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Predicting 1972 Concentration Levels Using 1967 Concentration and other Variables for 280 4-Digit Industries

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National concentration levels in industries tend to change slowly over time. Hence, if one wishes to predict the concentration ratio of an industry in 1972, the best single predictor would be the 1967 concentration ratio for the same industry.

Because of the importance of advertising, product differentiation, and consumer tastes, it has often been argued that barriers to entry may be higher in consumer than in producer goods industries. In that case, we might expect concentration to rise more rapidly or fall less rapidly over time in consumer industries than in producer industries. Hence a dummy variable for consumer and producer industries has been included as an independent variable. The variable has been used in many studies which predict price cost margins and/or entry [4,6,7,12].

If economies of scale create barriers to entry, then concentration should tend to rise more rapidly or fall less rapidly in industries which have large economies of scale. In this study the measure of economies of scale used was the fraction of industry value of shipments accounted for by the average size of the largest plants which produce the top 50 percent of industry value of shipments. This measure has been used in a number of studies, [1,3,5], but has also been criticized since it tends to be correlated with the concentration ratio [1,17].

We also expect industries characterized by a high rate of growth in the past to have relatively high rates of entry and

declining market shares for the leading firms, especially if the leaders do not expand capacity rapidly enough. Hence, high rates of growth should be associated with declining concentration. Growth has been used as an independent variable in nearly all studies which predict price cost margins, entry, or changes in concentration [1, 3, 4, 5, 6, 7, 8, 10, 11, 17].

New entry into an industry is likely to cause concentration to fall because the new entrant is usually smaller than the largest existing firms. Indeed, since entrants are likely to be small, we would expect them to have a larger impact on the 50-firm concentration ratio than on the 4-firm concentration ratio. A number of studies have used entry as a variable to predict changes in price cost margins or in concentration [9, 10,13].

The Data

Most of the data used were obtained from a data set created for other research purposes and made available to this author. 1/ The data used includes 280 of the 451 4-digit industries reported in the 1972 Census of Manufacturers. Specifically excluded were 111 industries for which comparable data were not available for 1963, 1967, and 1972, and 38 additional industries listed as "not otherwise classified" or "not specifically classified" or "miscellaneous." In addition, 22 other industries were deleted because of problems in matching different data sets. 2/ All of the data originally came from Census Bureau [14,15] or Federal Trade Commission publications [16].

Together the 280 industries accounted for about 66.1 percent of value of shipments in all manufacturing in 1972 and 67.0 percent in 1967.

Thus, using data for 280 4-digit industries in 1967 and 1972, the following equation was estimated:

$$(1)\quad CR72 = a_1 + a_2\, CR67 + a_3\, PCDUM + a_4\, MES + a_5\, GROW + a_6\, EN + e$$

Where:

CR72 = 4-, 8-, 20-, or 50-firm value of shipments concentration ratio in 1972.

CR67 = 4-, 8-, 20-, or 50-firm value of shipments concentration in 1967.

PCDUM = 1, if the industry is a consumer industry.
= 0, if the industry is a producer industry.

MES = minimum efficient scale of plant, measured as the fraction of industry value of shipments accounted for by the average size of the largest plants which produced the top 50 percent of industry value of shipments in 1967.

GROW = (value of shipments in 1972 - value of shipments in 1967)/(value of shipments in 1967).

EN = (number of firms in 1972 - number of firms in 1967)/(number of firms in 1967).

e = the error term.

We hypothesize that:

$$\frac{\partial CR72}{\partial CR67} > 0$$

$$\frac{\partial CR72}{\partial PCDUM} > 0$$

$$\frac{\partial CR72}{\partial MES} > 0$$

$$\frac{\partial CR72}{\partial GROW} < 0$$

$$\frac{\partial CR72}{\partial EN} < 0$$

$$\frac{\partial CR472}{\partial EN} < \frac{\partial CR872}{\partial EN} < \frac{\partial CR2072}{\partial EN} < \frac{\partial CR5072}{\partial EN}$$

The Regression Results

Table 1 lists the simple correlations among all the variables used. All the concentration measures are higly correlated with each other. Also, all the concentration measures are strongly positively correlated with MES as Weiss has indicated [1].

