JOURNAL OF THE JAPANESE AND INTERNATIONAL ECONOMIES 9, 200–223 (1995)

Evaluating Administrative Guidance and Cartels in Japan (1957–1988)

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Received September 10, 1993; revised July 1, 1994

Weinstein, David E.—Evaluating Administrative Guidance and Cartels in Japan (1957–1988)

This paper uses cross-sectional and pooled time series data to examine the impact of administrative guidance and cartels in Japan. In general, government-organized cartels appear to have caused only small changes in prices and had no impact on sectoral margins. The lack of a stronger relationship between cartels and margins probably reflects either the difficulty of organizing cartels or the tendency of cartelized firms to compete away rents through competition through quality. It is also possible that Japanese cartels had little impact on prices because efforts to reduce costs offset incentives to raise prices. *J. Japan. Int. Econ.*, March 1995, **9** (1), pp. 000–000. Department of Economics, Harvard University, Cambridge, Massachusetts 02138. © 1995 Academic Press, Inc.

Journal of Economic Literature Classification Numbers L41, L43, L52.

1. INTRODUCTION

It is often argued that Japanese industrial policy differs from that of other countries because of its reliance on the coordination of firms and "administrative guidance." In fact, these informal policies have often been argued to be the main component of Japanese industrial policy (Johnson, 1982; Yamamura, 1982). Although some studies have examined mandated and actual reductions in capacity following the formation of certain cartels (Rotwein, 1964; Peck *et al.* 1988), there have been no

* The Abe Foundation graciously provided support for this project. I thank Alberto Alesina, Andrew Dick, Brad de Long, Guido Imbens, Mark Ramseyer, Frank Upham, Bob Uriu, and Yishay Yafeh for many helpful suggestions and comments. I also thank my research assistants, Sang Han, Selene Ko, and Emily McNeal, for excellent help compiling the data set.

0889-1583/95 $6.00

empirical attempts to question the hypothesis that cartels and guidance were actually successful in general. This paper seeks to fill these gaps by using cross-sectional and time series data to evaluate Japanese government attempts to coordinate business in the postwar period.

Japan's postwar cartel policy developed out of the belief on the part of some members of the Ministry of International Trade and Industry (MITI) that the Japanese government had the ability and the duty to guide Japanese industry. These bureaucrats argued that investment was largely financed out of current cash flow, and hence without maintaining a certain level of profits, industries would not have enough money to invest in new equipment and technologies during downturns. As Hoshi *et al.* (1991) have shown, this idea might not be entirely without merit: many Japanese firms seem to be dependent on their cash-flow streams to finance new investment. Furthermore, tight financial market regulations often forced banks to ration capital at the regulated interest rate and may also have contributed to an inability of Japanese firms to find funding sources for new projects.

Although some researchers have viewed Japan's cartels as largely failures due to insufficient monitoring and cheating (Miwa, 1988), others have argued that administrative guidance and cartels were an "integral part" of MITI's pro-growth strategy (see Yamamura (1982)). Yamamura suggests that a major reason why Japanese firms could invest in new plant and equipment with less risk than firms in other countries was that they knew that they would be allowed to form cartels during downturns. By shoring up profits with cartels in recessions, it is argued that MITI made it more profitable for Japanese firms to invest and thereby raised Japan's overall growth rate.

Superficially, at least, this would tend to suggest that during this time period MITI was making an enormous effort to coordinate the activities of various industries. However, it is important to put this policy in the proper perspective. Japanese antitrust enforcement during this time period was extremely lax, and MITI did not have the resources to enforce compliance for the vast majority of these cartels. Furthermore, well over half of Japanese cartels had no provisions to deal with producers that were not members of the cartel (Yoshida, 1964). Certainly, in comparison to the favorable tax treatment, subsidies, protection, and low-interest loans that some sectors received, exemptions from the virtually defunct Anti-Monopoly Law seem like relatively mild forms of government intervention.

In fact, the lack of visible mechanisms to enforce compliance has led many proponents of Japanese industrial policy to adopt either cultural reasons why firms would have followed MITI policy or appeals to enforcement mechanisms that are impossible to measure, such as bureau-

cratic harassment. However, given that the average number of establishments employing 10 or more workers in a cartelized four-digit sector was 430 (and over 1000 if one includes smaller firms), one must have considerable confidence in MITI's ability to oversee industries in order to believe that cheating would not be a major problem. Japanese producers had a long history of failed cartels.[1] This led MITI to use its guidance to cover not only price but also production and capacity: the latter, of course, being the easiest to monitor. Even so, assuring compliance was a major problem and sometimes involved scrapping equipment and sealing moving parts of machinery to ensure capacity reductions were met (Dore, 1986). Export cartels were the easiest to monitor and probably worked the best. Recession cartels and designated industry cartels were monitored to some degree because they usually involved a clear policy intent by MITI, but the vast majority of Japanese cartels—those organized for small and medium firms—were basically unsupervised.

Given these problems, it is not surprising that hard evidence on the impact of industrial policy has been mixed at best. In a pioneering study, Dick (1992) found little evidence that Japanese export cartels had an effect on prices despite the fact that many of these cartels were designed to raise prices. The data on compliance are also mixed. Using the information available in Rotwein (1964), the correlation between MITI capacity reduction requests and actual reductions was only 0.29. While Peck *et al.* (1988) found a higher correlation between requested cuts and actual reductions, it is hard to interpret how much of this was due to companies following MITI policy and how much was due to MITI setting targets in line with what the industry would have done anyway. The fact that they could find little evidence that prices rose faster under the depressed industry cartels of the late 1970s and early 1980s suggests that there probably was not a major change in pricing and production behavior.

However, there are a number of reasons to suspect that the behavior of Japanese industries with cartels in them might have deviated from classical cartel theory. First, one must remember that Japanese cartels were one component of a broader industrial policy toward declining sectors composed of tax relief, subsidies, low-interest loans, and tariff protection. It is therefore not surprising that some of the most cartelized sectors, such as textiles, apparel, paper/pulp, ceramics, and metals, had among the highest rates of subsidization and the lowest rates of taxes in manufacturing (Beason and Weinstein, 1993). Since conventional targeting measures were sometimes part of the same laws authorizing cartels, it is likely that cartelization is highly correlated with other industrial policy tools. Many

[1] See, for example, Ramseyer's (1992) discussion of prewar cotton cartels.

of the more conventional transfers to industries may have driven down firm costs or increased profitability and thereby reduced prices and margins through either new entry or changes in optimal pricing of existing firms.

