AN ECONOMETRIC STUDY OF PRICE FIXING, MARKET STRUCTURE AND PERFORMANCE IN BRITISH INDUSTRY IN THE EARLY 1950's.

by

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This paper is circulated for discussion purposes only and its contents should be considered preliminary.

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I. Introduction

Empirical studies of the relations between industry profitability and various measures of industry structure have appeared in numbers in recent years. Following Bain's {1} seminal work of 1951 are more or less similar studies of United States manufacturing industries by Schwartzman {34}, Stigler {36} Fuchs {13} Weiss {38} Hall and Weiss {16} Collins and Preston {7}{8} Mann {23}{24}{25} Miller {27}{28} Comanor and Wilson {9} George {14} Kilpatrick {19} MacAvoy, McKie and Preston {22} and Shepherd {35}. While criticisms of the conclusion that concentration ratios and the degree to which entry is barred are positively related to profit rates have been expressed by Brozen {4} {5} and Coase {6}, it is probably correct that most industrial economists feel that statistically significant - albeit small - relationships have been demonstrated.

Unpublished works by Long {21} and Greenberg {15} support this conclusion. Long finds that trade association activities, measured by the number of trade association employees per firm, are also positively related to profit rates. Greenberg concludes that the strongest relationship between price-cost margins and concentration occurs in industries in which the dispersion of firm size is relatively high and the number of firms is relatively small. Studies of commercial banking markets by Edwards {10} Kaufman {18} Phillips {30}, and Bell and Murphy {3} among others, suggest that concentration is positively associated with the pricing of bank services, though Flechsig {12} has argued that a regional rather than a concentration effect is being revealed.

Without disputing that concentration and entry barriers are related to the level of profits or prices, I have argued elsewhere {31} that the underlying model used by industrial economists represents a "naive Cournot-like" approach to the subject. Industry performance is viewed as a simple and static function of industry structure and conduct, with both of the latter taken as essentially exogenous variables. Further, it is common to conceive a conduct as being uniquely related to structure, leaving only differences in structure as an explanation of differences in performance.

Williamson {39} has developed a theoretical model in which the frequency of interfirm communications aimed at establishing collusive agreements among firms is related to profit levels and the rate of change in profits with respect to time. Thus, conduct is taken as a function of the state of demand and is partially endogenous to the system describing interrelations among performance, structure and conduct. Long's conclusions concerning trade association activities are based on an implicit hypothesis rejecting a unique relation between structure and conduct, but there is no suggestion that the latter is in any way endogenous to the system.

II. The Model

This study is based on the view that, at any point in time, performance is functionally related to structure and conduct, but that the latter tend to change over time in response to performance. While a partially endogenous system of interrelations over time is, in fact, envisioned, the model itself relates to but a single year due to data limitations.

Two dimensions of conduct are involved. One is a "propensity to attempt price-fixing agreements"; the other, the "effectiveness of price-fixing agreements" when such attempts are made. More specifically, the first aspect of the model assumes that:

$$\Pi = \Pi\ (CR,B,PD,D,EPF) \qquad (1)$$

and

$$EPF = EPF\ (N,H,\Pi\ ) \qquad (2)$$

where Π is a measure of profitability, CR is a concentration measure, N is the number of firms, B measures the substantiality of entry barriers, PD is the degree of product differentiation, D is market demand, EPF is the effectiveness of price-fixing agreements, and H is a measure of the "homogeneity of values" among the firms in the industry.[1]

For industries comprised of profit-maximizing forms, it is anticipated that:

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[1] The meaning of the term "homogeneity of values" will become clearer as the discussion proceeds. See, however, Phillips {29}{32} for earlier treatment.

$$\partial\Pi/\partial CR > 0 \qquad (1a)$$

$$\partial\Pi/\partial B > 0 \qquad (1b)$$

$$\partial\Pi/\partial PD > 0 \qquad (1c)$$

$$\partial\Pi/\partial D > 0 \qquad (1d)$$

$$\partial\Pi/\partial EPF > 0 \qquad (1e)$$

and

$$\partial EPF/\partial N < 0 \qquad (2a)$$

$$\partial EPF/\partial H > 0 \qquad (2b)$$

$$\partial EPF/\partial\Pi > 0 \qquad (2c)$$

The anticipated relations of (1a), (1b), and (1d) require no explanation. That of (1c) asserts that product differentiation should tend to increase profits and is based on the elemental notion that the greater the product differentiation the lower the (positive) cross-demand elasticities among firms and the lower the (negative) subjective own-demand elasticities within each of the firms. Given the magnitude of market demand and production costs product differentiation should lead to higher profit potentials.

The partial relationship of (1e) is virtually tautological. If firms prefer more profits to less[2] and if attempts are made to fix-prices in order to achieve firm objectives, effective price-fixing should, in and of itself, tend to increase profits.

