Where Do Cartels Form?: Antitrust Screens and the Cost of Cartel Transactions

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Abstract

Screening industries for antitrust review raises three questions. 1) Why do cartels form in some industries but not in others? 2) What determines a cartel's influence, as reflected in its industry market share and span of control? And 3) when are cartels more likely to raise or lower welfare? I answer these three questions directly by developing a transaction cost theory of cartel formation. I then apply the theory to a unique group of legal, privately–enforced industry cartels that formed under the *Webb–Pomerene Export Trade Act*. This approach avoids the methodological constraints and data biases that have limited previous empirical research into cartels' formation.

I. Introduction

In an influential article, Richard Posner (1969) proposed a simple screen that would combine economic analysis and evidence to guide horizontal antitrust review. Posner's (1976, 55) screen required "identifying those markets in which conditions are propitious for the emergence of collusion." The review screen met two objectives. First, by identifying industries whose structure might encourage and ultimately sustain cartel activity, antitrust resources could be concentrated where they would be most productive. Second, by acknowledging that cartels' conduct is ambiguous because they can both raise price and lower cost, the review screen would seek to narrowly target collusive pricing without discouraging efficient cooperation. Current antitrust review practices implicitly reflect these twin objectives of Posner's screen. For example, the Federal Trade Commission concentrates its merger investigations in industries whose structural characteristics suggest the greatest risk of collusion. But the agency also requires direct evidence of anti–competitive effects before eventually challenging a merger proposal (Coate and McChesney (1992)).

Antitrust screens are only as reliable as the methodology and data used in their construction. In practice, methodological constraints and data biases have sharply limited empirical cartel analysis used in developing antitrust screens. First, screens traditionally have been rooted in oligopoly models of firm behavior.[1] An important shortcoming of these models is that their predictions are sensitive to behavioral assumptions which cannot be tested directly, and which often do not generalize readily to other market structures (see Fisher (1989)). Second, relatively little attention has been devoted to distinguishing cartels by their probable span of control, industry market share, and primary function. These choices vary widely, however, and they reliably anticipate cartels' longevity and competitive impact (see Dick (1992, 1996)). Finally, empirical evidence about cartels' formation (and survival) has been biased by

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[1] In his review of antitrust investigation practices, White (1987, 13–14) notes that the Department of Justice's "Merger Guidelines are firmly rooted in standard oligopoly theory developed by Chamberlin (1933), Fellner (1949), and Stigler (1964), and strengthened by the insights of game theory's 'prisoners' dilemma'."

focusing on prosecuted and state–enforced cartels. By failing to separate the analysis of cartel decision–making from public policy towards cartels, these data samples obscure the private benefits and costs to firms of cartel organization (see Dick (1996)). A primary result of these methodological constraints and data biases has been that the empirical industrial organization literature contains many 'stylized facts' about cartel formation, but very little direct and reliable econometric evidence.

This paper adopts an alternative methodology, and applies it to new data, to identify more reliably the conditions under which cartels form. The paper's primary methodological innovation is to ground its analysis in transaction cost economics, rather than oligopoly theory. In the transaction cost model, economic primitives — namely, the private benefits and costs to firms from cartel formation, — rather than behavioral assumptions, determine the selection of industry organization. The result is a set of empirical predictions that do not rely upon untestable behavioral assumptions and that are robust to alternative market structures. I also endogenize cartels' choice of their span of control, industry market share, and primary function. These refinements help to sort cartels by their expected longevity, and by the expected size and direction of their competitive impact. This information yields finer antitrust review screens capable of targeting potentially anti–competitive behavior while leaving innocuous (or efficient) cooperation untouched. Finally, I apply these innovations to a group of legal, privately–enforced industry cartels. By avoiding earlier studies' sampling biases from antitrust prosecution and state enforcement, I analyze cartels' private benefits and costs without the contamination of public policy influences.

To develop a set of economic screens to preview horizontal antitrust cases, consistent with Posner's objectives, this paper answers three specific questions. First, what factors prompt cartels to form in some industries but not in others? Second, can these factors also forecast cartels' industry market share and span of control, which are reliable predictors of cartels' expected longevity and impact? Finally, can these factors anticipate whether a cartel is likely on balance to raise or lower total welfare? I answer these questions for the population of cartels

formed under the *Webb–Pomerene Export Trade Act of 1918*, which granted antitrust immunity to exporters to form industry cartels for overseas trade. *Webb–Pomerene* cartels were permitted to fix export prices and set quotas, allocate exclusive markets, exchange pricing information, and coordinate marketing and advertising. While immune from antitrust suits, however, the cartels were entirely self–policing, as neither the government nor the courts intervened to enforce agreements or adjudicate disputes.

I report three sets of empirical findings that correspond to drawing successively finer antitrust screens. First, a parsimonious set of product, industry and market characteristics predict with 75% accuracy industries' decision whether to form a cartel. Consistent with transaction cost theory, I find that *Webb–Pomerene* cartels were more likely to market non–durable, capital–intensive, standardized goods, to form in industries with low seller and geographic concentration, and to transact in large and rapidly growing export markets. While some of these findings mirror existing review screens, several predictions (such as those regarding concentration and market growth) conflict with standard oligopoly analyses of industrial organization. Second, these same characteristics forecast with 80 to 85% accuracy cartels' industry market share and their span of control over members, which themselves are reliable predictors of cartels' expected longevity and competitive impact. Finally, to distinguish collusion from efficient cooperation, I identify the conditions under which *Webb–Pomerene* cartels were more likely, on balance, to have raised or lowered total welfare. I find that cartels were less likely to have been welfare–improving when they exported non–durable, capital–intensive goods to large markets with many small buyers. Each of these characteristics plausibly raises price–fixing cartels' ability to exercise market power.

The remainder of the paper is organized as follows. After a very brief literature review, Section II explains the *Webb–Pomerene* cartels' unique legal status and briefly describes the extent of cartel activity. Section III develops a general framework for predicting cartel activity that is grounded in transaction cost economics. In Section IV, I use this framework to develop testable predictions about cartels' formation, market share, span of control and primary

function. The empirical test results, presented in Section V, form the basis for successive antitrust screens. Finally, Section VI summarizes and concludes.

II. Existing Research and *Webb–Pomerene* Cartels

A. The Existing Literature

The empirical literature on cartels is marked by a scarcity of direct econometric evidence on the factors leading to cartels' formation. Early investigations, by Hay and Kelley (1974), Asch and Seneca (1975) and Fraas and Greer (1977), reviewed case histories of price–fixing prosecutions to draw indirect inferences about the conditions under which collusion was more frequently observed. These studies suffered from two shortcomings. The first was their reliance upon poorly specified oligopoly models that lacked any explicit optimizing behavior. One result of this approach was Asch and Seneca's (1976) anomalous finding that profit rates among colluding firms were on average *lower* than rates among non–colluding firms. The studies' second limitation came from their selection of sampled industries. By analyzing prosecuted conspiracies, the samples confused antitrust enforcement success with cartel formation. Thus, low industry concentration and large memberships were found to raise cartels' profile to antitrust enforcement agencies, thereby raising the likelihood that these industries would be well represented in the sample of cartelized industries, even though oligopoly theory suggested that both characteristics should make cartel formation *less* viable (Hay and Kelley (1974), Posner (1970)).

