WORKING PAPERS

MARKET STRUCTURE AND PRICE-COST MARGIN FLEXIBILITY IN AMERICAN MANUFACTURING, 1958-1970

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In a trade which uses very expensive plant, the prime cost of goods is but a small part of their total cost; and an order at much less than their normal price may leave a large surplus above their prime cost. But if producers accept such orders in their anxiety to prevent their plant from being idle, they glut the market and tend to prevent prices from reviving. In fact however they seldom pursue this policy constantly and without moderation. ...Extreme variations of this kind are in the long run beneficial neither to producers nor to consumers; and general opinion is not altogether hostile to that code of trade morality which condemns the action of anyone who "spoils the market" by being too ready to accept a price that does little more than cover the prime cost of his goods, and allows but little on account of his general expenses....

Thus, although nothing but prime cost enters necessarily and directly into the supply price for short periods, it is yet true that supplementary costs also exert some influence indirectly. A producer does not often isolate the cost of each separate small parcel of his output; he is apt to treat a considerable part of it, even in some cases the whole of it, more or less as a unit.... And the analytical economist must follow suit, if he would keep in close touch with actual conditions. These considerations tend to blur the sharpness of outline of the theory of value: but they do not affect its substance.

------Alfred Marshall, Principles of Economics, 9th. ed., Book V, Ch. 5, pgh. 6.

In the next section of this paper I explore some administered pricing conjectures by reference to a simple pricing behavior model. Following this, empirical results of tests for a relationship between cyclical variability around trend of price-variable cost margins (not prices per se) and concentration are discussed. The price-cost margin data are not subject to the same "list" versus "transactions" problem as are, for example, Bureau of Labor Statistics price data. The findings conflict radically with the conventional "administered pricing" lore.

II. A Simple Price Fluctuation Model

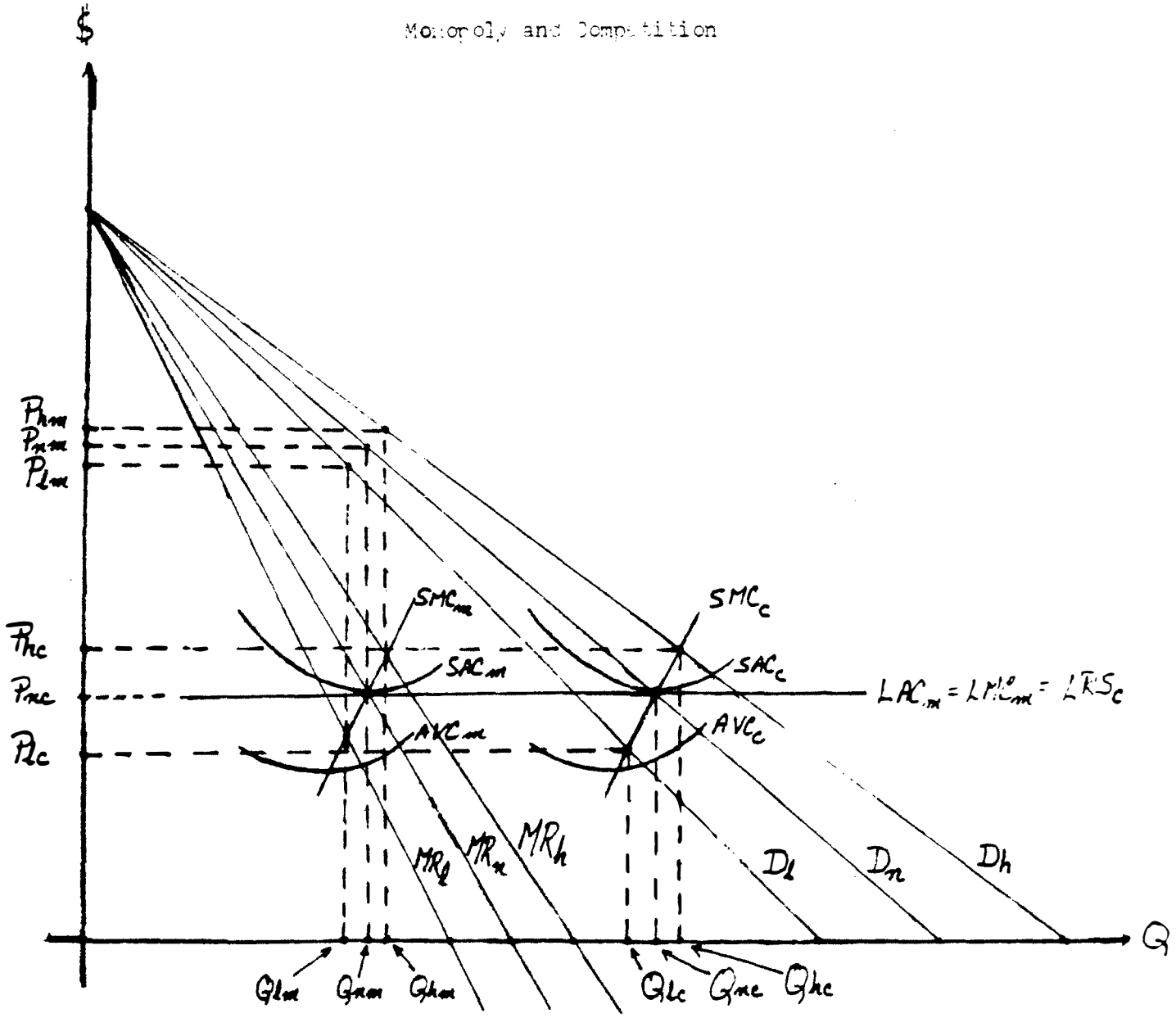
Pure Monopoly and Pure Competition

In order to compare price and price-variable cost margin behavior in the face of fluctuating demand in the polar cases of pure competition and monopoly, consider Figure 1. Here, for heuristic reasons, assume three alternative states of demand D_l, D_n, and D_h. For simplicity demand is assumed to be linear and to shift over time in a fashion such that price-elasticity remains constant at given prices. (Demand "rotates" about the price-axis intercept.) Assume that firms do not have certain information as to precisely when high demand (or "low" or "normal") periods will occur but that they have some stochastic knowledge with regard regard to the time distribution and normal range (D_l to D_h in our model) of demand variations. Assume the same cost conditions (both short run and long run) for the industry organized alternatively as single firm monopoly and pure competition. Assume constant long run average cost.

