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Factors Affecting the Duration of Agricultural Marketing Orders

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Marketing orders are government-supported cartels designed to help farmers by allowing them to set production quotas and quality standards. Given that, it is surprising that a growing number have been voluntarily terminated in recent decades by their constituent farmers. To better understand why, we construct a novel data set on the timing of initiation and termination of marketing orders active between 1974 and 2019 and estimate duration models to examine the impact of specific factors on marketing orders' probability of survival. We find that the most significant factor affecting marketing order persistence is whether the order had a corresponding marketing agreement.

Key words: agricultural policy, hazard regression, marketing agreements, survival analysis

Introduction

Since their establishment by the Agricultural Marketing Agreement of 1937, agricultural marketing orders have been an important legal tool administered by the US Department of Agriculture's Agricultural Marketing Service for stabilizing markets for fruits, vegetables, dairy, and other specialty crops to benefit farmers and handlers (US Department of Agriculture, n.d.c; National Agricultural Law Center, n.d.). However, their influence has been declining in recent decades, and an increasing number have been terminated. This is surprising given that marketing orders are effectively government-approved cartels that give the authority to collectively restrict supply (both levels and timing) with the intent to increase prices.[1] They also harmonize production across farms by setting grade and size standards and funding promotion, advertising, and research. There are forces that could contribute to the fragility of marketing orders including free riding, collective reputation, market structure, and political interests. Our objective in this research is to use variation across commodities, regions, and time to understand why marketing orders are in decline and assess the implications of these results for farms and agricultural policy.

Marketing orders have a long history in US agricultural policy. Originating during the Great Depression to help farmers suffering from low crop prices, they were designed to create a more orderly market, ensuring that farmers receive top prices for their product and consumers receive a quality product throughout the year. Marketing orders are also designed to give farmers benefits they may not be able to afford on their own, such as advertising and research and development. The hope is that every farm in a geographic region would have the same benefits regardless of size, which made the idea appealing to even the smallest farmers.

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[1] If companies merge to control a majority of a market, the US government will often step in under the Sherman Anti-Trust Act to break up the merged entity to ensure a competitive market. Conversely, marketing orders are encouraged by the government to work together to control the majority of the market. In essence, the government is supporting the marketing order to become a cartel.

Table 1. Marketing Orders (MO) Included in This Study

Crop	MO No.	Prev. No.	MA No.	Est.	Terminated	States Covered
Dessert grapefruit	904	-	-	1980	1984	CA
FL citrus[a]	905	33	84	1939	-	FL
TX citrus[a]	906	-	906	1960	-	TX
Navel oranges[a]	907	14	117	1953	1994	AZ, CA
Valencia oranges[b]	908	22	131	1954c	1994	AZ, CA
AZ, CA grapefruit[b]	909	55	96	1941	1980	AZ, CA
Lemons	910	53	94	1941	1994	AZ, CA
Limes	911	-	911	1955	2003	FL
Indian River grapefruit	912	-	912	1965	1987	FL
FL interior grapefruit	913	-	*[d]	1965	1987	FL
Avocados	915	-	121	1965	-	FL
Nectarines	916	37	124	1954	2011	CA
Pears, plums, and peaches[a]	917	36	85	1958	2011e	CA
GA peaches	918	62	99	1939	1997	GA
CO peaches[a]	919	-	919	1942	1991	CO
Kiwifruit	920	-	920	1984	-	CA
WA peaches	921	-	921	1984	1995	WA
Apricots	922	-	922	1960	-	WA
Sweet cherries	923	-	923	1957	-	WA
Fresh prunes[a]	924	-	924	1957	2011	OR, WA
Dessert grapes	925	-	925	1960	-	CA
Prunes	925	-	140	1980	1979	ID, OR
Tokay grapes	926	51	93	1940	1995	CA
Winter pears[a]	927	39	89	1939	-	CA[f], OR, WA
Papayas	928	-	928	1971	2007	HI
Cranberries	929	-	929	1960	-	CT, MA, MN, MI, NJ, NY, OR, RI, WA, WI
Tart cherries[a]	930	-	930	1996	-	MI, NY, OR, PA, UT, WA, WI
Tart cherries	930	-	-	1971	1987	MD, MI, NY, OH, PA, VA, WI, WV
Bartlett pears	931	-	147	1965	2006	OR, WA
Olives	932	-	932	1965	-	CA
ID, OR potatoes	945	57	98	1941	-	ID, OR
WA potatoes	946	-	113	1949	-	WA
Irish potatoes	947	59	114	1942c	2014	CA, OR
CO potatoes	948	58	97	1941	-	CO
High Plains potatoes	949	-	949	1989	1990	NM, TX
ME potatoes[a]	950	-	*[d]	1954	1996	ME
New England potatoes	951	-	-	1950	1975	CT, MA, NH, RI,VT
Southeastern potatoes	953	-	104	1948	2019	NC, VA
Vidalia onions	955	-	955	1988	-	GA
Walla Walla onions	956	-	956	1995	-	OR, WA
ID, OR onions	958	-	130	1957	-	ID, OR
South TX onions	959	-	143	1961	-	TX
TX valley tomatoes	965	-	-	1959	1995	TX
FL tomatoes	966	-	125	1955	-	FL
FL celery[a]	967	-	149	1965	2002	FL
Lettuce	971	-	*[d]	1960	1995	TX

Continued on next page...

Table 1. – continued from previous page

Crop	MO No.	Prev. No.	MA No.	Est.	Terminated	States Covered
Melons	979	-	156	1979	2006	TX
Almonds	981	9	119	1950	-	CA
Hazelnuts/filberts	982	-	115	1949	-	OR, WA
Pistachios	983	-	983	2004	-	AZ, CA, NM
Walnuts[a,g]	984	84	105	1948	-	CA, OR, WA
Spearmint oil	985	-	-	1980	-	ID, NV, OR, UT, WA
Pecans	986	-	986	2016	-	AL, AR, AZ, CA, FL, GA, KS, LA, MS, MO, NC, NM, OK, SC, TX
Dates	987	103	127	1955	-	CA
Raisins	989	89	109	1949	-	CA
Hops[a]	991	-	-	1966	1985	CA, ID, OR, WA
Plums/prunes	993	93	110	1949	-	CA

Notes: This information above was compiled from the following reports: US Department of Agriculture (n.d.a, n.d.c, 1943, 1954, 1961, 1974–2019, 1975, 1982), Hedlund (1962), Jesse and Johnson (1981), Zepp and Powers (1988), Powers (1990), Armbruster, Christ, and Jesse (1993), and Neff and Plato (1995). .

[a]Had at least one previously terminated marketing order (MO) and/or marketing agreement (MA).

[b]Was a part of at least one previously terminated MO and/or MA.

[c]MO and MA were established at different times: 908–MO in 1954 and MA in 1956; 947–MO in 1942 and MA in 1949.

[d]MAs exist for these orders, but records for specific numbers could not be located.

[e]Prunes were terminated in 1991, peaches were terminated in 2011, and pears have been suspended since 1994.

[f]California was only included for a short time.

[g]Oregon and Washington were only included for a short time.

While marketing orders cover almost every type of crop, there are important differences between milk and nonmilk products. Milk marketing orders are much more concentrated, with 11 orders covering approximately 75% of the US market (US Department of Agriculture, 2019). There have been significantly more marketing orders for fruit, vegetables, and nuts that cover a smaller geographic area. While both types of marketing orders are focused on increasing market stability, dairy marketing orders differ in important ways from other commodities and have received greater study in the academic literature (Balagtas and Kim, 2007; Ahn and Sumner, 2009). Therefore, our study focuses on the 57 marketing orders for fruit, vegetable, and nut active between 1974 and 2019 (see Table 1).

One of the most significant changes in farm structure in recent decades has been an increase in farm diversity in terms of size, quality, and the ability to differentiate products. Differences in farm characteristics are likely to create heterogeneity in the degree to which different farms are benefiting from marketing orders. In the realm of commodity promotion, Crespi and Marette (2002) find that high-quality firms are worse off because generic advertising conveys the idea that all output is the same. Isariyawongse, Kudo, and Tremblay (2007) find that firms' generic advertising brings in more customers, helping all firms; however, in a market with vertical differentiation, only the higher-quality firms have the incentive to brand themselves. Therefore, generic advertising can be helpful, but it is more important to low-quality firms. This heterogeneity in benefits across farms may create tension, threatening the persistence of a marketing order.

