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Trends in Marketing of Berry, Fruit, and Tree Nut Production through Cooperatives between 1996 and 2002

Michael A. Boland

Abstract

The objective of this study is to assess changes in berry, fruit, and tree nut production marketed by cooperatives between 1996 and 2022. The results show that the dried grape (raisin), orange juice, canning pears, apple juice, canning peaches, and olive industries saw a negative average growth rate while the other industries saw a positive growth rate with regard to overall supply produced in the United States (U.S.). Notably, the average growth rate of fruit U.S. production for cooperatives was also negative. This suggests that the overall share of cooperative volume and sales was declining during this time even though per capita availability increased in all industries except raisin grapes, orange juice, canning pears, olives, and apples.

Introduction

The objective of this study is to measure whether berry, fruit, and tree nut production marketed by cooperatives has increased or decreased between 1996 and 2022. The rationale for doing so is to better understand the make-or-buy/sell decision faced by producers when describing risk sharing activities. The make-or-buy/sell decision considers risk sharing through vertical coordination as a binary decision of integration or contracts. In doing so, a producer considers the boundaries of the production entity with regard to buying an input and selling an output. In particular, the research quantifies the direction over time of vertical coordination activities (the make-decision) for 29 different agricultural industries and eight other industry groups.

Vertical coordination involves integration and supply chain alliances such as marketing or production contracting. As discussed in the paper, it is not possible to quantify the proportional changes from integration increasing or decreasing over time. However, it is possible to compare the value and volume and per capita availability of commodities in each industry to the value marketed through cooperatives in certain aggregated industries. This can help provide evidence as to whether that value is increasing or decreasing in that industry.

Data between 1996 and 2022 was chosen because it coincides with the beginning of new farm domestic and international trade policy that affected United States (U.S.) production and increased coordination in many agricultural commodities as shown by the U.S. Department of Agriculture (USDA) statistics beginning with Martinez (2002). Boland (2018) further explains the changes in U.S. and global trade policy and in the U.S. domestic farm policies beginning with the 1996 Farm Bill.

The results show the dried grape (raisin), orange juice, canning pears, apple juice, canning peaches, and olive industries, collectively saw a negative average growth rate while the other industries saw a positive growth rate with regard to overall supply produced in the United States. Notably, the average growth rate of U.S. fruit production for cooperatives was also negative. This suggests that the overall share of volume and sales for agricultural cooperatives was declining during this time even though per capita availability increased in all industries except raisin grapes, orange juice, canning pears, olives, and apples.

Many agricultural marketing cooperatives were formed with the intent to aggregate as much production as possible into single commodity pools using multiple year marketing contracts as advocated by Aaron Sapiro (1923) and others. However, a declining growth rate in the marketing of member volume through cooperatives, despite an increase in vertical coordination, suggests that

producers may be using other legal structures to achieve their goals such as limited liability companies (LLC's) owned by producers to source domestic and foreign production. Additionally, channel captains may be vertically coordinating supply chains using marketing and/or production contracts in these industries. Many of these LLC's owned by producers are closely held and may include private equity partners. In addition, cooperatives have exited the avocado, fresh grape, olive, canning and frozen vegetable, hazelnut, and walnut industries.

The Make-or-Buy/Sell Decision

The rationale for risk sharing between entities has been articulated by Nobel laureates in Economic Sciences including Coase (1937), Hart (2017), Holmström (1979), Ostrom (1990), and Williamson (2005). The volume of agricultural production sold under contracts through the make-or-buy/sell decision has increased significantly in the 21st Century driven by a variety of issues that are described by Whitt, Miller, and Olver (2022). Note that the USDA does not track the volume of production sold through vertically integrated firms such as cooperatives but appears to combine vertical integration and contracting into one definition. For example, in USDA surveys by Martinez (2002), sugar beet production is shown as being contracted, however, all sugar beet processing plants are owned by producers through cooperatives (Brester and Boland, 2004; Risch et al., 2014). The cooperatives use contracts to procure sugar beets, but since producers own the processing plants, they are thus vertically integrated.

