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Market Power and Cartel Formation: Theory and an Empirical Test*

Darren Filson
Department of Economics
Claremont Graduate University
Darren.Filson@cgu.edu

Edward Keen
KPMG
Ted.(TPG).Keen@kpmg.co.uk

Eric Fruits
LECG
Eric_Fruits@LECG.com

Thomas Borcherding
Department of Economics
Claremont Graduate University
Thomas.Borcherding@cgu.edu

Abstract:

Antitrust enforcement makes it difficult to test theories of cartel formation because most attempts to form cartels are blocked. However, federal laws allow U.S. produce growers to operate marketing cartels through devices called marketing orders. These cartels use quantity controls and quality standards to raise prices on fresh produce. Some growers have adopted marketing orders and others have not. This paper develops and tests a positive theory of the adoption of marketing orders. The theory suggests that growers in a region are more likely to adopt a marketing order if the demand for fresh produce is inelastic, the growers' market share in the fresh market is large, there are barriers to entry and expansion, the fraction of the output the growers ship to the fresh market is not too large or too small, growers are homogeneous, and large cooperatives exist. Probit analyses support these hypotheses.

JEL Codes: D21, L12, Q13

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I. INTRODUCTION

"Man sensibly tries to collude to avoid costly competition." Armen A. Alchian (1977).

"... [C]ollusion is impossible for many firms, and collusion is much more effective in some circumstances than in others." George J. Stigler (1964).

Over two hundred years ago, Adam Smith noted that meetings between "people of the same trade" tend to beget "some contrivance to raise prices."[1] This tendency to collude is to be expected - rational, profit-maximizing sellers quite naturally attempt to escape the competitive pressures that reduce their prices and profits.[2] However, while the desire to collude may be universal, the ability to collude is not nearly so widespread, for Stigler reminds us that "collusion like most other things in this world, is not free" and that "if any member of the agreement can secretly violate it, he will gain larger profits than by conforming to it."[3] Thus, any contrivance to collude will be ineffective unless the colluders can detect and deter defectors. Government antitrust enforcement inhibits most attempts to deter defectors and therefore greatly limits the effectiveness of collusion in most industries. Accordingly, government antitrust enforcement inhibits most attempts to examine the benefits and costs of collusion as well as the circumstance under which collusion is observed. This paper examines a set of legal cartels - marketing orders in the United States' fresh produce industry - to investigate how producers reconcile their disparate interests in reaching an agreement to collude and what factors facilitate or impede collusion.

The Capper-Volsted Act of 1922 awarded both tax-exempt status and antitrust immunity to agricultural cooperatives. Likewise, since its passage in 1937, the Agricultural Marketing Agreement Act (the Act) has enabled growers of fruits, nuts, and vegetables to decide how much and what quality of their produce to sell on the fresh market. Whenever a two-thirds majority of growers within a region, by number or by volume, can agree to a set of marketing restrictions, the Act authorizes the Secretary of Agriculture to declare these restrictions legally binding on all distributors of the crop within the region. As formal agreements designed to reduce competition, marketing orders operate as government-enforced cartels.[4]

In 1995, 35 active marketing orders regulated the distribution of fresh fruits, nuts, and vegetables in the United States. While a few orders had been established since 1980, most had been operating for over 40 years.[5] We use an interest group approach to examine these cartels. The theory presented in the next section generates several testable hypotheses about cartel formation. Growers in a region are more likely to form a cartel if the demand for fresh produce is inelastic, the growers' market share in the fresh market is large, there are barriers to entry and expansion, the fraction of output the growers ship to the fresh market is not too large or too small, growers are homogeneous, and large cooperatives exist. In Section III we test the hypotheses using several probit models and find support; Section IV concludes.

II. AN INTEREST GROUP THEORY OF MARKETING ORDERS

Marketing orders evolved as an instrument to facilitate collusion, but collusion need not be profitable for all growers.[6] Among themselves, growers must reconcile disparate and

often conflicting interests, and there are several examples of proposed orders being turned down and existing orders being abandoned. For example, proposed marketing orders for California melons, lettuce, and apricots have never survived a referendum. Disagreements over quality standards moved grapefruit growers in California and Arizona to abandon their marketing order. Meanwhile, Texas lettuce and melon growers and Washington apricot growers have used marketing orders for decades.