Relationship (2a) posits that attempts at price-fixing should be more effective when the number of firms is small. Stigler {37} and Phillips {26} provide the theoretical foundations for the expectation. The expectation of (2b) that greater "homogeneity of values" gives

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2 Some of the empirical results below raise questions as to the truth of such an assumption.

rise to higher profits rests also on Phillips' arguments. If firms have similar cost and demand conditions, similar views on future industry growth, the level of entry-preventative prices, etc., and if there is little disparity in the relative importance of profits, sales growth and other managerial preferences in the objective functions which underlie the decisions of the several firms, agreements are easier to reach and to maintain than where such conditions do not exist.

Williamson {39} and Phillips {29} provide an explanation for (2c). When firms are realizing high profits, there is little temptation to "break" from interfirm agreements. "Rules of the game" tend to be adhered to, and "cheating" on price is less frequent than when profits are low.

The second aspect of the model contains (1), as above. Ideally, its second equation would express the propensity to attempt price-fixing agreements in terms of structural variables, the level of profits, and the change in profits with respect to time. That is attempts at price-fixing should arise from decreases in profits as much, if not more, than from just low levels of profits. Data limitations prevent the use of such a model, however, and the second equation of the second aspect is:

$$PPFA = PPFA\ (N, H, \Pi) \qquad (3)$$

where PPFA is the propensity to attempt price-fixing agreements. Here the anticipated directional relationships are:

$$\partial\ PPFA / \partial\ N > 0 \qquad (3a)$$

$$\partial\ PPFA / \partial\ H < 0 \qquad (3b)$$

$$\partial\ PPFA / \partial \Pi > 0 \qquad (3c)$$

The expectation of (3a) is that the existence of large numbers of firms tends to lead to attempts to fix-prices, even though the same conditions make effective price-fixing more difficult. Similarly, from (3b), more attempts at price-fixing should occur when value systems are disparate than when they are homogeneous. Conflicting values lead to conflicting behaviour, rivalry and overt attempts to stifle the rivalry. Relationship (3c) attempts to capture the dependence of price-fixing attempts on profits. It omits, as noted above, the change in profits with respect to time, relying instead on the possibly incorrect assumption that low levels of profits at a given time are positively associated with current and recently past decreases in profits.

III. The Data

Price-Fixing

Data on the effectiveness of price-fixing and on attempts to fix price came from a survey on industrial trade associations carried out by Political and Economic Planning in the years 1953 - 1956 {33}. In one part of the survey fifty large firms and over six hundred small firms were interviewed "to find out what associations mean to them in their day-to-day conduct of business"[3]. Government departments, public corporations, local authorities and hospital groups were similarly interviewed.

Among the questions asked in the interviews were some relating to price-fixing. Particular associations were listed by those buying from its member firms according to whether or not a price-fixing agreement existed and, if so, according to whether it was

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3 {33} p. xii

"effective" or "less effective". There was also a recording of whether the buyers could or could not obtain the same goods at prices set ostensibly independently y non-member producers. Some 1,300 associations of manufacturers, classified by Census of Production industry groups, were covered.

The PEP report shows only aggregate data, for rather obvious reasons. Excluding Order V, Metal Manufacture, many of the products of which were subject to price-setting by the Iron and Steel Board, 58 Minimum List Heading industries were found to have associations with price agreements. Within these industries, 122 products were found to be subject to "effective" agreements, and 105 other products, to "less effective" agreements. Overall, 243 of the 1,300 associations were reported as attempting to fix prices.[4] Because of the limited sample of buyers and because some of the sampled buyers might have been unaware of price-fixing, PEP concluded that their finding on the extent of price-fixing "errs if anything on the conservative side."[5]

The worksheets underlying the PEP aggregates were examined and the data were re-assembled by individual industry. Trade associations were further classified into industry-wide associations, on the one hand, and associations representing sub-product classes or particular geographic areas, on the other. The result was a list of trade associations, industry-wide and other, by SIC Minimum List Heading industries, with each association identified as "effective" "less effective" and "unreported". The latter might in fact be a price-fixing association which was not so reported by buyers.

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4 {33} pp. 161-162

5 {33} p. 163

PPFA was defined simply as the number of trade associations reported as attempting to fix prices in a given industry, regardless of whether it was "effective". EPF was defined in a more complicated - and a more subjective - way. Industry-wide associations with "effective" agreements were assigned a weight of 300; with "less effective" agreements, a weight of 150. Sub-industry associations were given a weight of 100 for "effective" agreements and of 50 for "less effective". The sum of these weights for each industry was then divided by the number of associations in the industry to yield the EPF variable. Thus, industry-wide price-fixing is given triple weight relative to sub-industry price-fixing, and "effective" agreement is given double weight relative to "less effective". PPFA and EPF had non-zero values for 27 of the industries for which structural data were available. The concentration ratio for one of these was based on the largest five firms rather than the largest three firms.