Cartels may also not have affected margins or prices because of endogenous changes in the competitive mix or cost structure. Dick (1992) has argued that one of the important effects of Japan's export cartel policy may have been to influence costs and quality more than price. Many recession and designated industry cartels contained not only horizontal restraints but provisions for joint cost reductions, joint marketing, and quality improvement measures. This may have created incentives for the member firms to lower prices if the cartels served to reduce their costs. If these effects dominated restraints on trade, then one might expect to see price reductions following cartelization. Furthermore, if cartels simply caused a switch from price competition to quality competition, one might expect them to have a negligible impact on margins but a positive effect on price and demand.

This suggests that the impact of cartels on margins as well as on supply and demand may have been complex. Unfortunately, data on subsidies and conventional targeting measures are not sufficiently detailed to match with specific cartels, and data on the quality of output simply do not exist. Since direct measurement of all of the effects is not possible, the following sections explore some of the data on Japanese cartels in an effort to understand which of the above effects was dominant with special emphasis on whether cartels raised prices or margins. The organization of the rest of the paper is as follows. Section 1.1 goes into greater detail about the structure of Japanese cartels. Section 2 examines the impact of cartels on margins. In Section 3, models of cartel impact that is appropriate for estimation using time series data are developed. In Section 3.1 these models are tested and evaluated. Section 4 concludes.

1.1. *An Overview of Japanese Cartels*

Japanese cartels usually varied in duration and rules according to the type of problem that needed to be corrected. In response to short-term cyclical downturns, MITI often formed recession cartels or issued administrative guidance that coordinated reductions in sales or capacity and often mandated increases in prices (MITI, 1957). Administrative guidance and recession cartels were generally left in place for under a year in order to help industries weather a recessionary period without widespread bankruptcies. To a large extent, the difference between recession cartels and administrative guidance cartels was one of formality. While recession cartels had a clear legal base and represented a very clear policy of inter-

vention, administrative guidance cartels were extra-legal interventions by MITI into the affairs of an industry.[2]

In addition to recession and administrative guidance cartels, MITI also organized rationalization, export, small and medium enterprise, and designated industry cartels. Rationalization cartels were designed to coordinate changes in production technology that would enhance efficiency and never covered firm pricing and production, although they sometimes did specify capacity reductions. Export cartels generally lasted for years and were primarily justified as attempts to prevent dumping and raise prices in foreign markets (MITI, 1957). Finally, if an industry seemed to face a more permanent decline in demand, MITI often organized designated industry cartels that lasted for periods of around five years.[3] These designated industry cartels generally mandated limits on capacity or production but did not have provisions to cover minimum price levels.

Although the number of legally sanctioned cartels has fallen drastically since the early 1970s, the importance of these cartels in the mid 1960s can be seen in Table I. Each entry in the table provides information about the percentage of cartelized shipments at the four-digit industry level within each two-digit industry. Since Japanese cartels were generally organized at the six-digit industry level, a sector that is listed in Table I as being, for example, 40% cartelized implies that the output of the cartelized six-digit industries within that two-digit sector account for 40% of the two-digit output.[4] From Table I it is clear that roughly 20% of all manufacturing sectors had a cartel present, and 43% of all Japanese manufacturing output was being conducted in four-digit sectors with some cartel activity.

[2] Although administrative guidance is used by a variety of Japanese ministries as a means of making legally nonbinding suggestions to industries, in this paper the focus is on guidance given to firms to raise prices or cut production or capacity. This is the type of guidance that is usually considered to be most important in the industrial policy debate.

[3] The most famous of these designated industry (*Tokutei Sangyō*) cartels are the ones formed under the 1978 law, entitled Temporary Measures for Stabilization of Designated Depressed Industries Law, and the 1983 law, entitled Temporary Measures for the Structural Adjustment of Designated Industries. The 1978 law was not the first time that MITI had created special cartel provisions for industries in decline. Hence, it makes sense to consider these cartels as part of a broader class of designated industry cartels rather than each industry law separately.

[4] This paper focuses on data at the four-digit industry level because it is not possible to get sufficient data at the six-digit level to perform meaningful analyses. Because four-digit sectors represent relatively narrow product definitions, the number of cartelized four-digit sectors with low coverage ratios is relative small. The average percentage of shipments covered by cartels in four-digit sectors with cartels in them was 63% (standard deviation 29%). To get a sense of the difference between four-digit and six-digit sectors, one can consider the following example. Butter would constitute a six-digit industry while the larger four-digit sector would contain all processed milk products.

TABLE I
GOVERNMENT-AUTHORIZED CARTELS (1963)

Two-digit industry	Percentage of four-digit sectors with cartels	Percentage of shipments in sectors in which >10% of output is covered by a cartel	Percentage of shipments in sectors in which >50% of output is covered by a cartel
Food	27.2	44.6	33.2
Textiles	63.2	93.6	84.7
Apparel	54.2	66.5	65.2
Wood	6.1	11.9	11.9
Furniture	10.5	2.0	2.0
Paper/pulp	11.9	53.5	33.5
Printing	25.0	46.3	45.3
Chemicals	17.2	50.4	15.4
Petroleum products	0.0	0.0	0.0
Rubber	15.0	40.5	0.3
Leather	4.8	13.4	13.4
Ceramics/cement	16.5	56.6	38.5
Steel	12.5	68.9	7.1
Nonferrous metals	22.8	58.5	58.5
Metal products	7.1	27.1	2.2
Machine tools	8.9	22.7	18.0
Electrical machinery	3.0	21.8	0.7
Transportation equipment	1.0	2.9	2.9
Precision instruments	13.0	47.8	5.4
Weapons	0.0	0.0	0.0
Other manufactures	4.6	9.5	6.0
Average	19.2	43.3	25.2

Source. Yoshida (1964, p. 180).

Hence, it is not surprising that many authors have seen Japanese cartels as having had a significant impact on Japanese industrial organization.