We develop a theory that predicts the characteristics of growers that enable them to successfully collude through marketing orders. The theory we develop follows from the premise that growers adopt a marketing order whenever the anticipated gains exceed the anticipated costs of establishing and maintaining the order for at least two-thirds of the growers, by number or by volume. Therefore, any factor that increases the anticipated gains or decreases the anticipated costs of collusion will increase the probability that growers will vote in favor of regulation under a marketing order.

A. Quantity Restrictions

An agricultural cartel operates like a dominant firm facing a competitive fringe: the cartel can adjust the amount it ships to the fresh market to influence price, while growers outside the region covered by the marketing order are price takers. In this subsection, we use a simple model of a dominant firm facing a competitive fringe to consider how factors that affect the cartel's ability to use quantity restrictions in the fresh market affect the likelihood that the cartel is formed. For now, we ignore the secondary market; it is discussed in the next subsection.

If the cartel restricts quantity in the fresh market then the increase in revenue is given by

$$\Delta R = p_2 q_2 - p_1 q_1, \quad (1)$$

where p_1 and p_2 represent the prices before and after the quantity restriction, and q_1 and q_2 represent the quantities before and after the quantity restriction. Expression (1) can be rearranged as follows:

$$\Delta R = p_1 (q_2 - q_1) \left(\frac{1}{e} \frac{q_2}{q_1} + 1 \right) \quad (2)$$

where e is the price elasticity of the cartel's demand curve. The cartel's demand curve, $Q(p)$, can be expressed as follows:

$$Q(p) \equiv Q_m(p) - Q_f(p), \quad (3)$$

where $Q_m(p)$ is the fresh market demand curve and $Q_f(p)$ is the competitive fringe's supply curve. From identity (3), e can be expressed as follows:

$$e = \frac{e_m}{s} - \frac{(1-s)}{s} \sigma, \quad (4)$$

where e_m is the fresh market elasticity of demand, s is the cartel's share of the fresh market, and σ is the competitive fringe's elasticity of supply.

Under the assumption that the likelihood of cartel formation is increasing in ΔR, the following testable hypotheses can be generated:

Hypothesis 1: The likelihood that a cartel is formed is decreasing in the absolute value of the fresh market elasticity of demand.

Proof: From expressions (2) and (4),

$$\frac{\partial \Delta R}{\partial e_m} = p_1 (q_2 - q_1) \frac{q_2}{q_1} \left(\frac{-1}{e^2} \right) \frac{1}{s},$$

which is positive because $q_2 < q_1$. Because $e_m < 0$, this implies that ΔR is decreasing in the absolute value of e_m. ***QED***

Hypothesis 2: The likelihood that a cartel is formed by growers in a region is increasing in the growers' market share in the fresh market.

Proof: From expressions (2) and (4),

$$\frac{\partial \Delta R}{\partial s} = p_1(q_2 - q_1)\frac{q_2}{q_1}\left(\frac{-1}{e^2}\right)\left(\frac{-e_m + \sigma}{s^2}\right),$$

which is positive because $q_2 < q_1$ and $-e_m$ and σ are both positive. ***QED***

Hypothesis 3: The likelihood that a cartel is formed by growers in a region is decreasing in the elasticity of supply of growers outside the region.

Proof: From expressions (2) and (4),

$$\frac{\partial \Delta R}{\partial \sigma} = p_1(q_2 - q_1)\frac{q_2}{q_1}\left(\frac{-1}{e^2}\right)\left(-\frac{(1-s)}{s}\right),$$

which is negative because $q_2 < q_1$ and $0 < s < 1$. ***QED***

Many marketing orders have no provisions for explicit quantity restrictions; these rely instead on grade and size standards to increase returns for growers. Quality restrictions may effectively restrict quantity. For example, minimum quality standards limit the amount of output shipped to the fresh market, and the profitability of implementing such restrictions depends in part on the forces outlined in the hypotheses. As discussed below in Subsection IIC, different methods for increasing cartel profits have

different distributional effects; minimum quality standards may be more acceptable to a larger number of growers than explicit quantity restrictions.

Of course, some quality restrictions do not restrict quantity but are designed to raise the average market price in other ways by overcoming informational asymmetries between producers and consumers and reducing search and transactions costs. For example, grading standards reduce consumer search costs by sorting fresh produce. The effects of these types of quality restrictions are discussed further below in Subsection IIC in the context of regional heterogeneity.[7]

B. The Secondary Market

Restricting supply to the fresh market comes with a cost for cartel members: they must either produce below their capacities or find other markets for their excess output. Producing much below capacity is unlikely due to the nature of agricultural production functions: many of the inputs are fixed during the growing season, such as land and farm machinery. Each grower expands production as long as the anticipated market price covers average variable costs.