Further illustrations include large grocery retailers that have vertically integrated into wholesaling (Schumacher and Boland, 2004; Volpe and Boland, 2022) and producers and first handlers in food and feed grains that have vertically integrated into corn ethanol production and soybean crushing (Secor and Boland, 2018). Furthermore, vertical integration has been increasing as shown by Dorsey

and Boland (2009) for reasons other than diversification and that vertical coordination, overall, has been efficiency enhancing (Sexton, 2012).

Methodology

Little research exists on measuring the producer decision to participate in making a product through vertical integration. There are three alternatives for vertical integration with the intent to purchase supplies or market products: 1) producer investment in a mutual benefit type firm such as a cooperative; 2) producer investment in an investor benefit type firm such as an LLC in processing assets; or 3) producer investment in making-assets as a sole proprietor.

In order to understand a producer's behavior toward business risk, it would be desirable to have data on the market share of ownership in vertically integrated enterprises for agricultural inputs or marketing outputs over time. If market share was increasing, this would suggest that producers were receiving benefits by making the product through integration whereas if market share was decreasing this would suggest the opposite effect.

This research looks at the first of the three vertical integration alternatives because data on the other two alternatives is not available. An attempt was made to identify and create such a database for the latter two alternatives. For example, there are investor-benefit firms that are publicly traded such as Calavo which demutualized in 2000, Limoneira which used to be a cooperative member of Sunkist Growers, and Mission Produce which report some data on trade volumes to the U.S. Security and Exchange Commission in their annual 10-k reports. Standard and Poor's Compustat database was used to look at firms in the North American Industrial Classification Systems (NAICS) codes of 11 **Agriculture, Forestry, Fishing and Hunting**; 311 Food Manufacturing, and 3253 **Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing**. Data for the

second alternative is not consistent, and it was not possible to build a cross sectional, time series database of volume for the seven firms identified. No data could be found for the third alternative although 37 firms were found who had acquired cooperative assets or were producers and members of a closely held LLC. This number likely understates the presence of such firms given the structure of farming as reported by the USDA in other publications using the Census of Agriculture data.

Because of difficulties due to laws on foreign ownership of farmland, it is not likely that one would see vertical integration between input suppliers and first handlers marketing agricultural products, and producers across countries. Thus, common vertical integration strategies by U.S. producers would involve owners of U.S. farmland.

Consequently, it would be useful to know the rate of growth in four variables: 1) consumer demand, 2) domestic production to understand the maximum supply available to have been marketed through cooperatives, 3) total supply to understand the impact of trade and inventory stocks, and 4) overall value of domestic production. This information provides a better understanding how agricultural berry, fruit, and tree nut producers have chosen to use cooperatives for marketing their products between 1996 and 2022.

A sensitivity analysis is done using moving averages of two and three years to account for possible fluctuations in inventories, trade, and other factors that might impact changes in demand and supply. Because some of the data is reported on a marketing year basis and some on a calendar basis, the calendar data was converted to a marketing year by weighting the calendar year monthly data to be equal to the marketing year. For example, if data was reported on a calendar year ending in December and the marketing year ended in September, those three months (October, November, December) are removed by multiplying the calendar

data by 75 percent (nine months divided by 12 months) and adding those three months to the following year.

Data

A congressional mandate of the USDA is to collect a wide variety of production data on agricultural commodities and agricultural cooperatives. Because this study is interested in cooperatives, industries were restricted to those where cooperatives were identified between 1996 and 2022. Spatz and Reynolds (1990) conducted a study on cooperative trademarked brands in which they compiled a directory of 144 cooperatives with more than 1,000 trademarks. An extensive analysis was done which identified that 92 of these cooperatives did not exist in August 2025. It was determined that 52 had merged into another cooperative, 12 had their assets purchased by another firm and 16 entered bankruptcy. No information could be found on the remainder. Many of the 52 that merged were citrus cooperatives in Florida and California. This declining trend in the number of cooperatives was noted by Grashuis and Franken (2025).