More recent studies, including Jacquemin *et. al.* (1981), Suslow (1988) and Marquez (1992), have analyzed cartel longevity using samples that avoid biases from antitrust prosecution. Unfortunately, each of these studies introduced biases in the opposite direction. Governments frequently subsidized policing among Japanese export cartels and international commodity cartels by making these agreements legally–binding or making cartel membership

compulsory.[2] This led the studies to understate cartels' private enforcement costs and inflate their estimated return. These studies also continued to rely upon oligopoly models of tacit collusion, without specifying explicitly the organizational choice faced by firms considering cartel formation. The result was that the studies tended to over–estimate the stability of industry cartels, the likelihood that they would re–form following a breakup, and the cartels' ability to learn with age and experience to better monitor against cheating (Dick (1996)).

While sampling biases could be removed econometrically, a more direct approach is to analyze cartel data that do not suffer from antitrust–prosecution or state–enforcement biases. A more complete methodology also requires establishing not simply whether a cartel would be viable in a particular industry, but also whether cartelization would be the cost–minimizing (or profit–maximizing) form of industry organization. Dick (1992, 1996) uses these data and methodology to analyze the stability and competitive impact of *Webb–Pomerene* export cartels. A question that those papers do not resolve, however, is why cartels formed in some industries yet not in others? Related to this question, it is interesting to ask also what determines a cartel's influence, as reflected in its industry market share and span of control, and when are cartels more likely to raise or lower welfare?

B. The *Webb–Pomerene* Antitrust Exemption

The Webb–Pomerene Export Trade Act of 1918 authorized United States exporters to legally enter into contracts to fix prices and set quotas, allocate overseas markets, exchange pricing information, and coordinate marketing and advertising strategies. Congress anticipated that the cartels would provide two benefits to exporters. First, "members would be able to offer and receive higher selling prices than they would were they forced to compete against

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[2] The Japanese export cartel agreements analyzed by Jacquemin *et. al.* (1981) typically were extended through government fiat to non–cartel members. Thirty percent of Suslow's (1988) sample of inter–war international cartels were directly or indirectly government–assisted, and during her period of analysis "legal systems operated to enforce contractual agreements among cartel members" (Griffin (1989, 180)). An undetermined percentage of Marquez's (1992) sample of international commodity cartels suffered from the same bias.

each other," and second, members could lower their selling costs by "spreading overhead and eliminating duplicate sales organizations" (U.S. Federal Trade Commission (1967, 6)). Any offsetting disadvantages, in the form of deadweight losses associated with price–fixing, were expected to be borne by the cartel's *foreign* customers. Following much the same rationale, many other industrialized nations have exempted export cartels from their domestic antitrust laws.[3]

Webb–Pomerene cartels operated virtually unfettered by antitrust oversight and restrictions. Cartels automatically received antitrust immunity upon registering with the Federal Trade Commission (FTC). Registration amounted simply to providing a list of member firms together with a copy of the cartel's articles of agreement. Failure to provide this documentation within 30 days of formation would deprive a cartel agreement of antitrust immunity. To remain registered and exempt from antitrust scrutiny, cartels had only to file an annual report with the FTC listing the value of their exports and summarizing their primary functions.

Congress and the FTC nominally restricted cartels' activities in three areas, but then effectively nullified each restriction through a combination of narrow interpretations and lax enforcement. First, Congress intended that the export cartels would not "adversely or intentionally" affect domestic prices. An FTC advisory opinion in 1924, however, affirmed that an export contract which "incidentally or indirectly restricts" domestic pricing would not violate the Act (U.S. Federal Trade Commission (1967, 102–06)). On several occasions, the courts also explicitly rejected arguments that *Webb–Pomerene* cartels were liable for ancillary restraints on domestic trade. Second, while the Act prohibited "restraints of the export trade of any domestic competitor," *Webb–Pomerene* cartels were permitted to negotiate exclusive dealing agreements that effectively blocked non–members' access to particular export markets. Finally, in a change of policy in 1955, the FTC began prohibiting side–agreements between

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[3] Export cartels' frequent exemption may explain why *Webb–Pomerene* cartels rarely were subjected to antitrust scrutiny in importing countries. A survey and comparison of antitrust exemptions for export cartels in other industrialized countries appears in Organization for Economic Cooperation and Development (1974).

Webb–Pomerene cartels and foreign producers. During the time span that I study, however, the FTC investigated just twelve agreements and ultimately prosecuted only two cartels for entering into side–agreements (U.S. Federal Trade Commission (1967, 109)).

While they were immune from antitrust scrutiny, *Webb–Pomerene* cartels remained privately–enforced. Neither the government nor the courts intervened to enforce agreements or adjudicate disputes. The cartels instead structured their contract terms to be self–enforcing. Anticipating the threat of cheating, the contracts specified explicit procedures for investigating alleged infractions and resolving disputes. Typically, the cartels created a governing body that was empowered to audit members' financial statements and shipping records. Members that failed to provide records or submit to audits, or that exceeded their quotas, usually were penalized with liquidated damages and quota reductions. In extreme cases, cheating members were punished by expulsion or dissolution of the entire agreement.[4]

C. The Extent of *Webb–Pomerene* Cartelization

Table 1 summarizes the extent of *Webb–Pomerene* cartel activity over a 45–year span. Economy–wide, the cartels were relatively few in number — between 30 and 35 cartels were active concurrently in an average year[5] — and collectively they accounted for just 5% of total manufactured exports. However, these aggregate statistics obscure the importance of *Webb–Pomerene* cartels in specific industries. The cartels were heavily represented in three product categories. Approximately 30% of the cartels marketed agricultural and food products (egs., rice, dried fruit, flour), another 30% exported raw or semi–finished industrial materials (egs., lumber, copper, phosphate), and a further 10% sold simple manufactures (egs., pencils, buttons, clothespins).[6] In many of these industries, *Webb–Pomerene* cartels accounted for a

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[4] A compendium of cartels' penalty clauses appears in U.S. Federal Trade Commission (1927).

[5] As explained shortly, for the purposes of this paper, a cartel was considered to be active if it either operated as a common sales agent for members or (at a minimum) set a target export price for the industry.

[6] U.S. Federal Trade Commission (1967), App. C–2. The remaining cartels sold a diverse range of manufactures, including locomotive engines, electrical machinery, and rubber tires.

substantial share of total United States exports. Examples included phosphates (92%), abrasives (88%), carbon black (70%), and redwood lumber (73%).[7] In many of these same industries, the United States also represented a significant fraction of total world exports, suggesting the potential for firms to exercise collective pricing power. Among these industries were walnut board (95%), crude sulphur (90%), carbon black (80%) and phosphate (45%).

Webb–Pomerene cartels varied widely in both their longevity and their competitive impact. One–half of the cartels remained active for 5 years or less, another 15% operated for 6 to 10 years, and the remaining 35% survived beyond 10 years.[8] In earlier research, I showed that variation in *Webb–Pomerene* cartels' lifespans could be explained by differences in their enforcement costs and service value to member firms (Dick (1996)). These services included both price–fixing and cost–sharing. For example, Dick (1992) estimated that *Webb–Pomerene* cartels marketing carbon black and crude sulphur raised export prices by an average of 6.5% and sustained fixed prices for more than two decades. In contrast, cartels in canned milk, dried fruit, metal laths, milled rice and paperboard sought primarily to exploit economies of scale by sharing common marketing costs. Any attempt to exploit collective export market power by these industries was more than fully offset by cost savings, with the result that export quantities rose while prices fell.