Figure 7

Price and Output Fluctuations in

Monopoly and Competition



Consider first the monopoly solution in Figure 1. With firm size oriented and established to minimize short run average cost at a "normal" level of output, the relevant short run cost curves are SAC_m, AVC_m, and SMC_m. [1/] With "normal" demand fluctuations between D_l and D_h, profit maximizing monopoly price fluctuates between P_{lm} and P_{hm}. [2/] (Price-variable cost margin fluctuates as the vertical distance between P and AVC.) Monopoly output fluctuates between Q_{lm} and Q_{hm}.

Consider now the competitive solution in Figure 1. Long run competitive adjustment yields short run industry curves SAC_c, AVC_c, and SMC_c. (For textbook-type models, industry curves SAC_c and AVC_c are regarded as analytically irrelevant and typically aren't developed or discussed.) Given our heuristic assumptions, these are just right-ward horizontal displacements of the monopoly's short run curves. [3/]

With demand fluctuations between D_l and D_h, competitive industry price fluctuates between P_{lc} and P_{hc}. Competitive industry price fluctuations are greater than monopoly industry marginal revenue fluctuations and hence greater than monopoly industry price fluctuations. Competitive industry output fluctuates between Q_{lc} and Q_{hc}. This is greater in absolute value (under our assumptions) than monopoly output fluctuations.

Our assumptions of similar demands and cost for monopoly and competition and iso-price elasticity demand shifts lead to the conclusion that price and price-average variable cost margin fluctuate more in the case of competition than in that of monopoly. It is important to note, however, that monopoly price and price-cost margin fluctuations are not zero. [4/] If one were

to assume that there were systematic differences in the nature of costs or cyclical demand behavior or elasticity as between monopoly industries and competitive industries, one might get somewhat different conclusions. All our assumptions are essentially neutral in these respects and seem to be the best for the purposes at hand.

Oligopoly

How will oligopolistic industries behave in the face of similar demand fluctuations? One conventional view is that oligopolists keep price (or price relative to something like "standard unit cost") constant in order to avoid outbreaks of competitive pricing behavior. This can be rationalized as "kinked demand curve" behavior. Going one step further, the notion that oligopolists price in accordance with a "standard unit cost plus customary markup" rule can be viewed as a modified kinked demand curve model. Any new demand curve for the individual firm product generated as a result of "cyclical" market growth or contraction will be viewed by the firm as containing a "kink" at the current price. The firm believes that others may not be aware that market demand has shifted. They will not match any price increase and they may interpret a price decrease as an aggressive action and respond with price undercuts. On the other hand, the first firm might not know for sure but what the change in its demand might really represent a temporary interfirm reallocation (perhaps a random stochastic event) of customers in the market rather than a change in market demand. In this case, a change in its individual product demand would be associated with opposite changes (on average) in demands for other firms' products. Individual price changes in accordance with individual firm product

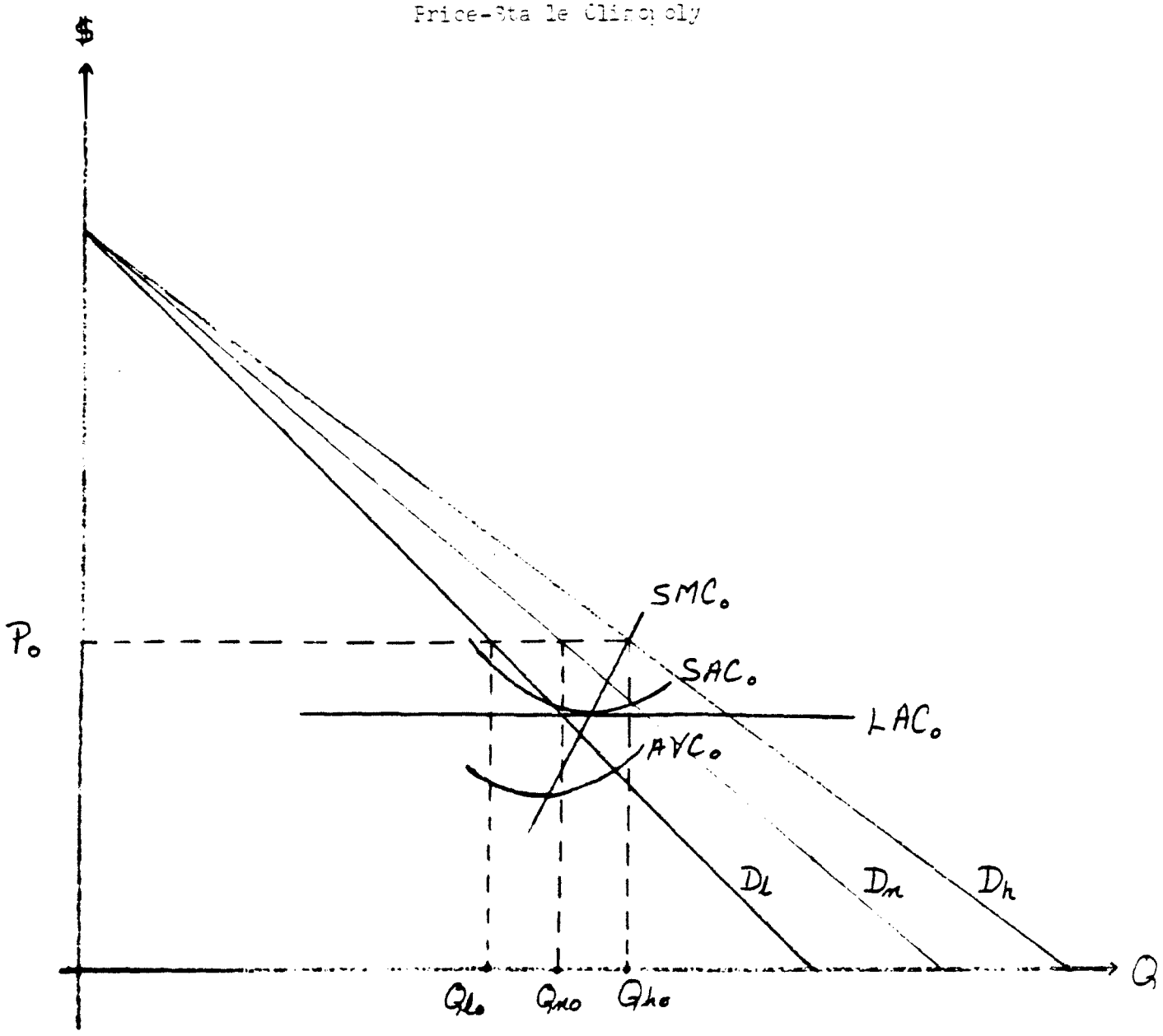
demand changes may lead to dangerous instability and a total breakdown in interfirm coordination.