Concentration and Number of Firms

Three-firm concentration ratios (CR) for 1951 were taken from Evely and Little {11}. The number of firms (N) are those reported by Evely and Little, and are directly from the 1951 Census of Production. There were 71 industries for which these data were available, including 26 of the 27 industries for which PPFA and EPF could be determined. The remaining industry was the one for which a three-firm concentration ratio was lacking.

Barriers to Entry and Product Differentiation

Two variables were chosen as measures of barriers to entry. The first was average plant size for 1951 (APS), computed by Evely

and Little as the number of employees (in thousands) divided by the number of plants in the industry. On the assumption of a positive relation between APS and the minimum efficient size of plant, APS was introduced as a proxy for the minimum efficient size.

The second measure of entry barriers was the ratio of advertising and market research expenditures to sales (A/S) for each industry. These are reported in Summary Tables 6 and 7 of the 1951 Census of Production, but the data pertain to 1948. Comanor and Wilson {9} and Miller {28} use the advertising - sales ratio in their studies of U.S. manufacturing industries, arguing that because of brand loyalties and the cumulative effects of past advertising, new firms require high initial working capital and incur high advertising costs to enter an industry with intensive advertising programmes. Alternatively, A/S could be viewed as a measure of the degree of product differentiation among the firms in an industry.

Demand

The demand variable (GO) used was gross output in 1954 less gross output in 1948, divided by gross output in 1948.

Homogeneity of Values

Trade associations, it is assumed, arise in industry not solely to provide "merriment and diversion", but also as an organisational response to problems found to be common among a number of firms. An industry with but a single association suggests that the firms have found one organisation effective in dealing with their common problems. Where several independent associations exist, there is evidence that different groups of firms have found that special organisations are more effective in dealing with their own special problems. In this

sense, the number of trade associations in an industry (TA) can be used as an indicator of homogeneity. The greater the number of associations, the more separable - that is, the less homogeneous - are the values of the included firms.[6]

Producer Goods and Consumer Goods Industries

From the product descriptions of the Census of Production industry classes, each industry was classified as a producer good or consumer good industry. The variable (PRO-CON) was introduced as a dummy, with producer goods assigned a value of one and consumer goods a value of zero.

Profitability

Census of Production data do not include rates of return on assets or stock holder equity. Following Collins and Preson {7} {8} the price-cost margin (Π) is used alternatively. Conceptually, Π is the ratio of profits to sales. Viewed on a unit basis, and with the assumptions that it is long-run costs that are reported, that long-run marginal costs are constant and that firms profit maximize, Π can be viewed as the Lerner measure of monopoly power.

Census data, however, do not permit computation of a pure profit to sales ratio. The data for Π are computed as valued added less wages and salaries divided by gross output. Accordingly, the ratio is actually that of the sum of profits, rents, interest, depreciation, non-wage advertising costs and other miscellaneous costs to gross output. Collins and Preston report significant simple

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6 The ratio of the average size of the three largest firms to the average size of all other firms and the ratio of value added/gross output for the three largest firms to value added/gross output for all other firms were also tried as homogeneity measures. The latter was conceived of as a measure of differences in the degree of vertical integration. Neither proved to have explanatory value.

correlation between the price-cost margin and rates of return for the industries in their study for which both were available. As used here, Π is an average of the price-cost margins for 1948, 1951 and 1954.

IV. Empirical Results

Table 1 gives OLS results for the 26 industries for which both structural data are available and price-fixing was reported. There is some indication of positive concentration and advertising effects and of a negative concentration-advertising interaction effect. If anything, effective price-fixing has a positive effect on the price-cost margin. None of the $\bar{R}^2$ values is significant at the five percent level, however. The number of variables is large relative to the number of observations and, as shown in Table 6, substantial multicollinearity exists among CR, CR^2, A/S, and CR.A/S.

In Table 2, results are given for 71 industries, with the actual EPF and PPFA values for each industry. That is, EPF and PPFA have zero values for the 45 industries for which PEP respondents did not report any price-fixing. Here all the $\bar{R}^2$ values while not high, are significant.

The CR and A/S effects are consistently positive, as expected. The APS effect is negative and significant, indicating that the partial effect of plant size is contrary to that anticipated. Similarly, while none of the coefficients is significant at the ten percent level, the concentration - advertising interaction term is again consistently negative. So, too, is the coefficient of the GO term. The EPF variable - expressed as a natural number rather than in the log form because of the 45 zero values - has a positive sign, though the effect is not significant by the usual criterion. The producer good - consumer good dichotomy produces a hint of higher margins among

the producer goods industries.