III. The Cost of Cartel Transactions: A Framework

A. Options for Organization

Empirical cartel research (and historical antitrust review) have been guided almost exclusively by oligopoly theories of tacit collusion. An important weakness of oligopoly theory is its reliance upon behavioral assumptions about firms' choice of strategy variables and their competitors' conjectured responses. These assumptions are not directly testable and often they do not generalize easily beyond a specific oligopoly market. To avoid these limitations, in

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[7] U.S. Senate (1946), Table B, Part I.

[8] U.S. Federal Trade Commission (1967, 26).

this section I develop an alternative approach to explain cartels' formation that is based upon transaction cost economics (Klein, Crawford and Alchian (1978), Williamson (1979)). Transaction cost theory links observed industry organization to economic primitives that measure directly the benefits and costs to firms from cartel formation. A single behavioral assumption is made, which is that an industry's organizational structure is chosen so as to minimize firms' private net cost of achieving specific business objectives. The assumption of cost minimization is supported by the finding that those *Webb–Pomerene* cartels that failed either to raise price or reap cost savings dissolved fairly quickly (Dick (1992)).

Webb–Pomerene cartels sought to exercise collective export market power in pricing and to capture economies of scale in marketing. To pursue these objectives, export manufacturers could select from among three general organizational structures. The first option was complete vertical integration downstream into export marketing. Vertical integration sacrifices the specialization economies and high–powered incentives that characterize market organization, yet it avoids the contracting and enforcement costs of market transactions. At the opposite extreme, a firm could delegate marketing responsibilities to an independent export broker or export merchant (dealer). Both agents act on behalf of the manufacturer and substitute arms–length, market transactions for internal control.

A third option, which lies between the extremes of vertical integration and market transactions, was for exporters to form a cartel. As compared to vertical integration, cartel marketing allows firms to capture more completely economies of specialization, such as in learning about local demand conditions. Cartels also may internalize externalities that arise from the public–goods nature of firms' pricing and advertising decisions. As compared to market transactions through an export broker or dealer, a cartel contract will tend to provide firms with greater flexibility and scope to customize their marketing strategies. Perhaps most importantly, the cartel can economize on incentive and enforcement costs relative to market transactions. *Webb–Pomerene* cartels typically were organized as joint stock corporations, with shares allocated in proportion to members' assigned export quotas. By making all firms

partial residual claimants, the cartel encouraged self–monitoring to lower agency and policing costs (Allen and Lueck (1993). The cartels supplemented this enforcement mechanism by specifying explicit procedures for investigating alleged infractions, resolving disputes, and punishing violators.

I confine my empirical analysis of industry organization to just two structures: vertical integration and cartel contracts. This simplification is supported empirically by Greene's (1968) observation that independent export brokers and merchants were an important marketing channel only for the very smallest exporters during the time span that I study. For these exporters, the organizational costs of cartel formation were likely to have proven prohibitive. At the same time, by dint of their very small export volume, these firms would have been largely unsuccessful at internalizing the full value of individual marketing efforts if they vertically integrated downstream. Selling through an export broker or merchant, in contrast, allowed small exporters to reap many of the benefits from marketing specialization while economizing on internal contracting costs. Finally, arms–length transactions through export brokers and merchants raise few antitrust concerns, and thus can be excluded appropriately from the choice set.

B. Private Benefits and Costs

To guide his search for an antitrust review screen, Posner (1976, 47) argued that by "examining the factors that bear on the private benefits and costs of colluding, we can identify the kinds of market settings in which collusion is likely to be attempted and ... [w]e may even be able to identify the specific economic symptoms of effective collusion." Transaction cost economics links the private benefits of cartel contracts to agents' bounded rationality, which establishes opportunities for specialization efficiencies. The private costs of cartel contracts are linked to the presence of market uncertainty, which creates the potential for opportunism. Confronted with these benefits and costs, firms select an economical contract "so as to

economize on bounded rationality while simultaneously safeguarding them[selves] against the hazards of opportunism" (Williamson (1986, 152)).

Bounded rationality exists because information is costly to acquire and to process. Herbert Simon (1957, 199) drew the implication for contracting by noting that "[i]t is only because individual human beings are limited in knowledge, foresight, skill and time that organizations are useful investments." The acquisition of information about market conditions was an important function of *Webb–Pomerene* cartels. Individual exporters were ill–suited to capture fully the economies of scale and scope that characterize information supply. First, many of the costs of creating and maintaining overseas information networks were unrelated to a firm's own transaction volume. Second, information acquired about a particular overseas market typically proved to be valuable for more than just one firm. Both considerations recommend that a group of manufacturers which choose to market their export collectively could have captured significant efficiencies from specialization. An additional benefit from pooling information on market conditions was identifies by Stigler (1964), who demonstrated that a cartel would allow firms to detect more subtle attempts to cheat or free–ride against an industry agreement.

Market uncertainty raises the cost of cartel transactions. The costs of uncertainty are reflected in negotiating and reaching agreement among firms, enforcing the terms of these agreements, and responding to unforeseen eventualities including the possibility of opportunism (Hart and Holmstrom (1987)). Opportunism has received particular attention in the transaction cost literature. When uncertainty leads parties to write incomplete contracts, the possibility of 'hold–ups' arises in which firms attempt *ex–post* to alter the distribution of gains from their transactions (Klein, Crawford and Alchian (1978)). Thus, price–fixing can be subverted by firms that opportunistically under–cut the cartel price to attract marginal buyers. And cost–sharing can be undermined by firms that opportunistically ship around the cartel's distribution system or dilute product quality to free–ride on joint marketing investments. Because *Webb–Pomerene* cartel agreements were not court–enforced, firms were forced to

rely on private, self–enforcement mechanisms — such as reputation and repeat sales incentives — to limit opportunism costs.

IV. Testable Predictions

Transaction cost theory offers testable predictions about the conditions under which export cartel contracts should be more likely to form. In the remainder of this section, I summarize these predictions. Consistent with Posner's search for a parsimonious antitrust screen, I search for a small number of economic primitives that can accurately predict cartels' formation. I limit my focus to three groups of factors determining cartels' private benefits and costs: *product* characteristics, *industry* characteristics, and *market* characteristics.

A. Product Characteristics

Transaction cost economics predicts that standardized commodities should be exported more frequently under cartel contracts than should differentiated goods. Standardization expands the industry's order size because the cartel is not required to distinguish among individual brands when filling export orders. A larger order size widens the cartel's opportunities to capture economies of scale and scope in export marketing. At the same time, however, the cartel will sacrifice some marketing flexibility and customization as compared to when firms market their exports individually. Flexibility and customization will tend to be more highly valued for differentiated goods, where buyers' requirements are more heterogeneous and less stable. Both of these considerations imply that cartel benefits will tend to be larger for standardized goods.

Working in the same direction, contracting costs generally will be lower when products are standardized. First, contract–writing will be simplified by the avoidance of negotiation over quality, style and related attributes.[9] Second, standardized commodities are less apt to require

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[9] If product standardization coincides with greater uniformity in manufacturers' production costs, contracting may be further simplified.

investments in brand name capital, dedicated distribution channels, and similar manufacturer–specific investments that could later be held hostage by opportunistic sellers. Finally, detection of cheating or free–riding will be facilitated when quality and other difficult to measure attributes do not have to be observed by cartel monitors. Each of these forces combines to predict that private cartel benefits should tend to be higher, while private cartel costs should tend to be lower, for standardized commodities. I use a dummy variable DIFFERENTIATED to distinguish differentiated consumer goods from relatively more standardized producer commodities. Transaction cost economics predicts that cartel frequency should be negatively correlated with DIFFERENTIATED.