Assuming, however, that all firms engage in reasonable degrees of input price search, one can argue that the same sorts of coordination problems should not occur with regard to changes on the cost side. [5/] All firms become aware when input prices change and, operating through the "standard unit cost plus customary markup" pricing rule, cost changes are passed along as output price changes. For pricing in response to cost changes, each firm regards its product demand curve as not containing a "kink." Or put differently and more logically, it may regard the "kink" as shifting vertically in proportion to the change in cost. For example, a firm might well believe that a failure to pass along industrywide wage increases in the form of higher prices for its products might be interpreted as, in effect, an aggressive price cut which would lead to an outbreak of overt price warfare.

Either the standard kinked demand curve model or this modified kinked demand curve model predicts more stable price-variable cost margins for oligopolies than for purely competitive industries in the face of fluctuating market demand. This sort of behavior is depicted in Figure 2. Here with constant input prices, output price is held constant. With price somewhere between the full monopoly level and the competitive level such as P_o, output fluctuations occur between Q_{lo} and Q_{ho}, perhaps greater than the competitive output fluctuations in Figure 1 depending on, among other things, how high P_o is relative to LAC. A side story is that firms install sufficient capacity so that Q_{ho} can be "supplied" in high demand

Figure 2

Price-Stable Oligopoly



periods with SMC_o equal to P_o. The price-variable cost margin varies only as a result of changes in AVC along the curve. Fluctuations are smaller than for either monopoly or competition in Figure 1.

Sometimes this sort of price-stable oligopoly argument is offered as a rationale for finding less short run price flexibility in industries of higher (as opposed to lower) seller concentration. The reasoning runs thusly. Problems of pricing coordination characteristic of oligopoly are handled by firms keeping prices stable in the face of fluctuating demand. The higher the degree of seller concentration, the more oligopolistic is the industry and the more stable, ceteris paribus, are prices. Or alternatively, there may be a crucial seller concentration threshold, above which oligopoly tends to exist and below which competition tends to exist, with greater price flexibility on average for industries below the threshold.

A different view, held by some, is that there is no systematic relationship between seller concentration and price stability (or flexibility). Which view seems most intuitively plausible a priori? Actually, I find neither satisfactory. Each is, I think, either wrong or incomplete.

Pure monopoly and pure competition represent the polar extremes of the concentration spectrum. Over the broad range of concentration which can be reasonably described as oligopolistic, however, the negative relationship between short term price flexibility and concentration argued above may be precisely backwards. As stated by Joe Bain, "Moderate concentration...should tend to give rise to imperfect collusion (and) kinked demand curve conformations...

whereas high concentration should provide an environment conducive to effective collusion or its equivalent (1950, p. 43).... I would agree with Stigler that most oligopolistic industries do not act as if their sellers... had very sharp kinks in their individual demand curves." (1960, p. 203)

High concentration fosters mutual trust and the interfirm flow of information. With effective behavioral coordination in highly concentrated oligopolies, price behavior might be roughly equivalent to that of monopoly and approximately the price-cost margin variability characteristic of monopoly may occur.

In oligopolies of moderate to low concentration, with a greater number of decision making firms, interfirm information flows should be much less nearly complete. This form of market organization should foster considerably greater uncertainty and mutual distrust of motives and actions. It is here that stable price behavior may be generally adopted. Although noncompetitive returns may be relatively modest, the only means whereby to effectuate a modicum of pricing coordination to protect those returns and avoid the profit and loss extremes of the competitive model may be to adopt some hard and fast pricing rule such as "standard unit cost plus customary markup" to which all firms rather rigorously adhere--Marshall's "code of trade morality."

For all oligopolies, both those of high concentration and those of moderate to low concentration, the behavioral principle of price calculation may be some variant of a full cost pricing rule such as "standard unit cost plus markup." One received tradition argues that the better information flows and the greater strength of recognized interdependence that accompanies "high" seller concentration allows for the maintenance of larger markups--higher prices

relative to costs--on the average over time (assuming some barrier to entry). Our hypothesis, stated simply, is that the same factors which allow for the maintenance of higher margins above cost also may allow for margins to be varied (in keeping with industry profit maximizing considerations) in the face of fluctuating industry demand, without interfirm coordination being destroyed.

Pricing coordination which allows for margins to be compressed in downswings and expanded in upswings is a higher level and more profitable form of behavioral harmony than that which, in order to be maintained, must involve a fixed markup above direct or prime costs that is invariant in the face of short run market demand flutuations. The weaker form of coordination involving markups that are fixed in the short run is, we hypothesize, more likely to be characteristic of weaker oligopolies of moderate to low concentration.

This view predicts a positive relationship between concentration (over the range consistent with oligopoly and monopoly) and short run price-cost margin variability. At the bottom of the oligopoly portion of the concentration spectrum--at those low concentration levels at which oligopoly is fading into pure competition in which each firm is a true price-taker--a negative relationship between price-cost margin variability and concentration is expected. True atomistic competition should yield price-cost margin variability characteristic of the competitive model in Figure 1--greater than the price-cost margin variability of price-stable oligopoly in Figure 2.