The EPS and PPFA variables undoubtedly suffer from reporting error. In particular, it is not clear that associations for which no price-fixing was reported did not, in fact, attempt to fix prices but remained unreported because of either bias in the sample of buyers from whom the reports were obtained or the buyers' lack of awareness of price-fixing.

Table 3 gives OLS estimates of EPF and PPFA based on variables from the underlying model. Price-fixing appears more effective where the number of trade associations is small. In the sense used here, price-fixing is more effective, that is, where little heterogeneity in values exists. The effect of number of firms has the expected sign, but is not significant. In the OLS form, no relationship between price-cost margins and EPF appeared.

The PPFA variable, as anticipated, is larger where the number of trade associations is large. Heterogeneity in values leads to frequent attempts to fix prices, but makes effective price-fixing more difficult. The effect of the number of firms has the opposite sign from that expected, but again is not significant.

The regressions of Table 4 utilize the estimated EPF and PPFA values. The CR, APS and A/S effects are much as those of Table 2, with plant size still showing a negative association with the margins. The CR.A/S interaction term has the negative coefficient previously found, but its significance is greater when the estimated price-fixing data is employed. Both the GO and PRO-CON variables have greater significance and indicate that lower rates of output growth and the producer goods classification are associated with higher margins. The CR^2 term has a consistently negative coefficient when it is included,

but the "t" statistic is relatively small, probably because of the high correlation between CR and CR^2.

Use of the estimated values for EPF and PPFA alters the role of these variables in the regressions. Effective price-fixing tends to raise the price-cost margins, while price-fixing attempts seem more numerous when margins are low. In both cases, these are the anticipated results.

Because the price-cost margins (Π) and EPF and PPFA are interdependent, the OLS regressions are not properly identified. In terms of the model, two stage least squares is the preferred estimating method. But TSLS estimates had to be restricted to the 26 industries for which price-fixing was reported, placing a great burden on that small number of observations, particularly because of the multicollinearity among the variables.

Table 5 gives the TSLS results. The CR^2 term has been omitted to alleviate the multicollinearity problem and because of the small and probably insignificant effects shown in the OLS regressions. Still, the estimated standard errors in Table 5 are inflated because of multicollinearity. In summary, the CR and APS effects found in the OLS regressions reappear in the TSLS estimates. The A/S effect shows the same positive sign, but is roughly three times as large. The CR.A/S interaction term, on the other hand, remains negative in its effect and is also roughly three times as large. By themselves, concentration and advertising intensity tend to be positively related to price-cost margins, but when they are combined so that their joint value is large, they are associated with lower margins.

The TSLS regressions show the negative relation between output growth and margins and provide limited evidence that the

producer good industries have higher margins than do the consumer goods industries.

Effective price-fixing, which tends to occur where the number of trade associations and, perhaps, the number of firms are small, has a positive effect on the margins. Effectiveness may also vary positively with the margins. Attempts at price-fixing occur more often when there are a large number of associations, a small number of firms and, if anything, when margins tend to be low. Except for the number of firms effect on attempts at price-fixing, these are all the anticipated results. The TSLS regressions also show more effective price-fixing and more attempts at price-fixing among the producer goods industries, but this could well be the result of the PEP sample of buyers, which was limited to firms and excluded consumers.

V. Evaluation

The predictions of the model with respect to the propensity of firms to enter price-fixing agreements and the effectiveness of price-fixing agreements are generally borne out. Yet the statistical results must be taken with caution. Neither the EPF nor the PPFA variable is defined in an ideal way, and multicollinearity makes meaningful statistical tests of significance quite difficult. The most that can be said in support of the results is that they are fairly consistent when different variables were entered in the regressions, when EPF and PPFA were extended by estimation to industries for which data were lacking, and when either OLS or TSLS methods of estimation were used. Further efforts to find relations between conduct variables and industry performance are obviously warranted - and obviously difficult for want of data on conduct.

Aside from the price-fixing relationships, the signs of the

APS, CR.A/S, GO, PRO-CON and, though its significance is questionable, the CR^2 coefficients capture special interest. These are not consistent with the expectations of the model nor with the results of studies of United States industries.

The CR^2 and CR.A/S terms were introduced because previous studies, especially those of Bain {1} Mann {23} {25} and Comanor & Wilson {9} suggest a compounding effect on profitability when both concentration and entry barriers are high. For the industries covered here, the reverse effect is observed. If, based loosely on the regressions of Table 4, the CR coefficient is taken to be +0.002, the CR^2 coefficient is -0.000015, the A/S coefficient is +5.5, and the CR.A/S coefficient is -0.08, on average the partial effect of increases in concentration on price-cost margins becomes negative after CR reaches about 48.[7] The partial effect of increases in A/S become negative when CR reaches about 56.[8] If the CR^2 coefficient is taken as zero, increases in concentration are associated with decreases in the margin after A/S reaches +0.025.

