Eastern Economic Journal, Volume XVI, No. 3, July–September 1990

The Effect of Market Growth and Contraction on Industry Price-Cost Margins

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INTRODUCTION

Industrial organization economics and antitrust policy have long acknowledged the relevance of factors besides market concentration that affect industry performance. Standard textbooks devote considerable space to the analysis of how product homogeneity, order patterns, information about transactions, market growth and contraction, and so forth affect firms' efforts to cooperate on pricing (Scherer, 1980, ch. 6–7; Martin, 1988, ch. 6). The Justice Department Merger Guidelines (Dept. of Justice, 1984) cite many of these as relevant to the proper interpretation of market shares and concentration, and they have represented mitigating circumstances in a number of mergers.

Despite their importance, most of these other factors have not received systematic attention. One of these—namely, market contraction or growth—is the focus of this paper. It is commonly argued in the literature that demand contraction, especially in the presence of sunk costs, may constrain the exercise of market power in concentrated industries. The reason is allegedly that, by driving price below cost, contraction may make firms less willing to sacrifice the opportunity to increase their own profitability for the sake of possible benefits from price coordination.

On the other hand, it has also been observed that adverse circumstances may cause firms to make special efforts to avoid behavior that would result in price collapse (Palmer, 1972; Asch and Seneca, 1975). These may take the form of more frequent meetings among the firms, stronger exhortations against price competition, or even some ancillary devices to help sustain price coordination.

Which of these forces—the centrifugal force of demand decline or the preservationist force of greater resolve—prevails is not a question that can be answered by theory. Moreover, as we shall see, existing empirical evidence from the concentration-profits literature is unpersuasive since it does not incorporate demand growth and contraction in a fashion that correctly reflects their theoretical role. The next section of this paper begins with a brief review of that theory and literature, followed by the development of new and superior evidence. We ultimately conclude that concentration does affect industry performance even in contracting industries with high capital costs, but those factors do indeed reduce the strength of the effect, presumably by handicapping efforts at coordination. A concluding section notes some policy implications.

REVIEW OF THEORY AND EVIDENCE

The most elementary depiction of market price determination, whether in a competitive industry or a monopoly, would seem to show that price and profits necessarily decline when market demand contracts. But theory emphasizes that what matters is not simply demand decline, but the degree to which the firms' costs are industry-specific, i.e., sunk. Without "sunkness," all costs are avoidable and are simply removed from the industry when demand no longer suffices.[1] For that reason, contraction does not necessarily drive

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price down. Rather, it is contraction together with sunk costs that represents the determining factor, and moreover the degree to which price declines is a function of the extent of sunk costs. Thus, theory implies that cost conditions and contraction should appear in an empirical model of price determination only as an interaction term.

This proposition requires slight modification in a noncompetitive market. Now even without sunk costs, declining demand causes price to fall as the marginal revenue intersection retreats along the unchanged horizontal marginal cost curve. Except for the unlikely case of isoelastic pivoting of the demand curve, the optimal price will fall. The implication from theory, then, is that in a concentrated industry—but only in a concentrated industry—growth by itself will cause price and profit to decline. Thus, growth and concentration should appear as an interaction term in the empirical estimation.

Note that theory does *not* imply that growth (or contraction) by itself plays a role. Rather, its role is mediated throughout either by cost conditions or by concentration. Next we turn to hypotheses relating growth and contraction to the degree of interfirm *coordination*, i.e., the success of firms' efforts to raise price above competitive levels.

As previously noted, the central hypothesis is that while concentration has a systematic positive effect on price and profit in all industries, contraction and capital intensity may make above-competitive price more difficult to sustain. Scherer (1980, p. 206) states the argument as follows:

> Industries characterized by high overhead costs are particularly susceptible to pricing discipline breakdowns when . . . decline in demand forces member firms to operate well below designed plant capacity. This tendency appears to be especially marked in industries with heavy investments in developed natural resource deposits . . . and those using highly capital intensive production processes.