For this analysis, 23 berry and fruit industries are grouped into berries, citrus fruit, pome fruit, stone fruit and tree nut categories. Berries include avocados, blueberries, cranberries, table grapes, grape juice, wine grapes, processing tomatoes, raisin grapes, raspberries, and strawberries. Citrus fruits include fresh oranges, orange juice, and lemons. Pome fruit includes canning pears, fresh apples, apple juice, and processing apples. Stone fruit includes apricots, canning peaches, sweet cherries, tart cherries, dates, olives, and prunes. The six tree nuts include almonds, hazelnuts, macadamias, pecans, pistachios, and walnuts. It should be noted that figs are a separate perennial crop that does not botanically fit into the any of the other categories. Also, table grapes were included despite there being no table grape cooperative, because of the potential

for the Thompson seedless grape variety which can be dried as a raisin grape or sold as a table grape.

The USDA Rural Business Cooperative Services (RBCS) began aggregating accounting and governance data on cooperatives in various industries beginning in 2000. Prior to that, the data were disaggregated into more narrow definitions. In particular, the data for 2000 to 2022 aggregated fruits into one category comprising the 23 berry and fruit categories discussed earlier. In order to compare the cooperative data against the USDA National Agricultural Statistics Service (NASS) and Economic Research Service (ERS) publications, seven USDA RBCS industries were used: Fruits and vegetables, grains and oilseeds, dairy, livestock, nuts, rice, and poultry (Wadsworth and Coleman, 2023).^a The six tree nuts were aggregated into a nut category for comparison purposes. For this study, gross revenues were used rather than net revenues because they included the cooperative value of agricultural production before member payments. This is more comparable to the value of the U.S. crop supply reported by the USDA NASS and USDA ERS.

It should be noted that the USDA reports cooperative data for inputs such as fertilizer, feed, crop protectants, seed, and petroleum. However, data on the four variables of interest are not reported by the USDA NASS or USDA ERS except for fertilizer production where a growth rate of 0.4% was found and the cooperative value was 4.7% during the 1996 to 2022 period. Consequently, that data was not used. Industries such as wool, cotton, and peanut have cooperatives, and it is possible to calculate growth rates for the first three variables using USDA NASS and USDA ERS data. However, the USDA RBCS does not report consistent data due to small numbers of cooperatives in these industries. The same

^a These publications are provided in the reference list.

is true for lamb although there have been new entrants, it is still low (Boland et al., 2007) and rhubarb, botanically a vegetable but used as a fruit in cooking, has only one cooperative (Washington Rhubarb Growers Association Cooperative). Thus, this data is not used.

Historically, the formation of cooperatives in fresh vegetable industries was not common for many reasons as noted by Jacobs (1990). Vegetables are grown annually or multiple times within a year and are highly perishable. Brokerage businesses have emerged to quickly merchandise vegetables, making processing or branding less important. Thus, it was not surprising to find an absence of cooperatives in these industries. The industry data from USDA NASS or ERS includes 23 fruit, six tree nut, and eight aggregated/other industries which, when multiplied by 27 years (26 growth rates from 1995) yields 999 observations. It should be noted that the Agricultural Marketing Act of 1937 authorized producers to form marketing orders which exist in 17 industries in this data: almonds, apricots, avocados, sweet and tart cherries, Florida and Texas citrus, cranberries, dates, grapes, hazelnuts, olives, pears (fresh and processing), pecans, pistachios, prunes, raisins, tomatoes, and walnuts. Cooperatives work with these marketing orders.

The USDA per capita wholesale availability is measured as **available commodity supply (the sum of production, imports, and beginning stocks) - measurable nonfood use (the sum of farm inputs, exports, and ending stocks, etc.)** divided by **Population** (the U.S. population plus individuals in the U.S. Armed Forces overseas).

Results and Discussion

The results are discussed in three sections: berries and fruits, tree nuts, and value marketed by cooperatives. The sensitivity analysis did not yield growth

rates that were much different from the annual rates except in the case of sweet cherries which is discussed elsewhere and consequently only the annual growth rate averages are presented.