If, based on the Table 5 regressions, the CR coefficient is +0.0015, the A/S coefficient is +16.00 and the CR.A/S coefficient is -0.25, the concentration effect is negative after A/S reaches +0.006 and the A/S effect is negative after CR reaches 60. Thus, unlike the results from the studies of United States industry, high concentration and high barriers to entry appear to combine to produce negative effects on profitability for the sampled British industries in the

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7 This is evaluated using the mean A/S ratio of approximately 0.007.

8 Because advertising is included in the price-cost margin, the net effect of changes in A/S on the margin is $\frac{\partial \Pi}{\partial A/S} - 1$ This evaluation is based on the assumed net coefficient of +4.5 rather than +5.5.

early 1950's.

It is difficult to conclude that monopoly power and the potential for profits in fact decline as market concentration and entry barriers reach high levels. Three alternative explanations come to mind. First, the results may be due to data deficiencies, particularly in the concentration data as measures of market structure. If industries in Great Britain with high concentration and large plants are, in fact, industries which tend to compete more with foreign firms for the British market and for export markets, the domestic concentration ratio would be a misleading structural measure. In such circumstances, high domestic concentration and large plants could be associated with low margins, and with relatively high advertising expenditure being used to maintain within the domestic market some degree of product differentiation based on preferences for British products.

This possibility cannot be wholly dismissed. Yet the information on the industries with high combined concentration and advertising given in Table 7 provides little supportive evidence. These industries seem to be at least as effective in their fixing of prices as are the other industries. Foreign competition, it would be supposed, would make price-fixing more difficult. The industries, on average, also show substantially higher rates of output growth than do the others. While this is not necessarily inconsistent with a high degree of foreign competition, it indicates that the industries were not being faced with such severe competition that foreign-made products were displacing them. It also appears that the industries with high combined concentration and advertising had plants no larger than the average for all industries and price-cost margins which are somewhat higher. Finally, the industries in the list are not typically ones in which international competition seems likely to be intense.

A second possible explanation is that post-war controls, both formal and informal, brought about the unusual results. Determining how government policies in this period constrained the exercise of monopoly power would be difficult, if not impossible. Nonetheless, preliminary findings by Holtermann {17} based on 1963 data are remarkably similar to those formed here. The variance of the profit-to-sales ratios used by Holtermann have no significant relationship with five-firm concentration ratios when neither a squared concentration term not a concentration-advertising interaction term is included. With either or both of the latter included, the concentration effect becomes significantly positive and the coefficients for the squared concentration and the interaction terms are negative. With the addition of capital-output ratios and investment-sales ratios, Holtermann obtains corrected coefficients of determination approaching .60, with 113 industries covered. These results weaken the argument that the 1951 performance was just a post-war anomaly.

The third explanation - and that which seems most plausible in view of Holtermann's findings - is that the performance of the high concentration - high entry barrier industries reflects something other than profit-maximizing behaviour. Following Williamson {40}, Marris {26}, Baumol {2} and Liebenstein {20}, it can be conjectured that what is being observed is a group of industries with firms so isolated from market pressures that managerial discretion and "X-inefficiency" appear. Advertising is relatively high - both to bar potential entrants and to achieve growth. Prices are set high enough to maintain at least average profits, even given possible cost inefficiencies, but neither price nor cost behaviour is such that profits are maximized. The combination of concentration and product differentiation gives rise to little overt rivalry within the industries. Even in their purchasing the firms fail to minimize costs, with the result that producer goods margins are higher than consumer goods margins. Monopoly is there,

but is exercised so as to achieve goals different from maximum profits.

Whatever the correct explanation, it is certain that strong caveats are necessary when questions of appropriate public policy are considered. None of the empirical studies has succeeded in explaining a high proportion of the variance in actual or potential profitability. Even if they had, other performance measures are often relevant for policy purposes. Structural variables are certainly important ingredients to studies aimed at aiding policy decisions, but we are far from the point that more detailed and "industry specific" inquiries can be abandoned.

