
LFOBPR	-.0971	(-.73)
TRND	.0550	(3.27)
T81	-.2995	(-3.25)
R^2=.975 Adj. R^2=.947 D.W. = 3.21		

T-statistics appear in parentheses to the right of each coefficient. An L prefix indicates log form estimation.

Independent variables included total almond production, carryin stocks, f.o.b. price, a trend variable, and a dummy variable that represented the shift in the supply-demand balance that began in the early 1980s. Estimated coefficients are presented in Table 32.

6.2.1.2. Full Model and Solution Process

This section presents the full model, which links the five econometrically estimated equations and the identities. The model carries out dynamic sequential predictions of the endogenous variables. Below is an overview of how the blocks fit together to carry out the sequential computations.

6.2.1.2.1. Overview of Almond Econometric Model

BLOCK I. BEARING ACREAGE, PRODUCTION AND QUANTITY REDETERMINED MARKETABLE

[Supply response in terms of bearing acreage is based on a three-year moving average of lagged grower prices, (T-4) through (T-6). Yield is exogenous and acreage times yield equals production. Quantity Redetermined Marketable is equal to 95% of production.]

BLOCK II. CARRYIN, SEASONAL SUPPLY, AND MARKETING ORDER IMPLEMENTATION

[Seasonal supply is equal to carryin stocks plus the quantity redetermined marketable. Total salable supply is less than the seasonal supply by the quantity set aside in the marketing order reserve. The quantity of almonds set aside in the reserve (RESERVE) and the quantity released in subsequent years (RELEASE) are exogenous variables.]

BLOCK III. U.S. DOMESTIC ALMOND DEMAND

[Estimates f.o.b. almond prices and domestic consumption (delivered sales). A two-equation simultaneous system is solved by three stage least squares and reduced form equations are used for dynamic sequential forecasts.]

BLOCK IV. GROWER PRICE

[Grower price is predicted from a regression of f.o.b price. A moving average of lagged grower prices is used in estimating bearing acreage in Block I.]

BLOCK V. EXPORT SALES AND CARRYOUT

[Export sales are estimated and carryout is calculated as a residual by subtracting domestic and export sales from total salable supply].

6.2.1.2.2. Model Structure Showing Equations and Solution Process

One loop of the model (Step A through Step L) calculates values for each variable for one year. A DO LOOP restarts the calculations for each succeeding year. The numbered equations are the econometrically estimated equations presented above. The coefficients are represented by the letter a_i. The remainder are computations (identities) based on the estimated variables. Verbal descriptions appear above the variable names for most equations.

****

DO T = 1973 TO 1989

BLOCK I. BEARING ACREAGE, PRODUCTION AND QUANTITY REDETERMINED MARKETABLE

A. Compute 3-year moving average of lagged grower prices =

PGAV3 = (GRPR(T-4) + GRPR(T-5) + GRPR(T-6)) ÷ 3

B. Bearing = acreage	constant	+ a_1 lagged bearing acreage	+ a_2 average lagged price
(#1) ACRES =	constant	+ a_1ACRES(T-1)	+ a_2PGAV3

C. PROD = ACRES X YIELD

D. REDMARK = PROD X 0.95

BLOCK II. CARRYIN, SEASONAL SUPPLY, AND MARKETING ORDER IMPLEMENTATION

E. Carryin =	Carryout(T-1)
CI =	CO (T-1)

F. Free tonnage =	quantity redetermined marketable -	quantity in reserve
FREEQ =	REDMARK -	RESERVE

G. Total salable supply =	carryin +	free tonnage +	quantity released from reserve
TOTSUP =	CI +	FREEQ +	RELEASE

BLOCK III. U.S. DOMESTIC ALMOND DEMAND

H. Domestic sales =	constant -	a_1 handler f.o.b. price +	a_2 total salable supply +	a_3 lagged domestic sales
(#2) LDOMSAL =	constant -	a_1LFOBPR +	a_2LTOTSUP +	a_3LDOMSAL(T-1)

I. Handler f.o.b. = price	con- stant -	a_1 domestic sales -	a_2 walnut price +	a_3 dispos- able income +	a_4 dummy variable
(#3)LFOBPR =	con- stant -	a_1LDOMSAL -	a_2LWPRIC +	a_3LID -	a_4T81

BLOCK IV. GROWER PRICE

J. Grower price =	constant +	a_1 handler f.o.b. price
(#4) GRPR =	constant +	a_1FOBPR

BLOCK V. EXPORT SALES AND CARRYOUT

K. Export sales =	con- stant +	a_1 produc- tion +	a_2 carry- in +	a_3 handler f.o.b. price +	$a_4$trend -	a_5 dummy variable
(#5)EXPSAL=	con- stant +	a_1PROD +	a_2CI -	a_3FOBPR +	a_4TRND -	a_5T81

L. carryout =	total salable supply -	domestic sales -	export sales
CO =	TOTSUP -	DOMSAL -	EXPSAL

END DO T
****

6.2.1.3. Model Performance

Table 33 shows goodness-of-fit measures for dynamic sequential predictions of variables over the period 1973-1989. The model appears to provide quite good estimates of the first four variables in that table, all of which have a mean absolute percentage error

Table 33. Goodness-of-fit Measures for Dynamic Sequential Predictions of Almond Model Variables, 1973-1989

	Mean of Vari- able (M)	Root Mean Square Error (RMSE)	Mean Abso- lute Error (MAE)	Mean Absolute Percent- age Error (MAPE)
Bearing Acres, thousands (ACRES)	333.1	9.4	7.8	2.3
Total Production, mill. lbs. (PROD)	357.1	10.3	8.3	2.3
Quantity redetermined marketable, million lbs. (REDMARK)	336.9	9.9	8.6	2.3
Total salable supply, million lbs. (TOTSUP)	426.7	15.0	18.6	3.5
Domestic sales, mill. lbs. (DOMSAL)	112.5	7.8	6.6	7.8
Export sales, million lbs. (EXPSAL)	208.5	19.2	14.9	7.0
Carryout stocks, mill. lbs. (CO)	105.7	15.0	13.4	16.5
F.O.B. price, $ per lb.	1.43	.22	.19	13.8
Grower price, $ per lb.	1.05	.22	.18	16.8

of 3.5% or less. Those four variables are all related to the supply of almonds -- (1) acreage, (2) production, (3) the portion of production that is redetermined marketable after culled almonds are removed, and (4) total salable supply. Estimates of domestic and export almond sales are off by an average of 7%, and estimated carryout differs from its actual value by an average of 17%. Estimated f.o.b. prices and grower prices for almonds differ from their actual historical values by an average of 19¢ (14%) and 18¢ (17%), respectively. Those errors in prediction are somewhat high for key variables. The results presented here were nevertheless superior to various alternative models, so the model specification presented herein was used for the analysis of almond marketing order price impacts. The model results were judged to be adequate for historical simulation purposes.

6.2.2. Simulated Alternative Scenario: Non-implementation of Almond Reserve

The model carries out dynamic sequential predictions of grower and handler prices as well as quantities of almonds produced and consumed over the period 1973-1989. Price impacts of the almond reserve are measured by comparing actual prices to prices estimated in an alternative scenario in which reserve pools are not implemented. If the almond order had not been in effect, reserves could not have been established and all harvested almonds would have to be sold into domestic or international markets or end up as carryover stocks at the end of the season. The increased seasonal supply of almonds (relative to historical levels) in the simulated "no reserve" scenario is hypothesized to result in lower simulated grower and handler prices than occurred historically. Just as with the tart cherry simulation, the magnitude of the price change is the value in terms of increased grower prices of using the almond reserve.

6.2.2.1. Method of Analysis

The exogenous variable RESERVE in the model represents the quantity of almonds set aside in the reserve. In most years reserve almonds were diverted to non-competitive outlets. However, in 1988 and 1989, reserve almonds were released into the primary market. The quantities released in those two years are represented by the exogenous variable RELEASE. In the base run, RESERVE and RELEASE are set equal to their actual values (see steps F. and G. in Block II. of the "Almond Model Structure Showing Equations and Solution Process" in Appendix B). In the scenario representing non-implementation of the reserve, the values of RESERVE and RELEASE are set equal to zero, resulting in a higher seasonal supply of almonds in the alternative scenario compared to the base run for those years in which a reserve was declared.

Although the almond federal marketing order has been in effect since 1950, no reserves were established between 1973 and 1979. Simulation over a ten year period in the 1980s was judged to be sufficient to demonstrate the dynamic price impact of not implementing the order.

6.2.2.2. Estimated Price Impacts Without Marketing Order Implementation

Reserves were implemented in seven of the ten years between 1980 and 1989. In five of those seven years, all of the reserve almonds were diverted to non-competitive outlets. However, in 1988 and 1989 all of the reserve almonds were released onto commercial markets the following year, as shown in column 4 of Table 34. Columns 1 through 4 of Table 34 show the historical record of reserve percentages and associated almond quantities placed in reserve.

Columns 5 through 7 present estimates of changes in almond quantities that would have occurred in the absence of reserves (changes in carryin stocks, total salable supply, and domestic sales). Columns 8 through 10 show the historical grower prices and the estimated

Table 34. Estimated Quantity and Price Chnages Without Almond Marketing Order Implemenation, 1980-1989

	Reserve Pool Implementation				Estimated Changes if Reserve Pool Not Implemented					
Year	Quantity of Almonds Redetermined Marketable (1)	Percentage Declared Reserve (2)	Quantity Placed in Reserve (3)	Quantity Released from Reserve (4)	Estimated Change in Carryin Stocks Without Reserve (5)	Estimated Change in Domestic Sales Without Reserve (6)	Estimated Change in Total Salable Supply Without Reserve (7)	Actual Grower Price (8)	Estimated Grower Price Change Without Reserve Pool (9)	Price Change as a Percentage of Actual Grower Price (10)
	mil.lbs.	percent	------------------million pounds------------------					dollars per lb.		percent
1980	305.140	2	6.103	0	0	7.170	6.103	1.47	-.020	-1.3
1981	383.134	0	0	0	5.196	1.013	5.196	.78	-.013	-1.7
1982	330.761	2	6.615	0	2.687	1.709	9.301	.94	-.024	-2.5
1983	221.791	3	6.654	0	6.631	2.935	13.585	1.04	-.046	-4.4
1984	562.657	5	28.182	0	9.371	5.095	37.175	.77	-.076	-9.8
1985	443.996	10	44.400	0	27.702	10.734	71.400	.80	-.104	-13.1
1986	235.694	0	0	0	53.549	12.953	52.801	1.92	-.258	-13.4
1987	634.558	18	114.220	0	31.552	22.117	142.487	1.00	-.334	-33.4
1988	564.537	25	141.134	114.220	100.059	26.494	121.962	1.05	-.273	-26.0
1989	457.174	0	0	141.134	62.440	2.865	-85.610	1.02	+.036	+3.5

[1]Generally 4-6% on new crop is culled due to damage, poor quality, etc. (referred to as "computed loss.") This is subtracted from production and the remainder is the quantity redetermined marketable, which is a more accurate representation of supply than total production.

price changes that would have occurred based on the simulation if reserves had not been established.

Columns 9 and 10 are some of the key results of the analysis. The simulation results indicate that without the reserve, both f.o.b. and grower prices would have declined relative to their historical level for each year between 1980 and 1989 (however, only grower price changes are shown in Table 34). Estimates of price decreases range from 2¢ in 1980 (a year in which only a small reserve was declared) to 33¢ in 1987, a heavy production year in which a large quantity of almonds had been placed in reserve. These estimates of price decreases in the absence of the order can also be considered as the price impact of using the reserve as a supply management tool.