As a result, the presence of a secondary market is important for reducing the costs associated with forming and maintaining a cartel. Without a secondary market, in which excess output is either shipped overseas, frozen, processed, or used for animal feed, growers have greater incentives to undermine their cartel and ship their excess output into the fresh market. It seems reasonable to assume that the larger the secondary market, the lower is the impact of shipping excess output on the secondary market price. This effect makes the likelihood of cartel formation increase with the size of the secondary market. However, there is an offsetting effect: the higher the fraction of output that cartel

members ship to the secondary market, the lower the gains from raising prices in the fresh market, because any price increase applies to a smaller amount of output. This suggests the following testable hypothesis:

Hypothesis 4: Suppose that growers in a region ship fraction *f* of their output to the fresh market. There is some critical fraction f^* that maximizes the likelihood that growers in the region form a cartel.

C. Transactions Costs, the Allocation of the Cartel's Profit, and Regional Heterogeneity

Our analysis in the above two subsections focuses on the cartel as a single unit and analyzes factors that affect the profits of the cartel as a whole. While these factors are important, a cartel must also find ways to allocate its profits to its various members in a way that economizes on transactions costs. Doing so may lead to conflict. For example, consider the following scenario. Suppose that there are two major growing regions in a state, and that the average qualities (as measured by size, appearance, consistency, and so on) in the two regions differ. Will growers be able to agree on which quality restrictions the cartel should impose?

With zero transactions costs within the cartel this problem is simple: choose quality restrictions to maximize the joint profits and then divide the profits among growers to ensure that each grower prefers being in the cartel to being outside it. However, because transactions costs within cartels are positive, the problem is not so easily solved: quality restrictions have distributional effects as well as efficiency effects.

Because of this, potential cartel members may not be able to agree on the appropriate quality restrictions. The likelihood of agreeing depends on how similar the produce of the different firms is; as heterogeneity increases the likelihood of agreeing falls.

Systematic differences among growers are often related to the growers' locations. For a crop grown in a small geographic area, climate, soil, produce quality, and cost conditions are not likely to vary much among growers. Such growers are less likely to have conflicting interests over a marketing order. Growers in small areas also may find communication with other growers less costly than if they were dispersed over a wider area. These lower costs of communication make it easier for growers to negotiate the terms of the order and to monitor compliance with the order. Furthermore, geographic concentration may also capture the effects of cultural homogeneity. All of these factors make cartel formation more likely. Alternatively, if there are several distinct subregions within a region then growers within the region are less likely to form a cartel. This suggests the following testable hypothesis:

Hypothesis 5: Regions with more than one major subregion are less likely to form a cartel because of the transactions costs associated with allocating the cartel's profits and monitoring its members.

D. The Role of Cooperatives

Growers in a region may form a cooperative in which they essentially hire a manager to manage their shipments of produce to the fresh market. The cooperative may restrict the

output shipped to the fresh market or enforce quality restrictions. In this subsection we argue that marketing orders are more likely to be adopted when large cooperatives exist.

There are several reasons why large cooperatives make adoption more likely. First, cooperatives often have the incentive to adopt a marketing order. The analysis of the dominant firm facing a competitive fringe described above in Subsection IIA applies to cooperatives: the cooperative can restrict its members' output and enforce quality restrictions among its members but it has no control over non-member firms.[8] The cooperative can use a marketing order to reduce the size of the competitive fringe because as long as at least two-thirds of the growers in a region prefer adopting the order, the terms of the order apply to all growers in the region.

Second, under the Act a cooperative can vote on behalf of its members. Thus, it is easier for a cooperative to obtain the two-thirds majority required to adopt an order. When members of the largest cooperative account for over two-thirds of growers in the region, by number or by volume, the adoption decision depends entirely on what the cooperative wants. Further, the coalition of cooperating firms may be able to draft rules that place non-members at a considerable disadvantage, taking these free riders "to a destination that they do not favor."[9]

Third, a cooperative lowers the transactions costs associated with negotiating, monitoring, and enforcing the terms of the order. For example, cooperatives with a reputation for supplying high quality produce are likely to have developed effective techniques for monitoring quality in their own grading, sorting, packing, and shipping operations. To the extent that demand for the whole industry, including the cooperative, would increase if other packers used this technology, the cooperative has a strong

incentive to have this technology adopted and used by enforcing quality standards. This may explain why Sunkist boasts that it shares its technological innovations with independent packers.[10]

Fourth, the presence of a large cooperative is an indicator of regional homogeneity, which as described in the previous subsection makes adoption more likely. The reason why the presence of a large cooperative is an indicator of regional homogeneity is that the cooperative has to overcome many of the same problems that any cartel needs to overcome. The fact that the cooperative exists suggests that the conditions are favorable for cooperation among its members, which means that the members are likely to be similar.