The Fruit Industries

Table 1 shows the average growth rates for berries, citrus, pome, and stone fruit industries. Per capita availability (“Availability” in table 1) was found to have positive growth rates except for processing tomatoes, raisin grapes, fresh oranges, orange juice, canning pears, fresh apples, canning peaches, sweet cherries, olives, and prunes. Each industry is different and has different patterns of behavior. It should be noted that some of these foods are in Okrent and Alston’s (2012) comprehensive study of demand elasticities for 43 products over the 1998 to 2010 time period. For example, fresh apples were found to have significant cross price elasticities with other fruit substitutes such as bananas. It is well known that consumption of fresh fruits and vegetables has increased relative to canned fruits and vegetables.

The growth rates in agricultural production by U.S. producers (“Domestic Supply”) was positive except for raisin grapes, orange juice, canning pears, canning peaches, sweet cherries, and olives. Sanchez et al. (2007) discuss changes in the raisin grape industry. Orange juice consumption has decreased and the citrus greening disease in Florida has decreased supply. The canning pear industry saw the exit of cooperatives such as Snokist Growers and canning peaches have seen the exit of Tri Valley Growers with the number of canners declining to three in 2022 and one in 2026 (Cross and Buccola, 2004; Hariyoga and Sexton 2009).

The sweet cherry industry is somewhat puzzling, but it should be noted that there has been tremendous variability during the study period due to weather issues such as frost. The industry has experienced declining production from 21.4

million pounds in 1996 to 2.9 million pounds in 2022. A two-year moving average adjusted the Total Supply and Domestic Supply to -8.3% and -6.7%, respectively. In addition, it is likely that there is less demand for sweet cherries in processed products such as bakery goods. The volume of imported olives doubled, and domestic production declined from 322.4 million pounds in 1996 to 40.2 million pounds in 2022. Lindsay Olive Growers, a cooperative whose brand still exists, exited the industry during this time as its members were slow to adjust to the increased demand for small olives for use in slicing and products such as pizza toppings relative to member production of larger olives used in canning.

Overall, the value of U.S. production (“Value”) was positive except for raisin grapes, oranges, and orange juice. Across industries, the range of value was much higher than the two measures of supply, but each industry is different. For example, the value of the U.S. avocado crop and total supply increased as avocado consumption increased even as the principal cooperative, Calavo Growers, demutualized (Stanford and Hogeland 2004). Blueberries, raspberries, lemons, tart cherries, dates, olives, and prunes had double digit increases in the growth rate of domestic value. It is interesting to note that the principal cooperative in the blueberry, raspberry, tart cherry, and date industries entered into an LLC with non-cooperatives to create additional processing and grow these industries (excluding dates) in other U.S. geographies. Boland et al. (2009a) described how lemons saw widespread use in food away from home and in juice. The olive and prune industries underwent significant differentiation during this time and Sunsweet Growers purchased prune assets in Chile (Boland et al., 2012).

The Tree Nut Industries

As shown in Table 2 the average growth rates for the six tree nuts and all variables were positive. Notably, the U.S. domestic supply for hazelnuts, macadamias, pecans, and pistachios experienced double digit growth. Hardesty

(2009) and Boland and Cakir (2013) noted the exits of cooperatives from the walnut and hazelnut industries, respectively. Boland et al. (2009b) discussed the growth in almond production and noted that Blue Diamond Growers had seen an increase in the number of brokers in this industry.

Comparing Growth Rates with Cooperative Growth Rates

Table 3 presents the growth rates for the eight other industry groups for which the USDA RBCS reports data on cooperatives. For berries and fruits, the cooperative value had a growth rate of 0.7% which was much less than the overall increase in domestic and total supply.