A second prediction from transaction cost analysis is that contracting costs generally will be higher for durables, so that the frequency of cartel marketing will decline with product durability. The marketing of durable goods generally requires expenditures for brand names and quality guarantees, which create sunk investments that could later be held hostage by opportunistic cartel members. Durability also tends to increase contracting costs by introducing inter–temporal competition, which raises the short–run return to under–cutting the cartel price or free–riding on cartel marketing investments (Carlton and Gertner (1989)). Working in the same direction, the private benefits from cartel marketing will tend to be smaller for durables. Durables may require partially customized marketing, which will reduce order size and narrow the economies of scale and scope that the cartel can capture. Product durability also reduces the cartel's collective pricing power by introducing additional competitive discipline from the secondary market (Coase (1972)). A dummy variable DURABLE will distinguish goods whose services are consumed over a period of three or more years, and it is expected to be negatively correlated with cartel formation.

A third characteristic of production, capital intensity, should tend to lower the cost of cartel contracting. Long–lived capital investments in production facilities reduce firms' incentive to behave opportunistically at the marketing stage. A firm that cheats can be punished by premature termination of its marketing relationship with the cartel. Termination imposes a

capital loss equal to the discounted value of the quasi–rents on the firm's sunk investments. Working in the same direction, the benefits from cartel contracting will tend to increase with the capital intensity of production. Large fixed capital requirements will tend to slow the rate of entry that would dissipate cartel profits or rents, and will thereby raise the private return to cartel formation. Higher capital intensity also is likely to promote deeper specialization by firms at the production stage and, to economize on the fixed managerial input, will lead to increased contracting–out at the marketing stage. Export cartels therefore should be adopted more frequently by firms when production is highly capital intensive. A variable CAPITAL will measure industries' ratio of fixed capital stock to output, and should be positively related to cartel formation.

B. Industry Characteristics

Industry concentration is the structural characteristic most frequently used to select cases for antitrust review. Transaction cost economics suggests that two measures influence private cartel benefits and costs: seller concentration and geographic concentration. Cartel contracting should tend to offer larger private benefits in industries where firms are numerous and small, and seller concentration therefore tends to be low. Firms whose own export volume is insufficient to allow them to fully capture specialization economies in marketing stand to benefit more from cartel formation. The benefits from pooling information within the cartel, including swifter and more accurate monitoring, also will be greater when sales are spread across many sellers. Low seller concentration may tend to raise a cartel's internal contracting costs, however, and this will act to limit the cartel's optimal membership and size. In industries where firms are extremely small and numerous, higher contracting costs could altogether offset the private benefits from cartel contracting. I measure seller concentration by the standard four–firm index, CR4, and expect it to enter negatively under most circumstances.

Industries that have low geographic concentration — implying that firms cater to local markets — also should reap larger benefits from cartel marketing. When markets are regional

rather than national, firms will tend to have only local selling experience and will find export marketing initially very costly. Analyzing Japanese export trading groups, Shin (1989, 294–95, 304) therefore predicted that "manufacturers attempting to expand into a new market area need specialized marketing analysis and information ... [and would find the cartel's] specialized knowledge and trading experience particularly valuable to identify sales potential and overcome startup difficulties." As with seller concentration, low geographic concentration also will tend to raise contracting costs and therefore again will work to limit the cartel's efficient size. I use a dummy variable REGIONAL that identifies industries where markets are primarily regional rather than national, and expect it to affect cartel formation positively.

C. Market Characteristics

The private benefits from cartel formation will tend to increase with market size. Applying Adam Smith's maxim that the division of labor is limited by the extent of the market, Stigler (1951) argued that market size would be a fundamental determinant of industry organization. Marketing cartels will be better positioned to capture economies of scale and scope in gathering information and operating distribution networks when the investments supporting these activities can be spread across a greater volume of export trade. Operating in the same direction, contracting costs will tend to fall with market size. In larger markets, cartel members will be better positioned to shift towards alternative trade channels, such as spot markets or direct sales. This flexibility will reduce each firm's exposure to the hazards of incomplete contracting, including rent appropriation. I measure the size of U.S. firms' export market, scaled by total world exports in that industry, using the variable MKTSIZE and expect it to positively influence cartel formation.

For similar reasons, cartels should prove more economical in growing export markets. Growing markets provide greater opportunities to capture specialization efficiencies in information–gathering and network distribution, which are subject to economies of scale and scope. This will be strengthened by the fact that knowledge about product characteristics and

local market conditions will depreciate more quickly in growing markets, which further raises the marginal value of information to cartel members. Finally, the risk of opportunism generally will be smaller in growing markets, because the potential punishment for cheating is higher. Specifically, opportunism will be constrained by the fact that sellers will have larger quasi–rent streams in markets with strong expected sales growth. A variable GROWTH will measure the growth rate of U.S. export demand during the three years preceding a cartel's formation, and is expected to influence cartel formation positively.[10]

Finally, transaction cost theory predicts that cartel marketing will be more economical when buyers are small and widely dispersed. Identifying potential customers and tracking variation in local demand conditions are functions subject to economies of scale and scope. When buyers are numerous and spread geographically, it will be more cost effective to pool information acquisition and processing across firms. Working in the same direction, contracting costs also will tend to be lower when buyers are numerous and dispersed. Cartels will have access to a larger pool of independent price observations, which they can rely upon to identify and curb cheating or free–riding (Stigler (1964)). For both reasons, cartels are predicted to form more frequently in industries serving many small export markets. A variable BUYSIZE will measure the percentage of United States exports in an industry that were purchased by the four largest importing countries. Because *Webb–Pomerene* cartels generally exported to a single purchasing agent in each foreign country, BUYSIZE will be correlated with average buyer size, and should negatively influence cartel formation.

V. Developing Antitrust Screens

This section develops a series of horizontal antitrust screens by testing transaction cost theory's predictions for a sample of 250 industries, half of whom formed *Webb–Pomerene* cartels. I begin with the broadest screen, which predicts simply whether a cartel will form in a

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[10] To ensure exogeneity, GROWTH was measured at the product category level, with each product classified as either a raw material, crude food, manufactured food, semi–manufacture, or finished manufacture.

particular industry. I then refine this screen to identify cartels with a greater likelihood of sustaining prices significantly above competitive levels. I introduce this refinement by distinguishing among cartels according to their industry market share and the tightness of their span of control. Finally, to reflect the Department of Justice's review practices, I consider the trade–off between enhanced market power and efficiencies stemming from cartel organization. I distinguish cartels according to whether their primary function was to fix price and allocate markets, making them less likely to provide offsetting cost–savings. Definitions, summary statistics and data sources for each of the variables used in the regression analysis are reported in Table 2.

I use a simple choice–theoretic model to identify the determinants of cartels' formation. Consistent with the framework developed in Section III, exporting firms are assumed to select between two organizational structures: vertical integration and cartelization. Exporters that vertically integrate downstream into marketing (denoted by VI) have costs

$$C_{VI} = x\,\alpha_{VI} + u_{VI},$$

and firms that export through a cartel (denoted by C) have costs

$$C_C = x\,\alpha_C + u_C.$$

In both equations, x is a vector of product, industry and market characteristics that are correlated with firms' export marketing costs, α_{VI} and α_C are parameter vectors, and u_{VI} and u_C are random cost influences.