2. CARTELS AND MARGINS

In this section, we seek to evaluate the impact of Japanese cartels on margins by estimating price–cost margin equations similar to those estimated by Domowitz *et al.* (1986). Here, we postulate that margins are related to industry structure variables in the following manner,

$$\begin{aligned} PCM_i = {} & \beta_0 + \beta_1 HERF_i + \beta_2 KY_i + \beta_3 CARTEL_i + \beta_4 DSALES_i \\ & + DSALES_i * (\gamma_1 HERF_i + \gamma_2 KY_i + \gamma_3 CARTEL_i) + \varepsilon_i, \end{aligned} \quad (1)$$

TABLE II
MARGIN DATA: SAMPLE STATISTICS

	Definition	Mean	Standard deviation	Minimum	Maximum
HERF	Herfindahl index	0.05	0.07	0.00	0.45
DSALES	$(Sales_t - Sales_{t-1})/Sales_{t-1}$	0.20	0.50	−0.94	6.18
DSALES4	$(Sales_t - Sales_{t-4})/Sales_{t-4}$	1.02	1.24	−0.74	16.15
KY	Fixed Assets/Sales	0.25	0.22	0.04	2.96
PCM	(Value Added-Wages)/Sales	0.22	0.08	0.00	0.75
CARTEL	Share of shipments covered by cartel	0.17	0.32	0.00	0.99
EXP	1 if export cartel	47[a]			
INC	1 if cartel rules cover outsiders	28[a]			
NON	1 if cartel does not cover price, production, or capacity	5[a]			

[a] Number of 1's in sample.

where PCM is the industry value added less wages divided by sales, HERF is the estimated industry Herfindahl index, KY is the capital-to-sales ratio, CARTEL is the share of shipments in the sector covered by the cartel, and DSALES is the growth rate of sales over the last year (See Table II for variable definitions and sample statistics).[5] Theory would suggest that the impact of concentration and capital intensity on price–cost margins should be positive. There are various theories regarding the impact of sales growth on margins (see Fisher (1987), Green and Porter (1984), Rotemberg and Saloner (1986), and hence while we include DSALES in the regression, it is not clear what sign the coefficient should have.[6]

We identify three main hypotheses regarding the impact of cartels on margins: (h1) If the cartel succeeds in raising prices or lowering costs, and

[5] There a number of theoretical justifications for specifying the Lerner equation in this way. Domowitz *et al.* (1986) and Fisher (1987) for details. Malueg (1992) argues that partial ownership of rivals might enhance the ability of firms to collude. This suggests that it might be appropriate to control for keiretsu ties. In actuality, keiretsu-related cross-shareholding is rarely between competing firms; rather, it occurs among buyers and suppliers or among firms centered around the same bank. For a more detailed discussion of this issue see Weinstein and Yafeh (1993).

[6] In Green and Porter's model, margins are likely to be low in low-growth sectors due to the instability of cartel agreements. Rotemberg and Saloner find endogenous cartel agreements to be more stable during downturns than upswings suggesting a reverse sign, and Fisher suggests that DSALES is likely to be correlated with measurement errors. All of these papers suggest that it probably is important to control for DSALES, although one should not interpret the coefficient on DSALES as a test of any of these theories.

rents are not driven away by quality competition or new entry, then margins should rise; (h2) if cartels fail to affect firm behavior or if cartel rents are dissipated through cost-increasing quality competition[7] or new entry, then cartels should have no impact on margins; and (h3) if the impact of cartels is to reduce costs (other than labor and raw materials costs) through either joint marketing or government intervention and entry is free, then margins will decline.

The data used in this section are all cross-sectional four-digit industry data for 1963 from either the Japanese Fair Trade Commission (FTC) (Yoshida) or from the Census of Manufacturers ("Kōgyō Tōkei Nempō"). Yoshida provides data on the ratio of sectoral shipments covered by the cartel to total shipments, as well as data on what the cartel covered, whether it was an export cartel, and whether the cartel could impose its rules on outsiders. Sales, capital, cost, and Herfindahl index data for each four-digit sector were obtained from the Census Manufacturers. The only variable that was not readily available was the Herfindahl indices. The earliest FTC Herfindahl indices go back to 1965 and these are not very accurate because they were only calculated using some of the firms in the industry, and the FTC industry definitions do not match the industry definitions. Furthermore, because the FTC was only interested in highly concentrated industries, the indices were only calculated for a few sectors. In order to overcome this problem, data on the number of firms, capitalization, and sales from the Census of Manufacturers were used to estimate the Herfindahl indices. The Census breaks down sales and numbers of firms in each four-digit sector into generally nine categories based on the assets of the firms. Usually, there are only two or three firms with the highest level of assets with the vast majority of firms concentrated in the low asset categories. Our measure of the Herfindahl index is

$$\mathrm{HERF}_i = \sum_{j=1}^{J_i} \frac{1}{\mathrm{FIRMS}_{ij}} \left(\frac{\mathrm{SALES}_{ij}}{\mathrm{SALES}_i}\right)^2,$$

where J_i is the number of subcategories in four-digit industry i, FIRMS_{ij} is the number of firms in capital subcategory j, SALES_{ij} is the level of sales in the subcategory, and SALES_i is total sales in the sector. If firms within each capital subcategory sell the same amount, then this measure of the

[7] It is important to remember that quality competition can occur along a number of dimensions. Improvements in quality can encompass more than product changes but can also include changes in the terms under which products are sold (terms of delivery, financial terms of transactions, etc.). In this sense, quality competition might actually be closer to price shaving.

Herfindahl index will equal the true measure; otherwise this measure will tend to underestimate the true measure.[8]

Table III presents the results from estimating Eq. (1) under a number of different specifications. In general, the R^2's of the regressions were slightly lower than those of Domowitz *et al.*, but even so it was possible to identify certain factors which seem to influence margins. The coefficients on the change in sales, concentration, and capital intensity were significant and positive in virtually all of the specifications. The coefficient on cartelization, however, was negative in all specifications and often significant. This seems to suggest that in general, whatever horizontal restraints were put in place by these cartels appear to have been dominated by factors which caused margins to decline. One likely interpretation is that the favorable tax treatment and outright subsidies that often composed depressed industry policies either caused output to rise or resulted in new

[8] This is likely to cause an upward bias of the coefficient on concentration.