Without the ability to set aside in a reserve a portion of almonds produced in a heavy production year, total salable supply would increase. The "no reserve" simulation results also indicate that increased almond quantities in the primary market and lower prices also bring about other changes, including higher domestic sales, export sales, and carryout stocks. In the simulation, the higher ending stocks in the absence of a reserve in one year in turn have a price depressing effect in the subsequent year by increasing carryin stocks and consequently total salable supply for that year.

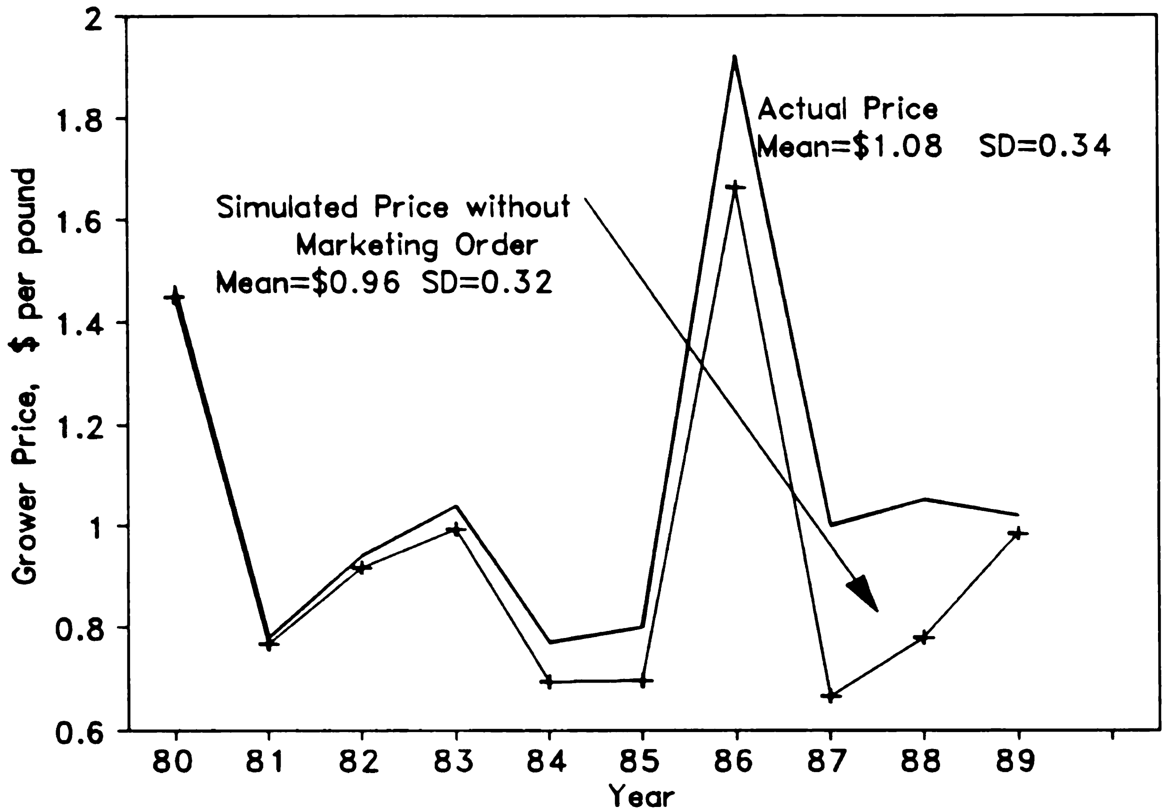
For example, in 1985 a 10% reserve was established by the Almond Board of California, resulting in 44 million pounds being placed in reserve. Season average grower price with the reserve was 80¢ per pound. The "no reserve" simulation suggests that without a reserve, the average grower price would have been 10¢ lower (a 70¢ price), due largely to the increase in total salable supply of 71 million pounds. Associated with the lower price in the simulation results were a domestic sales increase of 10.7 million pounds (column 7) and increased export sales of 7 million pounds (not shown in Table 34). However, the increased supply in the simulation resulted in a 53 million pound increase in carryover stocks (which appears as carryover stocks for 1986 in column 5). This increase in carryover raised total salable supply in 1986, a short crop year in which no reserve was needed. This additional carryover would have decreased average grower price by an estimated 26¢ in 1986. Note, however, that this large simulated price decrease in 1986 was from a record high actual price of $1.92 per pound. The estimated percentage price decrease from the simulation in both 1985 and 1986 was around 13% (column 10). Estimated changes in total salable supply in 1985 and 1986 were 11.5% and 14.1%, respectively.

The situation is more complicated for 1988 and 1989. Large reserves were established in both 1987 and 1988 due to unusually heavy production in both years. Almond Board records indicate that portions of these reserves were released in the same marketing year (not shown in Table 34). The remainder of the reserve in each case was released into the primary market in the following year rather than diverting the almonds to non-competitive outlets as had been done in earlier years. In the "no reserve" scenario, there would have been neither an almond reserve nor a release, and the estimates of the simulated net effect for 1987 and 1988 were grower price decreases of 33¢ and 27¢, respectively, due to increases in total salable supply in the simulation of 142 million and 122 million pounds.

Actual and simulated almond grower prices are compared graphically in Figure 42. As Table 34 indicated, "no reserve" prices were lower in each year of the simulation. The analysis suggests that, considering the whole period, prices would have averaged 8¢ lower without the order (mean prices were $1.08 versus $0.96). The graph also illustrates the simulation result that the marketing order dampened steep price declines in 1987 and 1988. However, overall variability would have been about the same.

Changes in total grower revenue attributable to the almond reserve is another key consideration. Table 35 shows estimates of changes in revenue based on the simulated price changes. Only small reserves (2-3%) were used during the period 1980-1983. The reserves in those years were created mainly for market development purposes. The ABC policy was

Figure 42. Comparison of Actual Almond Grower Price to Simulated Price Without Reserve



to set aside specific quantities to sell at reduced prices to food manufacturers that were in the process of developing new almond-based food products. The model results indicate that although grower prices were increased through use of the marketing order, the higher quantities that would have been sold in the <u>absence</u> of the order would have generated slightly higher total grower revenue than was obtained with the order. Simulation results indicated that use of the order reduced total grower income in specific years between 1980 and 1983 by amounts ranging from $600,000 to $3.3 million (0.2% and 1% of actual grower revenue, respectively).

With larger reserves beginning in 1984, however, the revenue impact became strongly positive, with net gains in grower revenue of between $17 million in 1984 (4% increase) and $117 million in 1987 (18% increase). The largest estimated decline occurred in 1986, $27 million (6%). This result occurred because in the "no marketing order" scenario simulated

Table 35. Estimated Grower Revenue With and Without the Almond Marketing Order Reserve

Year	Total Sales (mil. lbs.)	Grower Price with M.O. ($/lb.)	Total Revenue with M.O. (mil. $)	Estimated Change in Total Salable Supply Without Reserve (mil. lb.)	Grower Price without M.O. ($/lb.)	Total Revenue without M.O. (mil. $)	Net Change in Total Revenue with M.O. (mil. $)
1980	305.1	1.47	448.6	6.1	1.45	451.3	-2.7
1981	383.1	0.78	298.8	5.2	0.77	297.8	1.0
1982	330.8	0.94	310.9	9.3	0.92	311.5	-0.6
1983	221.8	1.04	230.7	13.6	0.99	234.0	-3.3
1984	562.7	0.77	433.2	37.2	0.69	416.3	17.0
1985	444.0	0.80	355.2	71.4	0.70	358.7	-3.5
1986	235.7	1.92	452.5	52.8	1.66	479.5	-26.9
1987	634.6	1.00	634.6	142.5	0.67	517.5	117.0
1988	546.5	1.05	573.9	122	0.78	519.4	54.4
1989	457.2	1.02	466.3	-85.6	0.98	365.6	100.7

by the model, the private carryover stocks and overall sales would have been higher and the price substantially lower leading to increased revenue relative to the actual historical record.

As indicated previously, the 1986 experience with shortages and very high prices led to a shift in Almond Board policy, in which certain quantities could be retained in a reserve pool to be released in subsequent years in case of a shortage, rather than diverting all of the reserve to secondary market uses. This policy was applied in 1987-1989. Large crops in 1987 and 1988 led to Almond Board to declare reserves of 18% and 25%, respectively. The 1987 reserve was released in 1988, but since the crop was again large, an even larger reserve (25%) was declared. When 1989 turned out to be a short crop year relative to prior years, the entire remaining reserve was released, thus providing the stabilizing effect for which it was intended. The simulation results indicated that without this stabilizing effect, grower price would have been slightly higher (approximately 4¢ higher or a 4% increase over the the actual price). However, the substantial extra supplies led to larger sales in 1989 than would have occurred in the absence of the order, yielding a net grower revenue increase of $100 million.

After the following section on the raisin marketing order, the three marketing order analyses are compared using several performance criteria.

6.3. Raisin Marketing Order Simulation

The purpose of this section is to describe the results of the 1991 French and Nuckton (FN) study of the economic impact of the federal marketing order for raisins. In the next section, comparisons are made with the foregoing tart cherry and almond simulation results. FN used an econometric simulation model to estimate the potential impacts on prices and revenue if there had been no reserve pool operations under a federal marketing order. The tart cherry and almond simulation models examined earlier in this chapter were based in part on the FN approach.

Both the tart cherry and almond simulations involved comparison of a single alternative "no reserve" scenario with the historical record of prices, and quantities, and revenues which were influenced by use of reserves in large-crop years under the respective marketing orders. FN's approach involved a number of different scenarios.

FN generated nine different scenarios to analyze a range of possible impacts with the different economic environment that would exist without a marketing order. Their main assumption was that risk perceptions on the part of raisin grape growers would alter two specific behavioral responses. First, the higher risk environment that would exist without the stabilizing effect of the marketing order would bring forth reduced planting responses.