Limit Pricing in Concentrated Oligopoly and Monopoly

It is sometimes asserted that limit pricing behavior will lead to cyclical price stability, or perhaps even perverse cyclical price behavior. If, for instance, with unchanged LAC curves one shifts market demand to the left in the Bain economies of scale barrier model (1956), or in the Bain model as modified by Modigliani (1958), the limit price read out of the model goes up. If one shifts market demand to the right, the calculated limit price goes down. Recession shifts demands to the left. Expansion shifts them to the right. So, it seems that for "effectively impeded" entry, [6/] monopoly and oligopoly pricing, if not cyclically perverse, should be at least cyclically stable.

This argument misses an important point. The Bain entry model is a long run equilibrium comparative statics model, not a short run price dynamics model. The limit price is the maximum long run equilibrium pre-entry price which can be established without attracting new firm entry. The important "price" for the potential entrant is the post-entry equilibrium price. The pre-entry price is important only insofar as it provides an indication to the potential entrant of what the putative post-entry equilibrium price might be. The real question concerning the effect of limit pricing and barriers to entry on flexible versus stable pricing should go something like this, "Given a long run average price level and its relationship to long run average cost, is entry more or less likely if industry price is more flexible in the short run?" So

far as I know, no existing limit pricing model really provides even a hint of an answer to this. (A more fruitful approach, however, is likely to be through a Gaskins-type (1971) small scale entry or competitive fringe expansion model rather than a Bain-type model.) Nevertheless, since barriers to entry have been alleged to have a possible effect, dummy variable estimates of the heights of entry barriers are included as independent variables in the empirical analysis below.

III. The Relationship Between Concentration and Price-Cost Margin Variability

If the sample contains industries of low concentration in which firms behave in accordance with the precepts of the purely competitive model, the above discussion predicts a U-shaped relationship between price-cost margin variability and concentration. If, however, the firms in the low concentration industries behave in the manner of Marshall's real world "competitors" (who, in the contemporary nomenclature, appear to be oligopolists), a generally positive relationship may be found. [7/]

One caveat must be added. The model predicts this relationship as long as cyclical demand fluctuatuations are within a range which might be normally expected. It might not hold in the face of a cataclysmic collapse or explosion of demand. If, for example, in Figure 2 demand unanticapatedly (in the sense that capacity was not pre-contracted) collapses far below D_1, the fragile coordination characteristic of moderately or lowly concentrated oligopoly may break down, pricing rules may be abandoned, and industry price may drop all the way to the vicinity of average variable cost. This would be quite like the behavior predicted for the competitive model in Figure 1. Under these same conditions, however, pricing discipline in highly concentrated oligopolies may

be maintained so that only the approximate price declines expected for the monopoly model in Figure 1 would be experienced.

On the other hand, if demand in Figure 2 unanticipatedly explodes way beyond D_h, low grade oligopoly pessimism and uncertainty will be overcome and price will expand along SMC_o. This would yield price increases similar to those for the competitive model under similar demand conditions. For the highly concentrated oligopoly approximating monopoly behavior, we would expect price increases roughly equal only to those expected for monopoly--considerably smaller than those predicted for competition under our initial assumptions.

In short, for demand collapses and explosions which lie outside the normal range of expectations, a negative relationship between price-cost margin flexibility and concentration may be expected for oligopolistic industries. A significant characteristic of the post-1950 American economy has been the absence of demand collapses (such as that of the 1930s) and explosions (such as that of the immediate post-World War II period).

IV. Data, Empirical Tests, and Findings

Seventy-nine SIC four-digit industries were selected as a sample. The primary selection criteria were: (1) SIC industry definitional comparability over time, (2) reasonable industry specialization and coverage, and (3) reasonable correspondence between SIC industry definitions and economically meaningful market definitions. 8/ Annual observations over 1958 - 1970 on price-cost margins for each industry were calculated from Census of Manufactures and Annual Survey of Manufactures data. The beginning and end years 1958 and 1970 were chosen to

avoid data gaps prior to 1958 and to exclude the recent price controls p... Fortunately for trend calculations, beginning and end years both represent similar "business cycle" stages.

The price-variable cost margin was calculated as the difference between Value Added and Wages, divided by Value of Shipments, or (VA-W)/VS. Given the way Value Added is calculated by the Census Bureau, (VA-W) is equal to Value of Shipments minus the wage and materials costs in goods actually shipped. Since VS is equal to goods shipped valued at their market prices, (VA-W)/VS bears very close resemblance to total revenue minus total variable costs divided by total revenue, or (TR-TVC)/TR. Dividing by quantity of goods shipped, (TR/Q-TVC/Q)/(TR/Q), it is seen to equal the difference between price and average variable cost divided by price, or (P-AVC)/P. [9]

Price-cost margin trend for each industry was estimated by linear regression against time. The standard error of the regression, labeled PCSE, was taken as a measure of short term variability. [10] PCSE was regressed cross-sectionally against four-firm concentration (CR4A),[11] a dummy variable for "high" barriers (HB), a dummy variable for "medium" barriers (MB),[12] a dummy variable (CG) to split consumer from producer goods industries, a dummy variable (ND) to split non-durable from durable goods industries, and a dummy variable (LYE) for those industries which should exhibit very low short run income elasticities of demand. [13] Consumer goods, non-durable goods, and low income elasticity goods may have less variable demands than producer goods, durable goods, and high income elasticity goods, respectively. A concentration-squared term (CR4ASQ) was included to test for the hypothesized non-linear U-shaped relationship between flexibility and concentration.

Cross-sectional results are displayed in Tables 1 and 2, regressions 1-1 through 1-8, and 2-1 and 2-2. The specification in Table 1 treats the effect of concentration and barriers as additive and takes the form of

$$PCSE = \beta_o + \beta_1 CR4A + \beta_2 CR4ASQ + \beta_3 HB + \beta_4 MB + \beta_5 CG + \beta_6 ND + \beta_7 LYE + u \quad .(1)$$

The estimated coefficient for CR4A is positive in all regressions, and significant (t-ratios are in parentheses) in all except for those, 1-2 and 1-4, in which the concentration-squared term is entered. In both of these, the estimated coefficient of CR4ASQ is miniscule and very insignificant. [14/] The U-shaped hypothesis is not supported, therefore the concentration-squared term is not entered in the other regressions. As expected, the coefficients for CG, ND, and LYE have negative signs. None of the coefficients, however, is statistically significant. The coefficients for the high barriers and medium barriers dummies have opposite signs and are insignificant.