The arguments of this subsection suggest the following testable hypothesis:

Hypothesis 6: The likelihood that growers in a region adopt a marketing order is increasing in the market share of the largest cooperative in the region.

III. EMPIRICAL RESULTS

A. Data

Data were collected for 182 fruit, nut, and vegetable crops grown in California, Colorado, Florida, Idaho, Oregon, Texas, and Washington. These states have accounted for the majority of marketing orders since 1935; they accounted for 39 of the 44 marketing orders operating in 1981 and continue to account for most of the orders today. Each crop from each state is treated as a single observation. For example, apricots grown in Washington count as one observation; apricots grown in California count as another.[11]

The data set includes all crops from the seven states that satisfy two conditions: 1) the crop had to be eligible to be regulated under a marketing order; 2) the crop had to have a large enough annual harvest to be mentioned in the 1950 issue of Agricultural Statistics. The years around 1950 were among the most active periods for marketing orders - many marketing orders were adopted within two years after the Agricultural Marketing Agreement Act was amended in 1948 to allow growers to use quality standards even when prices exceeded parity levels.[12]

The hypotheses presented in Section II are tested using several probit models. Five different dependent variables are used that vary according to how long growers were able to maintain their marketing order. The measures take the value 1 if the crop was marketed under a marketing order for at least: 1) 1960-1995; 2) 1965-1995; 3) 1960-1981; 4) 1965-1981; 5) at least three consecutive years since 1940.[13]

Several independent variables are used. Hypothesis 1 is tested using *elasticity*, the absolute value of the estimated price elasticity of demand in the national fresh market. The measures are primarily from Camm (1976), who obtained national level estimates from numerous industry sources.[14]

Hypothesis 2 is tested using *share*, the state's share of annual fresh market output of the crop. *Share* is computed from the figures given in *Agricultural Statistics*. Wherever possible, a ten-year average from 1939-48 is used to minimize any bias arising from freezes or other anomalies. Imported crops are excluded from the calculation of market share because data on imports is not available for most crops in the sample.[15]

Hypothesis 3 is tested using *yearsb*, the number of years before new acreage comes into bearing; it is a measure of barriers to entry. Direct measures of the elasticity

of supply of competing firms are unavailable. If *yearsb* is high it is more difficult for firms to enter or expand. Vegetable crops like potatoes, tomatoes, beans, and onions take only one season to grow. Deciduous fruits, citrus fruits, grapes, and nuts require several years of cultivation before the trees or vines bear marketable produce. Growers of fruits and nuts thus have an even stronger incentive to seek regulation through marketing orders than vegetable growers. The number of years required for each fruit and nut crop was gathered from agricultural sources and the *Federal Register*.

Hypothesis 4 is tested using *fresh*, the fraction of the state's crop that is marketed to the fresh market. As noted above in Subsection IIB, the theory predicts that there is a value of *fresh* that maximizes the likelihood of forming a cartel. Therefore, both *fresh* and $fresh^2$ are used in the estimation below. *Fresh* is computed from the figures given in *Agricultural Statistics*.

Hypothesis 5 is tested using *regions*, a dummy variable that takes the value 1 if there is more than one major growing region in the state. A region consists of one county or a contiguous group of counties that accounts for at least 20 percent of the state's production. Regions are taken to be distinct and geographically separate if (1) they are identified as such in USDA or other agricultural publications, or (2) if they can be identified by examining county statistics in the *Census of Agriculture*.

Hypothesis 6 is tested using *coop*, the market share of the largest cooperative in the state. Large cooperatives are easily identifiable, in part because of their familiar brand names such as Sunkist, Diamond, and Sun-Maid. Obtaining precise information on cooperatives' market shares, however, is fairly difficult because cooperatives view this information as confidential. USDA sources are careful not to report figures on

cooperative marketing when doing so might reveal the identity of a particular association. The *Federal Register* only rarely reveals market share information. Benton, Steen, Macklin, Knapp, and Farrell provide market share for cooperatives during the 1920s.[16] Since then, cooperatives typically do not publish their market shares. For each crop in the sample, the largest estimate of cooperative market share was used. Where no market share information could be obtained for a crop, that crop was assigned a cooperative market share of zero. While this method produces a somewhat noisy series, it produces reasonable estimates of the extent of cooperative marketing for each crop in the sample.