Figure 43. Mean Grower Prices for Grapes for Drying, 1964-1985: Actual and Alternative Scenarios Based on French and Nuckton Simulation

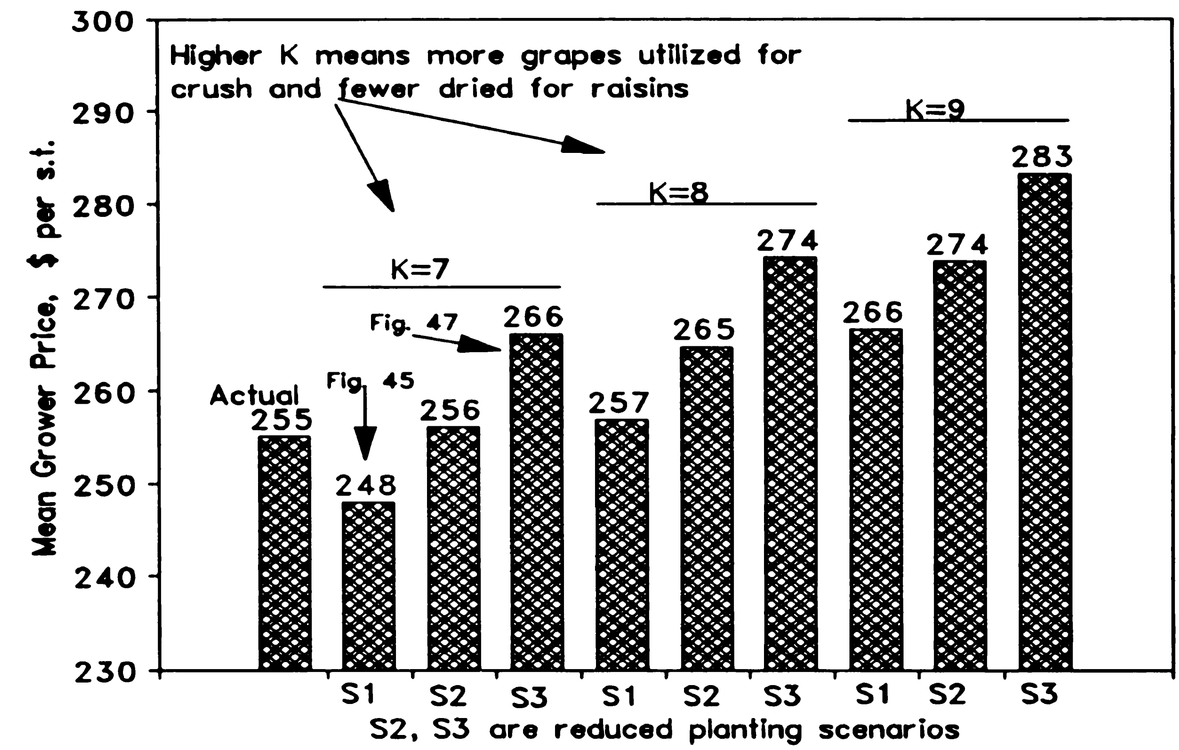
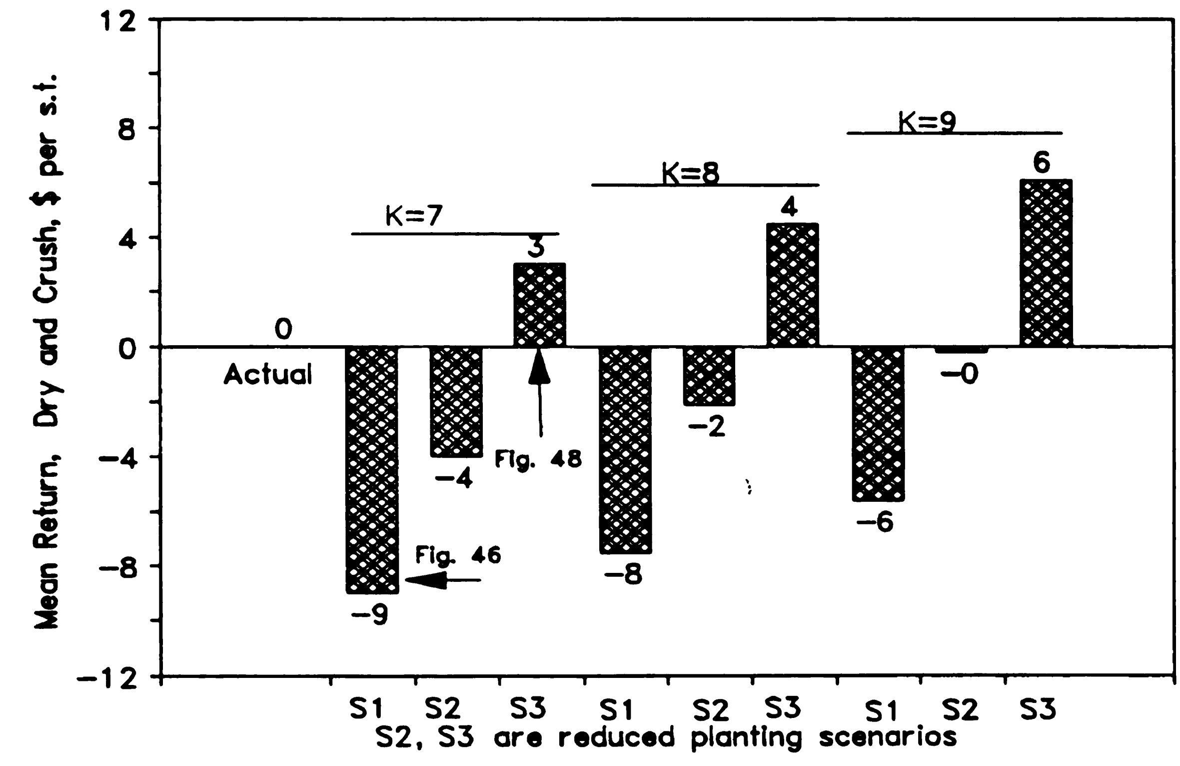


Figure 44. Mean Grower Net Revenue, Grapes for Drying and Crush, 1964-1985: Actual and Alternative Scenarios Based on French and Nuckton Simulation



Thus S1 in Figure 43 and Figure 44 represents a scenario in which the planting response is unchanged from the planting equation which FN determined best represented the actual historical situation. In the alternative scenarios S2 and S3, the coefficient on the planting equation in the FN simulation model is reduced to represent planting response reductions of 20% and 40%, respectively, due to the higher risk perceived by growers. Note that the bar in Figure 43 representing mean grower price for the S1 scenario ($248) corresponds to Figure 45 below, which compares the S1 scenario to actual grower price for the period 1964-1985. Similarly, the bar representing S3 (mean grower price of $266) in Figure 43 corresponds to Figure 47.

The other behavioral change that FN thought should be accounted for was that in a higher risk environment without a marketing order, growers would choose to send somewhat higher proportions of their raisin-type grapes to crush, which before the early 1980s represented a steadier market, and would dry a somewhat smaller proportion to sell as raisins. In Figure 43 and Figure 44, higher levels of K mean that in the equation that allocated grapes between the raisin and crush markets, the coefficient is adjusted to represent a "tilt" toward sending a greater proportion to crush. Thus the three levels of planting response and three levels of raisin versus crush allocation resulted in nine scenarios. The scenario most comparable to the tart cherry and almond analyses above is represented by the bar (S1, K=7) showing a price of $248 per ton in Figure 43 and negative net revenue of $9 in Figure 44.

A key result of the FN analysis is that for every scenario but the first (S1, K=7, with a price of $248 per ton), the lower level of bearing acreage devoted to producing raisins resulted in higher raisin prices relative to the historical record (an average of $255 per ton) when the whole period was considered (1964-1985). However, FN also note that another performance measure, grower net return, accounts for grower sales into both the raisin and crush markets, since many growers typically sold in both markets prior to the reduced availability of the crush outlet in the 1980s. Figure 44 shows that historically the average net return was near zero for the entire period, but that six out of nine of the alternative scenarios yielded negative net revenue. Only in the case of a severely reduced planting response (S=3; 40% lower) was production low enough to yield higher net grower returns, combining grapes sold for drying and grapes sold for crush. Note that the bar in Figure 44 representing mean grower net revenue for the S1 scenario (-\$9) corresponds to Figure 46 below, which compares the S1 scenario to actual grower net revenue for the period 1964-1985. Similarly, the bar representing S3 (mean grower net revenue of \$3) in Figure 44 corresponds to Figure 48.

To provide further detail on the FN simulation results, prices and returns from two scenarios are presented graphically (S1 and S3, K=7). Figure 45 compares actual grower prices for grapes for drying with prices estimated in S1 (no reduction in planting response). Figure 46 compares actual and simulated net returns for the same situation. Simulated prices without a marketing order in S1 are both lower on average and more variable, with a standard deviation of prices of \$129 versus \$98 for the actual prices. Figure 45 shows that the most significant price stabilizing effects occurred in the 1960s and the 1980s. The marketing order prevented steep price declines in 1965-66 and 1982-85. Recall from Chapter 2 that the rapid decline in the availability of the crush outlet led to a sharp increase in raisin production increase during the 1980s. The marketing order was used to a considerably lesser degree in the 1970s since prices and returns were higher due to stronger demand for raisins.

Comparable results for the S3 scenario are presented in Figure 47 and Figure 48. Prices and net revenue are higher without a marketing order in this scenario due to the assumption of a 40% reduction in grower planting response due to the higher risk associated with a less stable market for raisins. Mean price in S3 rises by \$11, and net revenue rises from an average of zero to an average of \$3. Also, the reduced planting response in this

Figure 45. Raisin Grape Grower Price, Actual and Simulated Without Marketing Order, 1964-1985

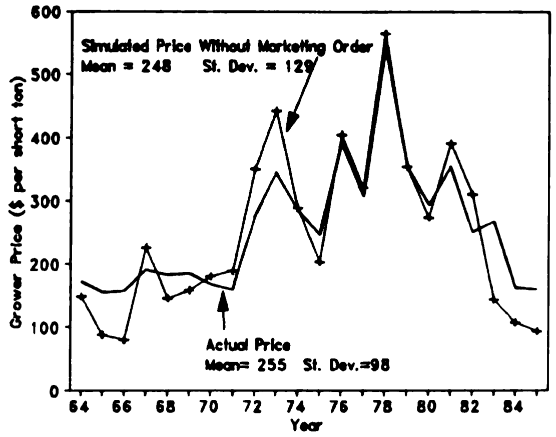


Figure 46. Grower Net Return to Dry and Crush, Actual and Simulated Without Marketing Order

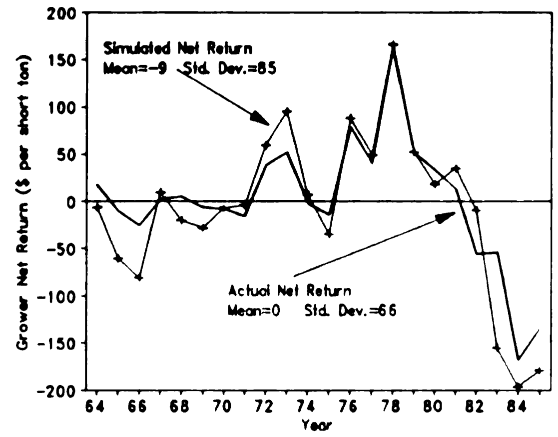


Figure 47. Raisin Grape Grower Price, Actual and Simulated Without Marketing Order and With Reduced Planting Response

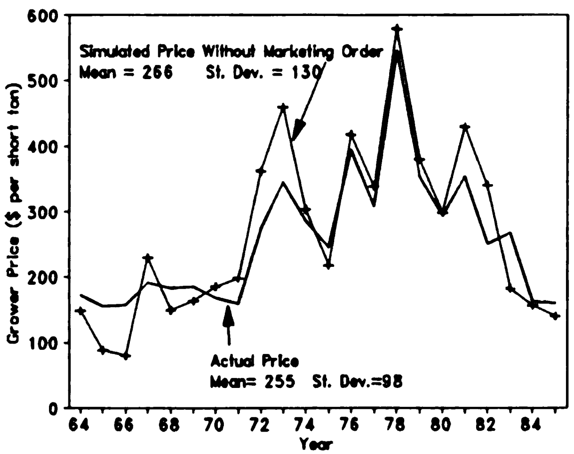
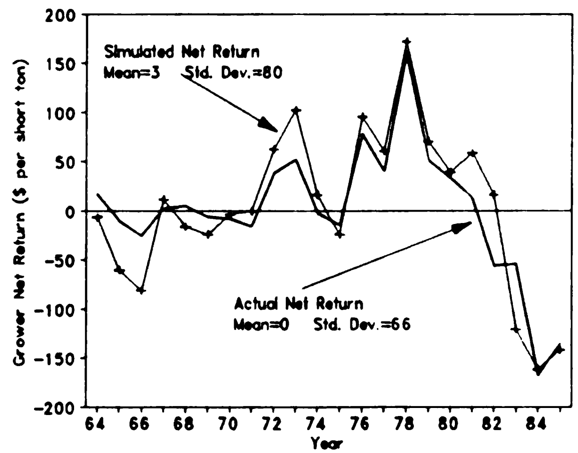


Figure 48. Grower Net Return to Dry and Crush, Actual and Simulated Without Marketing Order, Reduced Planting Response



scenario also reduces production to such a degree that the steep price declines of the 1980s are not nearly as great, and the marketing order has a correspondingly smaller impact. Prices and returns are also more variable without a marketing order in this scenario, roughly to the same degree as in scenario S1.