Thus, in addition to a simple concentration variable, an empirical model of price determination should include concentration interacted with growth and a measure of capital intensity simultaneously. This permits the possibility that industry concentration is less effective in raising price in the presence of these adverse circumstances. Note that this effect, representing changed *behvior*, is quite different from the purely *structural* effects of demand changes on optimal price that were outlined previously.[2]

A somewhat similar hypothesis has been advanced for the case of very rapid growth (as opposed to contraction). Specifically, in rapid expansions firms may encounter greater difficulties in coordinating prices, are already satisfied with profits from such expansion, or are confronted with easier entry that limits profit opportunities (Porter, 1974). These possibilities can be tested empirically by including interaction terms between concentration and growth, and between concentration and the square of growth. A negative sign on the latter would make the net effect of concentration on price diminish for higher growth rates.[3]

A review of the literature reveals that, typically, concentration-performance studies simply include an additive growth term to represent the effect of demand changes. Few studies have gone farther. Porter (1974) includes a growth-concentration interaction in regressions explaining retailer profits. He finds a significant negative coefficient for this interaction, which he interprets as evidence that very high growth makes concentration less important. His linear concentration variable, however, is unstable in sign and well below conventional levels of statistical significance.[4] Grabowski and Mueller (1978) perform the same exercise on their data and model, with similar results. Bradburd and Caves' (1980) examination of the role of growth finds a negative interaction with concentration and a negligible interaction with capital/output ratios, a proxy for sunk costs.[5]

The persistent finding of a negative growth-concentration interaction may well be reflecting the reduced role of concentration in high-growth industries, but it does little to illuminate the constraint on concentration imposed by contraction. Indeed, read literally, the negative sign on the interaction would imply that concentration is *more* effective in raising margins in contracting industries. That utterly implausible implication results from an incorrectly specified model, as our earlier discussion has made clear.

EMPIRICAL RESULTS

This section employs an otherwise standard model and data set to test for the various effects of demand growth and contraction on industry performance. The data set consists of 314 four-digit manufacturing industries for the year 1972.[6] The dependent variable is price-cost margin (PCM), defined as industry value-added minus payroll, divided by value of shipments. Market concentration CON is measured by the two-firm concentration ratio, which has in the past proved to be the best explanator of performance (Kwoka, 1979). The growth variable GR is deflated 1972 industry value of shipments minus 1967 shipments, divided by the latter.

Cost conditions have been shown to be important in theory, but their characterization encounters a problem. Since sunk costs are not easy to measure, empirical studies have focused simply on fixed costs, and we must do so as well. This is an appropriate procedure as long as sunk costs are highly correlated with fixed costs, e.g., if they are some relatively constant fraction of each other. Indeed, some observers believe precisely in this correlation (Spence, 1983, p. 986). Fixed costs or capital intensity CAP is measured as the ratio of gross book value of fixed assets to value of shipments.

The crucial variables and their predicted effects on price-cost margins are as follows:

a) CONGR, the interaction of concentration and growth. This is predicted to have a positive sign reflecting the decline in margins in contracting, noncompetitive markets regardless of capital intensity.

b) CONGR2, the interaction of concentration and the square of growth. As previously noted, this term should capture the greater difficulty of coordination in either high growth or sharply contracting industries, and hence bears a negative sign.

c) GRCAP, the interaction of growth and capital intensity. A positive coefficient on GRCAP would demonstrate the decline of margins in capital-intensive industries undergoing contraction.

d) CONGRCAP, the interaction of concentration, growth and capital intensity. This key behavioral term should bear a positive sign if the effect of concentration on margins is diminished in the presence of high fixed costs and negative growth.

Other control variables in the regression include two entry barrier measures: (1) scale economies, measured by the mid-point plant size (SCALE), and (2) a dummy variable for consumer goods industries (DCONS), representing greater product differentiation. Capital intensity must also be included additively in a regression on price/variable—cost margins to control for different capital costs among industries. Also, a measure of geographic dispersion DISP is included to correct national concentration data for the extent of true economic markets.