Under the assumption that firms select an organizational structure to minimize their exporting costs, the probability of observing a cartel form is[11]

$$\begin{aligned} Prob\,[\,Cartel\ Forms\,] &= Pr\,[\,C_{VI} \geq C_C\,] \\ &= Pr\,[\,x\,\alpha_{VI} + u_{VI} \geq x\,\alpha_C + u_C] \end{aligned}$$

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[11] The absence of data on firm characteristics implies that firms within an industry must be treated as identical *ex ante*. This implies that each firm faces the same decision problem regarding whether or not to join a cartel. Empirically, however, few *Webb–Pomerene* cartels included all exporters within a particular industry, suggesting either heterogeneity in firm characteristics or the presence of random cost influences. Unfortunately, the data do not permit testing this hypothesis.

$$= Pr\,[\, x\,(\alpha_{VI} - \alpha_C) \geq u_C - u_{VI}\,]$$

$$= Pr\,[\, x\beta \geq e\,].$$

Estimating this probability using a logistic distribution yields the estimating relationship,

$$Prob\,[\,Cartel\ Forms\,] = exp\,(x\beta)\ /\ [\,1 + exp\,(x\beta)\,].$$

(Estimation using a probit specification yielded nearly identical results regarding the model's overall predictive power and the significance levels for individual regressors.) In subsequent regressions, I modify the dependent variable to reflect cartels' industry market share, span of control, and primary function.

A. Predicting Cartels' Formation

To explain initially firms' decision whether to form a cartel, I constructed a sample of 250 exporting industries that was divided evenly between cartelized and non–cartelized (control) products. The sample includes all 125 *Webb–Pomerene* cartels that first registered between 1918 and 1965 and which remained active for longer than one year.[12] I defined a cartel as having been active in a particular year if either (i) it operated a common sales agency to centralize order–taking, shipping and billing on behalf of members, or (ii) the cartel set an export price target for the industry (but left shipping logistics to member firms). Recalling that firms were required to register at little cost to receive antitrust immunity, and therefore the population of registered cartels therefore should represent essentially all horizontal export pricing and sales agreements in effect during the sample period. I chose to limit the sample to agreements that were active for longer than one year so as to exclude cartels that registered in error, that formed solely to market a temporary surplus in production, or that quickly dissolved for other reasons.

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[12] FTC records were the most detailed for this time span. The *Webb–Pomerene* antitrust exemption remains in effect, and was expanded in 1982 by the *Export Trading Company Act* to apply to service exports.

The remaining 125 sampled industries were chosen randomly from among all exporting industries that did not organize into a cartel anytime during the study period.[13] These 125 industries comprised the control group. The control industries corresponded to the same level of product disaggregation as the *Webb–Pomerene* cartels, and were restricted to industries that exported during the study period. Each control industry was paired with a randomly–selected year between 1918 and 1965 to create (industry, year) observation pairs to mimic the identifier for cartelized industries.

Table 3 estimates the logit model in which the dependent variable CARTEL equals one for the 125 industries with a *Webb–Pomerene* cartel, and equals zero for the 125 control industries. Jointly, the transaction cost characteristics explain a significant portion of the variation in exporting industries' organizational choice. The logit correctly predicts firms' decision of whether to form a cartel in 74.4% of the sample industries. Individually, seven out of the eight transaction cost characteristics enter significantly at the 5% level or lower, and each does so with the expected sign. (Only BUYSIZE fails to be correlated with cartel formation.) As predicted by transaction cost theory, *Webb–Pomerene* cartels were more likely to ship non–durable, capital–intensive, standardized goods, to form in industries with low seller and geographic concentration, and to transact in large and rapidly growing export markets.

The transaction cost characteristics also have economically significant effects. For example, a one standard deviation increase in the export market's size or growth rate raises the average probability that firms form a cartel by 21.1% and 15.1%, respectively.[14] A one standard deviation increase in seller concentration lowers the probability that a cartel forms by 8.0%. Increasing the capital intensity of production by one standard deviation raises by nearly one–third the likelihood that an industry is cartelized. Standardized commodities are more than

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[13] The product universe was defined by the National Resource Committee's (1939) classification of approximately 350 industries in existence during the sample period. Removing industries that did not export, and removing industries that organized a *Webb–Pomerene* cartel anytime between 1918 and 1965, I randomly selected 125 industries to constitute the control group.

[14] The marginal effects are estimated at the regressors' means.

twice as likely to be covered by an export cartel than are differentiated goods, non–durable products are one–third more likely than durables to be cartelized, and geographically–concentrated industries are only about one–half as likely to form export cartels.

In some cases, the transaction cost screen offers predictions about cartel formation similar to those from antitrust screens rooted in oligopoly theory. For example, the Department of Justice's horizontal guidelines allow product characteristics (eg., DIFFERENTIATED), the structure of buyers' side of the market (eg., BUYSIZE), and the likelihood of entry barriers (eg., CAPITAL) to influence the selection of cases for antitrust review. However, the two approaches diverge in several key respects. First, the transaction cost screen indicates that cartels are *less* likely to form in concentrated industries (using either correlation measure), whereas oligopoly theory predicts the opposite. Second, the transaction cost screen indicates that cartels tend to form more frequently in rapidly growing markets, while oligopoly theory is mixed on this point.[15]

These discrepancies stem from the very different questions asked by the two theories. Oligopoly theory asks, when is collusion viable? Transaction cost theory asks, what is the cost–minimizing (or profit–maximizing) organizational form in each industry? Answering the latter question requires explicitly comparing *alternative* organizational structures — in this case, cartelization and vertical integration — to predict firms' choice. Thus, while collusion may be viable in highly concentrated industries, firms in those industries also will be better able to internalize informational economies of scale and scope in export marketing by dint of their large size and fewness in number, and therefore will stand to benefit less from entering into a cartel arrangement. In the same way, the benefits of specialized marketing offered by the cartel will be more valuable to firms in rapidly growing markets, thus making cartelization a more economical organizational structure in those industries.

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[15] According to oligopoly theory, collusion may be easier in industries with declining demand because entry is less likely to occur in response to firms' attempts to raise price (Posner (1976)). Alternatively, Green and Porter (1984) show that price–fixing is more likely to be disrupted (as part of an equilibrium enforcement strategy) during demand downturns. The net effect on cartel formation incentives is ambiguous.

B. Predicting Cartels' Industry Market Share

I begin the process of refining the initial antitrust screen by introducing information about cartels' industry market share. This share ranged from less than 5% among some *Webb–Pomerene* cartels (egs., fresh fruit, powdered milk, milled flour) to more than 70% among other cartels (egs., abrasives, carbon black, crude sulphur).[16] A productive antitrust screen will target industries where cartels account for a substantial fraction of industry sales, because these cartels tend to be longer–lived. In particular, *Webb–Pomerene* cartels whose industry market share exceeded 50% survived on average nearly twice as long as cartels that marketed less than half of their industry's exports (Dick (1996)).[17]

To predict where cartels with large market shares will form, I reclassified the 250 industry sample into two groups: 42 industries in which a *Webb–Pomerene* cartel had over a 50% market share, and the remaining 208 industries that either were not cartelized (125 industries), or which had less than half of their exports sold through a cartel (83 industries).[18] A logit regression was then estimated in which the dependent variable SHR>50% identified industries where cartels had the largest market shares, and the independent variables were the transaction cost characteristics summarized in Section IV.

Estimation results are reported in Table 4. Jointly, the transaction cost characteristics explain a substantial portion of the variation in industry organization. The logit predicts with 85.6% accuracy industries where a cartel formed to market more than half of firms' exports. Individually, four characteristics enter significantly and in the direction predicted by transaction cost theory. These characteristics refine the initial antitrust screen to target more narrowly standardized goods that are sold to relatively small buyers in large and rapidly growing export

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16 U.S. Senate (1946), Table B, Part I and U.S. Federal Trade Commission (1967), Table III–5.