Even when all firms are identical, a strategic incentive exists for any one farm to leave and free ride. This is why marketing orders were intended to be compulsory from their initial legislation. In commodity promotion or generic advertising (Crespi and Marette, 2002; Chung and Kaiser, 2003; Isariyawongse, Kudo, and Tremblay, 2007), an individual producer has the incentive to shirk on paying for advertising while still benefiting from the higher prices it can bring. This incentive to shirk can also occur when it comes to the quality of the product. Quality standards—including grade, size, and maturity requirements—are common when establishing a marketing order to ensure a high-quality product. With that strong collective reputation, individual producers may have the incentive to cut costs to produce a lower quality product while still benefiting from higher prices (Quagrainie, McCluskey, and Loureiro, 2003; Winfree and McCluskey, 2005; Saak, 2012; Castriota and Delmastro,

2015). This effect can also grow over time. As the marketing order evolves, the cost to ensure a high-quality product may increase. With more producers or a larger amount of land to monitor, there could be decreases in traceability that causes producers to have a greater incentive to cut quality. With a low-quality product, the collective reputation of the marketing order falls, which could explain the decline in marketing orders.

It could also be the case that factors external to the marketing order (e.g., recessions or policy changes) affect their durability. To our knowledge, this explanation has not been previously considered in the literature. This is a significant omission given the significant changes in the structure of global food markets since marketing orders came into being. Consider, for example, the tomato war between Florida and Mexico (Brooker and Pearson, 1975; Bredahl, Schmitz, and Hillman, 1987; Chambers and Pick, 1994; Armbruster, Christ, and Jesse, 1993). Facing increasing competition from imported tomatoes in the 1960s, a Florida marketing order tried several methods to increase their market share at the expense of Mexico (Bredahl, Schmitz, and Hillman, 1987). Since the order could not control the quantity of imports, they needed an alternative solution to help domestic producers. This was done by choosing grade and size requirements to ensure domestic producers had an advantage. While these standards were active, domestic producers achieved significantly higher incomes; however, the gains were short-lived. Within a few years, consumers sought legal intervention, straining trade relationships with Mexico. Ultimately, the restrictions were lifted, but the battle for market share would continue for many decades. As trade volumes grew, it became increasingly difficult for marketing orders to maintain control.

There is also evidence that regulators' political interests have affected marketing order continuation. Padberg and Hall (1995) argue that the marketing order for tart cherries was terminated during the Reagan Administration on the basis of a general objection to government intervention into markets.[2] The marketing order had a large surplus crop for consecutive years and was at odds with the government about their reserve pool. The US Department of Agriculture (USDA) rejected the reserve pool in 1982, citing the US Office of Management and Budget's belief that consumers would be negatively impacted if producers decided to discard portions of their crop. This decision was estimated to cost producers $13 million–$15 million.[3]

Given these possible explanations, we set out to empirically examine the factors most strongy associated with marketing order persistence. To accomplish this, we created a novel dataset on the timing of initiation and termination of marketing orders combined with other variables describing the initial creation as well as their continued operation. These data are used to estimate econometric models that assess alternative explanations for the termination of marketing orders.

Background on Marketing Orders

The establishment of a marketing order begins with a proposal from industry members providing evidence that a marketing order is necessary for the industry in a specific geographic area (US Department of Agriculture, n.d.b).[4] This proposal includes the level of industry support in the specified geographic area and the desired features to be included. If approved, the marketing order proposal moves to a public forum, and exceptions can be filed. The USDA will then issue the proposal for a vote of the industry. This referendum must obtain approval from two-thirds of producers, either by number or by volume.[5] If it meets the requirement, the marketing order is then issued by the US Secretary of Agriculture. During the voting process, a concurrent marketing agreement may also be sent to handlers for their signatures (Neff and Plato, 1995; US Department of Agriculture, n.d.b).[6]

[2] This objection included an economic review in May 1981, which led to the USDA issuing a set of guidelines for all marketing orders in 1982 (US Department of Agriculture, 1982).

[3] This eventually led the tart cherry order to be terminated in 1987. In 1996, a new tart cherry order was created.

[4] Alternatively, a marketing order can be established independently by the US Secretary of Agriculture.

[5] This continuing referendum for every marketing order was started in 1982 (US Department of Agriculture, 1982).

[6] The term "handler" refers to anyone who handles and transports fresh product. A handler is essentially the middleman between producers and retailers or processors.

While both marketing agreements and marketing orders have similar goals, there is a difference in who initiates the proposal and whether it is binding on the entire industry. Marketing orders are initiated by producers and are binding for all handlers. Marketing agreements are initiated by handlers and are only binding for the handlers who sign on to them. Theoretically, if 100% of handlers signed on to the marketing agreement, a marketing order (with the same authorizations) would be redundant (Hedlund, 1962). As with a cartel, handlers may find it advantageous to cooperate by committing to a marketing agreement. For example, they may agree to standardize containers or packaging, which reduces transaction costs. When both a marketing order and a marketing agreement exist for the same industry, it shows commitment to cooperation.

Once a marketing order is established, it needs to continually prove its effectiveness. Each marketing order has a committee of members, comprised of both producers and handlers, who oversee the day-to-day operations of the marketing order. After a marketing order has been in place for a period of time, a referendum will be issued to confirm this order is still desired by producers. If the majority of producers are still in favor of the marketing order, the cycle starts again. However, if the majority declines, the marketing order is subject to termination. In addition to grower approval, the marketing order must also abide by the Secretary of Agriculture's requirements. The marketing order is also subject to termination if the Secretary has determined it to be ineffective.

Hypothesis Development

Authorizations

During the proposal stage, the participants choose the set of authorizations they want in their marketing order. Given that some authorizations, such as market flow and volume management, have significantly more influence on the market than others, it is probable that some authorizations are more beneficial than others. Conversely, it is possible that some characteristics have such minor influences on the market that they have no significant impact on the order's survival. To differentiate these qualities, we separate the internal authorizations into six hypotheses.

Our first hypothesis is that a marketing order with a corresponding marketing agreement will survive longer. While a marketing agreement is not required to establish a marketing order, it demonstrates that handlers support it voluntarily. Thus, if a marketing order has a corresponding agreement, we expect the probability of termination to decrease.

Hypothesis 1a. *Having a marketing agreement increases the survivability of the marketing order.*

A marketing order can specify industry standards such as grade or size requirements. Since these authorizations increase the overall quality of the commodity and are arguably the least intrusive in the market, we expect specifying standards to have a positive impact on a marketing order's survivability (Carman and Klonsky, 2004).

Hypothesis 1b. *Product standards increase the survivability of the marketing order.*

In a similar vein, a marketing order can also request authorizations for research and advertising. Research helps everyone in a market, but the benefitâĂŤcost ratio may differ across producers based on their size. Since most small farmers may not be able to afford this level of research, we expect research expenditures to help the marketing order to survive (Carman and Klonsky, 2004; Kalebjian, 2012), especially when the average size of producers is small.

Hypothesis 1c. *Research authorizations increase the survivability of the marketing order. This may depend on the size of farms within the marketing order.*

Generic advertising is somewhat similar in that it potentially benefits all participants, but larger producers may prefer to invest in advertising for their own brands rather than the collective brand of the marketing order. Since many producers already engage in their own advertising (Cosentino and

Baker, 2015), they recognize the uneven split of costs and benefits (Crespi and Marette, 2002; Chung and Kaiser, 2003) or do not believe that generic advertising is helpful (Carman and Klonsky, 2004). Therefore, we hypothesize that advertising expenditures decrease survivability.

Hypothesis 1d. *Market promotion via advertising decreases the survivability of the marketing order.*

Marketing orders may influence supply through market flow controls and volume management. Market flow involves handler prorates and shipping holidays, whereas volume management involves producer allotments, market allocations, and reserve pools. While both provide a significant amount of market control, they also puts the marketing order under more scrutiny from claims that product was being destroyed (Shepard, 1986; Thompson and Lyon, 1989; Richards et al., 1996). We theorize this additional struggle among marketing orders and consumers will cause an increased probability of termination.

Hypothesis 1e. *Controlling the market flow has a negative impact on survivability.*

Hypothesis 1f. *Volume management has a negative impact on survivability.*

Age

We hypothesize that the probability of termination increases with marketing order age. This could be due to a failure to adapt to changing market conditions or the commitment to the order slipping away as farms are passed down to the next generation.