An alternative interactive specification of the form

$$PCSE = \beta_o + \beta_1 (CR \cdot HB) + \beta_2 (CR \cdot MB) + \beta_3 (CR \cdot LB) + \beta_4 CG + \beta_5 ND + \beta_6 LYE + u \quad (2)$$

was also utilized. The a priori expectation here was that the estimated coefficients $\hat{\beta}_1$, $\hat{\beta}_2$, and $\hat{\beta}_3$, would be positive, and that $\hat{\beta}_4$, $\hat{\beta}_5$, and $\hat{\beta}_6$ would be negative. Differences among $\hat{\beta}_1$, $\hat{\beta}_2$, and $\hat{\beta}_3$, would indicate the effects of barriers to entry.

Regressions of this specification were run with and without the CG, ND, and LYE dummies. The estimates are listed in Table 2, numbers 2-1 and 2-2. The coefficients for CG, ND, and LYE have the hypothesized negative signs, but they are not statistically significant. The differences among $\hat{\beta}_1$, $\hat{\beta}_2$, and $\hat{\beta}_3$ are not statistically significant.

Table 1--Regression Results, Additive Concentration and Barriers to Entry Specification

Regression Number	Dependent Variable	Intercept	CR4A	CR4ASQ	HB	MB	CG	ND	LYE	R^2	F
1-1	PCSE	1.1190 (3.5697)	.0167*** (3.0385)							.11	9.2329
1-2	PCSE	.7778 (1.1855)	.0318 (1.2223)	-.0001 (-.5921)						.11	4.7529
1-3	PCSE	1.0321 (3.2182)	.0175*** (2.7549)		-.2418 (-.6130)	.2064 (.7392)				.13	3.6525
1-4	PCSE	.9944 (1.4511)	.0192 (.6734)	-.0000 (-.0624)	-.2379 (-.5920)	.2012 (.6869)				.13	2.7040
1-5	PCSE	1.4631 (3.9539)	.0155*** (2.7948)				-.1281 (-.5107)	-.4092 (-1.2441)	-.0968 (-.2679)	.16	3.5608
1-6	PCSE	1.3791 (3.6498)	.0169** (2.6082)		-.2958 (-.7463)	.1345 (.4688)	-.1283 (-.5025)	-.4393 (-1.3221)	-.0286 (-.0777)	.18	2.6010
1-7	PCR58	.6630 (.9617)	-.0251** (-2.0706)							.05	4.2873
1-8	PCR58	.6131 (.8796)	-.0121 (-.8806)		-1.4873* (-1.7348)	-.9237 (-1.5222)				.10	2.6707
1-9	PCR58	.4214 (.5129)	-.0251** (-2.0379)				-.3292 (-.5913)	.6902 (.9450)	.4429 (.5520)	.09	1.9145
1-10	PCR58	.3215 (.3859)	-.0135 (-.9527)		-1.3338 (-1.5268)	-.7088 (-1.1208)	-.1901 (-.3577)	.5667 (.7737)	.3970 (.4882)	.12	1.7048

Table 1 - Continued

Regression Number	Dependent Variable	Intercept	CR4A	CR4ASQ	HB	MB	CG	ND	LYE	R^2	F
1-11	PCR66	-.7727 (-1.4840)	.0244*** (2.6630)							.08	7.0913
1-12	PCR66	-.8708 (-1.6276)	.0229** (2.1562)		-.0163 (-.0247)	.4332 (.9302)				.10	2.7209
1-13	PCR66	-.6843 (-1.0833)	.0242** (2.5624)				-.00003 (-.00007)	.0644 (.1147)	-.4118 (-.6675)	.09	1.8810
1-14	PCR66	-.7695 (-1.1878)	.0229** (2.0628)		-.0243 (-.0357)	.3799 (.7725)	.0393 (.0898)	.0585 (.1028)	-.3071 (-.4855)	.10	1.3706
1-15	PCR70	1.4742 (1.9444)	-.0407*** (-3.0511)							.11	9.3093
1-16	PCR70	1.2089 (1.5800)	-.0293* (-1.9350)		-1.7121* (-1.8193)	-.1179 (-.1770)				.15	4.4902
1-17	PCR70	.7598 (.8409)	-.0376*** (-2.7800)				.3625 (.5921)	1.2231 (1.5229)	-.7173 (-.8130)	.15	3.1779
1-18	PCR70	.4712 (.5182)	-.0265* (-1.7045)		-1.6530* (-1.7334)	-.1024 (-.1494)	.4572 (.7566)	1.0630 (1.3296)	-.5657 (-.6873)	.19	2.7323

* Significant at .1 (two tailed test).
** Significant at .05 (two tailed test).
*** Significant at .01 (two tailed test).

Table 2--Regression Results, Interactive Concentration and Barriers Specification

Regression Number	Dependent Variable	Intercept	CR·HB	CR·MB	CR·LB	CG	ND	LYE	R^2	F
2-1	PCSE	1.0382 (3.0601)	.0142** (2.4150)	.0207*** (3.2315)	.0177** (2.2831)				.13	3.5817
2-2	PCSE	1.3554 (3.3990)	.0134** (2.2560)	.0190*** (2.9500)	.0177** (2.2190)	-.1190 (-.4618)	-.4250 (-1.2748)	-.0540 (-.1470)	.18	2.5453
2-3	PCR58	.1604 (.2177)	-.0271** (-2.1223)	-.0191 (-1.3770)	-.0028 (-.1670)				.10	2.6462
2-4	PCR58	-.0766 (-.0873)	-.0275** (-2.1104)	-.0178 (-1.2552)	-.0060 (-.3418)	-.1685 (-.2971)	.5540 (.7553)	.4306 (.5328)	.12	1.7034
2-5	PCR66	-.8528 (-1.5104)	.0206** (2.1030)	.0300*** (2.8170)	.0239* (1.8478)				.10	2.7803
2-6	PCR66	-.7804 (-1.1450)	.0208** (2.0473)	.0294*** (2.6673)	.0243* (1.7812)	-.0182 (-.0413)	.6451 (.1132)	-.3270 (-.5210)	.10	1.4041
2-7	PCR70	.9476 (1.1698)	-.0482*** (-3.4330)	-.0271* (-1.7775)	-.0257 (-1.2766)				.15	4.5742
2-8	PCR70	.1816 (.1895)	-.0450*** (-3.1579)	-.0235 (-1.5185)	-.0209 (-1.0859)	.4750 (.7625)	1.1047 (1.3796)	-.6004 (-.6805)	.19	2.7629

* Significant at .1 (two tailed test).
** Significant at .05 (two tailed test).
*** Significant at .01 (two tailed test).