Table 1 presents mean values of all the relevant variables, together with maximum and minimum values. Obviously, not all of these variables can be included simultaneously with any prospect of isolating significant separate effects. Multicollinearity among them is very high, with bivariate correlations generally over .80. While the complete regression will be reported, a more informative research strategy is

TABLE 1

Variable Name	Mean Value	Maximum	Minimum
PCM	.272	.617	.059
CON	.275	.875	.0186
GR	.0600	1.75	−.673
CONGR	.0170	.488	−.318
CAP	.368	2.31	.0119
GRCAP	.00858	.428	−.533
CONGRCAP	.00222	.231	−.316
SCALE	.219	1.39	.00251
DCONS	.342	1.00	0.0
DISP	.582	2.14	.0185

to take relevant subsets of these variables and probe more focused hypotheses. Since the results of each stage may be affected by excluded variables, the interpretation will require caution. The composite picture will, nonetheless, be quite consistent and revealing.

The present inquiry begins by re-examining the traditional model that simply includes growth as an additive explanator:

$$(1) \qquad PCM = a_0 + a_1\,CON + a_2\,GR + a_3\,CAP + AX + e$$

where X is a vector of other control variables and e is the random error term. This model predicts $a_1 > 0$, $a_2 > 0$, and $a_3 > 0$. As shown by equation (a) of Table 2, these predictions are confirmed on the present data. The coefficient on GR is significant at the five percent level in a one-tail test, although its magnitude implies a relatively modest effect of growth or contraction on industry margins. All other variables are yet more highly significant. The R^2, while modest, is in the range generally found in such studies, and more importantly the F-tests here and throughout show a very high degree of statistical significance to the regressions, controlling for degrees of freedom.

The variation of test equation (1) tested by a few researchers has been to add the interaction term CONGR. Equation (b) of Table 1 reveals that its coefficient is positive, but not strongly significant, and it "steals" much of its explanatory power from GR.[7] The positive sign on CONGR, of course, is at odds with earlier findings but is more consistent with our prediction that negative values of growth undermine the coordinating power of concentration.

By previous discussion, a more appropriate specification would include CONGR2 as well as CONGR. The interaction with the square of growth permits concentration to diminish in importance in both contracting industries (as is hypothesized) and very high growth industries (as others have focused

TABLE 2

Variable Name	(a)	(b)	(c)
CON	.0900	.0745	.0958
	(2.55)	(2.00)	(2.63)
GR	.0280	−.0037	
	(1.69)	(.13)	
CONGR		.1243	.2149
		(1.32)	(3.62)
CONGR2			−.3670
			(3.60)
CAP	.0777	.0802	.0758
	(4.20)	(4.31)	(4.16)
SCALE	.0512	.0578	.0580
	(2.16)	(2.38)	(2.45)
DCONS	.0402	.0400	.0349
	(3.80)	(3.79)	(3.34)
DISP	−.0458	−.0466	−.0385
	(3.30)	(3.35)	(2.80)
CONST	.2186	.2209	.2201
R^2	.180	.184	.217
F	11.19	9.87	12.14

on). In addition, for theoretical reasons, the linear term GR is not appropriately included in this model. One might, in fact, interpret its weak showing in equation (b) as confirmation that contraction without concentration (or, as discussed below, capital intensity) does not affect margins. Hence, in equation (c), CONGR2 is added while GR itself is omitted (here and in all subsequent regressions.)

The results are very strong and represent striking confirmation of our hypothesized role of growth. While concentration is relevant to the level of price-cost margins, the effect has an inverted-U relationship to industry growth. Taken literally, equation (c) implies that the effect of concentration is at a maximum when an industry grows by 29 percent over five years, and vanishes when it either contracts by 30 percent, or expands by 88 percent over the same interval.[8] This result differentiates the role of growth and contraction depending on the extent of such growth and contraction. Its impact is much greater than in the naive model of equation (a) for middle ranges of growth, but smaller at the extremes.