Hypothesis 2. *Probability of survival is a negative function of age.*

Average Farm Size

As firms grow larger, they may achieve economies of scale, become more efficient, and rely less on the marketing order (Kalebjian, 2012). Ultimately, it may be cost effective for the producers to provide services for themselves rather than collectively. They can set their own standards (which are often higher than those imposed by the marketing order) and advertise their own brands; thus, we hypothesize that the survivability of marketing orders will decrease as average farm size increases.

Hypothesis 3. *As average farm size increases, the survivability of the marketing order decreases.*

Market Power

Marketing orders are designed to give producers collectively increased market power. However, once achieved, there may be a temptation to dissolve either due to complacency or elimination of rival producers. We test this in two ways. First, we evaluate the impact of a HerfindahlâĂŤHirschman Index (HHI) on survival. Second, we assess the effect of the marketing order's within-commodity production share on survival.

Hypothesis 4a. *As the concentration level increases, the survivability of the marketing order decreases.*

Hypothesis 4b. *As the percentage of total production by the marketing order increases, the survivability of the marketing order decreases.*

Trade Value

Lowering trade barriers increases competition for the marketing order, which may make it harder to maintain a higher price since consumers can switch to the lower priced import. This was seen during

the tomato war with Mexico (Bredahl, Schmitz, and Hillman, 1987; Hawkins, 1998; Armbruster, Christ, and Jesse, 1993). According to Hawkins (1998), imports of tomatoes from Mexico increased by 275% in the first year, while Florida production dropped by 37%, decreasing producers' income by over $750 million. Thus, we hypothesize that an increase in trade leads to a higher probability of termination.

Hypothesis 5. *As the value of imports and exports increases, the survivability of the marketing order decreases.*

Data

The objective of our empirical analysis is to understand how various factors influence the timing of marketing order terminations. From this survival analysis perspective, time in our application starts from when we can track marketing order termination in the historical record, which is the year 1974. We also track time in terms of the age of the marketing order measured in years since it was created, which is an explanatory variable in our model. This is akin to following the survival of medical patients, where the age of the patient is a covariate. In addition, we have multiple additional combinations of time varying and invariant explanatory variables across the models estimated.

To identify marketing orders to track, we reviewed multiple USDA reports published in 1974, 1981, 1988, 1990, 1995, and 2019. These reports provide a complete list of all marketing orders, with two caveats. First, we do not track marketing orders terminated prior to 1974. Second, marketing orders created and terminated between two USDA reports may be missing. The exact year of creation and termination for marketing orders is reported in the *Federal Register* where they receive a unique marketing order number. The *Federal Register* also contains information about the commodity type and state(s) of operation for each marketing order.

The USDA reports also provide information about whether the marketing order has the authority to set quality standards (e.g., size, grade, and maturity) and use market support tools (e.g., volume controls, market flow, advertising, and pack and container regulations). These data are used to examine the relationship between the marketing order's characteristics and their longevity (Hypotheses 1a–1f).

Since these USDA reports are from a variety of sources, there is sometimes an overlap in information across reports collected without complete agreement on all the marketing order characteristics of interest. We used two approaches to deal with inconsistencies. First, we assumed that these marketing order characteristics were approved but are currently inactive. Since it takes considerable time to authorize the removal of a marketing order characteristic, it is far more likely that an authorization is still active but not used than for it to have been removed. In this case, we created a dummy variable for each characteristic that takes a value of 1 if the majority of reports showed the authorized characteristic to be in place, and 0 otherwise. For example, if a marketing order shows a grade authorization in four of the seven reports, it was given a value of 1, showing that the marketing order had the grade authorization characteristic.

While some of these marketing orders or provisions of an order might be suspended, they can be reinstated at any time and should not have a significant impact on our data. To check whether our results are robust to this assumption, we used a second approach in which marketing order characteristics are allowed to be time-varying. In those models, every characteristic could vary based on the reported value for each USDA report (1974, 1981, 1985, 1988, 1990, 1995, and 2019). The resulting panel dataset for each marketing order allows us to verify our results, which remain largely unchanged, even if a marketing order had these authorizations removed and reintroduced. If a marketing order was terminated between report years, then the value of time-varying covariates is the value from the previous report.

We use additional information compiled from the USDA Census of Agriculture to control for time-varying factors that may affect farm profitability (USDA, 1974–2017). This information includes variables that change during the operation of the marketing order (e.g., real import and export values,

average farm size, real value of marketing order production, and adjusted net farm income). This second group of data is used to test the impact of the marketing orders' operating characteristics on their longevity (Hypotheses 2–5).

Trade values are calculated for each individual commodity from NASS (US Department of Agriculture, 1974). A measure for market power is created from those data using commodity prices and total US production for each marketing order. Using average prices and the value of marketing order production, the production share for each marketing order is calculated by dividing the production by total US production of the commodity to obtain an approximate percentage produced by the marketing order. In some cases, the production value is not provided, so the most recently reported value is used. If more than one value is missing, the second value is imputed based on previous values. Information is gathered for the value of production done by the marketing order, which is then adjusted by the consumer price index (CPI). Finally, net farm income is from the USDA Economic Research Service (US Department of Agriculture, 2020).

Average farm size comes from the US Census of Agriculture, weighted by the states covered in the marketing order and by the type of commodity (e.g., fruit, vegetable, or field crop). The HHI is utilized as a concentration measure. Since the Census of Agriculture breaks farm sales into categories, the lower value is chosen for calculating total market share. As with farm size, this variable is used for each marketing order based on the type of commodity and weighted by the states involved. The Census of Agriculture is only reported every 5 years, so there are marketing orders that were terminated between Census of Agriculture years. In this case, the value for time-varying covariates for the terminated year is from the previous Census of Agriculture report.

Table 2 presents summary statistics for marketing order characteristics, including a breakdown between active and terminated marketing orders. This is the first group of variables mentioned. Most marketing orders covered are for vegetables and fruits with 30% and 58%, respectively. Of the 57 marketing orders included in this analysis, just over half have been terminated, and most have a marketing agreement. Interestingly, of the still-active orders, 96% have a corresponding marketing agreement, while only 83% of terminated marketing orders had one. Several have authorized grade or size requirements. For orders with the more controversial requirements, such as volume management and market flow, those numbers drop considerably. This is especially true between the groups: 32% of active orders used volume management compared to 10% of terminated orders, and 18% of active orders used market flow compared to 31% of terminated orders. Interestingly, there was also a considerable difference in the number of states involved (with means of 2.39 and 1.83, respectively).

Table 3 presents the second group of variables, which focus on production. Since the production values are from the Census of Agriculture, we were able to obtain slightly more observations than the data from Table 2, which only used the seven USDA reports mentioned earlier. On average, marketing order production covers about 1.8% of crops. However, due to the large variance in the types of marketing orders, coverage ranges from a negligible amount to almost all production. For example, California almonds covered 99.4% of almond production, while Tokay Grapes were approximately 0.000002% of all table grapes. The mean HHI for the market was 2,210, indicating a somewhat concentrated market.

Econometric Approach

We first estimate a Kaplan–Meier (1958) survival function, which is a graphical representation of the survival rate in the sample of marketing orders as a function of spell length. For our application, this is years since 1974 for those created prior to this year, or years since the marketing order was created, if it was created after 1974. From this, we determine the likelihood they will still be active as a function of the spell length. The estimation is presented graphically in Figure 1. Marketing orders, on average, are long-lived. As a marketing order ages, the probability of survival, or still being active, decreases, but the odds of survival do not drop below 50% until around 50 years.