TABLE III
MARGIN EQUATION ESTIMATION RESULTS
Dependent Variable Is PCM

	1	2	3	4
CONSTANT	0.201	0.207	0.209	0.201
	0.006	0.007	0.007	0.007
CART	—	−0.027	−0.029	−0.024
		0.012	0.013	0.012
HERF	0.168	0.148	0.119	0.130
	0.056	0.056	0.063	0.056
KY	0.044	0.046	0.046	0.049
	0.017	0.017	0.018	0.017
DSALES	0.018	0.017	0.004	0.017
	0.008	0.008	0.018	0.008
DSALES4	—	—	—	0.004
				0.003
DSALES*CART	—	—	0.009	—
			0.041	
DSALES*HERF	—	—	0.137	—
			0.132	
DSALES*KY	—	—	−0.008	—
			0.057	
Industry dummies	No	No	No	No
N	483	483	483	480
R^2	0.049	0.059	0.062	0.062
Adjusted R^2	0.043	0.052	0.047	0.052

Note. For Columns 1–9, the dependent variable is PCM. Standard errors are below estimates.

[a] EXIST is 1 if there is a cartel in the sector. There are 131 cartels in this sample.

TABLE III—*Continued*

	5	6	7	8	9
CONSTANT	0.205	0.208	—	—	—
	0.007	0.008			
CART	−0.039	−0.039	−0.013	−0.015	−0.017
	0.014	0.015	0.012	0.013	0.015
HERF	0.151	0.123	0.165	0.132	0.132
	0.056	0.063	0.052	0.058	0.059
KY	0.045	0.045	0.034	0.032	0.032
	0.017	0.018	0.017	0.017	0.018
DSALES	0.017	0.005	0.022	0.004	0.003
	0.008	0.020	0.007	0.018	0.018
DSALES*CART	—	0.006	—	0.007	0.008
		0.041		0.037	0.037
DSALES*HERF	—	0.128	—	0.139	0.141
		0.132		0.122	0.122
DSALES*KY	—	−0.007	—	0.011	0.011
		0.057		0.052	0.052
NON	0.059	0.059	—	—	0.008
	0.038	0.037			0.035
INC	0.002	−0.001	—	—	−0.004
	0.017	0.018			0.016
EXP	0.022	0.022	—	—	0.007
	0.014	0.014			0.013
Industry dummies	No	No	Yes	Yes	Yes
N	483	483	483	483	483
R^2	0.068	0.070	0.280	0.283	0.283
Adjusted R^2	0.054	0.50	0.244	0.242	0.242

	10	11	12
Dependent Variable	PCM	EXIST[a]	PCM
CART	−0.015	—	−0.013
	0.015		−0.012
HERF	0.160	−3.714	0.188
	0.054	1.273	0.068
KY	0.034	0.144	0.031
	0.017	0.301	0.017
DSALES	0.022	−0.446	0.031
	0.007	−0.213	0.019
DSALES4	—	−0.222	—
		0.082	
CARTEL*HERF	0.087	—	—
	0.257		
PROB	—	—	0.038
			0.037
Industry dummies	Yes	Yes	Yes
N	483	474	474
R^2 or percentage correct	0.280	75.3	0.288
Adjusted R^2	0.243		0.252

entry (or perhaps a slowdown in exit). These factors appear to have dominated any positive impact of horizontal cartel restraints on margins.

The result that cartelized sectors appear to have margins lower than those of noncartelized sectors is fairly robust with respect to whatever specification one chooses. In regressions 4 through 9, various other variables were added or dropped to the estimated equation to see if it were possible to cause the negative coefficient to reverse. Since many of these cartels were enacted in structurally depressed industries that had a long history of poor sales, in regression 4 the rate of change of sales over the past four years was included to see if controlling for long-run poor performance would have an effect on the results: it did not. Second, since there also was more detailed information on the cartel rules, dummies for whether the cartel was for exporters (EXP), had rules governing outsiders (INC), or did not cover price, production, or capacity (NON) were added to see if these had an impact. With the exception of some limited evidence that export cartels were more successful than domestic cartels, none of these variables seemed to have much explanatory power either. Finally 20 two-digit industry dummies were added to see if controlling for industry characteristics would affect the sign, but this seemed to only affect the significance levels.

Libecap and Wiggins (1987) have argued that cartels in which small firms have a large cumulative share tend to be less stable than those with larger firms. Their theory implies that a cartel coefficient that does not take the concentration of firms into account might underestimate the true effectiveness of cartels in concentrated sectors. While providing a full test of the Libecap and Wiggins hypothesis is beyond the scope of this paper, we can test whether allowing the cartel coefficients to vary with concentration affects the results. Column 10 in Table III presents a regression in which the cartel variable is interacted with the Harfindahl index, CARTHERF. While the coefficient of CARTHERF is positive as Libecap and Wiggins' hypothesis would suggest, it is far from significant, suggesting that even after controlling for cartelization of concentrated sectors, there is not a strong relationship between cartels and margins.

One obvious explanation for the lack of a relationship is potential endogeneity biases of cartel formation. For example, if margins are procyclical and cartels are implemented in sectors suffering from declining demand, then one might obtain a negative relationship between cartels and margins even though the cartels were actually working to improve margins. In order to correct for this possibility a two-stage estimation procedure was performed. In the first stage, we ran a probit to identify the probability of a cartel being formed in a sector based on industry characteristics (Table III, Column 11). The predicted probabilities from this regression (PROB) were then used in the OLS estimation to control for the endogeneity of cartel formation. The results of the OLS estimation in Column 12 indicate

that although sectors with a high probability of cartel formation tend to be sectors with lower (but not significantly lower) margins, even after controlling for this endogeneity, cartel coverage still does not result in higher margins.[9]

One unsettling feature of these results is that the R^2's were generally quite low even after accounting for industry effects. While it is not clear what impact omitted variables would have on the results, our model only explains a small part of the determination of margins. This problem is probably exacerbated by the fact that we were forced to use data at the four-digit level to analyze phenomena at the six-digit level. Furthermore, the fact that the vast majority of cartels in tihs sample were not the most monitored cartels (e.g., recession and designated industry cartels) suggests that we might obtain better results by looking at cartels which involved greater MITI supervision. In order to explore how important these factors are in terms of understanding the impacts of Japanese cartels, we need better data. The next section examines these issues using more detailed data which enables us to obtain a better understanding of whether the lack of an impact of cartels on margins probably arose from a failure of these cartels to raise prices, a switch to quality competition, cost reductions through subsidies or private efforts, or some combination of these factors.