This may be puzzling since the early 20th century saw many producers become members of marketing cooperatives that sought to add value through the marketing year in the processed fruit and vegetable industries. Aaron Shapiro was a principal proponent of such cooperatives forming pools with as much volume as possible to ensure market share (Larsen and Erdman, 1962; Ginder 1992). However, this data suggests that market share has eroded between 1996 and 2022. Further evidence can be seen in the fact that cooperatives in industries such as canning fruits (Pacific Coast Producers), apple juice and processing (Treetop, Knouse Foods), and sweet cherries (Oregon Cherry Growers) have closed or reduced processing capacity during this time (Boland et al. 2009c).

MacDonald et al. (2004) provided a comprehensive look at the use of marketing and production contracts between 1989 and 2001. The authors reported that in 2001, 56.5% and 30% of vegetables were sold under a marketing contract while another 12.9% of fruits and 8.4% of vegetables each were sold under a production contract. As noted earlier, the USDA appears to aggregate the first vertical integration alternative into its contract definition.

Cooperatives increased their value in grains and oilseeds, and dairy with rates greater than the domestic supply. Tree nuts had a positive but lower growth rate likely due to the cooperative demutualizations mentioned earlier in hazelnuts and walnuts and increased competition. Poultry no longer has any cooperatives with the demutualization of Goldkist and Norbest and the sale of West Central Turkeys. The largest cooperative beef processor (U.S. Premium Beef) demutualized although some much smaller processors were created near the end of this study period. Dairy remains strong for cooperatives even though there were a number of mergers among cooperatives between 1991 and 2025 and new entrants by Canadian and European dairy cooperatives such as Agropur Cooperative, Arla Foods, DMK Group, Friesland-Campina, and Lactalis. Rice cooperatives increased their value relative to an industry with somewhat flat per capita availability.

Summary

This paper looks at the make-or-buy/sell decision faced by producers when describing risk sharing activities. In particular, the research quantifies the direction over time of vertical integration activities (the make-decision) for 37 different agricultural industries. The average growth rate of berry and fruit production for cooperatives was positive for many industries but negative for aggregated berries and fruits suggesting that the overall share of cooperative volume and sales was declining during this time even though per capita availability increased in all industries except raisin grapes, orange juice, canning pears, olives, and apples. One implication is that increased trade has created year-round access to fruits and vegetables for consumers through imports and due to the difficulty of U.S. producers to own land outside the United States, it is likely that other forms of integration with non-cooperatives is occurring.

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Table 1. Average Growth Rates for Per Capital Availability, Total Supply, Domestic Supply, Value of Production and Example of a Cooperative in that Commodity for Berries, Citrus, Pome, and Stone Fruit Industries, 1996-2022

Industry	Availability	Total Supply	Domestic Supply	Value	Cooperative Name (Brand if different from name) ^b
Berries^a					
Avocadoes	7.5%	8.2%	7.1%	5.5%	Calavo Growers
Blueberries	9.6%	10.0%	7.5%	10.5%	Michigan Blueberry Growers - MBG (Naturipe)
Cranberries	1.7%	2.7%	2.1%	2.3%	Ocean Spray Cranberries
Grapes	1.0%	1.5%	0.4%	4.3%	Snokist Growers
Grape Juice	0.7%	0.7%	2.6%	3.5%	National Grape Cooperative (Welch Foods)
Wine Grapes	1.5%	2.2%	2.4%	2.7%	Allied Grape Growers
Processing					
tomatoes	-0.5%	0.2%	0.8%	4.5%	Pacific Coast Producers
Raisin grapes	-1.6%	-1.3%	-1.6%	-1.6%	Sun-Maid Growers
Raspberries	4.9%	9.1%	2.8%	18.6%	Northwest Berry Cooperative
Strawberries	2.5%	3.3%	2.7%	6.6%	Naturipe Berry Growers
Citrus Fruits					
Orange	-0.9%	0.3%	0.2%	-0.2%	Sunkist Growers
Orange Juice	-3.4%	-3.0%	-6.5%	-0.3%	Citrus World (Florida's Natural)
Lemons	3.8%	2.8%	2.3%	17.9%	Sunkist Growers