A somewhat different set of issues surrounds the role of fixed costs or capital intensity. As previously noted, GRCAP represents the negative effect of contraction on margins, properly stated as a function of capital intensity. It is this effect which most previous studies have attempted to capture in a simple growth variable. Thus, equation (a) of Table 3 begins by simply including GRCAP. The large quantitative effect and statistical significance leave no doubt about the interactive role of contraction and capital intensity. Comparison with equation (a) of Table 2 demonstrates the superiority of this theoretically correct specification.

TABLE 3

Variable Name	(a)	(b)	(c)	(d)	(e)
CON	.0785	.0727	.1031	.0823	.1872
	(2.26)	(2.07)	(2.84)	(1.13)	(2.50)
GRCAP	.1661	.0763	.1251	.3214	−.0069
	(3.78)	(.84)	(1.35)	(1.48)	(.04)
CONGRCAP		.2519	.2516	−.1625	.7892
		(1.13)	(.96)	(.30)	(1.99)
CONGR			−.0321	.1005	.1466
			(.28)	(.33)	(.31)
CONGR2			−.2592	−.4120	.4098
			(2.31)	(1.56)	(.42)
CAP	.0870	.0890	.0832	.0723	.0945
	(4.74)	(4.83)	(4.53)	(1.89)	(2.55)
SCALE	.0602	.0628	.0554	.0941	.0197
	(2.58)	(2.68)	(2.35)	(2.38)	(.70)
DCONS	.0408	.0409	.0376	.0413	.0358
	(3.93)	(3.94)	(3.61)	(2.87)	(2.30)
DISP	−.0450	−.0460	−.0393	−.0510	−.0288
	(3.30)	(3.36)	(2.86)	(2.46)	(1.51)
CONST	.2160	.2170	.2156	.2147	.1920
R^2	.209	.212	.235	.241	.239
F	13.50	11.76	10.39	5.98	4.32

1. Indeed, a little-noticed implication of the theory of contestable markets is that market growth and contraction should be without price effects. As with other implications, the weight of evidence does not support contestability.

Furthermore, for previously mentioned behavioral reasons this effect is expected to be larger in concentrated industries. Hence CONGRCAP is added in equation (b) of Table 3. Although all the coefficients have the predicted signs, significance levels on GRCAP and CONGRCAP are only about 15 to 20 percent in one-tail tests. Closer scrutiny, however, makes clear that the reason is multicolleniarity. The simple correlation coefficient between GRCAP and CONGRCAP is .89, and an F-test on their joint effect yields F (2,306) = 7.79, well above the one-percent critical value for F, namely, 4.61. Clearly, they jointly add significant explanatory power, although it becomes difficult to fully disentangle their separate effects.

Next the effects in equation (b) of Table 3 are combined with those previously found from CONGR and CONGR2. These are reported in equation (c). All coefficients except CONGR retain their signs and at least approximate magnitudes, but significance levels are sharply affected by the simultaneous inclusion of four closely related variables.[9] One can, nonetheless, draw inferences regarding the constraints on concentration. At the mean value for CAP, the estimated coefficients in equation (c) imply that the margin-increasing effect of concentration is at a maximum when real growth is 12 percent over five years, and vanishes when an industry contracts by more than 30 percent, or expands by 53 percent over that interval.[10] This is shown as the line marked $\overline{CAP}$ in Figure 1.

In the actual data set, average real growth in the sample industries was 6 percent, implying that the margin effect is enhanced at slightly above average growth rates. Twenty-six industries (of 314) experienced sufficiently sharp contractions to fully offset the role of concentration, and half that number grew fast enough to do so.

For more capital intensive industries, the margin effect is smaller and shifted to the right. That is, the effect of concentration is altogether weaker, and disappears at lesser rates of contraction. As shown by the line marked HI-CAP in Figure 1, this is precisely as theory would predict.