Table 2. Marketing Order (MO) Characteristics

		All (N = 57)		Active (N = 28)		Terminated (N = 29)	
Variable	**Definition**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Age (years)	Number of years a MO was active	46.298	21.388	55.500	20.977	37.414	18.003
Marketing agreement	=1 if a marketing order had a marketing agreement, 0 otherwise	0.895	0.310	0.964	0.189	0.828	0.384
No. of states in MO	Total number of states in the MO	2.105	2.498	2.393	3.224	1.828	1.513
Commodities covered							
Fruit	= 1 if the MO covered fruits, 0 otherwise	0.579	0.498	0.500	0.509	0.655	0.484
Vegetable	= 1 if the MO covered vegetables, 0 otherwise	0.298	0.462	0.286	0.460	0.310	0.471
Nuts	= 1 if the MO covered nuts, 0otherwise	0.088	0.285	0.179	0.390	0	0
Other	=1 if the MO covered any remaining crops that were not fruit, vegetable, or nuts (e.g., spearmint oil), 0 otherwise	0.035	0.186	0.036	0.189	0.034	0.186
Authorizations							
Grade	=1 if the MO is authorized to require crop grades, 0 otherwise	0.877	0.331	0.929	0.262	0.828	0.384
Size	=1 if the MO is authorized to require crop sizes, 0 otherwise	0.912	0.285	0.929	0.262	0.897	0.310
Research	=1 if the MO is authorized to spend on R&D, 0 otherwise	0.772	0.423	0.786	0.418	0.828	0.384
Volume mgt.	=1 if the MO is authorized to restrict the amount of product that members are able to sell, 0 otherwise	0.211	0.411	0.321	0.476	0.103	0.310
Advertising	=1 if the MO is authorized to spend on advertising, 0 otherwise	0.386	0.491	0.429	0.504	0.379	0.494
Market flow	=1 if the MO is authorized to restrict the flow of product that goes to the market, 0 otherwise	0.246	0.434	0.179	0.390	0.310	0.471
Pack/ container regs.	=1 if the MO is authorized to require specific packaging, 0 otherwise	0.596	0.495	0.643	0.488	0.552	0.506

Table 3. Production Variables for Marketing Orders and the Entire Industry (N = 391)

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Age (years)	35.233	17.973	1.000	81.000
Average farm size (acres)	219.324	167.964	25.000	1226.481
Herfindahl–Hirschman Index (number)	2,210.650	646.079	936.601	5,999.327
US imports & exports[a] (US$)	4,200.833	28,418.830	0.000	512982.400
Percentage production covered by marketing order (%)	0.018	0.122	0.000	0.994
Value of marketing order production[a] (US$)	1,062.241	2,013.915	0.000	22,862.070
Adj. net US farm income[a] (US$)	452,514.70	115,781.50	282,625.50	697,434

Notes: [a]Indicates CPI-adjusted $1,000 values.

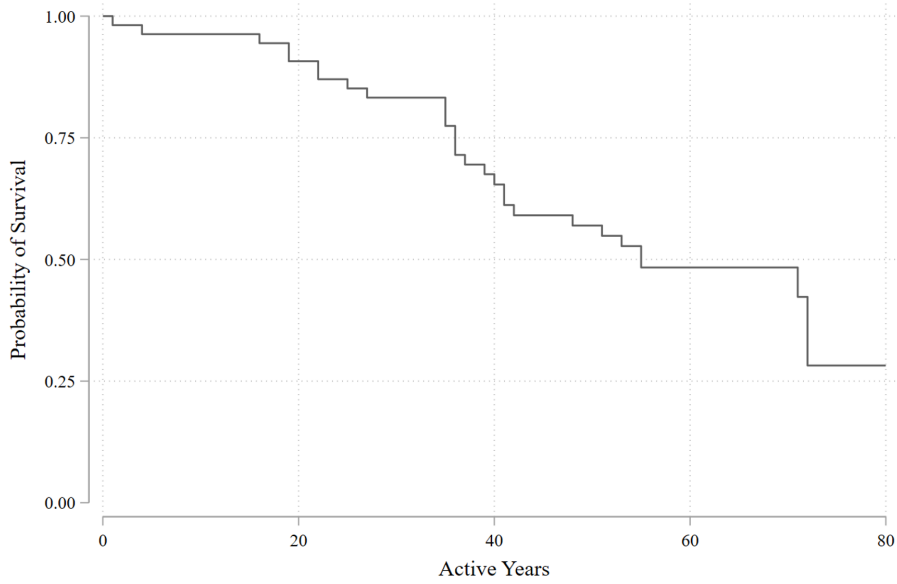

Figure 1. Kaplan–Meier Curve Showing the Probability of Survival (or still being active) as a Function of Age

Notes: On average, marketing orders live for quite a long time. Their probability of termination does not drop below 50% until they have been in the market for over 50 years.

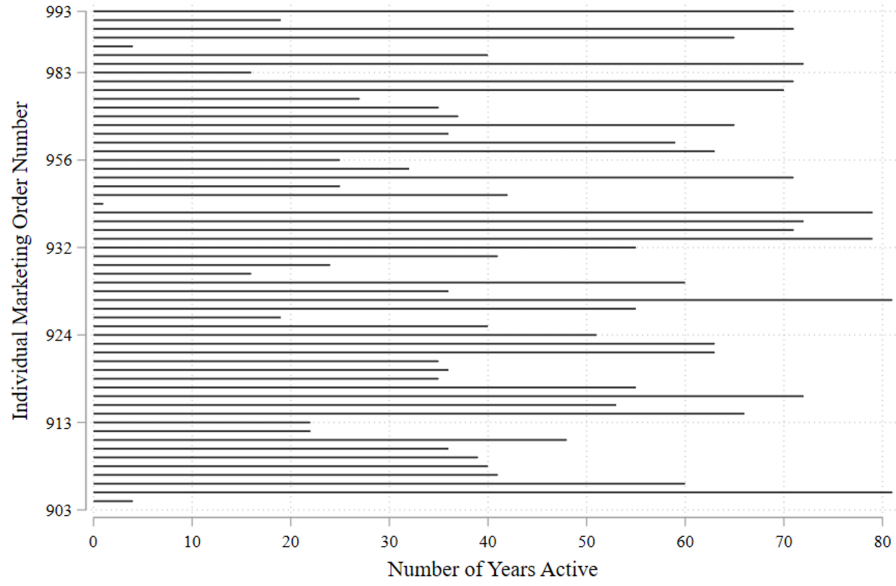

Figure 2. Number of Active Years for Individual Marketing Orders Covered in This Article

Additional graphs on the life of marketing orders over both calendar time and lifespan are presented in Figures 2 and 3, respectively. With the variety of starting and ending points in Figure 2, there is no exact time when all marketing orders were terminated. A similar result can be seen in Figure 3. While this again shows that most marketing orders are somewhat long-lived, there is nothing that indicates marketing orders are all being terminated at the same age. This level of variation indicates something else must be driving these terminations, which motivates the following regression models.

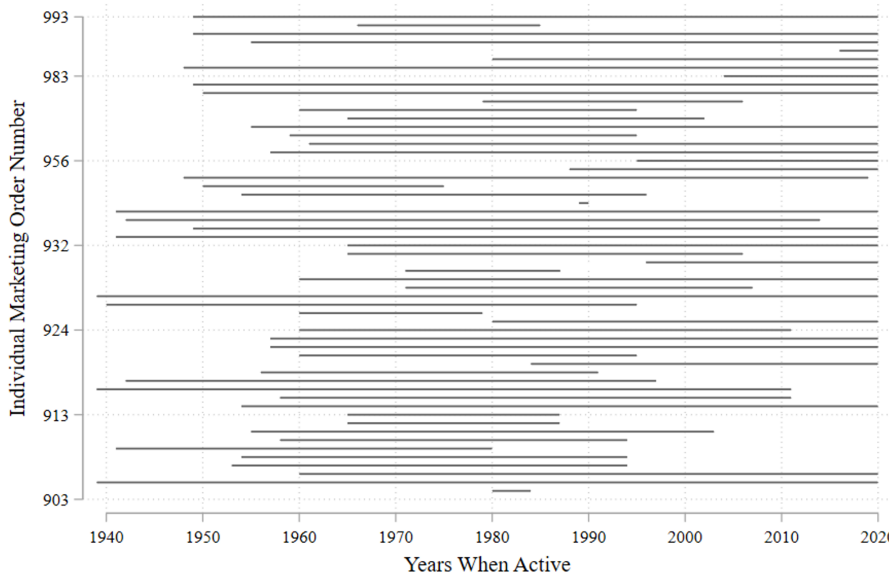

Figure 3. Lifespans of Individual Marketing Orders Covered in This Article

Cox Survival Model

We next model the duration of marketing orders with a Cox proportional hazard regression, which models the survival or hazard rate. In this study, the event in question is the termination of an order. With this approach, the effects of specific variables on termination can be isolated. The basic model is represented by

$$h_j(t) = h_0(t) \times \exp\left(\boldsymbol{x}_j\boldsymbol{\beta}\right), \tag{1}$$

where $h_j(t)$ represents the probability that marketing order j will be terminated after t years, $h_0(t)$ represents the base hazard level, $\boldsymbol{x}_j$ is a vector that contains the marketing order characteristics, including the type of order, any authorizations, the number of states, and other characteristics, and $\boldsymbol{\beta}$ is their corresponding coefficients. These characteristics can modify the baseline hazard rate for marketing order j. The base hazard level is the probability of termination if all variables in the $\boldsymbol{x}_j$ vector are equal to 0. If a coefficient is positive (negative), it indicates an increased (decreased) probability of termination, which shifts the baseline hazard function up (down). The Cox model estimates the parameters via maximum likelihood. Rearranging equation (1) to equation (2) shows that coefficient estimates are most directly interpretable as a ratio that compares the hazard rate for the tested variables to the baseline hazard level:

$$\frac{h_j(t)}{h_0(t)} = \exp\left(\boldsymbol{x}_j\boldsymbol{\beta}\right). \tag{2}$$