6.4. Comparison of Three Marketing Order Simulations

A set of performance criteria arising from issues examined in previous chapters serve as a basis for assessing several policy implications of marketing order implementation based on the simulations. The criteria are: (1) grower net revenue, (2) grower price variability, (3) consumer prices, and (4) industry productive capacity (acreage). Another important performance criteria is the change in supply variability from implementing the order, since improving reliability of supply as a means of maintaining sales levels is one of the key reasons for implementing the marketing order. However, this question was not specifically addressed in the simulations, which were focused on price impacts. The models were not designed to assess other impacts relating to the variability of supplies.

Grower net revenue. A key policy issue is the impact on grower net revenue of marketing order operation. If the orders dampen price declines in large crop years, thus reducing grower losses on downside of supply fluctuations, and if net revenues are positive in other years, the overall result could be above-normal profits to growers for extended periods. This could be considered an undesirable effect of public policy. A study team commissioned to study the impacts of federal marketing orders offered performance guidelines suggesting that marketing orders should neither contribute to above-normal profits by growers nor cause a decline in grower net revenue compared to the situation that would exist without the order.[94] Thus an important question to pose is whether marketing order operation contributed to above-normal profits for growers or declines in grower net revenue.

In each of the five years in which the tart cherry marketing order was used, net revenue (price minus cost) improved by using the supply management provisions, but did not exceed zero (price was less than average total cost of production per pound in each of the five years). Considering the entire period of analysis in the simulation (1972-1989), tart cherry net revenue averaged just seven tenths of a cent higher using various marketing order supply management provisions than would have been the case with no marketing order. Raisin grower net revenue in the FN study averaged zero under the reserve pool program.[95] Both of these results suggest that growers did not make above-normal profits as a result of the order. Almond grower net revenue was not computed because of a lack of adequate cost-of-production time series data with which to make comparisons of cost and price.

It is also clear that average grower net revenue was not reduced because of the raisin or tart cherry marketing orders. The FN analysis showed that mean returns were higher under the marketing order except for the simulations involving a 40% reduction in supply response. Since tart cherry net revenue was slightly higher on average with supply management than without, grower net revenue was obviously not reduced because of the marketing order.

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[94]Leo C. Polopolus, Hoy F. Carman, Edward V. Jesse and James D. Shaffer, "Criteria for Evaluating Federal Marketing Orders: Fruits, Vegetables, Nuts, and Specialty Crops," Washington, D.C. National Technical Information Service, Identification Section, 1986.

[95]FN offer two caveats to their conclusion, "...the representative cost series, while indicating changes in costs over time, may not fully reflect industry-wide averages...net returns varied considerably over time, and were affected by many factors besides the volume control program." French and Nuckton, Econometric Analysis of the California Raisin Industry.

Grower price variability. Part of the coordination problems in these three subsectors stems from the year-to-year price variability from the combination of supply fluctuations and inelastic demand. A key aspect of maintaining demand is providing reliable supplies and steady raw product prices so that manufacturers are encouraged to create new products or at least not to cease production of food products from a particular commodity due to problems of unreliability. Thus marketing order impact on grower price variability is an important criterion.

The tart cherry simulation demonstrated that in each of the years of tart cherry marketing order implementation, price declines due to large crops were dampened. Considering the entire period, the standard deviation of tart cherry prices were also slightly smaller with the use of supply management provisions than without. Almond price variability with the marketing order was slightly higher than the no-reserve simulation when measured by standard deviation, but was the same when measured by the coefficient of variation. Thus the almond marketing order apparently did not reduce overall price variability, but it did dampen price declines in large crop years. FN found that raisin prices were less variable with the marketing order than with any of the no-control scenarios. These results suggest that marketing orders as implemented for these commodities have contributed somewhat to price stability, but that a degree of price and revenue instability remained even with use of the marketing orders.

Consumer prices. The FN analysis suggests that use of the marketing order did not result in higher average raisin prices to U.S. consumers since the mean of simulated f.o.b. packer prices for all no-control scenarios was about the same or above the historical mean. In contrast, the simulations indicated that f.o.b. prices for almonds and frozen tart cherries were increased by the marketing order. However, the raw product price changes attributable to supply management under federal marketing orders were generally not of a magnitude that would bring about significant price increases of consumer products on retail market shelves. This is in part due to the common retailer practice of pricing on the nines and other related SOPs that contribute to the lack of price responsiveness at the retail level to changes in raw product supply levels. In addition, large proportions of each of these three commodities are sold as industrial ingredients, and price changes of the magnitudes considered in these analyses are unlikely to change the price of other manufactured food products, since commodity ingredient costs generally represent only a relatively small part of total retail product cost.

Industry productive capacity and surplus production. A key issue here is whether a lower risk economic environment due to the existence of a marketing order combined with higher prices for a commodity that can result from operation of the marketing order induces additional planting that contributes to surpluses of a commodity. Evidence of surpluses could include continual or frequent low-use disposal of a portion of the crop.

The report by the aforementioned marketing order study team (Polopolus, Carman, Jesse, and Shaffer) and the French and Nuckton analysis provide a useful guideline in this regard. One of the marketing order study team guidelines is that marketing orders should not contribute to chronic surpluses. FN state correctly that additional production can be considered "surplus" only if it results in returns consistently below competitive levels (e.g., prices below cost of production) or continually require low-use disposal of part of the crop. So what happened with tart cherries, almonds, and raisins?

Under the tart cherry order, most reserves were carried over and subsequently released. Only small quantities were diverted to secondary markets in certain large crop years--definitely not continual low-use disposal. Although the tart cherry market did experience persistent overproduction beginning in the mid-1980s, it is not attributable to the marketing order. High prices due to shortages in the late 1970s were the primary reason for increased plantings and subsequent higher production levels.

Diversions to noncommercial outlets that could be considered low-use disposal was even smaller under the almond order, averaging around 4% of total production in the 1980s. A large proportion of the almond reserves from 1980 through 1985 were used for domestic market development purposes (not low-use disposal) and the 1987 and 1988 reserves were carried over.

Raisin production was higher on average with the marketing order in the FN analysis than with any no-control scenarios. Raisin grape grower returns were higher with the marketing order compared to most no-control scenarios, but nevertheless averaged near zero. Reserve pool quantities were mostly exported or carried over to be sold later. In large crop years, significant diversions to certain noncommercial outlets did occur which could be considered low-use disposal. However, it was not continual and averaged about 4% of raisin production, and FN argue that these diversions should probably not be considered chronic surpluses.

The study team argued that it is reasonable to withhold or divert quantities through a marketing order that would otherwise drive returns further below costs. Using this criterion, FN contend that diversions could be viewed as adjustments to unplanned short-run output variations rather than as wasted resources. The marketing order study team also pointed out that most diversions have been in years of low or negative return.

That is certainly applicable in the case of tart cherries--marketing order diversions were undertaken in years of negative returns, and thus the failure to store or divert quantities in each of the five large crop years would have driven returns even further below costs. The non-harvest diversion option was merely a recognition that a certain proportion of tart cherries are not harvested in large crop years with or without a marketing order. Thus non-harvest diversion should also not be considered a means by which the marketing order contribute to wasted resources.

6.5. Suggestions for Model Improvement

There are several aspects of the model which could be improved upon. First, alternative specifications of the acreage supply response equation could do a better job of modeling grower planting and removal decisions. The current equation uses grower price as a proxy for net revenue, because grower cost of production data over a sufficiently long time period was not readily available. Additional research could turn up cost data from the 1960s to compute a complete net revenue time series which could be used in place of prices. The lag structure chosen for tart cherries, the simple average of prices in (t-6) to (t-12), could be replaced with an improved lag structure such as polynomial distributed lag which does not weight distant years the same as recent years. Various lag structures were investigated, but a more exhaustive look at lag structures could yield an improved supply response model. Also, the removal decision was not explicitly considered in the current specification, but could be modeled by lagging net revenue over a period such as (t-2) to (t-5).

Second, all prices were entered in the equations as nominal prices, because of considerably better performance than with deflated prices with the equations as currently specified. The prediction errors of key variables were smaller with nominal prices. Alternative specifications of each equation could be attempted using deflated prices, which would be more consistent with economic theory which states that firm and consumer behavior is guided by real rather than nominal prices. In addition, it would be preferable to use per capita quantities rather than total quantities in the estimated equations. Total quantities were used because of better model performance in terms of predicted values in the base scenarios, given the current specifications of the equations.

Third, simulation of the "no marketing order" scenarios runs afoul of the "Lucas critique." The case can be made that the economic structure of a market is sufficiently different without a marketing order than any coefficients estimated with a marketing order cannot be used to model alternative non-order scenarios. However, this criticism is probably too strong. In their raisin model, French and Nuckton attempt to get around this problem by adjusting the parameters that would be most affected by a shift to a market without a marketing order. The key decisions that would be different in the higher risk economic environment without a marketing order were the grower planting decision and the allocation of grapes between the raisin market and the wine (crush) market. As discussed earlier, they adjusted the parameters on these equations and then projected key variables using nine different scenarios. The tart cherry and almond models represent a reasonable "first cut" at modeling the markets without marketing orders, but future research could consider adjusting the planting response downward as was done with the French and Nuckton model, and examining which other economic decisions could be similarly adjusted.

Fourth, marketing order reserve pool releases that had to be accounted for in the simulation, could be modeled more effectively. One difficulty in modeling the impact of releases was that spring releases were judged to have less of an impact on prices that an equivalent amount of tonnage released in the fall. This was largely because of more elastic demand in the spring due to differing risk perceptions by those buying and selling cherries. The method for representing CAB decision making regarding reserve storage and release in the simulations was through increasing or reducing tonnage. Therefore the method chosen to approximate the smaller impact of a spring reserve pool release due to changes in demand elasticities was downward adjustment in the simulation of the actual tonnage. This is an area that should be further investigated in future research to see if there are ways to explicitly model the shifting demand elasticities.

The marketing order simulations in this chapter and the application of several performance criteria have provided a means to assess marketing order performance. The final chapter summarizes the roles of marketing orders and cooperatives in responding to the challenges posed by supply volatility.

CHAPTER 7: SUMMARY AND OVERVIEW

The problem addressed in this research was agricultural production instability and mismatches in supply and demand in three perennial crop subsectors. Imbalances in supply and demand are a cause for concern, primarily because resources may be wasted by producing greater quantities of agricultural products than can be sold by growers at remunerative prices, with the result that the raw agricultural commodities are worth less than it costs to produce them. Unmet potential demand is another possible consequence.

The analysis was limited to three perennial crops. The crop-specific nature of the assets in perennial crop enterprises gives them a distinct set of problems and circumstances. Three perennial crops (tart cherries, almonds, and raisins) were selected which had similar enough marketing institutions that they could meaningfully be compared, yet different enough that comparison would provide useful insights.

The supply instability and coordination problems in each of the three commodity subsectors were described and diagnosed. Some aspects of the behavior of firms at various subsector levels were analyzed, focusing on certain standard operating procedures (SOPs) that hinder effective coordination.