The striking thing about the regression results is the consistently positive and significant relationship between PCSE and concentration. This tentatively suggests that price-cost margins are cyclically more variable around trend in more highly concentrated industries. Tentatively, because at this point it seems possible that the finding might be the result of sampling error in the Annual Survey of Manufactures data. [15] Or it might be the result of greater random fluctuation around trend, since in a more highly concentrated industry there are, in effect, fewer independent price decision-makers than in an industry of lower concentration. In an industry of lower concentration, random variations in pricing, on an intra-industry basis, might tend to "cancel out" to a greater extent. [16]

In order to shed light on these possibilities, the price-cost margin residuals from long run trend for particular years were examined. 1958 and 1970 were NBER trough years, and according to Stigler and Kindahl (1970), 1966 was a peak year. In 1966 the major fiscal impacts of the 1964 tax cut and the Viet Nam war expenditures buildup beginning in 1965 were taking place. For each of these years the price-cost margin trend residuals (PCR58, PCR66, and PCR70) were regressed against the same independent variables discussed previously using both the additive and interactive specifications. The estimates are given in Tables 1 and 2, Equations 1-7 through 1-18 and 2-3 through 2-8.

If the positive relationship between price-cost margin variability and concentration is due to random variation or biased sampling (measurement) error, no particular relationship between trend residuals and concentration should be found. If, on the other hand, the positive relationship between price-cost margin variability and concentration reflects greater cyclical variability in more highly concentrated industries, one should observe a

negative relationship between residuals from trend and concentration in recession years (such as 1958 and 1970) and a positive relationship in expansion years (such as 1966). 17/ These are precisely the findings.

In all regressions the estimated concentration coefficients have the appropriate signs, negative in recession years and positive in the expansion year. For the most part, these coefficients are significant. The noticeable exceptions are for 1958, Equations 1-8 and 1-10, where the dummy variables for high barriers and medium barriers are entered, and Equations 2-3 and 2-4 for the low barriers concentration coefficients. In the trend residuals equations also, the CG, ND, LYE, and "barriers" dummies do not do anything much of significance.

The persuasive conclusion is that a statistically significant, positive relationship between cyclical variability of price-cost margins and concentration exists. This is consistent with a priori expectations if it can be assumed that the industries at the lower end of the concentration range should be described as "loosely oligopolistic" (Marshallian "competition" with "code of trade morality") rather than purely competitive industries composed of "price-takers." 18/

This conclusion survived a number of sensitivity analyses. First, since there is an element of arbitrariness involved in adjusting concentration ratios, the regressions were rerun with all concentration ratios unadjusted. Basically the same statistical findings emerged.

A second problem was that the greater variability of price-cost margins in more highly concentrated industries might be due simply to the fact that price-variable cost margins (as a percentage of price) tend to be larger in more highly concentrated industries. [19] The price-cost margin might compress, and hence subsequently expand, relatively more with cyclical swings in more highly concentrated industries for the simple reason that there is more room for compression, given that the margin is bigger on the average over time. One way this was dealt with was to normalize PCSE by dividing it by PCMN (where PCMN is the thirteen year arithmetic mean price-cost margin for the industry) to create an adjusted standard error, PCSEA. [20] PCSEA was regressed against CR4A and the dummy variables and a positive significant relationship to concentration resulted. A second procedure was to trend the logarithms of price-cost margins and repeat all the empirical work with log-linear time trends. With logs, all the residual variation is automatically adjusted (percentagewise) for interindustry variation in the size of price-cost margins. [21] All the regression analyses were repeated and similar results obtained. The standard error around log-linear trend was significantly and positively related to CR4A, and the log-residuals were significantly and negatively related to concentration for 1958 and 1970 and significantly and positively related for 1966. The positive relationship between cyclical variability of price-cost margins apparently is not merely a matter of a postive relationship between the size of price-cost margins and concentration.

Since Dr. Gardiner Means and Professor John Blair, the two most widely recognized exponents of the "administered price hypothesis", argue for a threshold relationship, [22/] I estimated the following regression equations.

$$PCSE = \underset{(9.440)}{1.620} + \underset{(3.066)}{.730}\ HC4A \qquad r^2 = .11,\ F = 9.40 \qquad (3)$$

$$PCR58 = \underset{(-.200)}{-.750} \underset{(-2.142)}{-1.122}\ HC4A \qquad r^2 = .06,\ F = 4.59 \qquad (4)$$

$$PCR66 = \underset{(.282)}{.820} + \underset{(2.044)}{.824}\ HC4A \qquad r^2 = .05,\ F = 4.18 \qquad (5)$$

$$PCR70 = \underset{(.109)}{.046} \underset{(-2.322)}{-1.371}\ HC4A \qquad r^2 = .07,\ F = 5.39 \qquad (6)$$

Here the dependent variables are as previously defined, and HC4A is a binary variable which assumes a value of 1 for "high" concentration (CR4A$\geq$ 50%) and a value of 0 for "low" concentration (CR4A< 50%). Fifty percent four-firm concentration is a customary cutoff in such "threshold" studies.