17 Marquez (1992) found that larger market shares also prolonged international commodity cartels' life expectancy.

18 For the majority of cartels, it was only possible to identify whether their industry market share was above or below 50%. Thus, market share could not be treated as a continuous dependent variable in the regression analysis.

markets. These characteristics also have economically significant effects. Standardized products were three times more likely than differentiated goods to be marketed extensively through *Webb–Pomerene* cartels. A one standard deviation increase in the export market's size or growth rate would raise the average probability of a cartel marketing over half of its industry's exports by 67.2% and 60.8%, respectively. And raising average buyer size by one standard deviation reduced by more than one–third the likelihood of a large–market–share cartel forming. The significant economic magnitude of these effects indicates that antitrust resources could productively be focused on industries with these characteristics.

C. Predicting Cartels' Span of Control

A second dimension along which the initial antitrust screen can be refined is to introduce information about cartels' span of control. *Webb–Pomerene* cartels' primary means of tightening their control span was to organize themselves as a common sales agency. Common sales agency cartels negotiated prices and terms of sale, assigned orders to member firms, bargained with shippers over freight and insurance rates, and collected remittances. By expanding their control over these activities, common sales agency cartels enhanced members' opportunities to capture economies of scale in joint marketing and lowered the cost of monitoring against cheating. Cartels that did not organize themselves as common sales agencies exercised a narrower span of control. These cartels usually limited their authority to setting prices and terms of sale guidelines, and devolved control over shipping logistics to individual member firms. This limited span of control reduced cartel members' potential returns from cost–savings and price–fixing. One explanation for why a significant minority of *Webb–Pomerene* cartels declined these potential returns, alluded to by Stigler (1964, 45), is that common sales agencies tend to be "ill suited to custom work and ... [often impose] serious administrative costs in achieving quality standards, cost reductions [and] product innovations."

Earlier research found that common sales agency cartels generally were more successful at raising industry export prices to supra–competitive levels (Dick (1992)). Organization as a

common sales agency also tended to prolong cartels' life expectancy by improving their monitoring accuracy (Dick (1996)). For both of these reasons, productive antitrust screening will target industries where cartels exercise a tight span of control. To predict these industries, I reclassified the industry sample into two groups: 60 industries in which a *Webb–Pomerene* cartel operated as a common sales agency, and 164 industries that either were never cartelized (125 industries) or in which a cartel operated without a common sales agency (39 industries).[19] The 60 industries with a common sales agency cartel are identified by a dummy dependent variable CSA.

Regression results are reported in Table 5. The logit model correctly predicts industries' choice of organization for 80.8% of cases. Four characteristics again enter significantly to raise the probability of a cartel forming with a tight span of control. The sign of each characteristic's coefficient is consistent with transaction cost theory. Common sales agency cartels were more likely to ship capital–intensive, standardized products and to transact in large and rapidly growing export markets. Each of these characteristics has an economically significant effect on the probability of cartel formation. For example, standardized commodities were three times and capital–intensive goods were nearly twice as likely to be marketed through a tightly–controlled cartel as were differentiated and capital–scarce goods, respectively. A one standard deviation increase in the export market's size or growth rate would raise the average probability of cartel formation by 66.0% and 61.3%, respectively. The regression findings imply that antitrust screens will be more productive when they target industries satisfying this minimal set of characteristics.

D. Predicting Price–Fixing Cartels

Posner's second objective in developing an antitrust screen was to distinguish between pro– and anti–competitive cartel behavior. In general, a cartel will seek both to lower

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[19] For the remaining 26 cartelized industries, cartels' span of control could not be identified through FTC records.

marketing costs, by capturing specialization efficiencies, and to exploit collective pricing power, by restricting output. Until 1984, the Department of Justice's horizontal antitrust guidelines essentially precluded defenses based on claims that production and marketing efficiencies could offset the effects of enhanced market power resulting from a merger. The most recent revisions to the guidelines treat such claims more sympathetically. If firms can cite efficiencies as an antitrust defense, then the relevant standard for review is whether, on balance, a cartel raises or lowers total welfare. Clearly, a sufficient condition for total welfare to rise is that the cartel raise industry output and lower price. A necessary (and still sufficient) condition is that the cost savings from cartel efficiencies exceed the deadweight loss cause by exercising market power. Williamson (1968) demonstrated that even very small cost savings generally will more than offset market power effects. This suggests that a final refinement to the initial antitrust screen should categorize cartels according to the likelihood that they will generate non–trivial cost savings.

Information about *Webb–Pomerene* cartels' primary functions can shed light on whether non–trivial cost savings were likely to be generated. Because *Webb–Pomerene* cartels did not face the threat of antitrust prosecution, registration documents and annual filing reports provide reliable information about cartels' functions. Approximately 55% of the cartels reported primary functions that allowed firms to lower their foreign selling costs by capturing economies of scale from specialization. These functions included coordinating advertising, collaborating on market research, consolidating warehouse facilities and jointly negotiating shipping tariffs. Scudder (1955, 45) estimated that one *Webb–Pomerene* cartel realized a 55% savings in export marketing costs by consolidating these functions on behalf of its members. Cartels such as these would be among the most likely to generate the necessary efficiencies to outweigh any market power effects. If efficiencies can be cited as a defense by firms, then these cartels would warrant a weaker standard of antitrust review.

The remaining 45% of *Webb–Pomerene* cartels had as their primary or sole function setting a common industry price and/or allocating markets. Examples of these cartels included

the Phosphate Export Association, which sought primarily to achieve "stable export prices at profitable levels," and the United States Alkali Export Association, which sought to "eliminate unnecessary competition in export sales by members".[20] For these cartels, exercising collective market power was the over–riding rationale for their formation. The cartels' choice of functions in turn was guided by their need to police against attempts to undercut the agreed–upon industry price and market shares. Cartels whose primary function was price–fixing or market–allocation were less likely to have generated efficiencies to offset their market power effects, and thus would warrant heightened antitrust review.

To implement this final antitrust screen, I estimate a logit regression that distinguishes industries in which a price–fixing cartel was present (PRICE–FIX = 1, for 45 industries) from industries where either no cartel existed (125 industries) or where the cartel performed cost–saving functions (51 industries).[21] The estimation results are summarized in Table 6. The logit model's overall explanatory power is high — in 83.7% of the industries, firms' organizational choice is correctly predicted. As before, a subset of the characteristics are individually significant and each enters with the sign predicted by transaction cost theory. Price–fixing cartels were more likely to export non–durable, capital–intensive goods in large markets with many small buyers. These variables' economic significance also is high. For example, non–durable goods were more than twice as frequently sold by price–fixing cartels than were durables. Raising an industry's capital intensity by one standard deviation increased the probability of a price–fixing cartel forming by 84.4%. A one standard deviation rise in export market size increased this probability by 82.0%. And raising average buyer size by one standard deviation raised the probability by 29.8%.

Each of these characteristics plausibly raises price–fixing cartels' ability to exercise market power abroad. Cartels that capture a larger share of the total export market, reflected in high values of MKTSIZE, will enjoy greater pricing power (Posner (1976)). Higher capital

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[20] Temporary National Economic Committee (1940, 210) and U.S. Senate (1946, 43).