A hazard ratio of greater than 1 indicates that the variable increased the probability of termination, and a hazard ratio of less than 1 indicates a decreased probability of termination.[7]

Logistic Regression

To solidify the above findings, we followed Fernandes and Paunov (2015) by estimating our regressions as a logit model. Since the logit model does not depend on time or account for the right-censoring from any marketing orders still in operation, it provides another way to verify what was

[7] Hazard ratios frequently use 95% confidence intervals to calculate significance (see Machin and Gardner, 1988; Spruance et al., 2004). Contact the authors for all confidence intervals used in this analysis.

Table 4. Cox Model Hazard Ratios for Time Invariant Characteristics

Variable	1	2	3	4	5	6	7
Has a mktg. agreement	0.047***		0.046***		0.107***	0.102***	
Number of states	1.040	1.131	1.044	1.139	1.144	1.139	1.149
Fruit	15.034	0.698	17.195*	2.370	7.474	9.301	2.275
Vegetable	9.186	0.562	10.419	1.871	4.646	5.726	1.916
Nuts	1.66e−18	4.00e−17			2.83e−18		
Grade	1.101	0.841	1.102	0.824	0.919	0.924	0.839
Size	0.479	0.801	0.455	0.561	0.515	0.481	0.577
Research	1.254	0.898	1.275	0.992	1.442	1.480	1.460
Volume mgt.	0.163	0.215	0.160	0.234	0.169	0.175	0.254
Advertising	0.524	0.880	0.517	0.812	0.595	0.579	0.691
Market flow	1.607	1.290	1.607	1.259	1.430	1.438	1.174
Pack & container reg.	0.432	0.555	0.435	0.586	0.616	0.616	0.652
No. of obs.	57	57	57	57	302	302	302

Notes: Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively.

found in the Cox model. In this case, we used seven or ten periods of data (for the first and second groups, respectively), where the dependent variable takes a value of 1 if an order was terminated, and 0 otherwise, leaving us with 302 and 388 observations, respectively. The basic model is represented as

$$p = \Pr(y = 1 \mid x) = \frac{e^{a+\boldsymbol{x}_j\boldsymbol{\beta}_i}}{1 + e^{a+\boldsymbol{x}_j\boldsymbol{\beta}_i}}, \tag{3}$$

where p represents the probability of termination given a set of explanatory variables, x. To better understand the magnitude of the results, we choose to use the odds ratio represented by

$$\ln\left(\frac{p}{1-p}\right) = a + \boldsymbol{x}_j\boldsymbol{\beta}_i. \tag{4}$$

In this case, the odds ratio is the probability of termination over the probability of survival. Using this approach, all regressions are reestimated. By using this multitiered approach, we can robustly verify our results.

Results

Tables 4 and 5 present the first results, which focus on the initial characteristics of the marketing orders. In models 1–4, we consider each variable as time-invariant, while models 5–7 allow the variables to vary over time. Since none of the nut marketing orders are terminated in the dataset, we also estimate some models with those marketing orders omitted (models 3, 4, 6, and 7). Finally, multiple models are estimated removing marketing agreements as a robustness check (models 2, 4, and 7).

Tables 5 and 6 present the second set of regressions, which focus on the operating variables. Similar to the earlier regressions, multiple iterations are included in the estimation. In models 2 and 3, net farm income and lagged income are added, while a dummy variable indicating the decade is added in models 3 and 5–9 to account for unobserved characteristics. There have been significant changes in agricultural markets in the last few decades, including transitions away from small farms to large farms, a reduction in the number of processors, shifting consumer demand, and increased globalization. Using these decadal controls allows us to account for these unobserved characteristics and potentially provide initial results that could be explored in future research.

A dummy variable is included in models 7–9 to create two separate groups within our sample related to the North American Free Trade Agreement (NAFTA). We argue that NAFTA opened up

Table 5. Cox Model Coefficients for Time-Invariant Characteristics

Variable	1	2	3	4	5	6	7
Has a mktg. agreement	−3.055***		−3.089***		−2.235***	−2.282***	
	(0.756)		(0.743)		(0.674)	(0.654)	
Number of states	0.040	0.123	0.044	0.130	0.134	0.131	0.139
	(0.202)	(0.177)	(0.199)	(0.137)	(0.197)	(0.183)	(0.130)
Fruit	2.710	−0.360	2.845	0.863	2.011	2.230	0.822
	(1.762)	(1.522)	(1.680)	(1.193)	(1.720)	(1.571)	(1.196)
Vegetable	2.218	−0.576	2.344	0.627	1.536	1.745	0.650
	(1.754)	(1.547)	(1.681)	(1.235)	(1.708)	(1.569)	(1.233)
Nuts	−40.937	−37.757			−40.405		
	(-)	(1.18e+08)			(1.91e+09)		
Grade	0.096	−0.174	0.097	−0.194	−0.084	−0.079	−0.176
	(1.052)	(1.030)	(1.055)	(1.056)	(0.935)	(0.937)	(0.932)
Size	−0.736	−0.222	−0.788	−0.578	−0.664	−0.732	−0.550
	(1.163)	(1.131)	(1.141)	(1.062)	(1.156)	(1.125)	(1.054)
Research	0.226	−0.108	0.243	−0.008	0.366	0.392	0.378
	(0.577)	(0.555)	(0.573)	(0.546)	(0.640)	(0.635)	(0.594)
Volume mgt.	−1.816	−1.535	−1.834	−1.453	−1.780	−1.745	−1.369
	(1.320)	(1.145)	(1.311)	(0.950)	(1.291)	(1.206)	(0.882)
Advertising	−0.646	−0.128	−0.659	−0.208	−0.519	−0.546	−0.369
	(0.551)	(0.503)	(0.548)	(0.486)	(0.476)	(0.467)	(0.440)
Market flow	0.474	0.256	0.474	0.230	0.357	0.363	0.161
	(0.513)	(0.489)	(0.514)	(0.490)	(0.497)	(0.497)	(0.470)
Pack & container reg.	−0.839	−0.589	−0.833	−0.534	−0.484	−0.485	−0.428
	(0.594)	(0.569)	(0.595)	(0.561)	(0.518)	(0.518)	(0.500)
No. of obs.	57	57	57	57	302	302	302

Notes: Values in parentheses are standard errors. Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively.

markets for agricultural commodities to producers who are outside of the marketing orders' influence. As a result, the rents from market power are eroded when the obstacle that limited competition is partially removed. Our hypothesis is then that the reduction in the marketing order's market power through increased foreign competition resulting from greater trade liberalization increases the probability that an order will terminate. This follows from the idea that a reduction in the value of a marketing order to producers decreases its existence. The "NAFTA group" in the sample are marketing orders that were in existence when NAFTA was adopted. The "non-NAFTA group" consists of marketing orders that either terminated prior to NAFTA or were created after NAFTA.

Beginning with the time-invariant characteristics in Tables 4 and 5, we note the significance related to the presence of a corresponding marketing agreement. In three of the four models in Table 4, the probability of termination is a significant fraction of what it would be for a marketing order without a marketing agreement. For example, model 1 from Table 4 shows that a marketing order with a corresponding agreement has 18% of the probability of termination as a marketing order without an agreement. This is further confirmed after the never terminated nut orders are dropped in model 3 (17%) and characteristics are allowed to vary in model 6 (37%).