3. The Impact of Cartels on Supply and Demand: Theory

The data which we will explore in this section consist of monthly time series observations on prices, outputs, and cartelization similar to the data used by Porter (1983).[10] Here, we modify Porter's methodology by allowing for the quality of output to change as well as by pooling the results of each class of cartel.

Assume that demand in sector j at time t can be written as

$$\log Q_{jt} = \alpha_{0j} + \alpha_{1j} \log p_{jt} + \alpha_{2j} \log X_{jt} + \alpha_{3j}\mathrm{POST}_{jt} + \alpha_{4j}\mathrm{TPOST}_{jt} + U_{1jt}, \tag{2}$$

where X_{jt} is a demand shift parameter that reflects how sectoral demand increases with overall increases in production. POST_{jt} is a dummy variable that is 1 in the month when a cartel starts and remains 1 to the end of

[9] Another possible problem is that the coefficient on cartels might differ significantly across sectors due to differences in industry characteristics. One way to test for this is to interact the cartel variable with industry coefficients and test whether the cartel variable differs across sectors. An F test revealed that treating all sectors identically could not be rejected at standard levels of significance.

[10] See Appendix I for details on the construction of the data set.

the sample, and $TPOST_{jt}$ equals $POST_{jt}$ times a time trend. These variables are included to account for any increases in demand arising from joint research, marketing, or quality assurance that might have been a part of the cartel's purpose.[11] The U_{jt} are assumed to be a normally distributed error term with

$$E(U_{1jt}) = 0 \text{ and } E(U_{ijt}, U_{1jt-1}) = 0.$$

Assume that there are n_j firms in each sector j and that firm i has a cost function of the form

$$C_{ij}(q_{ijt}) = a_{ijt} q_{ijt}^{\delta_j} + F_{ij},$$

where δ_j represents the level of returns. If δ_j is larger than 1 then the firms have increasing returns; if δ_j is less than 1 then firms face decreasing returns. The parameter a_{ijt} is allowed to vary over time to allow for changes in the cost structure of firms due to joint research on the part of the cartel. Assume further that pricing behavior can be described by

$$p_{jt}\left(1 + \frac{\theta_{ijt}}{\alpha_{1j}}\right) = a_{ijt}\delta_j q_{ijt}^{\delta_j - 1}.$$

If θ_{ijt} equals 0, then this specification implies that competition is Bertrand; if it equals s_{ijt}, the share of sales held by firm i in sector j, then competition is Cournot; and if it equals 1, then firms maximize joint profiles. As in Porter's original piece, we make two crucial assumptions about the underlying level of competition: first, equilibrium prices must map into marginal costs according to the above equation (Bertrand and Cournot competition both satisfy this criterion). Second, a cartel must increase the value of θ_{ijt} relative to whatever type of competition exists without the cartel. If both sides of this equation are multiplied by s_{ijt} and then summed over all firms, the following variation of the Lerner equation can be derived:

$$p_{jt}\left(1 + \frac{\theta_{jt}}{\alpha_{1j}}\right) = \sum_i s_{ijt} a_{ijt} \delta_j q_{ijt}^{\delta_j - 1},$$

where

$$\theta_{jt} = \sum_i s_{ijt} \theta_{ijt}.$$

[11] TPOST may also reflect learning by the cartel members on how to shave prices through terms and conditions of the agreement. Ideally, we would have had data on quality and other measures of cheating, but unfortunately these data are not available. These facts notwithstanding, POST and TPOST should capture shifts in demand following cartels.

Using this type of cost function, Porter demonstrates that each firm's market share will only be dependent on the a_{ij}'s, and hence we can write the supply relationship as

$$p_{jt}\left(1 + \frac{\theta_{jt}}{\alpha_{1j}}\right) = D_j Q_{jt}^{\delta_j - 1}, \tag{3}$$

where

$$D_j = \delta_j \left(\sum_i a_{ijt}^{1/(1-\delta_j)}\right)^{1-\delta_j}.$$

If we take the log of Eq. (3) and rearrange terms, we obtain

$$\ln p_{jt} = \ln D_j - \ln\left(1 + \frac{\theta_{jt}}{\alpha_{1j}}\right) + (\delta_j - 1) \ln Q_{jt},$$

or

$$\ln p_{jt} \approx \ln D_j - \frac{\theta_{jt}}{\alpha_{1j}} + (\delta_j - 1) \ln Q_{jt}.$$

If we assume that θ_{ijt} is a (linear) function of whether a cartel was in place at time t, at any time in the past, and the amount of time since the cartel was implemented, then we can write,

$$\theta_{jt} = -\alpha_{1j}(\omega_{1j} + \omega_{2j}\mathrm{ON}_{jt} + \omega_{3j}\mathrm{POST}_{jt} + \omega_{4j}\mathrm{TPOST}_{jt}).$$

On the other hand if cartels succeed in reducing costs we can also write,

$$\ln D_j = \varphi_{0j} - \varphi_{1j}\mathrm{POST} - \varphi_{2j}\mathrm{TPOST},$$

where φ_{1j} and φ_{2j} will be greater than 0 if cartels serve to lower costs. Substituting these equations into the price equation produces,

$$\begin{aligned}\log p_{jt} = {} & (\varphi_{0j} - \omega_{1j}) + \beta_{1j} \log Q_{jt} + \omega_{2j}\mathrm{ON}_{jt} + (\omega_{3j} - \varphi_{1j})\mathrm{POST}_{jt} \\ & + (\omega_{4j} - \varphi_{2j})\mathrm{TPOST}_{jt},\end{aligned}$$

or

$$\log p_{jt} = \beta_{0j} + \beta_{1j} \log Q_{jt} + \beta_{2j}\mathrm{ON}_{jt} + \beta_{3j}\mathrm{POST}_{jt} + \beta_{4j}\mathrm{TPOST}_{jt} + U_{2jt}, \tag{4}$$