CONCLUSIONS

This paper has examined the theory and empirical evidence concerning the effect of market contraction and growth on firm's behavior and the margins they realize. Industry contraction, especially in the presence of high fixed costs (a proxy for sunk costs), acts as a constraint on cooperative behavior. But it is also true that within quite broad ranges, concentration still matters. It matters less, but contraction and fixed costs do not generally negate the margin-increasing power of concentration.[11]

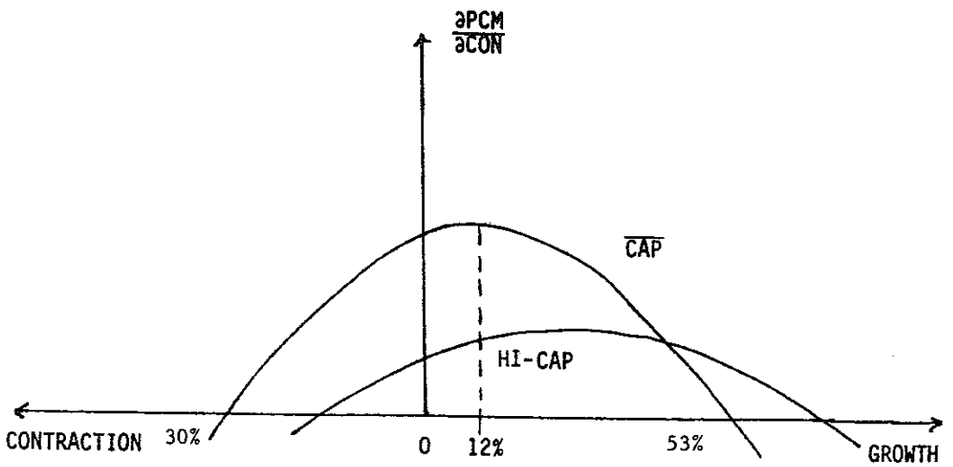

Figure 1

The policy implications of these findings are straightforward. The coordination that concentration fosters cannot generally be ignored, and so antitrust scrutiny of contracting industries is still appropriate. *Extreme* contraction in a capital intensive industry, however, does reduce the need for concern. Hence, some degree of antitrust accommodation may well be appropriate with respect to mergers in contracting industries.

NOTES

1. Indeed, a little-noticed implication of the theory of contestable markets is that market growth and contraction should be *without* price effects. As with other implications, the weight of evidence does not support contestability.
2. Recall, for example, the discussion as to whether price falls when demand contracts—assuming monopoly pricing throughout. Here we are concerned with whether the *same* price coordination results under *different* cost and demand conditions.
3. Its inclusion would also permit the logical possibility that the adverse effects of contraction on the price-sustaining role of concentration *increase* with greater contraction (negative growth).
4. Porter also includes growth as an additive term.
5. They also state that an unreported regression including a joint interaction of concentration, growth, and capital intensity adds no explanatory power (Bradburd and Caves, 1980, p. 640). But their model and data were explicitly directed at positive growth industries only (p. 638, fn 3).
6. For a description, see Kwoka (1979).
7. The simple correlation between GR and CONGR is .83.
8. This is calculated by solving for the zero values in the terms from equation (c) denoting the effects of concentration, i.e.,
$$0.96\ \text{CON} + .215\ \text{CONTR} - .367\ \text{CONGR2}.$$
The effect of concentration is at a maximum when GR equals 29.3 percent and becomes zero at GR = 88.3 percent and GR = −29.7 percent.
9. It is for this reason that we have thus far focused on subsets of these variables. Simultaneous inclusion, however, has the advantage of unbiased coefficients, although with inflated standard errors.
10. This calculation is made in a fashion analogous to that described in footnote 8.
11. Empirical studies of this sort have come under some criticism. Most of that, however, has been directed at measures of profit, not the price-cost margins employed here (or, in other studies, price itself). A complete defense of such empirical work is beyond the scope of this paper, which adopts and adapts an accepted methodology.

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