These results correspond with Hypothesis 1a: The presence of a marketing agreement has a positive effect on a marketing order's survival, as it shows the handlers' buy-in. This also matches what was found in *Federal Register* reports announcing the termination of marketing orders. When a marketing order is terminated, the USDA issues a report in which producers explain why they are

Table 6. Hazard Ratios for Time-Varying Characteristics (N = 391)

Variable	1	2	3	4	5	6	7	8	9
Age	1.019	1.022	1.301**	1.019	1.231*		1.253**	1.250	
MO farm size	0.998	0.998	0.999	0.998	1.000		1.001	1.001	
HHI	1.000	1.000	1.000	1.000	1.000		1.000	1.000	
Adj. imports and exports	1.000	1.000	1.000	1.000	1.000		1.000	1.000	
Pctg. of commodity covered by MO	0.597	0.68	0.000				0.000		
Adj. value of MO production	0.999**	0.999**	1.000	0.999**	1.000		0.999*	0.999*	
Adj. net farm income		1.000	1.000						
Lagged adj. net farm income ($t-1$)		1.000	1.000						
Lagged adj. net farm income ($t-2$)		1.000	1.000						
Active during 1940s			0.017**		0.044**	0.879	0.052*	0.059*	1.012
Active during 1950s			0.530		0.489	1.783	0.321	0.276	1.503
Active during 1960s			0.548		0.395	2.029	0.375	0.352	2.202
Active during 1970s			176.518		0.255	0.256	0.315	0.758	0.312
Active during 1980s			0.573		0.575	0.181	0.783	0.758	0.222
Active during 1990s			0.009***		0.018***	0.033***			
Active before NAFTA (1990–1994)							0.058**	0.068**	0.056**
Active after NAFTA (1995–1999)							0.145*	0.132*	0.626
Active during 2000s			0.012		0.172	0.112*	0.242	0.228	0.100*
Active during 2010s			0.009***		0.017***	0.016***	0.014***	0.017**	0.015***

Notes: Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively.

Table 7. Cox Coefficients for Time Varying Characteristics (N = 391)

Variable	1	2	3	4	5	6	7	8	9
Age	0.0192	0.022	0.263**	0.019	0.208*		0.023**	0.223**	
	(0.012)	(0.020)	(0.122)	(0.020)	(0.108)		(0.111)	(0.110)	
MO farm size	−0.002	−0.002	−0.001	−0.002	0.000		0.001	0.001	
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)		(0.002)	(0.002)	
HHI	0.000	0.000	0.000	0.000	0.000		−0.000	−0.000	
	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)		(0.001)	(0.001)	
Adj. imports and exports	−0.000	−0.000	−0.000	−0.000	−0.000		−0.000	−0.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	
Percentage of commodity made by MO	−0.516	−0.385	−63.18				−30.07		
	(13.060)	(12.750)	(69.500)				(68.550)		
Adj. value of MO production	−0.001**	−0.001**	−0.001	−0.001**	−0.000		−0.001*	−0.001*	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.001)	(0.001)	
Adj. net farm income		0.000	−0.000						
		(0.000)	(0.000)						
Lagged adj. net farm income ($t-1$)		−0.000	0.000						
		(0.000)	(0.000)						
Lagged adj. net farm income ($t-2$)		−0.000	−0.000						
		(0.000)	(0.000)						
Active during 1940s			−4.079**		−3.131*	−0.130	−2.965*	−2.827*	0.011
			(1.853)		(1.593)	(0.600)	(1.680)	(1.640)	(0.685)
Active during 1950s			−0.635		−0.716	0.578	−1.137	−1.287	0.408
			(1.053)		(0.959)	(0.613)	(1.087)	(1.033)	(0.663)
Active during 1960s			−0.602		−0.928	0.708	−0.981	−1.045	0.789
			(1.570)		(1.322)	(0.860)	(1.367)	(1.354)	(0.879)
Active during 1970s			5.173		−1.367	−1.364	−1.156	−0.99	−1.165
			(13.276)		(1.444)	(1.414)	(1.511)	(1.463)	(1.456)
Active during 1980s			−0.557		−0.554	−1.71	−0.245	−0.277	−1.507
			(1.369)		(1.194)	(1.043)	(1.142)	(1.132)	(0.993)
Active during 1990s			−4.68***		−4.04***	−3.405**			
			(1.319)		(1.208)	(1.189)			
Active before NAFTA (1990–1994)							−2.855**	−2.686**	−2.878**
							(1.343)	(1.287)	(1.183)
Active after NAFTA (1995–1999)							−1.933*	−2.028*	−0.468
							(1.095)	(1.086)	(0.758)
Active during 2000s			−4.45		−1.759	−2.186*	−1.42	−1.478	−2.298*
			(3.932)		(1.272)	(1.212)	(1.323)	(1.320)	(1.278)
Active during 2010s			−4.68***		−4.06***	−4.12***	−4.25***	−4.09***	−4.19***
			(1.455)		(1.209)	(1.085)	(1.287)	(1.246)	(1.114)

Notes: Values in parentheses are standard errors. Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively.

Table 8. Odds Ratio and Coefficients for Time Invariant Characteristics

	Odds Ratio		Coefficient	
Variable	**1**	**2**	**1**	**2**
Has a mktg. agreement	0.113**		−2.178**	
			(0.730)	
Number of states	1.106	1.144	0.101	0.134
			(0.169)	(0.124)
Fruit	10.445	3.615	2.346	1.285
			(1.596)	(1.281)
Vegetable	7.634	3.424	2.033	1.231
			(1.613)	(1.325)
Grade	1.753	1.611	0.561	0.477
			(0.923)	(0.929)
Size	0.284	0.290	−1.258	−1.238
			(1.131)	(1.058)
Research	1.864	1.829	0.623	0.604
			(0.653)	(0.617)
Volume mgt.	0.188	0.269	−1.67	−1.314
			(1.112)	(0.862)
Advertising	0.753	0.789	−0.283	−0.237
			(0.468)	(0.450)
Market flow	1.327	1.097	0.283	0.092
			(0.527)	(0.508)
Pack & container reg.	0.592	0.621	−0.525	−0.477
			(0.544)	(0.519)

Notes: Values in parentheses are standard errors. Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively.

choosing to terminate (*Code of Federal Regulations*, 1974–2019). While many reasons are given for a termination, there are quite a few similarities. The most common reason is cited as tension and lack of support from producers and handlers. This industry turmoil appears in more than 40% of the terminated orders. While having a marketing agreement shows community involvement, not having one may lead to this added tension and potential for termination.

In the second group of variables in Tables 6 and 7, the age of the marketing order is significant in about half of the models, indicating an increased probability of termination as the marketing order ages, so we fail to reject Hypothesis 2. As a marketing order ages, the higher probability of termination increases. The value of marketing order production is also quite significant across all models. As the marketing order production becomes more valuable, the probability of termination also decreases. For example, if the marketing order increases its production value by $10,000 in model 1, the odds of termination decrease by 1%. Similar results are found after including income (model 2) and including the unobserved effects from NAFTA (models 7–8). Considering that the value of the average marketing order is almost $1.5 million, this is a small increase that could lead to much larger cumulative effects. This result matches other reasons often reported for termination, including concerns about reduction in market power[8] or inability to fulfill its original purpose[9] (*Code of Federal Regulations*, 1974–2019). If a marketing order is not successful in helping producers increase their value, there is a decreased incentive to keep it around.

[8] This includes a decline in market share, demand, or the industry itself.

[9] This includes staying current, being an effective marketing tool, being too expensive, or not meeting the needs of growers and handlers.

Table 9. Odds Ratio for Time Varying Characteristics

Variable	1	2	3	4	5	6	7	8	9
Age	1.027**	1.023	1.341***	1.027**	1.370***		1.390***	1.392***	
MO farm size	0.998	0.998	1.000	0.998	1.000		1.001	1.001	
HHI	1.000	1.000	0.999	1.000	0.999		1.000	1.000	
Adjusted imports and exports	1.000	1.000	1.000	1.000	1.000		1.000	1.000	
Pctg. of commodity covered by MO	0.702	0.425	0.000				0.000		
Adjusted value of MO production	0.999***	0.999**	0.999*	0.999***	0.999*		0.998**	0.998**	
Adj. net farm income		1.000	1.000						
Lagged adj. net farm income ($t-1$)		1.000	1.000						
Lagged adj. net farm income ($t-2$)		1.000	1.000						
Active during 1940s			0.01***		0.008***	1.265	0.016***	0.016***	1.425
Active during 1950s			0.638		0.368	1.304	0.152*	0.141*	1.126
Active during 1960s			0.405		0.247	1.110	0.220	0.207	1.121
Active during 1970s			0.053		0.037*	1.130	0.047	0.050	1.344
Active during 1980s			0.069		0.927	0.500	1.020	0.985	0.511
Active during 1990s			0.007***		0.01***	0.378			
Active before NAFTA (1990–1994)							0.074	0.076	0.528
Active after NAFTA (1995–1999)							0.055*	0.055*	0.757
Active during 2000s			0.115		0.15*	0.881	0.239	0.223	0.895
Active during 2010s			0.001***		0.000***	0.075***	0.000***	0.000***	0.076***

Notes: Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively.