Several coordination mechanisms, including cooperatives and marketing orders, were analyzed and categorized in regard to their actual or potential role in improving subsector supply-demand balance. Types of cooperatives and alternative marketing strategies employed by cooperatives were examined. Supply management programs, with emphasis on federal marketing orders, were analyzed in regard to their ability to mitigate the consequences of variable supplies. Econometric models of the tart cherry and almond industries were developed to estimate the impact on grower prices of implementing a federal marketing order in each of those two subsectors.

This chapter reviews key points, accomplishments, and implications of this research. The evidence presented here suggests that committed marketing cooperatives and federal marketing orders have useful roles to play in contributing to the balance of supply and demand in certain perennial crop subsectors.

7.1. Supply Instability, Uncertainty and Coordination Problems

This section highlights research findings related to the nature of the uncertainty facing subsector participants and the supply-demand balancing problems facing subsector participants. The use of graphic tools to illustrate the supply-demand balancing problems is also reviewed.

7.1.1. Nature of the Uncertainty Facing Subsector Participants

Perennial-crop subsector participants face considerable uncertainty, some of which is substantially different from the uncertainties faced by annual crop subsectors. Part of the uncertainty relates to the supply variability caused by biological and climatic factors combined with the inability to vary bearing acreage quickly and economically from year to year. Additional uncertainty relates to the difficulty facing growers of knowing how other growers' individual production decisions will affect overall productive capacity of the perennial crop commodity. Growers may make collective mistakes in planting and removal decisions because it is difficult to predict likely aggregate future supply and demand. While this can be a problem for many commodity subsectors, it commonly has more far-reaching consequences for perennial crops. In addition, when a series of low price years sends a signal to growers of excess productive capacity, perennial crop growers tend to adjust slowly, largely because they have made significant investments in crop-specific assets (especially orchards and related equipment) whose salvage value is near zero or negative. A common result in certain perennial crop subsectors is years of excess capacity, in some cases alternating with periods of underproduction.

Variable weather conditions and alternate bearing tendencies of perennials, along with slow adjustment in bearing acreage, commonly contribute to substantial year-to-year fluctuations in crop sizes. This pattern is especially noteworthy in tart cherries. Although tart cherries are much more likely to have short crops than are almonds or raisins, they occur with all three.

7.1.2. Consequences of Supply Variability in the Three Subsectors

An important set of questions addressed in this research related to the nature and extent of the supply variability facing the three subsectors. All three subsectors have had problems due to (1) annual fluctuations in supplies and (2) overcapacity in terms of planted acreage.

Instability in quantities and prices of commodities makes planning for processors and manufacturers more difficult and products more expensive, reducing the demand for commodities. Reliance on individual firm storage in some commodity subsectors has generally proven inadequate to the task of carrying sufficient supplies from large-crop years to short-crop years to mitigate the impacts of short supplies. This is largely because the pattern of short crops is too irregular and the risks of making a mistake can be financially disastrous to a firm trying to stabilize annual supplies. Carrying substantial inventories when the following year brings another large crop can be very costly.

Periods of overcapacity in terms of planted acreage is another problem common to the three subsectors. If growers collectively plant excess acreage of a perennial crop, many individual growers may endure extended periods of negative net revenue. Furthermore, the simultaneous occurrence of annual supply fluctuations and periods of overcapacity makes it difficult for commodity industry participants to ascertain what demand expansion and supply management strategies to pursue.

7.1.3. Analytical Methods Used to Illustrate Supply-Demand Imbalance

One contribution of this research was the use of graphic tools to illustrate certain supply-demand balance conditions and related vertical coordination aspects. Comparison of long-run productive capacity with demand trends for tart cherries was done in Chapter 2. Supply-demand trends over a period of several years were examined. Tart cherry industry observers stated that the late 1970s were years of underproduction because bearing acreage was in a low productive capacity phase and prices were consistently and substantially above grower cost of production during this period. These high prices contributed to a period of increased planting and thus the late 1980s were years of excess capacity. This was illustrated by Figure 7 in Chapter 2, which showed prices well above costs for a number of years in the late 1970s and prices below costs for an extended period in the late 1980s.

To show the shifting supply-demand balance for almonds, another measure was needed due to the lack of cost data. The method chosen involved constructing time series that smoothed both annual production and sales by computing moving averages. The smoothing of production was accomplished by multiplying a moving average of yields by bearing acres. For the period 1972-1979 shown in Figure 11 in Chapter 2, the bars representing average production are approximately the same height as the line representing average sales. This suggests an approximate match of supply and demand, which is consistent with the fact that no marketing order reserves were established during that time. Almond yields and acreage continued to increase in the 1980s, and various factors contributed to a slowdown in sales growth. A key factor was that a strong U.S. dollar slowed export sales, contributing to a period of supply-demand imbalance. This is represented by the graph which shows that beginning around 1980, height of the bars in the graph

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representing production were generally above the line representing sales. The excess was disposed of mainly through secondary market diversion via the federal marketing order to firms experimenting with new almond-based products and to USDA commodity feeding programs. Similar moving average graphs were also constructed for raisins and tart cherries to help highlight when periods of excess capacity existed.

This portion of the research, including development of means to present comparisons of production and sales data trends, illustrated production variability and the mismatch of agricultural supply (in terms of productive capacity) with demand. It thus helped to set the stage for the subsequent analysis.

7.2. Problems of Vertical Coordination Between Subsector Stages

Another phase of the research was to analyze aspects of the vertical marketing system for commodity-based food products that hinder effective vertical coordination. Chapter 3 presented evidence that certain procurement and merchandising practices of food manufacturers and retail food distributors can limit the capacity of prices to coordinate through the vertical stages of a perennial crop subsector. The series of graphs linking four subsector stages illustrated the fact that changes in raw product supplies and prices under certain circumstances have little impact on price changes at the retail level. SOPs such as product line pricing and pricing on the nines can contribute to a lack of retail price responsiveness to supply changes. Retailers commonly employ SOPs, such as pricing on the nines, that can result in a degree of price rigidity in part because they observe that consumers tend to respond very little to price changes within specific ranges (e.g., nine cents or less per unit), unless the price changes are accompanied by additional promotion and/or merchandising. This inelastic nature of consumer demand for certain processed food products within certain price ranges thus helps bring about the resulting retailer and manu

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manufacturer behavior. The graphs with stepped demand curves were illustrations of consumer non-responsiveness to price changes within certain ranges of prices.

Retailer decisions about which food items to put on the shelf can significantly influence the quantities purchased. Retailers are in the business of "selling" shelf space and often have little or no incentive to promote a commodity which happens to be in oversupply. They tend to compare the volume of sales and profitability of a particular food product to a set of alternative products to decide whether to provide shelf space for that product.

Retailers are likely to use a similar comparative analysis to decide whether to engage in promotion or merchandising activities on behalf of a particular product. Retailer pricing strategies also tend to be heavily affected by the pricing and promotional strategies employed by other retailers within specific markets areas.

Since price changes by themselves may play only a limited role in vertical market coordination, an important means of moving additional quantities of a commodity through retail market channels in response to increased supplies is through various non-price merchandising and promotion methods or a combination of price and non-price retail-level merchandising and promotion. Since retailers do not generally undertake merchandising of specific products on their own without specific incentives from suppliers, food manufacturers try to influence retailers to engage in promotion and merchandising, and to provide more shelf space for specific food products. Manufacturers also take on other activities related to promotion and merchandising such as couponing.

A food manufacturer will generally undertake promotional activities for branded processed food products with significant profit potential, but not necessarily for food products based on a particular agricultural commodity. Non-grower-owned food manufacturers have few incentives to undertake such actions for food products made from a particular commodity.

Growers have the most to lose from the consequences of instability and overproduction. Growers therefore have a greater incentive than other market participants to collectively undertake supply-demand coordination roles, such as attempting through merchandising and promotion to move additional quantities of food products based on these commodities into distribution channels in response to increased production. Thus, another purpose of the research was the examination of selected institutional means for collective supply-demand balancing, especially cooperatives and marketing orders.

The three perennial crop subsectors made use of three options to improve vertical coordination: (1) large marketing cooperatives that are strongly committed to the commodity subsector, (2) actions to balance long-run supply and demand, and (3) marketing orders for supply management. Summarized below are research results relating to each of those options.

7.3. The Role of Committed Marketing Cooperatives

Although grower-processors and small processing cooperatives may desire well-coordinated subsector balancing of supply and demand, they have little ability as individual firms to play a balancing role due to their small size. However, this research explored how larger marketing cooperatives can take on such supply-demand balancing roles with greater likelihood of having a substantial impact on subsector coordination.

The term committed marketing cooperative was used in this research to represent the type of cooperative with a potentially greater contribution to subsector coordination than other types of cooperatives. Committed marketing cooperatives have a large share of the total U.S. production of a commodity and a commitment to using the cooperative's resources to benefit growers by expanding demand and other actions.

Committed integrated marketing cooperatives (CIMCs) market a significant portion of member production through strong national branded consumer products. Blue Diamond and Sun Maid both have large shares of the retail market for their respective commodities, so in their roles as food manufacturers they work through their brand position to influence consumer demand and retailer merchandising. They have the ability to significantly influence the demand side in order to help balance subsector supply and demand.

The type of cooperative that was labeled in this research as a committed commodity marketing cooperative (CCMC) lacks a strong national brand franchise, but focuses on selling large volumes of processed products to food manufacturers and the food service industry along with retaining a commitment to being a reliable supplier of the commodity. CCMCs have a goal of influencing demand and prices as well as maintaining strong marketing programs for a particular commodity. CCMC members typically represent a large proportion of the total production volume of a commodity, and the cooperative is usually the largest marketing firm in a commodity subsector, or among the largest.

7.3.1. Demand Expansion Roles of Committed Marketing Cooperatives

A major goal of both CIMCs and CCMCs is to maintain and expand demand for their particular commodities, and the research focused on understanding different types of demand expansion strategies. Three main aspects of brand marketing strategies examined in this research were: (1) advertising, promotion, and merchandising, (2) development of new markets (mainly export markets), and (3) market research and product development.

The approaches followed by CIMCs for advertising, promotion, and marketing of branded products are similar to those of IOF food manufacturers with strong brands, and often include couponing and stimulating the use of special displays by retail food distributors. Examples of new market development strategies include Blue Diamond's efforts to open up export markets in a number of foreign countries. Brand strategies have also included product development through introduction of new food products as well different sizes and types of packaging. For examples, Blue Diamond increased over time

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their line of flavored almonds products. Sun-Maid raisins were offered in an increasingly varied array of package sizes and package types. Tart cherry pie filling manufacturers continued to market their regional brands of pie filling through special promotions and occasional limited advertising.

Another somewhat unusual approach to expanding the number of branded retail products was licensing the use of the cooperative brand name, such as Sun Maid's licensing of baking companies to sell raisin bread and raisin English muffins under the Sun-Maid label. These approaches were all intended to maintain or increase grocery store shelf space for branded products made from the perennial crop commodities, and generally have had positive demand expansion impacts, thus improving the supply-demand balance when the subsectors were facing increased production.

Value-added strategies are another important part of demand expansion. The sale of special cuts of almonds by Blue Diamond to ready-to-eat breakfast cereal companies are an example of marketing value-added ingredients to a major food manufacturer customer.