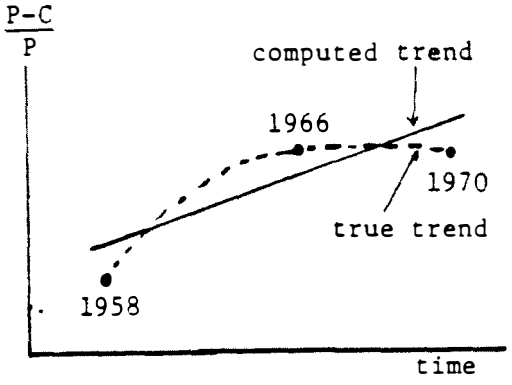
The coefficients in Equation 3 indicate that, on the average, price-cost margins are significantly (at the .01 level) more variable around trend in the forty-one industries of "high" concentration than in the thirty-eight industries of "low" concentration. Equations 4, 5, and 6 indicate that, on average, price-cost margins are compressed significantly (at .05) more relative to trend in the "high" concentration group during the recession years of 1958 and 1970 and expanded significantly (at .05) more during the peak year of 1966.

Another point was strongly urged upon me by F.M. Scherer. His view was that my "trending" procedure really took out the cyclical effect. Since roughly the first half of the 1958 to 1970 period was mostly characterized by stability or recession, and roughly the second half mostly by buoyancy, there would be a negative and significant relationship between trend coefficient and concentration, in his view confirming the administered pricing hypothesis. I was unwilling to accept this methodological criticism categorically; even with such a phenomenon there seemed to be no way that the traditional administered pricing hypothesis could be regarded as consistent with all my findings taken together. In any event, it didn't matter because the correlation between trend coefficient and CR4A was virtually zero ($r = -.03$). There apparently was no conventional "administered pricing" cyclical behavior masked by the trend calculation.

One other point concerning the use of trend calculations should be made. If there were a strong systematic tendency for the second derivative (with respect to time) of true price - cost margin trends to be lower for industries of higher concentration, then all the findings based on linear or log-linear trend calculations could be spuriously generated. Consider Diagram A in which the true price - cost margin trend for a representative highly concentrated industry is assumed to be concave, and Diagram B in which the true price-cost margin trend for a representative industry of low concentration is assumed to be linear.

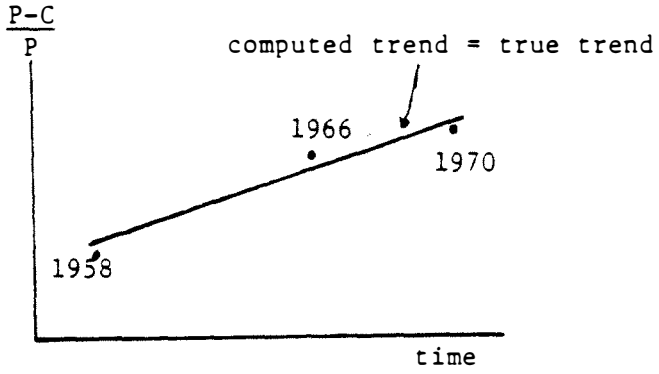
A

High concentration industry



B

Low concentration industry



As the diagrams illustrate, it is possible that the computed variability around a linear trend might be higher in the case of A than in the case of B, even though variability around true trend was higher in the case of B. Similarly, the actual price-cost margins for A might lie further below the computed trend line in 1958 and 1970, and further above for 1966, in the case of A than in the case of B, even though the actual price-cost margins for A in those years are assumed to lie exactly on the true trend.

To the best of my knowledge, however, there is no reason, on the basis of either economic theory or casual empiricism, to expect a systematically negative, cross-sectional relationship between seller concentration and the second derivative of the true industry price-cost margin time trend.

If anything, there is reason to expect this relationship to be positive. The dynamic limit pricing model developed by Gaskins (1971) suggests that for industries in which current levels of concentration are equal to their long run equilibrium levels,[23] the second derivatives of price-cost margin trends should be zero. For industries in which current levels of concentration are higher than their equilibrium levels, price-cost margin trends will be convex. For industries in which the current levels of concentration are lower

than their equilibria, price-cost margin trends will be concave. Over time, industry concentration will adjust toward its equilibrium level, and industry price-cost margin asymptotically approaches its equilibrium.

Assuming that the Gaskins model is real-world operative, one would expect a larger proportion of industries of below average concentration levels to have current concentration lower than their long run equilibrium levels, and a larger proportion of industries of above average concentration levels to have current concentration higher than their long run equilibrium levels.[24/] Given this, there should be a systematically positive, cross-sectional statistical relationship between the second derivative of true price-cost margin trend and seller concentration. If this is the case, it appears that whatever bias there is works <u>against</u> our findings. A mental adjustment for this strengthens our conclusions.

V. Conclusions

In this paper we have been concerned with cyclical price-variable cost margin (rather than price <u>per se</u>) flexibility and its relationship to industrial concentration. Using data which are not subject to the "list" versus "transactions" price problem, and abstracting from secular trend effects, we found a statistically significant positive relationship between the cyclical variability of price-cost margins and concentration.

The empirical results at this stage should be regarded as somewhat tentative since the hypothesis of a positive relationship between price-cost margin flexibility and concentration, and the finding of such a relationship, are entirely novel. As a pure statistical matter, the traditional hypothesis

of a negative relationship between price-cost margin flexibility and concentration appears to be rejected more strongly by the empirical results than is an alternative hypothesis of no relationship between margin flexibility and concentration.

In either event, the implication of the finding seems clear: any public policy proposal that is based upon conventional "administered pricing" assumptions should be seriously questioned.

Footnotes

1/ The optimal capacity solution obviously may be more mathematically complicated than this. Nevertheless, the general conclusions of the analysis hold as long as short run marginal cost is rising over a portion of the range of "normal" output fluctuation.

2/ For simplicity, the analysis assumes that the Marshallian "short run" is as long in calendar time as the typical period of demand fluctuation, or longer. This is not strictly necessary in order to generate the results.

3/ An assumption of zero multiple-plant scale economies, or at least zero multiple-plant scale economies which cannot be exploited in the context of a competitive structure, seems sufficient to give one this.

4/ The only case for which monopoly price fluctuations might be zero would seem to be that of an "over-expanded" monopoly operating on the downward sloping portion of its SAC curve with SMC constant over the whole relevant range of output. If this phenomenon were sufficiently severe so that SMC were falling over the range of output fluctuation, price might fluctuate in a perverse fashion. The only situation in which either of the foregoing might represent long run optimal behavior seems to be the "natural monopoly" case with LAC having a very steep negative slope. Even here, however, optimal long run adjustment is likely to lead to SMC rising over at least a portion of the short run output fluctuation range.