Table 10. Logit Coefficients for Time-Varying Characteristics

Variable	1	2	3	4	5	6	7	8	9
Age	0.027**	0.022	0.293***	0.027**	0.315***		0.33***	0.331***	
	(0.013)	(0.014)	(0.068)	(0.013)	(0.062)		(0.065)	(0.065)	
MO farm size	−0.002	−0.002	0.000	−0.002	0.000		0.001	0.001	
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)		(0.002)	(0.002)	
HHI	−0.000	0.000	−0.001	−0.000	−0.001		−0.000	−0.000	
	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)		(0.001)	(0.001)	
Adj. imports and exports	−0.000	−0.000	−0.000	−0.000	−0.000		−0.000	−0.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	
Percentage of commodity made by MO	−0.353	−0.856	−45.394				−27.096		
	(13.343)	(15.378)	(151.210)				(104.806)		
Adj. value of MO production	−0.001**	−0.001**		−0.001*	−0.001*		−0.002**	−0.002**	
	(0.000)	(0.000)		(0.001)	(0.001)		(0.001)	(0.001)	
Adj. net farm income		−0.000	−0.000						
		(0.000)	(0.000)						
Lagged adj. net farm income ($t-1$)		−0.000	−0.000						
		(0.000)	(0.000)						
Lagged adj. net farm income ($t-2$)		0.000	0.000						
		(0.000)	(0.000)						
Active during 1940s			−4.607***		−4.856***	0.235	−4.158***	−4.122***	0.354
			(1.305)		(1.252)	(0.622)	(1.304)	(1.299)	(0.704)
Active during 1950s			0.450		−0.999	0.266	−1.887*	−1.960*	0.119
			(0.960)		(0.897)	(0.625)	(1.127)	(1.096)	(0.685)
Active during 1960s			-0.904		−1.397	0.105	−1.516	−1.575	0.114
			(1.341)		(1.234)	(0.795)	(1.288)	(1.273)	(0.797)
Active during 1970s			−2.938		−3.287*	0.121	−3.068	−3.004	0.296
			(2.279)		(1.994)	(1.443)	(1.971)	(1.951)	(1.458)
Active during 1980s			−2.67		−0.076	−0.694	0.02	−0.015	−0.671
			(2.998)		(1.646)	(1.104)	(1.602)	(1.595)	(1.144)
Active during 1990s			−5.014***		−4.641***	−0.972			
			(1.307)		(1.268)	(0.714)			
Active before NAFTA (1990–1994)							−2.605	−2.582	−0.638
							(1.689)	(1.692)	(0.959)
Active after NAFTA (1995–1999)							−2.895*	−2.910*	−0.279
							(1.745)	(1.748)	(0.798)
Active during 2000s			−2.161		−1.905*	−0.127	−1.432	−1.502	−0.111
			(1.381)		(1.110)	(0.707)	(1.182)	(1.156)	(0.760)
Active during 2010s			−7.055***		−7.853***	−2.586***	−8.004***	−7.949***	−2.573***
			(1.810)		(1.789)	(0.808)	(1.774)	(1.764)	(0.819)

Notes: Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level, respectively.

Finally, Tables 8–10 present the logit model results. Table 8 focuses on time-invariant characteristics, while Tables 9 and 10 reports on time-varying characteristics. Results from multiple iterations of the model are presented in Tables 9 and 10, which add net farm income (models 2–3) and time dummy variables (models 3 and 5–9). In Table 8, the presence of a marketing agreement leads to a significant decrease in the odds of termination compared to marketing orders without marketing agreements, providing support for the findings discussed earlier. However, unlike earlier results, having a marketing agreement is the only significant variable. When considering the time-varying production variables, there is greater statistical significance. In Table 9, *Age* is significant at the 1% level in five of the eight models. For each year that a marketing order ages, the odds of being terminated increase by 2.7%–3.9%. Conversely, as the value of a marketing order's production increases, the odds of being terminated decrease, and this result is significant in every model. These results corroborate earlier findings, often with greater statistical significance in *Age* and *Value* of marketing order production.

Marketing orders active in the 1940s, 1990s, and 2010s have a statistically lower probability of termination than marketing orders not active during that time in both the survival and logit models. When comparing marketing orders in the NAFTA and non-NAFTA groups, Table 5 reports that the NAFTA group had a significantly higher probability of termination compared to the non-NAFTA group (13%–14% vs. 6%–7% respectively). This could indicate that NAFTA increased competition from producers outside of the marketing order, which decreased its value to member producers. Alternatively, since most marketing orders last at least 20 years, some of these results might be explained by the young age of the marketing order; however, the other results are less straightforward and provide a path for future research. While it is outside of the scope of this paper, these results point toward future research that accounts for differences in import changes due to NAFTA across commodities with marketing orders.

Conclusions

Much has changed since marketing orders were first established in 1937. The changes range from innovations in production, processing, packaging, transportation, marketing to changes in consumers' expectations for quality, availability, and product differentiation. The industrialization of agriculture changed the way food is produced, marketed, and consumed. Changes continue as food is increasingly customized with premium prices for quality and various production claims. Marketing orders that were advantageous in the 1940s might not be viable 80 years later. It is unsurprising that marketing orders come and go.

Thus, we endeavor to identify the factors that cause marketing orders to terminate. Our initial hypothesis is that marketing orders are an endogenous outcome of member incentives. That is, founding members choose the characteristics and authorizations, which determine the marketing order's longevity, but that is not entirely the case. We find that while having a corresponding marketing agreement is significant during a marketing order's initiation, it is also important to consider what it does during its operation. The age of the marketing order as well as the value of its production also plays a role. As marketing orders age, they increase their chances of termination, while an increase in the value of production has the opposite effect. If a marketing order has community involvement and the marketing order continues to provide value to its owners, it will have a better chance of survival. However, if it starts to lose its value, termination will occur sooner rather than later.

Understanding the factors that affect the viability of marketing orders will help policy makers and producers be more successful in their efforts. A major purpose of marketing orders is to provide stability in conditions and quality. This purpose will be better fulfilled if we understand the factors that affect the success of marketing orders. Also, knowing why marketing orders terminate may help policy makers consider whether new policies are needed to fill their role, particularly around assisting farms that benefited from marketing orders that were terminated. Our results highlight that older marketing orders for commodities that do not have growing production value are at risk of termination. This

can be used for advanced planning to assess the best approaches for at-risk marketing orders. For example, farmers could be surveyed about their perceptions on the viability of the marketing order and risks were termination to occur.

A caveat to our findings is that there are likely unobserved factors in our dataset, especially during certain periods of time, that contribute to a marketing order persisting. Understanding these unobserved factors provides avenues for future research. When indicator variables for pre- and post-NAFTA periods are added to the survival model, there is a similar decrease in probability for both, but the impact of NAFTA leads to a lower probability of termination before NAFTA is introduced than after.

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References

Ahn, B.-I., and D. A. Sumner. 2009. "Political Market Power Reflected in Milk Pricing Regulations." *American Journal of Agricultural Economics* 91(3):723–737. doi: 10.1111/j.1467-8276.2009.01261.x.

Armbruster, W. J., P. G. Christ, and E. V. Jesse. 1993. "Marketing Orders." Paper presented at the FAMC conference, Food and Agricultural Marketing Issues for the 21st Century. doi: 10.22004/ag.econ.265933.

Balagtas, J. V., and S. Kim. 2007. "Measuring the Effects of Generic Dairy Advertising in a Multi-Market Equilibrium." *American Journal of Agricultural Economics* 89(4):932–946. doi: 10.1111/j.1467-8276.2007.01037.x.

Bredahl, M., A. Schmitz, and J. S. Hillman. 1987. "Rent Seeking in International Trade: The Great Tomato War." *American Journal of Agricultural Economics* 69(1):1–10. doi: 10.2307/1241300.

Brooker, J. R., and J. L. Pearson. 1975. "Economic Impact of Federal Marketing Orders — The Florida Winter Tomato Case." *Journal of Agricultural and Applied Economics* 7(2):177–186. doi: 10.1017/S008130520001270X.