[21] For the remaining 29 cartels, it was not possible to identify their primary function and therefore they were excluded from the regression.

intensity acts to slow entry in response to profit opportunities, which raises the cartel's private return (Posner (1976)). Non–durability constrains the growth of second–hand markets as an additional source of competition that would undermine the cartel's long–run profitability (Coase (1972)). And collusion is more likely to be sustained against small buyers because secret price–cuts will be more easily detected (Stigler (1964)). Increases in market power, given the apparent absence of offsetting economies among cartels whose primary function was price–fixing, will lead to a fall in total welfare. As such, these transaction cost characteristics identify the most productive targets for antitrust screening under Posner's objectives.

VI. Conclusion

This paper illustrated that a parsimonious set of transaction cost characteristics can predict with high accuracy both where cartels will form and the extent of cartelization, as measured by cartels' industry market share and span of control. These characteristics also can anticipate whether a cartel is likely on balance to raise or lower total welfare, a necessary criterion for distinguishing between collusion and efficient cooperation. These conclusions allow a series of antitrust screens to be drawn, beginning with the most conservative screen and progressing to finer screens capable of narrowly targeting antitrust review. Extending these simple screens to include a broader range of characteristics could potentially raise their predictive power further, and thereby allow antitrust resources to be targeted still more narrowly. However, this refinement also would increase the informational demands placed on antitrust agencies. An efficient antitrust screen balances the informational costs imposed by formal economic models against the deadweight costs caused by mis–directed enforcement activity.

References

Allen, Douglas W. and Dean Lueck (1993). "Transaction Costs and the Design of Cropshare Contracts," *Rand Journal of Economics*, Vol. 24, no. 1 (Spring), 78–100.

Asch, Peter and Joseph J. Seneca (1976). "Is Collusion Profitable?," *Review of Economics and Statistics*, Vol. 68, no. 1 (February), 1–12.

_____ (1975). "Characteristics of Collusive Firms," *Journal of Industrial Economics*, Vol. 23, no. 3 (March), 223–37.

Carlton, Dennis W. and Robert Gertner (1989). "Market Power and Mergers in Durable–Good Industries," *Journal of Law and Economics*, Vol. XXXII, no. 2, pt. 2 (October), S203–26.

Coase, Ronald H. (1972). "Durability and Monopoly," *Journal of Law and Economics*, Vol. 15, 143–49.

Coate, Malcolm B. and Fred S. McChesney (1992). "Empirical Evidence on FTC Enforcement of the Merger Guidelines," *Economic Inquiry*, Vol. 30, no. 2 (April), 277–93.

Creamer, Daniel, Sergei P. Dobrovolsky and Israel Borenstein (1960). *Capital in Manufacturing and Mining: Its Formation and Financing* (Princeton: Princeton University Press).

Dick, Andrew R. (1996). "When Are Cartels Stable Contracts?," *Journal of Law and Economics*, Vol. 39, no. 1 (April), forthcoming.

_____ (1992). "Are Export Cartels Efficiency–Enhancing or Monopoly–Promoting?," *Research in Law and Economics*, Vol. 15, 89–127.

Fisher, Franklin M. (1989). "Games Economists Play: A Non–cooperative View," *Rand Journal of Economics*, Vol. 20, no. 1 (Spring), 113–24.

Fraas, G. Arthur and Douglas F. Greer (1977). "Market Structure and Price Collusion: An Empirical Analysis," *Journal of Industrial Economics*, Vol. 26, no. 1 (September), 21–44.

Green, Edward J. and Robert H. Porter (1984). "Noncooperative Collusion under Imperfect Price Information," *Econometrica*, Vol. 52, no. 1 (January), 87–100.

Griffin, James M. (1989). "Previous Cartel Experience: Any Lessons for OPEC," in Lawrence R. Klein and Jaime Marquez, eds., *Economics in Theory and Practice: An Eclectic Approach* (Dordrecht: Kluwer Academic Publishers), 179–206.

Hart, Oliver and Bengt Holmstrom (1987). "The Theory of Contracts," in Truman F. Bewley, ed., *Advances in Economic Theory: Fifth World Congress* (Cambridge: Cambridge University Press), 71–155.

Hay, George A. and Daniel Kelley (1974). "An Empirical Survey of Price Fixing Conspiracies," *Journal of Law and Economics*, Vol. 17, no. 1 (April), 13–38.

Jacquemin, Alexis, Tsuruhiko Nambu and Isabelle Dewez (1981). "A Dynamic Analysis of Export Cartels: The Japanese Case," *Economic Journal*, Vol. 91, 685–96.

Klein, Benjamin, Robert Crawford and Armen Alchian (1978). "Vertical Integration, Appropriable Rents, and the Competitive Process," *Journal of Law and Economics*, Vol. 21, no. 2 (October), 297-326.

Klein, Benjamin and Keith B. Leffler (1981). "The Role of Market Forces in Assuring Contractual Performance," *Journal of Political Economy*, Vol. 89, no. 4, 615–41.

Marquez, Jaime (1992). "Life Expectancy of International Cartels: An Empirical Analysis," Board of Governors of the Federal Reserve System, discussion paper no. 439.

National Resources Committee (1939). *The Structure of the American Economy* (Washington, D.C.: U.S. Government Printing Office).

Organization for Economic Cooperation and Development (1974). *Export Cartels: Report of the Committee of Experts on Restrictive Business Practices* (Paris: Organization for Economic Cooperation and Development).

Posner, Richard A. (1976). *Antitrust Law: An Economic Perspective* (Chicago: University of Chicago Press).

_____ (1970). "A Statistical Study of Antitrust Enforcement," *Journal of Law and Economics*, Vol. 13, 365–419.

_____ (1969). "Oligopoly and the Antitrust Laws: A Suggested Approach," *Stanford Law Review*, Vol. 21, no. 6 (June), 1562–1606.

Scudder, Richard A. (1955). *The History and Operations of Webb–Pomerene Export Associations*, unpublished dissertation, University of California at Berkeley.

Shin, Kwang–Shik (1989). "Information, Transaction Costs, and the Organization of Distribution: The Case of Japan's General Trading Companies," *Journal of the Japanese and International Economies*, Vol. 3, no. 3 (September), 292–307.

Simon, Herbert A. (1957). *Models of Man* (New York: Wiley).

Stigler, George J. (1968). "Barriers to Entry, Economies of Scale, and Firm Size," in his *The Organization of Industry* (Chicago: University of Chicago Press), 67–70.

_____ (1964). "A Theory of Oligopoly," *Journal of Political Economy*, Vol. 72, no. 1 (February), 44–61.

_____ (1961). "The Economics of Information," *Journal of Political Economy*, Vol. 69, no. 3 (June 1961), 213–25.

_____ (1951). "The Division of Labor is Limited by the Extent of the Market," *Journal of Political Economy*, Vol. 59, no. 3 (June 1951), 185–93.

Suslow, Valerie Y. (1988). "Stability in International Cartels: An Empirical Survey," Hoover Institution Domestic Studies Program working paper no. E–88–7.

Temporary National Economic Committee (1940). *Export Prices and Export Cartels*, Investigation of Concentration of Economic Power, Monograph no. 6 (Washington, D.C.: Government Printing Office).

_____ (1941). *The Structure of Industry*, Investigation of Concentration of Economic Power, Monograph no. 27 (Washington, D.C.: Government Printing Office).

United Nations (1952). *Commodity Trade Statistics, Series D, No. 10* (New York: United Nations).

United States Board of Governors of the Federal Reserve System (1972). *Industrial Production — 1971 Edition* (Washington, D.C.: Board of Governors of the Federal Reserve System).

United States Department of Commerce (1975). *Historical Statistics of the United States: Colonial Times to 1970* (Washington, D.C.: Government Printing Office).