TABLE 1 OLS Regressions of the Price-Cost Margin on Structural and Price-Fixing Variables - 26 Industries
(figures in parentheses are "t" statistics)

Regression	Constant	CR	CR^2	APS	A/S	CR.A/S	GO	EPF	ln EPF	PPFA	PRO-CON	$\bar{R}^2$
1	0.098	+ 0.0011 (1.93)	+0.00000 (0.34)	- 0.0174 (0.20)	+ 15.95 (1.99)	- 0.2629 (2.13)	+ 0.0065 (0.16)	+ 0.0002 (0.84)	-	-	-	.002
2	0.048	+0.0010 (0.47)	+0.00000 (0.36)	- 0.0388 (0.46)	+ 16.63 (2.20)	- 0.2628 (2.26)	+ 0.0035 (0.09)	-	+ 0.0186 (1.57)	-	-	.009
3	0.096	+0.0011 (0.51)	+0.00000 (0.32)	- 0.0038 (0.04)	+ 17.24 (2.14)	- 0.2842 (2.31)	+ 0.0109 (0.27)	-	-	- 0.0004 (0.07)	-	.004
4	0.089	+0.0018 (2.23)	-	-0.0246 (0.30)	+ 15.88 (2.03)	- 0.2608 (2.17)	+ 0.0051 (0.13)	+ 0.0002 (0.85)	-	-	-	.048
5	0.040	+0.0016 (2.16)	-	-0.0469 (0.58)	+ 16.54 (2.24)	- 0.2606 (2.30)	+ 0.0020 (0.05)	-	+ 0.0185 (1.61)	-	-	.130
6	0.089	+0.0018 (2.23)	-	-0.0111 (0.14)	+ 17.14 (2.18)	- 0.2822 (2.35)	+ 0.0094 (0.23)	-	-	- 0.0001 (0.02)	-	.012
7	0.083	+0.0017 (2.10)	-	-0.0177 (0.21)	+ 17.26 (2.17)	- 0.2661 (2.21)	- 0.0060 (0.15)	+ 0.0001 (0.49)	-	-	+ 0.0253 (1.00)	.048
8	0.040	+0.0016 (2.04)	-	-0.0406 (0.51)	+ 17.44 (2.35)	- 0.2599 (2.30)	- 0.0091 (0.23)	-	+ 0.0165 (1.41)	-	+ 0.0238 (1.03)	.132
9	0.086	+0.0017 (2.11)	-	-0.0116 (0.14)	+ 18.18 (2.34)	- 0.2798 (2.37)	- 0.0072 (0.17)	-	-	- 0.0016 (0.29)	+ 0.0311 (1.25)	.040

TABLE 2 OLS Regressions of the Price-Cost Margin on Structural and Price-Fixing Variables - 71 Industries with actual Price-Fixing Data (Figures in parentheses are "t" statistics)

Regression	Constant	CR	CR^2	APS	A/S	CR.A/S	GO	EPF	PPFA	PRO-CON	$\bar{R}^2$
1	0.137	+ 0.0021 (1.67)***	- 0.00001 (0.99)	- 0.1015 (2.06)**	+ 5.180 (2.58)**	- 0.0683 (1.42)	- 0.0094 (1.17)	+ 0.0002 (1.43)	-		.259
2	0.137	+ 0.0022 (1.73)***	- 0.00001 (1.07)	- 0.0925 (1.86)***	+ 5.188 (2.54)**	- 0.0697 (1.43)	- 0.0092 (1.23)	-	+ 0.0018 (0.43)	-	.237
3	0.131	+ 0.0021 (1.69)***	- 0.00001 (0.93)	- 0.1126 (2.22)**	+ 5.481 (2.69)*	- 0.0727 (1.50)	- 0.0102 (1.26)	+ 0.0002 (1.17)	-	+ 0.0146 (0.95)	.258
4	0.130	+ 0.0022 (1.76)***	- 0.00001 (1.01)	- 0.1075 (2.10)**	+ 5.545 (2.69)*	- 0.0750 (1.53)	- 0.0109 (1.34)	-	+ 0.0008 (0.18)	+ 0.0181 (1.17)	.242
5	0.147	+ 0.0010 (2.22)**	-	- 0.1127 (2.22)**	+ 5.609 (2.76)*	- 0.0730 (1.51)	- 0.0118 (1.50)	+ 0.0002 (1.27)	-	0.0155 (1.01)	.260
6	0.147	- 0.0010 (2.13)**	-	- 0.1063 (2.05)**	+ 5.669 (2.73)*	- 0.0744 (1.50)	- 0.0126 (1.57)	-	+ 0.0013 (0.30)	+ 0.0191 (1.23)	.240

* Significant at the one percent level
** Significant at the five percent level
*** Significant at the ten percent level

Table 3

OLS Estimates of Price-Fixing Fixing Variables

(figures in parentheses are "t" statistics)

	Price-Fixing Variable	Constant	N	lnN	TA	lnTA	$\bar{R}^2$
1.	$\widehat{\ln EPF}$	5.410	-	-0.083 (0.64)	-	-0.782* (3.13)	.29
2	$\widehat{PPFA}$	-0.323	-.001 (1.63)	-	+.374* (5.62)	-	.52

* Significant at the 1 percent level

TABLE 4 OLS Regressions of the Price-Cost Margin on Structural and Price-Fixing variables - 71 Industries with Estimated Price-Fixing Data (figures in parentheses are "t" statistics)