The summary statistics are reported in Table 1. The statistics show that most of the states did not adopt a marketing order, and those that did often abandoned it. For example, only 15% of the observations had marketing orders in place from 1960-1995, and only 33% of observations had marketing orders in place for at least three consecutive years since 1940. This establishes that even if it is legal to form a cartel it is often impossible to form one and sustain it.

B. Probit Estimation Results

The interest group theory provides a hypothesized relationship between the likelihood of observing a federal marketing order and the independent variables described above:

$$\Pr\{adoption\} = f\,(elasticity, share, yearsb, fresh, fresh^2, regions, coop).$$

This relationship is estimated using several probit models. The estimation results are reported in Table 2. The results are presented in order of how long the firms were able to maintain their marketing order; in the first column the dependent variable is 1 for

crop/states that maintained their marketing order from 1960-1995 and in the last column the dependent variable is 1 for crop/states that maintained their marketing order for at least three consecutive years since 1940.

The signs on the coefficients are in accordance with the theory's predictions in every case except for the coefficient on the elasticity in the first column. Thus, the results support the theory's hypotheses. However, many of the estimates are quite noisy; in the first two columns only the coefficient on *yearsb* is significant. As the time period for sustaining the cartel is reduced (moving from left to right in the table) the estimates become more precise, and in the last column all of the coefficients are significant.

As noted above in Subsection IID, if members of the largest cooperative account for at least two-thirds of the growers by number or volume then the cooperative is decisive in the decision to adopt a marketing order simply because of the voting rule. Therefore, it is of some interest to determine whether the theory's hypotheses are supported when the largest cooperatives are removed.

Table 3 repeats the estimation from Table 2 after removing decisive cooperatives (those with market shares larger than 66%) from the sample. Only 13 observations are removed, but the effects on the results are interesting. The signs are the same as in Table 2, but many of the estimates are more precise. For example, in the first column the coefficients on *yearsb*, *fresh*, $fresh^2$, and *coop* are all significant. As in Table 2, the estimates become more precise as the time period for sustaining the cartel is reduced.

Table 4 reports the marginal effects of each independent variable on the probability of adopting a marketing order. The most precise estimates, those associated with the last column in Tables 2 and 3, are used to compute the marginal effects; the

results from the two tables are similar. The marginal effects are computed at the mean values.

Table 4 shows that all of the independent variables have substantial effects on the likelihood of adopting an order. Using the estimates in the first column, increasing the absolute value of the price elasticity by .5 reduces the probability of adopting an order by 10 percentage points. Increasing the state's share of the fresh market by 20 percentage points increases the probability of adopting an order by seven percentage points. Increasing the years to bearing by five years increases the probability of adopting an order by 40 percentage points. Changing the fraction of output marketed to the fresh market has almost no effect on the probability of adopting an order at the mean values; this suggests that the mean value of *fresh*, 73.93, is approximately optimal for order adoption. If a state has more than one major growing region then the probability of adopting an order is reduced by 17 percentage points. Finally, increasing the market share of the largest cooperative by 20 percentage points increases the probability of adopting an order by 19 percentage points.

IV. CONCLUSION

The research presented in this paper addresses the questions of how, why, and where cartels operate. Because agricultural marketing orders are legal cartels they provide a unique opportunity for testing hypotheses about cartel formation. The empirical results show that growers in a region are more likely to form a cartel when demand in the fresh market is inelastic, the growers have a large market share in the fresh market, crops have

long cultivation times, the fraction of output shipped to the fresh market is neither too small or too large, growers are regionally concentrated, and large cooperatives exist.

One issue that we have not explicitly examined is the termination of marketing orders, but we believe that the variables that we have analyzed can be useful in explaining decisions to terminate. Over time if firms earn profits above the norm then other firms will find ways to compete. Variables such as the elasticity of demand and the share of output shipped to the fresh market may change as substitutes emerge. Smith (1961) describes this phenomenon in the market for lemons: as the technology for manufacturing and marketing premade lemonade became available the demand for fresh lemons became more elastic and the share of output that producers shipped to the fresh market dropped to well below half. According to our analysis both of these changes would increase the probability of abandoning the order, and the order has in fact been abandoned.