(cont.) Table 1. Average Growth Rates for Per Capital Availability, Total Supply, Domestic Supply, Value of Production and Example of a Cooperative in that Commodity for Berries, Citrus, Pome, and Stone Fruit Industries, 1996-2022

Industry	Availability	Total Supply	Domestic Supply	Value	Cooperative Name (Brand if different from name) ^b
Pome Fruits					
Canning Pears	-2.5%	-1.8%	-2.1%	1.1%	Snokist Growers
Apples	-0.4%	0.8%	0.7%	3.3%	Crunch Time Apple Growers
Apple Juice	0.5%	1.3%	-1.3%	1.1%	Tree Top Growers
Processing Apples	1.1%	-0.5%	1.8%	3.3%	Knouse Foods (Musselman's)
Stone Fruit					
Apricot	5.2%	5.1%	6.6%	3.6%	Apricot Producers of California
Canning Peaches	-2.1%	-1.5%	-2.6%	2.7%	Pacific Coast Producers
Sweet Cherries	-16.5%	-10.7%	-11.4%	5.9%	Oregon Cherry Growers / Flathead Lake Cherry Growers
Tart Cherries	1.0%	-2.1%	-3.0%	19.5%	Cherry Cen. (Fruit Haven) / Shoreline Fruit (Cherry Bay)
Dates	6.1%	7.4%	5.5%	13.8%	Bard Valley (Natural Delights)
Olives	-7.4%	-6.6%	-12.0%	36.6%	Lindsay Olive Growers
Prunes	-0.6%	-0.8%	10.5%	9.7%	Sunsweet Growers

^aTable data calculated from U.S. Department of Agriculture National Agricultural Statistics and Economic Research Service data

^bShaded cells denote no presence of cooperative in that industry or cooperative that exited that industry during the time period

Table 2. Average Growth Rates for Per Capital Availability, Total Supply, Domestic Supply, Value of Production and Example of a Cooperative in that Commodity for Tree Nuts and Fig Industries, 1996-2022

Industry	Availability	Total Supply	Domestic Supply	Value	Cooperative Name (Brand if different from name) ^b
Almonds	7.0%	7.9%	8.2%	7.4%	Blue Diamond Growers
Hazelnuts	2.1%	9.4%	19.5%	21.0%	Hazelnut Growers
Macadamia	2.0%	8.1%	12.2%	8.4%	Gold Crown Macadamia Association
Pecans	2.2%	3.6%	10.7%	11.1%	Southern Roots Nut Co.
Pistachios	8.1%	15.0%	26.8%	25.0%	Horizon Nut
Walnuts	4.9%	4.7%	6.0%	5.6%	Diamond Walnut Growers

^aTable data calculated from U.S. Department of Agriculture National Agricultural Statistics and Economic Research Service data.

^bShaded cells denote no presence of cooperative in that industry or cooperative that exited that industry during the time period.

Table 3. Average Growth Rates for Per Capita Availability, Total Supply, Domestic Supply, and Cooperative's Production Value, 1996-2022

	Availability	Total Supply	Domestic Supply	Co-op Value ^a	Cooperative Name (Brand if different from name) ^b
Fruit and Vegetable	-1.4%	4.0%	-3.8%	-0.7%	See Table 1
Grains and Oilseeds	-0.3%	0.5%	0.5%	6.4%	
Dairy	5.0%	-0.7%	-0.8%	4.6%	
Livestock	-8.4%	1.0%	1.0%	2.4%	Farmlands Foods
Nuts	1.8%	5.8%	7.4%	2.7%	See Table 2
Rice	0.1%	1.5%	1.4%	6.5%	Farmers' Rice / Producers Rice Mill, Riceland Foods
Poultry	1.0%	2.2%	2.0%	1.4%	Gold Kist
Figs	3.3%	-1.0%	1.2%	5.2%	Sunsweet Growers

^aCalculated from U.S. Department of Agricultural Rural Business-Cooperative Services Statistics annual data.

^bShaded cells denote no presence of cooperative in that industry or cooperative that exited that industry during the time period.