5/ Here we are talking about shifts in the cost curves which result from changes in input prices, not movements along the curves with output changes.

6/ For "blockaded" entry and perhaps for "ineffectively impeded" entry, this limit pricing argument would not apply.

7/ This model does not say that there are no other market structural dimensions or product characteristics that are important determinants of pricing coordination and flexibility. There may of course be many others.

8/ The sample of industries, their concentration ratios (as adjusted where necessary), and the estimated heights of barriers to entry are listed in an Appendix, available on request from the author.

9/ More precisely, it is equal to (P-AVC)/P on a weighted average basis for all products produced by establishments in the industry. The price-cost margin could have been calculated by subtracting Payroll rather than Wages from Value Added, (VA-PR)/VS. Payroll includes payments to non-production workers. Since some non-production workers are essentially "fixed" inputs (top management personnel for example) who clearly do not vary in proportion to output change, (VA-W)/VS seemed more appropriate as a price-variable cost margin. It should be less affected by changes in output, apart from changes in input and output prices.

10/ PCSE $= \sqrt{\sum_{t=1}^{13} e_t^2/(13-2)}$. The bigger the residuals, the greater is the variability around trend.

11/ In a few cases, either the product definition of the SIC four-digit industry was too broad or the "relevant market" was regarded as being local or regional in nature. In these cases the four-firm concentration ratio was adjusted, usually by averaging concentration over component five-digit product classes or averaging over state or regional ratios, so as to reflect concentration in relevant markets more closely. Those industries for which such adjustments were made, and the bases of such adjustments, are indicated in the Appendix.

In order to be consistent with the adjusted ratios (five-digit product class ratios are calculated with secondary product contamination excluded), unadjusted ratios were taken from 1967 Census of Manufactures, Concentration Ratios in Manufacturing, Part 2, in which four-digit ratios are calculated on a "product class" VS basis with secondary product contamination (and primary product exclusion) excluded. Actually, these ratios seem preferable to the "industry" four-digit ratios (which include secondary product contamination) as a general matter. CR4A is the mean of the ratios for 1963 and 1967.

12/ The barrier to entry in each industry was classified as "high", "medium", or "low." Reliance was place on previous estimates of Bain (1956), Mann (1966), Shepherd (1970), Palmer (1973), and Qualls (1972). Where differences of opinion existed, they were reconciled in accordance with the author's judgment.

13/ CG, ND, and LYE were entered to pick up possible differential demand variability. Consumer good and non-durable good classifications, with a few exceptions, were taken from the Federal Reserve's Index of Industrial Production. Industries were designated as LYE on the basis of author's guesswork backed up by very low short run expenditure elasticity estimates from Houthakker and Taylor (1970).

14/ The coefficients for CR4A and CR4ASQ do not even have the appropriate signs to indicate a possible U-shape. CR4SQ was run along with all the other regression variables. It did nothing there either so the results are not presented. Inspection of raw data and scatter diagrams did not disclose a possible U-shape.

15/ If the sampling error in the Annual Surveys tended to be larger in the more highly concentrated industries, this might be the outcome. The sampling error in the Annual Surveys tends to be larger, however, in the industries of lower concentration. See Scherer (1969, p. 76). This should bias the statistical procedure in the direction of a finding of more measured variability in the industries of lower, not higher, concentration.

16/ This assumes some degree of product differentiation of course. Incidentally, regressions were also run with "degree of product differentiation" dummies, taken from Mueller and Hamm (1974), on the right-hand side. These were not significant and added nothing to explanatory power. Given the adsence of any strong a priori theory, the results are not formally presented.

17/ The price-cost margin should be compressed more (relative to its trend value) in recessions and expanded more (relative to its trend value) in expansions for more highly concentrated industries.

18/ The finding does not appear to reflect merely the right-hand portion of a U-shaped relationship which might exist for the manufacturing sector universe. The sample, although slightly weighted in the direction of high concentration, is fairly representative of the range and distribution of industrial concentration in the manufacturing sector.

Nor does it seem plausible to argue that the finding might just reflect greater changes in AVC resulting from movements along the curve in highly concentrated, price-stable oligopolies. Assume for the moment that highly concentrated industries do behave as the price-stable oligopoly in Figure 2 and that lowly concentrated industries behave as the competitive industry in Figure 1. For our findings to be generated, increases in AVC_o along the curve from backward movement from $\dot{Q}_{no}$ would have to be greater (in absolute value) than declines in price from P_{nc} along SMC_c minus the decline along AVC_c, and increases in AVC_o along the curve from Q_{no} would have to be less than the increase in price from P_{nc} minus the increase along AVC_c. Indeed, even if all industries tended to behave as the price-stable oligopoly of Figure 2, for our findings to be generated, highly concentrated industry AVC curves would have to have significantly steeper slopes to the left of minimum and significantly shallower slopes to the right of minimum than was the case in industries of lower concentration. I see no plausible reason for such a peculiar tendency to significantly exist.

19/ This occurs for two reasons. There is a slight tendency for more highly concentrated industries to be more capital intensive and for variable costs, therefore, to be a slightly lower proportion of total costs, and there is a tendency for prices to be somewhat higher relative to full costs in more highly concentrated industries. In the sample here, there is a weak but significant, positive simple correlation between average price-cost margin (PCMN) and CR4A ($\underline{r}$=.20).

20/ PCSE essentially is a standard deviation around trend and PCSEA is something like a coefficient of variation around trend.

21/ The only difficulty with this procedure is that although prices and wages might be expected to "trend" at percentage rates of change, I have no reason to expect the same thing for price-cost margins.

22/ See their statements at the Conference of the Council on Wage and Price Stability (1975). Also see Blair (1972, p. 459).

23/ The equilibrium level of concentration is, in each case, determined by the extent of the advantages, if any, which leading firms have over competitive fringe firms, the speed of actual or potential expansion or contraction of the competitive fringe, and the subjective discount rates used by the leading firms.

24/ This expectation is supported by the Bain finding (1970) of a centripetal tendency in changes in industrial concentration over 1954 to 1966.

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