The fact that Sun-Maid and Blue Diamond have built up national brand recognition over many decades gives them a distinct advantage in carrying out these strategies. Retailers are much more likely to carry existing and new products because of brand name recognition. Strong brand marketing is much less predominant in the tart cherry subsector. Most tart cherry processors emphasize sales for industrial ingredients and food service, though there are a few exceptions--several firms market branded pie filling.

An element that influences the effectiveness of demand expansion through brand and value-added strategies is the versatility of the agricultural commodity in terms of potential for new product development. This is an important lesson for participants in other commodity industries. Versatility in terms of the number of different processed food products that can be made from an agricultural commodity is in part due to the commodity's inherent characteristics and in part due to the innovativeness of people working in product develop

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development. Almond demand expansion by Blue Diamond was facilitated both by exploiting the inherent versatility of almonds and by innovative thinking about ways to appeal to consumer tastes and preferences. Contributing factors to the success in almond retail demand expansion included the creation of numerous new products with alternative methods of salting, roasting, adding flavors, slicing, packaging, and so on. Increased use of almonds as ingredients in manufactured products was achieved through developing a number of different ways of processing, including cutting (slicing, dicing), blanching, and making paste. Demand expansion in other commodity industries depends on taking a broad-based approach to assessing potential food product uses in terms of either branded product development by cooperatives or IOFs, or as a focus for generic demand expansion programs, possibly funded through state or federal marketing orders.

One inducement for new product development is guaranteeing a food manufacturer reliable supplies at prices below prevailing market prices for a period of several years. This has been done to some extent by committed marketing cooperatives. This approach is subject to free rider problems since other firms marketing the same commodity can take advantage of futures sales opportunities without incurring the product development costs. Committed marketing cooperatives need to develop strategies that assure their members of the benefits of product development efforts.

New product development can also be achieved in conjunction with marketing order supply management. A means to encourage a food manufacturer to develop a new food product is to undertake secondary market diversion for certain quantities of a commodity for several successive years to manufacturers willing to experiment with new product uses, at prices below those prevailing in the primary market.

Another research task focused on identifying specific demand expansion responses to overproduction. The almond and raisin industries both provided useful examples. One example of a demand expansion strategy was Blue Diamond's response to rapidly growing production in the 1980s. The cooperative launched a major advertising campaign featuring scenes of growers chest-high in almonds in an attempt to communicate overproduction problems to consumers. Evidence based on interviews of almond industry representatives suggested that this approach helped increase almond sales in response to the overproduction problem.

An important raisin industry response to large supplies in the 1980s was to substantially increase generic promotion through the celebrated "dancing raisins" advertising program. This innovative advertising program was carried out by the raisin industry's generic promotion board. The raisin cooperative strongly supported this initiative and tailored some of its brand promotions to tie into the dancing raisin theme. The results of interviews with raisin industry participants suggested that the dancing raisins campaign, in conjunction with other initiatives, helped to reduce the oversupply problem by effectively expanding demand for raisins.

In summary, cooperatives and generic demand expansion organizations have played key roles in balancing supply and demand in their respective subsectors by undertaking these activities in response to annual supply fluctuations and long-term production trends. For raisins and almonds, the ability to sell a large proportion of total production as branded retail products has enabled almond and raisin growers to react collectively to changing supply conditions by initiating various additional measures to increase sales.

Committed marketing cooperatives have led the way in demand expansion for raisins and almonds through their efforts to apply the several types of brand and value-added strategies. This represents a key supply-demand coordination function for cooperatives that have a large share of the consumer market through a strong national brand position and a large proportion of total U.S. tonnage of that subsector.

7.3.2. Changing Roles of Committed Marketing Cooperatives

A key implication of this research is that certain types of cooperatives have a role in promoting a better match of supply and demand in specific commodity subsectors. However, the ability to perform this role has declined for some cooperatives. For example, some evidence of Blue Diamond's declining role comes from its decision to refocus its strategies because of a declining share of almond production. The cooperative made a policy decision to close membership and focus on effective marketing of a smaller proportion of the total U.S. almond tonnage than the cooperative has had in the recent past.

This points out a general problem that can occur with demand expansion efforts by committed marketing cooperatives. The cooperative incurs the expenditure of developing new products and expanding export opportunities. Other firms can frequently take advantage of the increased sales opportunities created by the cooperatives. Growers supplying those firms expand production, eroding the cooperative's share of total production. Free riding by non-member growers and IOF handlers can act as a disincentive for cooperative demand expansion efforts, hindering the ability of committed marketing to play supply-demand balancing roles.

Opportunities for cooperatives to develop new commodity-based retail products in the future are probably limited for cooperatives that are not currently marketing a portion of their members' production through branded retail products. The main reasons are the substantial financial barriers to entry into national markets for branded grocery products. New product development is expensive and risky. There are very large financial requirements for undertaking advertising programs to achieve successful product differentiation and to establish new products in the market. Cooperatives acting in their role as food manufacturing firms must engage in large-scale advertising and promotional activities to influence retailer merchandising and the selection of products carried on supermarket shelves. Additional requirements for retail demand expansion for branded retail products are substantial sales forces and/or networks of brokers and distributors for distribution of the food products. Substantial promotional resources are also required to maintain and increase food service sales such as influencing the selection of food products on the menus of a national fast food chains. Despite the positive role for cooperative brand marketing up to the present in balancing supply and demand, such a supply-demand coordination role for cooperatives may be more limited in the future because of the financial barriers to entry.

7.3.3. Future Research on the Role of Committed Marketing Cooperatives

An important accomplishment of this research was categorizing and classifying types of coordination mechanisms, cooperatives, and marketing strategies. However, the research did not entail gathering specific figures on the quantities going into various categories. Nor was there an attempt to quantify the extent to which cooperatives or generic demand expansion commissions have increased sales successfully in the face of supply increases. This research focused on making observations and discerning key trends, based on the interviews conducted and publications reviewed. Future research can attempt to quantitatively assess the success (or lack of it) of cooperative and generic demand expansion efforts.

The analysis for this research did not specifically define the threshold level for a cooperative to be categorized as a committed marketing cooperatives. Refining the concept to specify more precisely what is a sufficiently large proportion of total production to be a CIMC or a CCMC is another area for future research.

7.4. Long-Run Supply-Demand Balancing

The long run supply-demand balancing approaches that were investigated included approaches to reduce acreage when overplanting had occurred and to avoid overplanting.

Raisin acreage reduction has been accomplished to some degree through the Raisin Diversion Program (RDP) as part of the raisin marketing order. Some growers that participated in the RDP removed their vines entirely, thus reducing industry productive capacity. However, most participants in the RDP only trimmed their vines to eliminate production for a single year.

An orchard removal incentive program for tart cherries was proposed but never implemented. The tart cherry orchard removal program was intended to reduce acreage to a level at which quantities produced would be closer to quantities typically sold in commercial markets at prices approximating average grower cost of production, thus contributing to an improved balance of supply and demand.

Methods of avoiding overplanting examined in this research were: (1) dissemination on information on production projections and related long-run market analysis, (2) limiting cooperative membership, (3) stock tonnage contracts, and (4) acreage contracts.

At different periods in the past, Blue Diamond attempted to influence planting levels by disseminating market analyses and projections of future levels of excess almond supply and by limiting cooperative membership. Industry participants indicated in interviews that neither method was effective in bringing long-run supply and demand into balance, and the efforts were subsequently abandoned. When Blue Diamond attempted through information dissemination to influence production capacity (bearing acreage), cooperative officials found that the information was widely ignored by growers. In addition, almond sales increased by greater proportions than expected, which ironically benefitted most those growers who increased their plantings, in contradiction of the cooperative's suggested reductions based on the long-run market outlook.

When Blue Diamond limited membership, non-member production continued to increase steadily, eroding the cooperative share. Limiting cooperative membership is only likely to be effective if a cooperative sells most of its output under strong brands and if the cooperative's share of total U.S. production of the particular commodity is quite high, perhaps 70-80% or more of total production. Examples of such cooperatives include Welch's for Concord grape products and Ocean Spray for cranberries. Blue Diamond cooperative membership has accounted for around 50% of production in recent years, and cooperative officials expect that figure to decline as non-member production expands and is marketed through IOFs.

Stock tonnage has been used in the tart cherry subsector to coordinate supplies with expected sales for one of the larger tart cherry cooperatives. This approach is most appropriate for cooperatives which market most of their product through strong national brands. The reason for this is that strong brands provide a market segment somewhat separate from the unbranded commodity portion of the market. The demand for branded commodity-based food products in more inelastic than the product sold in the undifferentiated commodity markets. Since supply requirements for a particular brand are more predictable than for a commodity as a whole, brand marketers may be able to use stock tonnage to avoid oversupplying the market for their brand. The supply-demand balancing impact for the subsector may be substantial if cooperatives that use stock tonnage market a large portion of total crop production. Neither of these aspects has been characteristic of the tart cherry industry, and the long-run supply-demand coordination impact of the stock tonnage approach has been correspondingly limited.

Acreage contracts are common in the almond subsector. However, acreage contracts have not been used for long-run supply-demand balancing in the almond, raisin, or tart cherry subsectors.

Although several of these long-run supply-influencing approaches have been tried in the three subsectors that were studied, it is difficult to quantify whether any of them influenced planting decisions on a large enough scale to have a significant impact on bringing productive capacity into better balance with demand trends. Presentation of these app

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approaches nevertheless provides a starting point for considering how various combinations of long-run supply-demand balancing measures might be employed in a particular subsector.

7.5. The Role of Supply Management

Implementation of marketing strategies and demand expansion efforts by committed marketing cooperatives and through generic demand expansion programs is enhanced by having reliable supplies of a commodity at prices that do not fluctuate sharply from one year to the next. Firms at various subsector stages, including cooperatives, are negatively affected by the reduced supplies and high prices in short crop years.

Committed marketing cooperatives in all three subsectors are subject to significant free-rider problems in dealing with some of the supply problems. When cooperatives carry large inventories as a result of large crops, or attempt to divert excess supplies to secondary markets, their members bear the burden of short-run coordination, and non-members do not. Supply management programs through federal marketing orders have helped to address this free-rider problem of dealing with surplus supplies in large crop years and lack of supplies in short crop years.

7.5.1. Supply Management Provisions of Federal Marketing Orders

Chapter 5 presented the three main types of supply management provisions of federal marketing orders which are commonly implemented to mitigate the consequences of annual supply fluctuations. Reserve pools address the problem of annual supply fluctuation through storing a portion of grower deliveries in large-crop years and releasing some or all of the storage reserve in short-crop years. Market allocation provides another stabilization approach by removing excess product in large crop years from the designated major markets. This is more appropriately used in situations of persistent oversupply. Diversion to secondary markets (market allocation) is the means to remove product from *f*

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the primary market, and some secondary market uses involve experimenting with new product development. The third set of provisions, non-production or non-harvest diversion, provides additional flexibility in managing excess supplies.

Certain supply management programs through federal marketing orders have contributed to supply and price stability and have addressed problems related to short-run aspects of supply-demand balancing. A major contribution has been to alleviate some of the negative consequences of supply instability by helping to promote increased sales and to prevent erosion of demand through more stable commodity supplies. The supply management provisions of the federal marketing orders have also helped dampen price declines in large crop years, thus mitigating the negative impact on growers.