More generally, future work could examine the *timing* of cartel formation and disbandment and also consider which variables each cartel controls. As noted above in Section IIA, marketing orders vary: some provide for explicit volume restrictions, most provide for quality controls, and some provide for research and development or advertising. The dynamics of how cartels form, disband, and make choices would be interesting to analyze empirically. The interest group approach used herein could likely be adapted to the dynamic setting; such an approach would generate several additional testable hypotheses.

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[1] Adam Smith, An Inquiry into the Nature and Causes of the Wealth of Nations (1776).

[2] Armen A. Alchian, Economic Forces at Work (1977).

[3] George J. Stigler, The Theory of Oligopoly, 72 J. Pol. Econ. 44 (1964).

[4] Cartel formation through a marketing order differs in some ways from other forms of collusion, but these differences do not prevent the results from applying generally. First, the terms of the agreement are not kept secret – because marketing orders are legal there is no need for secrecy. Second, the instruments used to increase member profits go beyond explicit quantity restrictions and include quality controls and other devices. Export cartels are another set of legal cartels under the Webb-Pomerene Export Trade Act. However, the two types of cartels differ. Whereas export cartels are entirely self-policing, agricultural marketing orders are legally enforced through the United States Department of Agriculture. See Andrew R. Dick, When Are Cartels Stable Contracts?, 39 J. Law & Econ. 241 (1996) for a detailed study of the stability of export cartels.

[5] Steven A. Neff and Gerald E. Plato, Federal Marketing Orders and Federal Research and Promotion Programs: Background for 1995 Farm Legislation (Agricultural Economic Report No. 707, Food and Consumer Economics Division, Economic Research Services, Department of Agriculture, May 1995).

[6] The most notorious marketing orders - such as those regulating oranges and lemons grown in California and Arizona - draw criticism from business journalists who liken these cartels to OPEC. See, for instance, Pulling the Plum Out of the Pie, Sacramento Bee, December 24, 1993; Putting the Squeeze on Big Orange, Los Angeles Times, May 9, 1993; The Squeeze on OLEC, Wall St. J., August 20, 1985; and James Brovard, Can Sunkist Wrap Up the Citrus Industry? Wall St. J., January 24, 1985.

[7] Quality restrictions raise a variety of additional issues that would be interesting to investigate, such as whether the degree of informational asymmetry affects the likelihood of cartel formation. Many growers have argued that consumers' bad reaction to inferior products could reduce the demand for high quality producers' products. However, as our data does not allow us to test hypotheses related to these issues, we do not develop our analysis further along these lines. We also do not investigate some other aspects of marketing orders, such as their advertising and research programs. Advertising and research provide long-run benefits to all producers that need not raise prices, but might increase profits in other ways.

[8] The annual report of the United Date Growers of California describes members' attitudes towards free riders on the fringe: "There are a few who do not participate in this endeavor to make the date industry of greater value. We grumble at holding the umbrella for their benefit. Some members resent the participation in the benefits of our cooperative program of a minority who do not contribute toward the cost of market development and advertising. More serious is the disrupting influence on the orderly distribution and marketing of our dates by this minority grading or selling dates in a manner or at a price that does not conform to the general industry program. We hope they will see the value of

united effort and join with us. If not, the benefits are so obvious to the rest of us that we propose to carry on and make the date industry continue a successful agricultural enterprise despite the attitude of a few who are unwilling or unable to comprehend the basic principles and purposes of cooperative action." William W. Cook, Report of the United Date Growers of California (1942). The free rider problem faced by cooperatives is also discussed in U.S. Department of Agriculture, A Review of Federal Marketing Orders for Fruits, Vegetables, and Specialty Crops: Economic Efficiency and Welfare Implications (Technical Report, Agricultural Marketing Service, Agricultural Economic Report No. 477, 1981).