_____ (1969). *The Position of the United States in World Commodity Exports in 1968*, Technical paper no. 23 (Washington, D.C.: Government Printing Office).

United States Federal Trade Commission (1967). *Webb–Pomerene Associations: A 50–Year Review* (Washington, D.C.: Government Printing Office).

_____ (1927). "Penalty Clauses Adopted by Export Associations to Insure Performance of Agreement by the Members," Export Trade Section internal memorandum, October 1927.

United States Senate (1967). "International Aspects of Antitrust, 1967," Hearings before the Subcommittee on Antitrust and Monopoly of the Committee of the Judiciary, United States Senate, 19th Cong., 1st session (Washington, D.C.: Government Printing Office).

_____ (1946). *Small Business and the Webb–Pomerene Act.* Report of the Foreign Trade Subcommittee of the Special Committee to Study Problems of American Small Business (Washington, D.C.: Government Printing Office).

White, Lawrence J. (1987). "Antitrust and Merger Policy: A Review and Critique," *Journal of Economic Perspectives*, Vol. 1, no. 2 (Fall), 13–22.

Williamson, Oliver E. (1986). "Vertical Integration and Related Variations on a Transaction–Cost Economics Theme," in Joseph E. Stiglitz and G. Frank Mathewson, eds., *New Developments in the Analysis of Market Structure* (Cambridge: MIT Press), 149–74.

_____ (1979). "Transaction–Cost Economics: The Governance of Contractual Relations," *Journal of Law and Economics*, Vol. 22, 233–61.

_____ (1968). "Economies as an Antitrust Defense: The Welfare Tradeoffs," *American Economic Review*, Vol. 58 (March), 18–36.

Table 1

***Webb–Pomerene* Cartels' Frequency and Export Share**

Time Period	Number of Active Cartels	Share of Total U.S. Exports
1920–24	30	2.9 %
1925–29	39	7.9
1930–34	35	12.2
1935–39	31	6.2
1940–44	30	2.1
1945–49	33	4.9
1950–54	30	4.5
1955–59	31	5.1
1960–64	27	4.6
1920–65	130	4.8

Source: United States Federal Trade Commission (1967), p. 23.

Table 2

Variable Definitions, Statistics and Sources

Variable[1]	Definition[2]	Mean	Std. Dev.	Max.	Min.	Source(s)
CARTEL	1 for cartel industries	0.500	0.501	1	0	(1)
SHR>50%	1 for cartels with >50% industry share (42 industries)	0.168	0.375	1	0	(2), (3), (4)
CSA	1 for cartels with a common sales agency (60 industries)	0.268	0.444	1	0	(2), (3), (4)
PRICE–FIX	1 for price–fixing cartels (45 industries)	0.204	0.404	1	0	(2), (3), (4)
DIFFERENTIATED	1 for consumer goods (–)	0.360	0.481	1	0	(5)
DURABLE	1 for goods consumed over ≥ 3 years (+)	0.408	0.492	1	0	(5)
CAPITAL	Ratio of fixed capital stock to output (+)	0.410	0.339	2.79	0.07	(6)
CR4	4–firm industry concentration ratio (–)	42.88	25.68	100	2.6	(7)
REGIONAL	1 for industries with regional markets (+)	0.176	0.382	1	0	(5)
MKTSIZE	U.S. share of total world exports (+)	20.27	18.76	76.0	1.0	(8)

[1] 250 observations for each variable except for CSA (224 observations) and PRICE–FIX (221 observations).

[2] Predicted sign appears in parentheses for independent variables.

GROWTH	Growth rate in U.S. exports over 3 years prior to event date (+)[3]	0.098	0.363	1.54	–0.56	(9)
BUYSIZE	Percent of U.S. exports sold to 4 largest importing countries (–)	53.36	18.62	100	0	(10)

Legend for Data Sources:

(1) U.S. Federal Trade Commission (1967)
(2) U.S. Senate (1946)
(3) U.S. Senate (1967)
(4) Temporary National Economic Committee (1940)
(5) Temporary National Economic Committee (1941)
(6) Creamer, Dobrovolsky and Borenstein (1960)
(7) National Resources Committee (1939)
(8) U.S. Department of Commerce (1969)
(9) U.S. Department of Commerce (1975)
(10) United Nations (1952)

[3] Event date is defined as either the year of cartel formation or, for control industries, the randomly selected year in the (industry, year) pair.

Table 3
Predicting Cartels' Formation

Dependent variable CARTEL = 1 for cartelized industries
Logit estimation

Variable	Coefficient	T–statistic
Constant	–1.161	–1.85
DIFFERENTIATED	–1.429	–4.01**
DURABLE	–0.676	–2.09*
CAPITAL	2.588	3.49**
CR4	–0.012	–1.97*
REGIONAL	0.943	2.31*
MKTSIZE	0.049	4.55**
GROWTH	1.747	3.38**
BUYSIZE	0.36 E–2	0.42

Notes:
Percentage correct predictions = 74.4%
Log–likelihood = –126.77
Chi–squared (8 d.f.) = 93.02 **
Number of observations = 250
* = significant at 5% level
** = significant at 1% level

Table 4

Predicting Cartels' Market Share

Dependent variable SHR>50% = 1 for industries where cartel accounts for more than 50% of total industry exports

Logit estimation

Variable	Coefficient	T–statistic
Constant	–1.214	–1.67
DIFFERENTIATED	–1.566	–2.96**
DURABLE	–0.399	–0.94
CAPITAL	0.448	0.88
CR4	0.94 E–2	1.25
REGIONAL	–0.572	–0.95
MKTSIZE	0.032	3.13**
GROWTH	1.521	3.09**
BUYSIZE	–0.027	–2.45**

Notes:

Percentage correct predictions = 85.6%

Log–likelihood = –88.69

Chi–squared (8 d.f.) = 48.97 **

Number of observations = 250

* = significant at 5% level

** = significant at 1% level

Table 5

Predicting Cartels' Span of Control

Dependent variable CSA = 1 for industries where cartel is organized as a common sales agency

Logit estimation

Variable	Coefficient	T–statistic
Constant	–2.184	–3.00**
DIFFERENTIATED	–1.369	–2.92**
DURABLE	–0.215	–0.57
CAPITAL	2.357	3.04**
CR4	–0.46 E–2	–0.64
REGIONAL	0.646	1.38
MKTSIZE	0.038	3.72**
GROWTH	1.840	3.82**
BUYSIZE	–0.63 E–2	–0.62

Notes:

Percentage correct predictions = 80.8%

Log–likelihood = –98.41

Chi–squared (8 d.f.) = 63.53 **

Number of observations = 224

* = significant at 5% level

** = significant at 1% level

Table 6

Predicting Price–Fixing Cartels

Dependent variable PRICE–FIX = 1 for industries with a cartel whose primary function was price–fixing

Logit estimation

Variable	Coefficient	T–statistic
Constant	–1.469	–2.01**
DIFFERENTIATED	–0.714	–1.58
DURABLE	–0.972	–2.19**
CAPITAL	2.324	2.90**
CR4	–0.40 E–2	–0.49
REGIONAL	–0.163	–0.28
MKTSIZE	0.041	3.97**
GROWTH	0.608	1.22
BUYSIZE	–0.022	–2.07**

Notes:

Percentage correct predictions = 83.7%

Log–likelihood = –86.46

Chi–squared (8 d.f.) = 50.46 **

Number of observations = 221

* = significant at 5% level

** = significant at 1% level