7.5.2. Modeling Federal Marketing Order Price Impacts

The question of the impact of supply management programs analyzed in this study focused on the grower price impact of federal marketing order implementation. Chapter 2 pointed out that large tart cherry crops commonly result in grower prices falling below typical grower total cost of production and sometimes below variable cost of production. The decline in prices is dampened by removing a portion of the temporary surplus supplies from the market through secondary market diversion or reserve pool storage. This aspect of the research was designed to estimate the magnitude of the price change. The question was: How much lower would grower prices have gone without the marketing order in those years in which the marketing order supply management provisions were implemented? A related question was: In certain years when the marketing order was not used, how much higher would grower prices have been if a marketing order had been used? The answers were sought through development and use of econometric models of the tart cherry and almond markets. Comparisons with an econometric study of the raisin market by French

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and Nuckton were also made. The French and Nuckton study provided guidance in developing the tart cherry and almond models.

The estimated price impacts of the tart cherry marketing orders from the model varied by subsector stage. The tart cherry simulation indicated that grower prices would have been lower without the marketing order in each of the five years that the marketing order was used. The price impact on the grower level of marketing order implementation appeared to be substantial in some years and moderate in other years. The last two years of marketing order use, 1984 and 1985, in which reserve percentages of 15% and 7% were established, were good examples of the impact the simulation was intended to measure. The simulation results indicated that grower price would have been 5¢ and 1¢ lower in 1984 and 1985, respectively, if the marketing order had not been used. This represented price changes of 20% and 7%, respectively, relative to the actual grower price.

For tart cherry processed prices in 1984 and 1985, the f.o.b. frozen price impacts were 8¢ and 3¢ per pound, respectively. Although the tart cherry model estimated only grower and processor prices, price impacts at the retailer and manufacturer levels were also considered. The analysis in Chapter 3 of retailer and manufacturer SOPs, and the rigidity of retail-level pricing within certain price ranges, indicated that the f.o.b. price changes estimated in the simulation would likely have had little impact on consumer product pricing. Retail level price increases would have been unlikely not only because of product line pricing and pricing on the nines, but also because the tart cherry ingredients represent a small part of the total cost of the processed food product.

For almonds, evidence from the econometric simulation indicated that substantial grower price impacts from marketing order use occurred in 1987 and 1988. Grower prices were an estimated 33¢ and 27¢ per pound higher due to the marketing order. Reserve percentages in those two years were 18% and 25%, respectively. The higher f.o.b. almond prices due to the use of the almond marketing order reserve in the late 1980s may have be

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been enough to bring about price changes of almond-based food products of a food manufacturer. However, the estimated price changes resulting from marketing order supply management represent dampening of the price declines that would have resulted from large crops in the absence of the marketing order. F.o.b. almond prices averaged around $1.00 per pound during the late 1980s when the marketing order was used for supply management. Use of the marketing order mainly prevented the f.o.b. price from declining in large-cop years substantially below $1.00 per pound, which was the average price level prevailing at that time.

On the issue of retail prices, a useful area for additional research would be to extend the simulation analyses for almonds and tart cherries to further assess the price impact of removing various quantities from the primary market through marketing order supply management.

The impact of the marketing order on grower net revenue was another aspect considered. The analysis showed that in each year of tart cherry marketing order implementation, net grower revenue was higher than it would have been without the marketing order, but that based on average prices and costs, growers still had negative net revenue. Similarly, the French and Nuckton study indicated that mean net grower returns from raisin production were higher as a result of the marketing order, but nevertheless averaged around zero for the period under study (1964-1985).

There is room for simulation model improvement regarding the estimated price impacts for tart cherries and almonds. Since the baseline historical simulations indicated relatively large errors in predicting grower and f.o.b. prices, the estimated price impacts of supply management should be viewed with caution. Alternative specification of key behavioral relationships may reduce the margin of error in estimating price impacts.

The stabilizing effect on supplies over several years is another feature of marketing order supply management. Table 13 in Chapter 5 showed the net stabilizing effect of the tart

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cherry marketing order by storing reserve cherries in 1972, 1975, and 1980, and releasing stored cherries the following year, which in each case was a short-crop year. The reduction in supply fluctuations attributable to the order over each two-year period ranged from 5 to 32 million pounds. Reducing the impact of shortages in short crop years helps prevent erosion of demand caused by unavailability of the raw product. This aspect of the analysis could be extended in future research by attempting to assess what additional sales took place because of the additional supply made available through the tart cherry reserve pool.

7.5.3. Differences in Use of Supply Management Among the Three Subsectors

Supply conditions have differed among the three commodity subsectors. The greater number of short crops of tart cherries when compared with almond and raisin production patterns was an important measure of variability; between 1967 and 1991, there were ten short tart cherry crops, compared to three for almonds and four for raisins. The larger number of short crops in years following large crops was a key reason for making greater use of the storage reserve pool in the marketing order for tart cherries than was done for almonds or raisins.

The three commodity industries have emphasized different supply management approaches depending on their differing supply conditions. Reserve pools have stabilized supplies through storage of a portion of grower deliveries in large crop years and release of the reserves either later in the same season or in subsequent short crop years. The tart cherry industry has tended to make greater use of reserve pool storage due to its greater frequency of short crops. This was intended to contribute to maintaining demand through more reliable supplies.

Because almonds and raisins tend to have frequent large crops but few short crops, use of marketing order provisions has emphasized market allocation which diverts portions of the crops to secondary markets. The main secondary market outlet for both almonds and raisins for two decades was the export market. This contributed to the growth of expor markets to the point where export sales were no longer residual outlets, but had become primary commercial market channels. In the 1970s and 1980s, market allocation provisions of the marketing orders emphasized using lower-priced raisins and almonds for new product development and diversion to such uses as USDA feeding programs.

The tart cherry industry is especially interesting in terms of the large number of programs that have been considered by the industry for dealing with supply volatility and periods of overcapacity of cherry orchards. A number of different programs were considered before the federal marketing order was implemented in 1972. After the termination of the order in 1986, tart cherry industry participants discussed and analyzed a wide variety of supply management options, including creation of different kinds of special cooperatives to facilitate group action in reducing acreage and/or for dealing with annual supply volatility. None of these programs have yet been implemented. The industry has recently developed a new marketing order program proposal.

Under the previous tart cherry federal marketing order (1972-1986), supply management provisions were implemented five times. During that time, the relative emphasis of the different provisions varied. Reserve pool storage was the provision most emphasized. Secondary market diversion would have been more emphasized during the 1980s had the order continued because short crops were becoming less frequent due to the increase in acreage leading to a situation of persistent overproduction. Non-harvest diversion was the option chosen by a number of growers in 1972, but use of that option declined to near zero in subsequent years when the previous marketing order was implemented.

An additional area for future research would be to examine the differing impacts of using different marketing order supply management provisions. For example, simulation analysis could be undertaken to see by how much price impacts would vary if in certain years market allocation was used instead of reserve pool storage or vice versa. Such analyses could provide decision-making guidelines for people serving on marketing order administrative bodies that are charged with making supply management decisions.

7.5.4. Supply Management: Applications to Other Commodity Industries

An important question is how might a perennial crop commodity industry choose among the supply management coordination mechanisms examined herein to address specific problems. An objective of this research was to highlight some of the conditions under which specific coordination mechanisms could be most appropriately applied. The supply management-oriented coordination mechanisms investigated were: 1) reserve pool storage, 2) market allocation, 3) non-harvest/non-production diversion, and 4) acreage removal.

An approach for deciding upon the appropriate supply management tools for specific commodity industries can logically include examination of the circumstances and problems facing that industry, followed by assessment of which mechanisms might be used to address those problems. Characteristics of the specific commodity are important: 1) crop production variability patterns and causes, 2) feasibility of methods for temporary non-production diversion, 3) storage capability and cost,

1. <u>Crop production variability patterns and causes</u>. If the dominant production variation pattern is chiefly one of frequent short crops in years following large crops, then reserve pool storage is likely to be the more appropriate tool of the four listed above. This pattern was characteristic of the tart cherry subsector in the 1970s and early 1980s. Release of stored commodities from reserve pools in short crop years contributed to market stability.

On the other hand, market allocation is especially relevant for a subsector which has an historic supply pattern of several excessive supply years in succession and for which short crops are not frequent. The third provision, non-harvest diversion, chiefly serves as an additional means to give growers credit for diversion when the limited number of secondary markets opt

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markets options are overwhelmed by the extent of the temporary surplus in certain large-crop years, leaving certain growers without alternative diversion outlets.

The fourth provision, acreage removal (or orchard/vine removal) is appropriate when perennial crops are in a period of excessive capacity and the industry could benefit from a reduction in the total number of acres planted to a specific crop.

Recognizing that various factors can contribute to supply variability is also important. Varying weather conditions is a major factor in the substantial production shifts of a number of perennial crops. However, changes in market utilization of a crop can also be a factor. The example cited in this research was that raisin-type grapes have uses in multiple markets. Therefore, a factor that contributed to raisin production variability was grower decisions to shift between the crush market and the raisin market. With additional factors contributing to annual variability, there is a need for greater flexibility and innovativeness in developing supply management tools.

2. <u>Feasibility of methods for temporary non-production diversion</u>. If it is feasible to make orchard or vines cease production for a single year, this affords a commodity industry considerable flexibility in dealing with temporary excess production. Non-production diversion can be used in conjunction with the other federal marketing order supply management tools to reduce supplies in particular large-crop years. The only crop for which this method is currently practiced is raisins. The Raisin Diversion Program is made possible by the fact that preventing grape production on particular vines for a single year is a fairly simple procedure of cutting off the "spurs" that produce grapes. Spurs grow back again the next year so that production resumes. The same effect may be feasible in the future for other crops by aborting blooms by spraying (or possibly by some other method) so that the blooms will produce no fruit in a given year. If it can be made technically and economically feasible, this can be an additional supply management tool for other perennial crops.

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3. Storage capability and cost. For any of the storage supply management tools to work, the commodity must be storable. The cheaper it is store the commodity, the more flexibility there is. Tart cherries are stored frozen, which is a more expensive than storage methods for raisins or almonds. This adds to the risk to an individual firm of making mistaken storage decisions. Almonds can be stored in large bins or piles inside warehouses, and raisins can be stored outside in large boxes covered with tarpaulins with periodic fumigation but no refrigeration. Thus, a commodity industry must consider the cost and ease of storage.

However, the cost of storage is only one among many factors to consider, and reserve pool storage may be an appropriate method for short-run supply demand balancing even when storage costs are high. Even though tart cherries are the most expensive of the three commodities to store, reserve pool storage was appropriately emphasized to a greater degree by the tart cherry industry.

7.6. Implications for Marketing Order Establishment for Other Commodities

Key elements that facilitate establishment of a marketing order by commodity industry are 1) a widespread sentiment shared by growers of a particular commodity that they face a serious supply-demand balancing problem, 2) substantial agreement among growers that the problems can be significantly reduced through establishment of a marketing order, and 3) a consensus that a marketing order is clearly the best alternative. Establishing a consensus on subsector problems and a sense of community can be facilitated by the geographic proximity of growers. A sense of community can be channeled into collective action when the growers of a particular commodity face an identifiable set of problems and challenges that can be addressed by the actions of an organized group representing those growers. This research has examined examples in three subsectors how this sense of community among growers is sometimes expressed through membership in cooperatives that represent a significant proportion of all growers in a region or the nation (and also r

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representing a large proportion of total production), and through the establishment of a marketing order. Committed marketing cooperatives are in some instances influential in the creation and maintenance of marketing orders.