[9] George J. Stigler, Free Riders and Collective Action, 5 Bell J. Econ. and Management Science 359 (1974). Recent research on regulations that impose standards supports Stigler's conjecture. Most research has focused on industry-wide environmental and safety standards and has shown regulations that set standards do not normally impose compliance costs uniformally across firms. See, for example, Michael Maloney and Robert McCormick, A Positive Theory of Environmental Quality Regulation, 25 J. Law & Econ. 99 (1982); George Neumann and Jon Nelson, Safety Regulation and Firm Size: The Effects of the Coal Mine Health and Safety Act of 1969, 25 J. Law & Econ. 183; B. Peter Pashigian, Environmental Regulation: Whose Self-Interests are Being Protected?, 28 Econ. Inquiry 551 (1985); Ann Bartel and Lacey Glen Thomas, Direct and Indirect Effects of Regulation: A New Look at OSHA's Impact, 28 J. Law & Econ. (1985); Scott Fuess and Mark Loewenstein, Further Analysis of the Theory of Economic Regulation: The Case of the 1969 Coal Mine Health and Safety Act, 33 Econ. Inquiry 354 (1990). Regulation that imposes costs on all firms in an industry, but which forces some of the

marginal firms to exit, leaves the inframarginal firms better off. Furthermore, it is often the inframarginal firms that are instrumental in crafting the regulations.

[10] C.H. Kirkman, The Sunkist Adventure (1975).

[11] Ideally, we would allow for the fact that marketing orders can go across state boundaries or cover only part of a state. However, the available data is measured at the state level so we treat each crop in each state as a single observation.

[12] Parity is a measurement of the purchasing power of a unit (for example, a bushel) of farm product.

[13] The sources for these measures are U.S. Department of Agriculture, *supra* note 8; Neff and Plato, *supra* note 5; Kenneth Farrell, Marketing Orders and Agreements in the U.S. Fruit and Vegetable Industries, in Organization and Competition in the Fruit and Vegetable Industry (Technical Study No. 4 of the National Commission on Food Marketing, 1966); Murray Benedict and Oscar Stine, The Agricultural Commodity Programs (1956); Farrell, Kenneth R., Federal and State Enabling Legislation for Fruit and Vegetable Marketing Orders: Evolution and Current Status (Supplement No. 3 to Technical Study No. 4 of the National Commission on Food Marketing, 1966), and the Federal Register.

[14] Frank A. Camm, Political Exchange and Marketing Orders (unpublished Ph.D. dissertation, Univ. of Chicago 1976). Re-estimating demand elasticities would have been possible, but of questionable value. Bruce L. Gardner, Causes of U.S. Farm Commodity Programs, 95 J. Pol. Econ. 290 (1987) estimated demand elasticities for 17 commodities simultaneously using Zellner's seemingly unrelated regressions technique. Gardner concludes that elasticity estimates obtained from prior studies give more "reasonable"

values, but produce results that are qualitatively the same. Camm did not report an elasticity for potatoes; we use Gardner's. The results do not change if we drop potatoes from the analysis.

[15] Even if the data were available, including imports in the calculation of market share may not be appropriate for the purpose at hand. Whenever a marketing order establishes grade and size standards, these standards apply to imported crops as well. While competition from imports can undermine a cartel, it also motivates firms to seek regulation to control the flow of these imports. Thus, the market share of imports has an ambiguous effect on the likelihood that growers adopt a marketing order.

[16] Alva Benton, An Introduction to the Marketing of Farm Products (1926); Herman Steen, Cooperative Marketing: The Golden Rule in Agriculture (1923); Theodore Macklin, Efficient Marketing for Agriculture: Its Services, Methods, and Agencies (1921); Joseph G. Knapp, The Rise of American Cooperative Enterprise: 1620-1920 (1969); and Farrell, Marketing Orders, *supra* note 13.

Table 1. Summary Statistics (182 observations)

Variable	Mean	Std. Dev.	Minimum	Maximum
Dependent Variables				
1960-1995	0.15	0.36	0.00	1.00
1965-1995	0.18	0.38	0.00	1.00
1960-1981	0.24	0.43	0.00	1.00
1965-1981	0.27	0.44	0.00	1.00
At least three years since 1940	0.33	0.47	0.00	1.00
Independent Variables				
Elasticity	0.64	0.41	0.10	1.90
Share	31.04	33.29	0.00	100.00
Yearsb	2.69	2.33	1.00	9.00
Fresh	73.93	34.51	0.00	100.00
Regions	0.34	0.47	0.00	1.00
Coop	13.58	24.46	0.00	90.00

Table 2. Determinants of Marketing Order Adoption (182 observations)