TABLE IV
PANEL DATA SAMPLE STATISTICS

	Year prior to cartel	During cartel period	Year after cartel
Administrative guidance (N = 11)			
Avg. log shipments	10.27	10.22	10.38
Avg. standard deviation	0.084	0.176	0.068
Avg. log real prices	0.48	0.42	0.41
Avg. standard deviation	0.107	0.092	0.072
Recession (N = 17)			
Avg. log shipments	10.89	10.92	11.08
Avg. standard deviation	0.040	0.051	0.058
Avg. log real prices	0.34	0.32	0.34
Avg. standard deviation	0.070	0.060	0.022
Designated industry (N = 8)			
Avg. log shipments	11.34	11.28	11.25
Avg. standard deviation	0.199	0.150	0.160
Avg. log real prices	0.27	0.32	0.27
Avg. standard deviation	0.077	0.093	0.048

where ON_{jt} is a dummy variable that is 1 when a cartel is in place at time t, and β_{2j} represents the change in θ_{jt} following the creation of a cartel. The coefficients multiplying POST and TPOST will have negative signs if the impact of a cartel on costs dominates the long-run impact of the cartel on price; otherwise they will be 0 or positive.

Like the analysis of the previous section, this analytic framework lets us separate some of the effects of a cartel on supply and demand into three hypotheses: (H1) if attempts to raise prices dominate cost reductions, then one should expect prices at any output level to rise following the creation of a cartel (i.e., β_{2j}, β_{3j}, and/or $\beta_{4j} > 0$); (H2) if efforts to reduce costs dominate horizontal restraints, then one should expect prices to fall following cartelization (i.e., β_{2j}, β_{3j}, and/or $\beta_{4j} < 0$); and (H3) if quality increases due to a switch from price competition to quality competition (or hidden price shaving), one should expect to see an increase in demand (i.e., α_{3j} and $\alpha_{4j} > 0$).[12]

3.1. *Estimation*

Table IV presents summary data on prices and shipments for 36 cartels broken down into three classes: administrative guidance, recession, and

[12] Note again that these coefficients may also pick up demand increases due to better agreement terms.

designated industry cartels.[13] The table displays information on the behavior of real prices and unit shipments (the latter measured in tons, meters, etc.) around the time when the cartels were started. It is interesting to note that for the sample of administrative guidance cartels and recession cartels, prices during the cartel periods were actually lower on average than prices prior to the cartel. Designated industry cartels seem to have pricing behavior that appears closer to that of a textbook cartel with prices rising during cartel periods. Shipments seem to have declined following the formation of cartels and risen following their dissolution in the case of administrative guidance cartels and designated industry cartels but not in the case of recession cartels. Price volatility seems to have been lower following cartel dissolution than before, although volatility appears higher during cartel periods. Overall, though, the stylized facts on Japanese cartels do not seem to suggest that there were enormous changes in firm behavior following the formation of cartels.

It is possible to estimate Eqs. (2) and (4) with a two-stage least-squares procedure using all predetermined variables as instruments. The problem with this approach is that given that there are 36 industries and five cartel coefficients per industry system, there is a relatively high probability that at least some of the cartel coefficients will be significantly different from 0.[14] One method to circumvent this problem is to estimate Eqs. (2) and (4) as a system of seemingly unrelated equations using three-stage least squares. Forcing the cartel coefficients to be equal across equations provides information on what the overall impact of cartels appears to be, and forcing the coefficients on shipments and prices to be equal across equations provides information on overall returns to scale and price elasticity.

Table VA presents the result from a three-stage least-squares estimation of Eqs. (2) and (4) for each type of cartel. The constant terms and coefficients on the production indices were allowed to vary across equations and are not reported. Overall, the equation fits were rater good, with a typical equation R^2 of around 0.5. The estimated average price elasticity ranged from 0.17 to 0.35, somewhat below Porter's estimate of 0.74 for railroad transportation, but still plausible. It is difficult to interpret directly from the coefficients the overall estimated impacts of the cartels on price and demand. To make the implications of the various coefficient

[13] See Appendix II for more information on which cartels were used in the sample.

[14] This problem has been present in earlier studies of Japanese cartels as well. In Dick's (1992) study, he examined 12 equation systems with 24 cartel coefficients. He found 4 coefficients significantly different from 0, but in his study the probability of finding at least 1 coefficient significant when in fact none were (a type I error) was more than 0.7. This problem is exacerbated in this study where there are three times the number of equations.

TABLE VA
THREE-STAGE LEAST-SQUARES RESULTS

	Administrative guidance		Recession cartel		Designated industry	
	Supply	Demand	Supply	Demand	Supply	Demand
Shipments	−0.1568	—	−0.0360	—	0.1614	—
	0.0056		0.0059		0.0105	
Price	—	−0.2080	—	−0.1725	—	−0.3525
		0.0422		0.0141		0.0234
ON	−0.0319	—	−0.0051	—	−0.0016	—
	0.0060		0.0033		0.0067	
POST	−0.0503	0.0895	−0.0261	−0.0162	−0.0539	−0.0275
	0.0050	0.0088	0.0032	0.0047	0.0090	0.0067
TPOST	−0.0003	0.0039	0.0033	0.0022	−0.0011	−0.0026
	0.0002	0.0004	0.0001	0.0002	0.0001	0.0001
Different equation intercepts	Yes	Yes	Yes	Yes	Yes	Yes
Different α_{2j}'s	Yes	Yes	Yes	Yes	Yes	Yes
Average equation R^2	0.471	0.670	0.406	0.520	0.155	0.527
Average equation D–W	0.206	0.546	0.121	0.500	0.080	0.360
−Log L	496.8	456.3	864.3	796.4	715.2	488.4
Number of observations per equation	71	71	71	71	179	179
Equations	11	11	17	17	8	8

Note. Standard errors are below estimates. Shipments, log (shipments); Price, log (real price); ON, dummy that is 1 when cartel is in place; POST, dummy that is 1 after cartel starts; TPOST, POST times a time trend.

estimates a bit clearer, in Table VB the results of the coefficient estimates are translated in terms of the three hypotheses about cartels and when they appear to be valid. The top indicates which factors were dominant in the first month of the cartel, and the bottom indicates what factors dominated on average in the last month of the cartel (evaluated at average cartel duration). For designated industry cartels, price increases dominated any decrease in costs initially. However, by the end of the cartel period, prices had actually declined below the level at which they had been before the cartel was formed. Administrative guidance cartels did not raise prices at all, but recession cartels seemed to have caused both prices and quality to increase over the cartel period. This suggests that, at least in the case of recession cartels, their impact on prices led to an increase in quality competition.