A recommendation for future marketing order development is that new national enabling legislation should contain no commodity-specific or geographic restrictions on the creation of marketing orders. Commodity-specific restrictions are not needed. Any group of agricultural producers should have the right to organize and establish a federal marketing order for a particular commodity if growers decide among themselves that there is sufficient economic justification, sense of collective self-interest, and capacity to organize. The analysis of the three subsectors tends to support this policy recommendation by showing that the use of supply management tools has had beneficial impacts for supply-demand balancing. Shaffer concurs that there is no need to limit the scope of orders, since "the problems of organizing a community of interest to support these types of orders is limiting enough."[96]

Establishing a marketing order can be facilitated by a geographic concentration of growers, but no geographic restrictions on the right to establish a marketing order are needed. The physical proximity of growers makes a sense of collective identity among growers of a specific commodity more likely to develop and continue. Establishment and continuation of the raisin and almond marketing orders was aided by the fact that all raisin and almond growers are within fairly close proximity to each other in California. Establishment of the tart cherry marketing order was helped by the fact that over two thirds of tart cherry production was within the state of Michigan. However, subsequent organizing problems since the demise of the tart cherry marketing order in 1986 are in part attributable

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[96]James D. Shaffer, "Designing Marketing Order Programs for the Future," Presentation at the Conference of the Food and Agricultural Marketing Consortium, Alexandria, VA, January 13-14, 1994, Staff Paper No. 94-7, Department of Agricultural Economics, Michigan State University, February, 1994.

to the difficulties of organizing farmers across several states, extending from New York to Oregon.

Marketing orders could be effective and flexible tools for supply-demand coordination if new national enabling legislation authorized the creation of federal marketing orders with each of the provisions examined in this research. Individual marketing orders could include some or all of the four types of supply management provisions examined in this research: 1) reserve pool storage, 2) market allocation, 3) non-harvest/non-production diversion, and 4) acreage removal. It would be up to the industry marketing order development committee and the supervisory body of each marketing order to draw up guidelines for determining under what conditions specific provisions should be invoked. Representatives of the commodity industry sitting on the administrative committee would assess supply-demand balance conditions and decide which provisions are most appropriate at a given point in time. The marketing order language should allow the administrative committees considerable flexibility to make decisions.

As is the case now, periodic grower renewal referenda should be required to ensure that growers continue to support the order. Where there is substantial agreement among growers on the performance of a particular marketing order, grower referenda would likely approve continuance by substantial margins, as has been the case with almonds and raisins.

7.7. The Role of Commodity Promotion and Research Programs

The national marketing order enabling legislation discussed in the previous section should also contain provisions, similar to provisions in the current legislation, for the establishment of commodity promotion and research programs as a part of federal marketing orders. Effective commodity promotion can adjust demand to more nearly match supply at prices consistent with costs. However, the question of when to engage in promotional activities for commodity-based products is an important issue. This research

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indicates that subsector supply-demand balancing can be improved when promotional programs are designed to undertake actions consistent with supply conditions, yet are flexible and have a multi-year horizon. Promotion is especially appropriate during periods with excessive supplies. During periods of short supply, promotional programs should be reduced somewhat in scope, but there must be some continuity in promotional activities for a program to remain effective.

Commodity research for new product development is an additional aspect of generic commodity demand expansion strategy. A useful goal for commodity research organizations would be to allocate funds for research that focuses on identifying commodity attributes desired by consumers and by firms that handle the product in various stages of the marketing chain. Shaffer points out that research on food product attributes desired by consumers can guide related research focusing on developing economical methods to produce such attributes.[97] Efforts should be made where possible to complement new product development efforts of committed marketing cooperatives, where they exist, and new product opportunities made possible through marketing order secondary market diversion to firms willing to experiment with new product development if they can obtain lower-cost reliable supplies of the commodity.

7.8. Additional Policy Implications

Since committed marketing cooperatives and federal marketing orders serve useful functions in balancing supply and demand in some perennial crop commodity subsectors, the U.S. government should continue to promote cooperatives and facilitate the development and use of federal marketing orders for supply management. In the 1970s and 1980s the federal government took policy positions hostile to cooperatives with large market shares

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[97]J. D. Shaffer, "Designing Marketing Order Programs for the Future.

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of certain commodities, and to the use of supply management provisions of federal marketing orders for fruits, vegetables and specialty crops. The government expressed considerable concern over the possible anti-competitive effects of large cooperatives and the combination of large cooperatives and supply management-oriented federal marketing orders. The results of this research suggest that cooperatives and marketing orders operating in conjunction with each other can under certain circumstances serve useful and legitimate economic purposes in perennial crop subsectors.

However, the issue of possible undue price enhancement through supply management should not be ignored. The federal marketing order guidelines proposed by the Marketing Order Study Team discussed in Chapter 6 indicated that marketing order supply management programs should not contribute to above-normal grower profits. The evidence from the marketing orders simulation analyses suggests that growers did not make above-normal profits. Design of future marketing orders should consider whether there are sufficient safeguards against undue price enhancement. This is another policy area that merits additional research.

A key point in this regard is that the committed marketing cooperatives and federal marketing orders working in combination have been able to influence demand and supply to a certain extent in their efforts to bring about a better balance, but have not attempted to control agricultural production. The ever-present likelihood of increased agricultural production in response to profitable agricultural prices from supply management puts a limit on potential anti-competitive effects of supply management. Low barriers to entry are typical of many types of crop production, including most perennial crops. If supply management is used to maintain grower prices at levels well above grower cost of production, increased plantings from existing growers and new growers are likely and could bring about a situation of excess productive capacity. The additional acreage would

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undercut the supply-demand balancing role that the supply management program was intended to ameliorate.

Large market shares held by cooperatives with strong national brands have not led to anti-competitive pricing effects in the tart cherry, almond and raisin subsectors. On the contrary, they have led to improved vertical market coordination. Having the ability to influence retailer merchandising practices in their role as food manufacturers has provided an important subsector coordination function for cooperatives in their efforts to coordinate fluctuating supplies with demand.

Some future demand-related efforts to improve subsector coordination for commodities lacking products with national brand franchises will likely come from grower collective action through generic commodity promotion organizations. Because of the advantages of demand expansion as one tool for supply-demand balancing, national government policy should be to encourage such programs.

Efforts of commodity industry participants--growers and firms in downstream stages of the subsectors--should be focused on assessing consumer preferences and developing commodity-based food products that match those preferences, and on influencing merchandising variables to ensure that consumers are informed about new and existing products. Growers can achieve this through collective action in the form of committed marketing cooperatives. Retail branded product marketing is a significant component of demand expansion that contributes to balancing supply and demand for perennial crops. The value-added industrial market for commodity ingredients and for food service will continue to play important roles, as will the undifferentiated commodity markets. Supply management should continue to play a complementary role to the demand-related efforts in subsector supply-demand balancing.

7.9. Concluding Comment

The value of this kind of research lies in the comprehensiveness of the examination of supply-demand balancing and vertical coordination roles. A thorough examination of the nature of the production instability facing particular crop subsectors helps to distinguish in what respects the causes and consequences are similar or different. In the tart cherry, almond, and raisin subsectors, some similarities in supply fluctuation patterns led to the adoption of similar approaches to mitigating the consequences. However, differences in the supply patterns led to emphasizing to different degrees the use of specific provisions of federal marketing orders. Understanding the similarities and differences provides some insights into the potential application of these approaches in other subsectors.

Using the subsector framework as an analytical tool provides a means to examine the interactions between vertical stages of a subsector. The incentives facing firms at a particular subsector level can be examined to analyze how the adoption of SOPs such as product line pricing affects vertical coordination. Because price changes by themselves may play only a limited role in vertical market coordination, this research examined various means by which subsector supply-demand balancing can be improved through combinations of price and non-price merchandising and promotion approaches. A number of examples were presented to show how committed marketing cooperatives take on such supply-demand balancing roles. The cooperative role in demand expansion can be better understood by examining various aspects, including brand strategies and the marketing of value-added ingredients to food manufacturers, as well as supplying the food service industry. Understanding the interaction of various marketing-related institutions contributes to our knowledge of how commodity marketing systems can be improved. Supply management is likely to continue to play a complementary role to the demand-related efforts in subsector supply-demand balancing. Comprehensive comparative analysis contributes to our understanding of the dynamic, evolving nature of perennial crop subsectors.

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APPENDIX A

Table 36. Tart Cherry Market Supply With and Without Use of the Federal Marketing Order, 1972-1975

	Year of Marketing Order Use				
	1972	1975	1980	1984	1985
	----Millions of lbs. (raw product equivalent)----				
Crop Size	311.7	290.5	218.1	271.6	286.2
- Fresh Utilization	6.2	7.2	6.3	8.0	7.6
- Non-marketing order abandonment	19.8	39.4	1.9	13.6	6.0
= New Crop Supply for Processing	284.9	243.9	209.9	250.0	272.6
+ Frozen Carryin Stocks	44.1	41.1	24.3	12.8	44.4
+ Canned Carryin Stocks	11.2	2.7	3.9	0.3	4.5
= Market Supply w/o Market Order	340.2	287.7	238.1	263.1	321.5
- M.O. Storage Pool	19.1	27.0	42.6[1]	31.6[2]	12.5
+ M.O. Storage Pool Release	14.3	27.0[3]	16.7	8.3	0
- M.O. Secondary Mkt. Diversion	0	0	0	1.8	3.4
- M.O. Non-harvest diversion	22.0	5.0	1.9	1.0	0.6
= Market Supply with Market Order	313.4	282.7	210.3	237.0	305.0

[1]Out of 42.6 million pounds originally placed in the storage reserve pool, 21.0 million were eventually sold to the USDA for feeding programs. Out of the the 21.6 million that remained in the reserve pool, 16.6 million were released in spring 1981.

[2]The remainder was sold to USDA school lunch program.

[3]Released the following fall and spring.

Sources: 1972 carryin stocks from Noncitrus Fruits and Nuts Annual, January 1975, Crop Reporting Board, SRS, USDA. Other figures from Red Tart Cherries Crop Statistics and Market Analysis 1990, Red Tart Cherry Growers Committee, Michigan Agricultural Cooperative Marketing Association, Inc. (crop data: p.1; stocks data: p.19, Table 10 and p.24, Table 17; reserve pool data: p.26, Table 19). Additional reserve pool and secondary market diversion data from Background Economic Analysis and 1986 Marketing Policy of Cherry Administrative Board (Table 3, "Tart Cherry Marketing Order Effects on Supplies," p. 21).

Table 37. Tart Cherry Supply in Years Following Marketing Order Use, With and Without Market Order Use in 1972, 1975, 1980

	Year Following Marketing Order Use		
	1973	1976	1981
	Mill. lbs.(raw prod.equiv.)		
Crop Size	175.2	146.6	134.6
- Production Abandonment	1.2	0	0.4
- Fresh Utilization	5.2	4.4	4.0
= New Crop Supply for Processing	168.8	142.2	130.2
+ Frozen Carryin Stocks	21.7[1]	30.6	9.5[2]
+ Canned Carryin Stocks	0.4	2.2	3.6
= Market Supply w/o Market Order	190.9	175.0	143.3
+ M.O. Storage Pool Release	8.4	0	4.3
= Market Supply with Market Order	182.5	175.0	147.6

[1]21.7 million in frozen carryover is calculated from July 1 stocks of 30.1 (Table 17) minus subseqent reserve pool release of 8.4.

[2]9.5 frozen carryover figure calculated from July 1 stocks of 35.4 (Table 17) minus 21.6 (subsequent USDA sale) minus 4.3 (1981 reserve pool sales).

Source: Red Tart Cherries Crop Statistics and Market Analysis 1990, Red Tart Cherry Growers Committee, Michigan Agricultural Marketing Association, Inc. (crop data: p. 1, stocks data: p. 19, Table 10 and p. 24, Table 19).