Regression	Constant	CR	CR^2	APS	A/S	CR.A/S	GO	ln $\hat{EPF}$	$\hat{PPFA}$	PRO-CON	$\bar{R}^2$
1	0.080	+ 0.0021 (1.70)***	- 0.00001 (1.09)	- 0.0978 (2.00)***	+ 5.328 (2.65)**	- 0.0750 (1.55)	- 0.0111 (1.39)	+ 0.0170 (1.45)	-	-	.260
2	0.152	+ 0.0026 (2.10)**	- 0.00002 (1.41)	- 0.1028 (2.12)**	- 5.358 (2.70)*	+ 0.0784 (1.64)	- 0.0108 (1.37)	-	- 0.0094 (1.98)***	-	.280
3	0.096	+ 0.0009 (1.88)***	-	- 0.0965 (1.97)***	+ 5.462 (2.71)*	- 0.0753 (1.56)	- 0.0131 (1.68)***	+ 0.0175 (1.50)	-	-	.253
4	0.175	+ 0.0010 (2.14)**	-	- 0.0998 (2.05)**	+ 5.502 (2.75)*	- 0.0777 (1.62)	- 0.0132 (1.70)***	-	- 0.0086 (1.81)***	-	.269
5	0.060	+ 0.0021 (1.69)***	- 0.00001 (0.96)	- 0.1190 (2.36)**	+ 5.836 (2.89)*	- 0.0826 (1.72)***	- 0.0124 (1.55)	+ 0.0199 (1.70)***	-	+0.0228 (1.53)	.275
6	0.143	+ 0.0026 (2.16)***	- 0.00002 (1.33)	- 0.1267 (2.54)**	+ 5.918 (2.98)*	- 0.0871 (1.84)**	- 0.0121 (1.55)	-	- 0.0109 (2.30)**	+0.0251 (1.70)***	.301
7	0.073	+ 0.0024 (2.16)**	-	- 0.1190 (2.36)**	+ 5.981 (2.97)*	- 0.0832 (1.73)***	- 0.0141 (1.82)***	+ 0.0205 (1.76)***	-	0.0241 (1.62)	.276
8	0.164	+ 0.0011 (2.49)**	-	- 0.1250 (2.50)**	+ 6.076 (3.05)*	- 0.0869 (1.83)***	- 0.0144 (1.87)***	-	- 0.0102 (2.15)**	+0.0263 (1.77)***	.293

* Significant at the one percent level
** Significant at the five percent level
*** Significant at the ten percent level

TABLE 5 TSLS Regressions of Price-Cost Margins and Structural and Price-Fixing Variables
(figures in parentheses are standard errors)

Regression	Dep. Variable	Constant	CR	N	TA	APS	A/S	CR.A/S	GO	PRO-CON	ln $\hat{EPF}$	$\hat{PPFA}$	$\hat{\Pi}$
1a	$\hat{\Pi}$	- 0.0228 (0.1052)	+ 0.0014 (0.0009)	–	–	- 0.0900 (0.1071)	+ 15.79 (8.21)	- 0.2329 (0.1310)	- 0.0072 (0.0435)	–	+ 0.0421 (0.0354)		
1b	ln $\hat{EPF}$	+ 3.458 (1.192)	–	- 0.0002 (0.0004)	- 0.0684 (0.0471)	–	–	–	–	–	–	–	+ 3.704 (5.642
2a	Π	+ 0.1152 (0.0525)	+ 0.0019 (0.0009)	–	–	- 0.0252 (0.0884)	+ 16.86 (8.46)	- 0.2905 (0.1293)	- 0.0044 (0.0431)	–	–	- 0.0092 (0.0074)	
2b	$\hat{PPFA}$	- 0.0903 (1.9044)	–	- 0.0009 (0.0006)	+ 0.3699 (0.0753)	–	–	–	–	–	–	–	- 0.878 (9.015
3a	$\hat{\Pi}$	- 0.0337 (0.1047)	+ 0.0014 (0.0009)	–	–	- 0.0941 (0.1109)	+ 16.20 (8.66)	- 0.2279 (0.1356)	- 0.0155 (0.0457)	+ 0.0144 (0.0289)	+ 0.0448 (0.0358)	–	–
3b	ln $\hat{EPF}$	+ 3.198 (1.109)	–	- 0.0002 (0.0004)	- 0.0644 (0.0464)	–	–	–	–	–	–		+ 4.995 (5.121
3c	ln $\hat{EPF}$	+ 3.582 (1.147)	–	- 0.0000 (0.0004)	- 0.0800 (0.0486)	–	–	–	–	+ 0.4725 (0.4211)			
4a	$\hat{\Pi}$	+ 0.1064 (0.0507)	+ 0.0018 (0.0008)	–	–	- 0.0233 (0.0857)	+ 18.26 (8.25)	- 0.2859 (0.1255)	- 0.0162 (0.0443)	+ 0.0405 (0.0269)	–	- 0.0097 (0.0073)	
4b	$\hat{PPFA}$	- 1.1113 (1.6631)	–	- 0.0010 (0.0006)	+ 0.3859 (0.0707)	–	–	–	–	–	–	–	+ 4.192 (7.799
4c	$\hat{PPFA}$	- 0.4302 (1.7995)	–	- 0.0008 (0.0006)	+ 0.3582 (0.0762)	–	–	–	–	+ 0.8383 (0.6605)	–	–	- 1.301 (9.144