TABLE VB
ESTIMATED IMPACTS OF CARTELS IN FIRST AND LAST MONTH OF CARTEL

Supply equation	Demand: Increase	Demand: Decrease
	First month	
Increase	Horizontal restraint Quality improvement[b]	Horizontal restraint Designated industry
Decrease	Cost reduction Quality improvement[b]	Cost reduction Administrative guidance recession
	Last month[a]	
Increase	Horizontal restraint Quality improvement[b]	Horizontal restraint
	Recession	
Decrease	Cost reduction Quality improvement[b]	Cost reduction Administrative guidance Designated industry

[a] Estimated at average cartel duration: 10 months for recession cartels, 14 months for administrative guidance, and 51 months for designated industry cartels

[b] Quality improvements may also reflect cheating through the offering of more favorable terms of agreement.

These results seem quite consistent with the evidence on margins presented in the previous section. They suggest that cartels probably failed to positively affect margins because of increased quality competition in the case of recession cartels, failures of the cartels to raise prices in the case of administrative guidance, and the failure of designated industry cartels to maintain higher prices. One might be tempted to suggest that the negative coefficient on the administrative guidance cartels is evidence of a fairly substantial reduction in costs. However, the records of the administrative guidance do not list cost reduction measures as a component of the guidance.[15] Since Yoshida does list cost reduction as an objective for some other cartels, the negative sign on the ON, POST, and TPOST

[15] All administrative guidance cartels in the sample, however, explicitly did try to achieve higher prices or lower production.

coefficients is probably best interpreted as either a failure of the regression to pick up a significant effect or, perhaps, hidden tax breaks or subsidies.

In addition to the possibility that cost and price impacts of cartels may have offset one another, there are a number of other possible explanations for why price increases tended to be small or negative. It is possible that the reason for the lack of a cartel impact stems from the fact that these cartels were generally implemented in sectors in which prices were falling. Since the equation Durbin–Watson coefficients suggest that there is likely to be serial correlation among the error terms, if cartel formation is correlated with unusually low past prices, then it is likely that this will bias the estimate of cartelization on prices downward. In order to correct for this possibility, the model was altered to allow for an AR(p, d) error process where d is the amount of differencing necessary to render the series stationary, and p denotes the degree of autocorrelation. It proved impractical to allow for each equation to have a different AR(p, d) process since in three-stage least squares this would result in more instruments than observations.[16] Instead each system of equations was estimated using various AR(p, 0) and AR(p, 1) disturbances for each set of cartels and the process that maximized the overall likelihood function for the equation system is reported in Table VI.

Correcting for autocorrelation greatly increased the value of the likelihood function but seemed to have relatively little effect on the overall magnitudes of the estimated impact of cartels on price. The reported average R^2's for each set of equations indicate the fit of the transformed data and are therefore considerably smaller than those in the previous set of regressions. After performing this correction, the estimated impact of administrative guidance cartels on prices rose but the impact of designated industry cartels fell. More importantly, none of the cartel variables were significant at the 5% level (two-sided), and administrative guidance cartels, which had a significant impact on prices at the 10% level, only

[16] This problem arises because lagged dependent variables must be used as instruments (see Fair (1970). One solution that was tried in an earlier version of this paper was to estimate the equations separately using two-stage least squares and then examine averages of the coefficients. This approach, which yielded similar results, sacrifices some of the efficiency gains of using three-stage least squares, but allows for a more complex error structure. It was computationally not possible to use a Hildreth–Lu procedure that allowed for every supply and demand equation to have a different autoregressive term because the number of possible AR processes equal n^y, where n is the number of autoregressive processes tried in each equation and y is the number of equations in the system. It is not hard to see that for recession cartels with 17 equations, estimation could easily take a tremendous amount of time.

TABLE VI
THREE-STAGE LEAST-SQUARES RESULTS WITH AUTOREGRESSIVE CORRECTION

	Administrative guidance		Recession cartel		Designated industry	
	Supply	Demand	Supply	Demand	Supply	Demand
Shipments	−0.0006	—	−0.0018	—	0.0192	—
	0.0023		0.0087		0.0312	
Price	—	−0.2185	—	−0.0032	—	−0.2831
		0.1186		0.0429		0.2594
ON	0.0065	—	0.0054	—	0.0000	—
	0.0037		0.0043		0.0044	
POST	−0.0085	0.0150	−0.0055	−0.0182	−0.0027	0.0034
	0.0050	0.0136	0.0063	0.0093	0.0062	0.0147
TPOST	0.0010	0.0053	0.0025	−0.0005	0.0001	−0.0057
	0.0014	0.0038	0.0015	0.0025	0.0012	0.0023
Different equation intercepts	Yes	Yes	Yes	Yes	Yes	Yes
Different α_{2j}'s	Yes	Yes	Yes	Yes	Yes	Yes
Error process	AR(0.3,1)	AR(0,1)	AR(0.1,1)	AR(0,1)	AR(0.1,1)	AR(0,1)
−Log L	239.8	306.684	621.3	620.2	95.3	74.6
Average equation R^2	0.012	0.232	0.013	0.175	0.01	0.039
Average equation D–W	1.83	2.21	1.938	2.28	1.74	2.45
Number of observations per equation	70	71	71	71	178	179
Equations	11	11	17	17	8	8

Note. Standard errors are below estimates.

appear to have increased prices by 1% in the first year of operation. The relatively small impacts of cartels on prices and outputs do not seem to be explainable by unusually low prices prior to cartel formation.[17]

[17] One possible explanation of these results is that the cartels might have just offset a shock that occurred at exactly the same time that the cartel was implemented, and hence the cartel perfectly maintained the underlying demand and supply relationship. This hypothesis is difficult to refute empirically because if the shock is uncorrelated with past prices, then we do not have the necessary data to tell us what would have happened if the cartel had not been implemented. However, there is reason to believe that cartels were not perfectly offsetting unobservable shocks. Cartels were usually implemented *after* the shock to demand occurred, not in anticipation of the shock. This is readily apparent in the data. In the probit equation, we see that lagged growth rates are a good predictor of eventual cartelization. Similarly, in probits that are not reported, lagged prices tend to predict eventual cartelization, which is the justification for the autoregressive corrections in the text. Hence, it is unlikely that all of our results are being driven by endogeneity of cartel formation.