Carman, H., and K. Klonsky. 2004. "Organic Almond, Kiwifruit and Winter Pear Handlers' Views on Federal Marketing Order Programs." *Renewable Agriculture and Food Systems* 19(03): 176–184. doi: 10.1079/RAFS200480.

Castriota, S., and M. Delmastro. 2015. "The Economics of Collective Reputation: Evidence from the Wine Industry." *American Journal of Agricultural Economics* 97(2):469–489. doi: 10.1093/ajae/aau107.

Chambers, R. G., and D. H. Pick. 1994. "Marketing Orders as Nontariff Trade Barriers." *American Journal of Agricultural Economics* 76(1):47–54. doi: 10.2307/1243919.

Chung, C., and H. M. Kaiser. 2003. "Distributional Effects of Commodity Promotion Programs by Type of Producer." *Agribusiness* 19(3):325–332. doi: 10.1002/agr.10062.

Cosentino, T. D., and G. A. Baker. 2015. "Organic Producers Perspectives on California State Mandated Marketing Programs and Implications for a Federal Organic Promotion Order." *International Food and Agribusiness Management Review* 18(4):1–20. doi: 10.22004/ag.econ.211651.

Crespi, J. M., and S. Marette. 2002. "Generic Advertising and Product Differentiation." *American Journal of Agricultural Economics* 84(3):691–701. doi: 10.1111/1467-8276.00328.

Fernandes, A. M., and C. Paunov. 2015. "The Risks of Innovation: Are Innovating Firms Less Likely to Die?" *Review of Economics and Statistics* 97(3):638–653. doi: 10.1162/REST_a_00446.

Hawkins, W. 1998. "Strategic Marketing Strategies for Florida Tomatoes." *Journal of Food Distribution Research* 29(1):33–36. doi: 10.22004/ag.econ.27439.

Hedlund, F. F. 1962. *The ABC's of Federal Marketing Orders and Agreements for Fruits and Vegetables*. Program Aid Report PA-506. USDA Agricultural Marketing Service. doi: 10.22004/ag.econ.338785.

Isariyawongse, K., Y. Kudo, and V. J. Tremblay. 2007. "Generic and Brand Advertising in Markets with Product Differentiation." *Journal of Agricultural & Food Industrial Organization* 5(1). doi: 10.2202/1542-0485.1179.

Jesse, E. V., and A. C. Johnson. 1981. *Effectiveness of Federal Marketing Orders for Fruits And Vegetables*. Agricultural Economic Report AER-471. USDA Economic Research Service. doi: 10.22004/ag.econ.307906.

Kalebjian, B. J. 2012. "The Effect of Terminated Federal Marketing Orders on Small Farms, and a Reflection on the Jeffersonian Spirit." *San Joaquin Agricultural Law Review* 22:115–140.

Kaplan, E. L., and P. Meier. 1958. "Nonparametric Estimation from Incomplete Observations." *Journal of the American Statistical Association* 53(282):457–481. doi: 10.1080/01621459.1958.10501452.

Machin, D., and M. J. Gardner. 1988. "Statistics in Medicine: Calculating confidence intervals for survival time analyses." *BMJ* 296(6633):1369–1371. doi: 10.1136/bmj.296.6633.1369.

National Agricultural Law Center. n.d. "Federal Marketing Orders and Agreements: An Overview." Available online at https://nationalaglawcenter.org/overview/marketingorders/ [Accessed January 18, 2024].

Neff, S. A., and G. E. Plato. 1995. *Federal Marketing Orders and Federal Research and Promotion Programs: Background for 1995 Farm Legislation*. Agricultural Economic Report AER-707. USDA Economic Research Service.

Padberg, D. I., and C. Hall. 1995. "The Effect of Terminated Federal Marketing Orders on Small Farms, and a Reflection on the Jeffersonian Spirit." *San Joaquin Agricultural Law Review* 5(73): 73–87.

Powers, N. J. 1990. *Federal Marketing Orders for Fruits, Vegetables, Nuts, and Specialty Crops*. Agricultural Economic Report AER-629. USDA Economic Research Service. doi: 10.22004/ag.econ.308137.

Quagrainie, K. K., J. J. McCluskey, and M. L. Loureiro. 2003. "A Latent Structure Approach to Measuring Reputation." *Southern Economic Journal* 69(4):966–977. doi: 10.1002/j.2325-8012.2003.tb00543.x.

Richards, T. J., A. Kagan, P. Mischen, and R. Adu-Asamoah. 1996. "Marketing Order Suspensions and Fresh Lemon Retail-FOB Margins." *Journal of Agricultural and Applied Economics* 28(2): 263–277. doi: 10.1017/S107407080000729X.

Saak, A. E. 2012. "Collective Reputation, Social Norms, and Participation." *American Journal of Agricultural Economics* 94(3):763–785. doi: 10.1093/ajae/aar154.

Shepard, L. 1986. "Cartelization of the California-Arizona Orange Industry, 1934-1981." *Journal of Law and Economics* 29(1):83–123. doi: 10.1086/467110.

Spruance, S. L., J. E. Reid, M. Grace, and M. Samore. 2004. "Hazard Ratio in Clinical Trials." *Antimicrobial Agents and Chemotherapy* 48(8):2787–2792. doi: 10.1128/AAC.48.8.2787-2792.2004.

Thompson, G. D., and C. C. Lyon. 1989. "Marketing Order Impacts on Farm-Retail Price Spreads: The Suspension of Prorates on California-Arizona Navel Oranges." *American Journal of Agricultural Economics* 71(3):647–660. doi: 10.2307/1242020.

US Comptroller General. 1985. *The Role of Marketing Orders in Establishing and Maintaining Orderly Marketing Conditions*. Report to the Congress of the United States GAO/RCED-85-57. US Government Accountability Office.

US Department of Agriculture. 1943. *Chronological Record of Marketing Agreements and Orders Issued by the Secretary of Agriculture for Fruits and Vegetables*. USDA Food Distribution Administration.

———. 1954. *Potato Marketing Agreements under Federal Legislation*. USDA Agricultural Marketing Service.

———. 1961. *Marketing Agreements and Orders for Fruits and Vegetables*. AMS Report 230. USDA Agricultural Marketing Service.

———. 1974. "Census of Agriculture." USDA National Agricultural Statistics Service. Available online at https://www.nass.usda.gov/AgCensus/ [Accessed January 12, 2019].

———. 1974–2019. "Agricultural Statistics 1974-2019." USDA National Agricultural Statistics Service. Available online at https://usda.library.cornell.edu/concern/publications/j3860694x [Accessed January 18, 2020].

———. 1975. *Marketing Agreements and Orders for Fruits and Vegetables*. Program Aid Report PA-1095. USDA Agricultural Marketing Service.

———. 1982. "Guidelines for Fruit & Vegetable Marketing Orders." USDA Agricultural Marketing Service. Available online at https://www.ams.usda.gov/publications/content/1982-guidelines-fruit-vegetable-marketing-orders.

———. 2019. *An Overview of the Federal Milk Marketing Order Program*. USDA Agricultural Marketing Service. Available online at https://www.ams.usda.gov/sites/default/files/media/Dairy FMMOBooklet.pdf.

———. 2020. "Farm Household Income and Characteristics." USDA Economic Research Service. Available online at https://www.ers.usda.gov/data-products/farm-household-income-and-characteristics/ [Accessed December 11, 2020].

———. n.d.a. "Commodities Covered by Marketing Orders." USDA Agricultural Marketing Service. Available online at https://www.ams.usda.gov/rules-regulations/moa/commodities [Accessed June 27, 2018].

———. n.d.b. "How to Create a Marketing Order." USDA Agricultural Marketing Service. Available online at https://www.ams.usda.gov/rules-regulations/moa/howto [Accessed June 18, 2023].

———. n.d.c. "Marketing Orders & Agreements." USDA Agricultural Marketing Service. Available online at https://www.ams.usda.gov/rules-regulations/moa [Accessed September 12, 2018].

Winfree, J. A., and J. J. McCluskey. 2005. "Collective Reputation and Quality." *American Journal of Agricultural Economics* 87(1):206–213. doi: 10.1111/j.0002-9092.2005.00712.x.

Zepp, G., and N. Powers. 1988. "Fruit and Vegetable Marketing Orders." *National Food Review* 11(3):18–23. doi: 10.22004/ag.econ.279958.