Table 6

Matrix of Simple Correlation Coefficients

	CR	CR^2	N^a	TA^a	APS	A/S	GO	CR.A/S	$LnEPF^a$	$PPFA^a$	Π	$\widehat{lnEPF}$	$\widehat{PPFA}$
CR	+ 1.00	–	–	–	–	–	–	–	–	–	–	–	–
CR^2	+ 0.97	+ 1.00	–	–	–	–	–	–	–	–	–	–	–
N^a	– 0.53	– 0.41	+ 1.00	–	–	–	–	–	–	–	–	–	–
TA^a	– 0.29	– 0.29	+ 0.38	+ 1.00	–	–	–	–	–	–	–	–	–
APS	+ 0.45	+ 0.44	– 0.33	– 0.34	+ 1.00	–	–	–	–	–	–	–	–
A/S	+ 0.09	+ 0.04	– 0.03	– 0.10	– 0.13	+ 1.00	–	–	–	–	–	–	–
GO	+ 0.41	+ 0.45	– 0.19	– 0.02	+ 0.30	– 0.03	+ 1.00	–	–	–	–	–	–
CR.A/S	+ 0.32	+ 0.26	– 0.19	– 0.21	– 0.06	+ 0.93	+ 0.03	+ 1.00	–	–	–	–	–
$lnEPF^a$	+ 0.19	+ 0.15	– 0.21	– 0.40	+ 0.36	– 0.20	+ 0.11	– 0.13	+ 1.00	–	–	–	–
$PPFA^a$	– 0.01	– 0.05	+ 0.07	+ 0.72	– 0.04	– 0.13	– 0.05	– 0.12	– 0.07	+ 1.00	–	–	–
Π	+ 0.07	+ 0.01	+ 0.06	– 0.19	– 0.22	+ 0.48	– 0.16	+ 0.42	+ 0.10	+ 0.01	+ 1.00	–	–
$\widehat{lnEPF}$	+ 0.32	+ 0.30	–	–	+ 0.21	+ 0.05	+ 0.19	+ 0.14	–	–	+ 0.14	+ 1.00	–
$\widehat{PPFA}$	– 0.13	– 0.15	–	–	– 0.14	– 0.08	– 0.11	– 0.12	–	–	+ 0.07	–	+ 1.00

[a] Based on 26 industries used in TSLS Regressions

Table 7

Structural and Performance Data on Sixteen Industries with above + 0.25 CR.A/S Values

Industry	CR	A/S	APS	$\widehat{\ln EPF}$[a]	GO	Π	$\hat{\Pi}$[b]
Fertilizers & disinfectants	59	.014	.14	-	1.45	.18	.21
Batteries & accumulations	74	.009	.41	-	0.51	.19	.16
Watches & Clocks	60	.006	.14	-	0.43	.21	.21
Musical instruments	46	.030	.06	-	0.44	.27	.25
Asbestos	59	.010	.37	-	0.58	.31	.21
Biscuits	26	.012	.32	-	1.30	.18	.18
Cocoa, chocolate & sugar confectionary	39	.010	.42	-	1.64	.17	.18
Margarine	79	.004	.18	-	4.81	.23	.15
Cattle, dog & poultry foods	53	.008	.08	-	2.77	.11	.20
Vinegar & other condiments	62	.020	.06	-	0.33	.27	.24
Starch	82	.021	.14	-	1.49	.19	.18
Wine, cider & soft drinks	18	.021	.04	-	0.41	.26	.24
Printing & publishing	25	.014	.17	-	1.02	.28	.19
Toys & games	40	.008	.12	-	0.69	.21	.20
Sport requisites	29	.011	.06	-	0.21	.20	.21
Film studios	41	.013	.10	-	-0.35	.22	.22
Mean, High CR.A/S Industries	50	.013	.18	3.88	1.11	.22	.20
Mean, All Industries	36	.007	.18	3.77	0.79	.18	.18

[a] Confidentiality prevents disclosure of individual items

[b] Based on OLS regression 7, Table 4.

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