	1960-1995	**1965-1995**	**1960-1981**	**1965-1981**	**At least three years since 1940**
Variable	**Coefficient (Std. Error)**	**Coefficient (Std. Error)**	**Coefficient (Std. Error)**	**Coefficient (Std. Error)**	**Coefficient (Std. Error)**
Constant	-2.86*** (0.69)	-2.80*** (0.71)	-3.20*** (0.82)	-3.60*** (0.92)	-2.50*** (0.69)
Elasticity	0.018 (0.32)	-0.089 (0.31)	-0.52 (0.34)	-0.45 (0.35)	-0.63* (0.33)
Share	0.0060 (0.0039)	0.0057 (0.0038)	0.0059 (0.0042)	0.0077* (0.0043)	0.0095** (0.0040)
Yearsb	0.23*** (0.067)	0.19*** (0.066)	0.21*** (0.069)	0.17** (0.072)	0.24*** (0.069)
Fresh	0.026 (0.024)	0.027 (0.024)	0.064** (0.028)	0.080*** (0.030)	0.045** (0.024)
***Fresh*^{2}**	-0.00017 (0.00019)	-0.00016 (0.00019)	-0.00046** (0.00022)	-0.00059** (0.00024)	-0.00032* (0.00019)
Regions	-0.15 (0.29)	-0.22 (0.28)	-0.80** (0.33)	-0.78** (0.34)	-0.50* (0.29)
Coop	0.0032 (0.0058)	0.0086 (0.0054)	0.025 (0.0066)	0.036*** (0.0075)	0.028*** (0.0072)
Log Likelihood	-51.18	-64.82	-57.03	-53.87	-66.60
Restricted Log Likelihood	-72.71	-84.63	-100.66	-106.01	-115.38

* Significant at the 10% level ** Significant at the 5% level *** Significant at the 1% level.

Table 3. Determinants of Marketing Order Adoption when Cooperatives with market shares greater than 66 are removed from the sample (169 observations)

	1960-1995	**1965-1995**	**1960-1981**	**1965-1981**	**At least three years since 1940**
Variable	**Coefficient (Std. Error)**	**Coefficient (Std. Error)**	**Coefficient (Std. Error)**	**Coefficient (Std. Error)**	**Coefficient (Std. Error)**
Constant	-4.06*** (1.07)	-4.26*** (1.16)	-3.37*** (0.92)	-3.76*** (1.02)	-2.50*** (0.72)
Elasticity	0.051 (0.36)	-0.12 (0.37)	-0.43 (0.35)	-0.58 (0.38)	-0.74** (0.35)
Share	0.0037 (0.0045)	0.0042 (0.0044)	0.0041 (0.0043)	0.0055 (0.0045)	0.0080* (0.0041)
Yearsb	0.22*** (0.078)	0.17** (0.080)	0.17** (0.076)	0.12 (0.083)	0.21*** (0.075)
Fresh	0.071** (0.035)	0.078** (0.037)	0.069** (0.030)	0.090*** (0.033)	0.048** (0.025)
Fresh^2	-0.00049* (0.00026)	-0.00052* (0.00028)	-0.00048** (0.00023)	-0.00064*** (0.00025)	-0.00034* (0.00020)
Regions	-0.34 (0.34)	-0.46 (0.34)	-0.70** (0.33)	-0.77** (0.35)	-0.50* (0.30)
Coop	0.014* (0.0083)	0.028*** (0.0088)	0.028*** (0.0088)	0.049*** (0.013)	0.036*** (0.011)
Log Likelihood	-49.08	-50.17	-54.85	-50.25	-63.68
Restricted Log Likelihood	-69.05	-75.88	-83.45	-88.82	-100.84

* Significant at the 10% level ** Significant at the 5% level *** Significant at the 1% level.

Table 4. Marginal Effects of the Determinants of Order Adoption, Computed at the Mean Values (Dependent Variable: Adopt for at least three years since 1940)

	Table 2	**Table 3**
Marginal Effect	**Coefficient (Std. Error)**	**Coefficient (Std. Error)**
Elasticity	-0.21** (0.11)	-0.22** (0.10)
Share	0.0033** (0.0014)	0.0024* (0.0012)
Yearsb	0.081*** (0.024)	0.062*** (0.022)
Fresh	0.016* (0.0081)	0.014** (0.0071)
***Fresh*^{2}**	-0.00011* (0.000066)	-0.00010* (0.000058)
Total Effect of Fresh	-0.00085	-0.00041
Regions	-0.17* (0.10)	-0.15* (0.089)
Coop	0.0096*** (0.0026)	0.011*** (0.0035)

* Significant at the 10% level ** Significant at the 5% level *** Significant at the 1% level