Looking at the maximum values from both sets of estimates, these regressions suggest that the impact of cartels on prices and quality seems to have been relatively limited. Recession cartels, which were probably the most carefully enforced, seem to have resulted in price increases on the order of 1–2% over their average life of 10 months and lead to quality improvements (or changes in the conditions of sale) that resulted in demand increases of 1% over the same time period. Administrative guidance seemed to have had a similar or smaller impact, and designated industry cartels seem to have had an impact on prices of less than 5%. Since evidence on how much these cartels were expected to affect pricing and production in general indicates that the government was trying get firms to reduce production and/or raise prices in the range of 10–20%, these results imply that cartels fell far short of their intended targets.

4. Conclusion

The results from both sets of regressions suggest that MITI's guidance and cartel policies seem to have had rather small impact on firm behavior. Prices did not rise much and margins actually fell. This analysis suggests three principle reasons for the lack of a larger impact on prices and margins. The first is that the ability of the government to change firm behavior was probably limited by cartel members and nonmembers undercutting cartel prices or not following recommended production reductions. This probably made it difficult for cartels to effectively raise prices more than a few percent. Second, cartels may have not been able to prevent firms from competing in quality, thereby driving their own margins down. The evidence on recession cartels suggests that firms seem to have raised both prices and quality to some degree. The added costs incurred in increasing quality may have eroded any gains in margins due to higher prices. Finally, other policies such as tax relief and subsidies may have worked to reduce optimal cartel prices and reduce firm margins through delayed exist, new entry, or changes in optimal margins.

Appendix I

Japan's cartel system, which still remains in effect to some extent today, created a massive database covering the extent of cartel agreements.

In order to form a cartel, the Japanese FTC had to grant MITI an exemption from the Anti-Monopoly Law. Although the FTC rarely opposed MITI policy, every time the FTC granted an exemption it recorded when the cartel was formed, when it ended, who were members, what the cartel covered, and why it was formed. These data regularly appeared in the FTC's annual report ("Kōsei Torihiki Nenji Hōkoku") as well as in special reports prepared by the FTC on cartels in Japan (e.g., Yoshida (1964). Because the Japanese bureaucrats wanted to maintain good records of what was being done in each industry, these FTC reports sometimes included "informal" Japanese regulation such as administrative guidance.

In order to estimate the supply and demand equations of Section 2, data on the industry picked as well as the start and end dates of recession and designated industry cartels were assembled from the FTC annual reports. Using this data it was possible to create ON, POST, and TPOST. In addition, using the data on administrative guidance available in Yoshida (1964), it was possible to obtain a listing of MITI administrative guidance orders to an industry asking it to raise prices, cut production, or reduce capacity. Since recession cartels and administrative guidance cartels were generally rather short-lived, 6 years of monthly data was collected for each industry equation. For designated industry cartels which generally lasted five years, 13 years of monthly data was collected for each regression. Shipment data, measured in units of output, for many of these sectors as well as the overall index of manufacturing output were available in the Nikkei Financial Database and for earlier years in MITI's monthly "Tsūsan Tōkei Geppō." The index of manufacturing output was used as a demand shift parameter, X_{jt}, in Eq. (1). The variable SHIP is the log of the number of units shipped in sector j.[18] Price data were obtained by using the monthly sectoral price indices in the Bank of Japan's "Bukka Shisū." These price indices are calculated on very narrow product categories and only those that corresponded exactly to categories reported in FTC reports were used. All prices were then deflated by dividing by the manufacturing wholesale price index. Since enormous care was taken to be certain that industry definitions from the three sources matched exactly, of the close to 100 cartels listed in various sources, in the end only 36 were perfectly matched in all three data sources. These cartels are listed in Appendix II.

[18] For some of the very early cartels only production data were available thus these were used instead.

APPENDIX II

TABLE A-I
LIST OF CARTELS IN PANEL DATA SET

Administrative guidance	Designated industry	Recession	
Calcium cyanamid (7/58–7/60)	Ammonia (6/79–6/83)	Acetic acid (9/78–1/79)	High density polypropylene (3/62–10/62)
Celluloid (4/58–11/58)	Cement (11/85–6/88)	Alloy steel (1/65–9/66)	Polyvinyl chloride resin 1 (11/68–3/69)
Cotton yarn (4/58–7/60)	Chemical fertilizer (12/83–6/88)	Alloy steel 2 (1/71–6/71)	Polyvinyl chloride resin 2 (1/72–9/72)
Fired brick (3/58–12/58)	Ethylene (9/83–6/88)	Aluminum ingot (9/78–3/79)	Polyvinyl chloride resin 3 (5/77–8/78)
Formalin (9/58–12/58)	Synthetic fibers (1/79–6/83)	Cement (10/77–2/78)	Polyvinyl chloride resin 4 (5/81–2/82)
Methanol (9/58–12/58)	Polyvinyl chloride resin (10/83–6/88)	Corrugated medium board 1 (2/72–7/72)	Small section steel bars (9/75–4/76)
Paper (1/58–9/58)	Urea (6/79–6/83)	Corrugated medium board 2 (9/77–2/79)	White paperboard (9/65–8/66)
Polyvinyl chloride resin (10/57–11/58)	Wool yarn (8/79–6/83)	Cotton yarn (4/77–6/78)	
Sulfuric acid 1 (8/59–7/60)		Cotton yarn 2[a] (5/81–9/81)	
Sulfuric acid 2 (1/62–3/62)		Ethylene (10/82–6/83)	
Wool yarn (12/57–7/60)		Ethylene glycol (4/72–12/72)	

[a] These cartels were so close together that they were included in the same regression.

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