Table 2 presents the regression results. Not surprisingly, 1972 concentration is highly positively correlated with 1967 concentration in every case. It should also be noted that the coefficient of CR67 is always less than 1.0. This implies that a 1 percentage point increase in concentration in 1967 (from 40 percent to 41 percent, for example), is associated with slightly less than a 1 percentage point increase in concentration in 1972. This is consistent with the Mueller-Hamm result that the absolute change in concentration is negatively related

TABLE 1

Simple Correlation Coefficients

	CR472	CR872	CR2072	CR5072	CR467	CR867	CR2067	CR5067	PCDUM	MES	GROW	EN
CR472	1.000											
CR872	.976	1.000										
CR2072	.901	.963	1.000									
CR5072	.778	.861	.957	1.000								
CR467	.961	.942	.873	.757	1.000							
CR867	.949	.971	.936	.837	.975	1.000						
CR2067	.879	.941	.974	.930	.895	.961	1.000					
CR5067	.765	.848	.938	.972	.776	.860	.956	1.000				
PCDUM	.087	.075	.057	.060	.046	.028	.009	.003	1.000			
MES	.692	.677	.627	.544	.697	.695	.647	.560	.088	1.000		
GROW	.062	.048	.018	-.019	.069	.060	.047	.005	.068	-.010	1.000	
EN	.193	.179	.158	.118	.258	.258	.256	.216	-.170	.198	.328	1.000

TABLE 2

Regression Results

Equation Number	Dependent Variable		Constant	1967 GR Measure	PCDUM	MES	GROW	EN	R^2
(2.1)	CR472	=	+.009773	+.9452CR467***	+.01361*	+.2388*	+.01032	-.05242***	.928
			(1.09)	(41.2)	(1.73)	(1.87)	(.87)	(-3.25)	
(2.2)	CR872	=	+.005518	+.9833CR867***	+.01772**	+.02073	+.008954	-.07216***	.950
			(.57)	(51.4)	(2.45)	(.18)	(.82)	(-4.85)	
(2.3)	CR2072	=	+.01689	+.9834CR2067***	+.01573**	-.03216	-.0005065	-.08238***	.958
			(1.61)	(60.9)	(2.57)	(-.34)	(-.05)	(-6.55)	
(2.4)	CR5072	=	+.03564***	+.9612CR5067***	+.01622***	+.02067	.002863	-.06775***	.956
			(3.01)	(64.2)	(3.13)	(.28)	(.36)	(-6.37)	

*** = Coefficient is significantly different from zero at the .01 level in a 2-tail test.

** = Coefficient is significantly different from zero at the .05 level in a 2-tail test.

* = Coefficient is significantly different from zero at the .10 level in a 2-tail test.

The numbers in parentheses are t-statistics.

to initial concentration. 3/ The entry coefficients have the predicted sign and are statistically significant at the .05 level or better in every case, and the PCDUM coefficients have the predicted sign and are statistically significant at the .10 level or better in every case. On the other hand, the GROW coefficient is never significant, and the MES coefficient is only significant (with the predicted sign) for the 4-firm concentration ratio.

It may also be seen that the coefficient for EN satisfies the hypothesis that $\frac{\partial CR4}{\partial EN} < \frac{\partial CR8}{\partial EN} < \frac{\partial CR20}{\partial EN}$. However, $\frac{\partial CR50}{\partial EN}$ is not greater than $\frac{\partial CR20}{\partial EN}$. In fact $\frac{\partial CR50}{\partial EN} < \frac{\partial CR8}{\partial EN}$.

Conclusions

As expected, these results show that 1972 concentration is strongly and positively correlated with 1967 concentration. It is also positively correlated with the existence of consumer goods industries and negatively correlated with entry. However, holding 1967 concentration constant, 1972 concentration was generally not correlated with industry growth or a measure of minimum efficient scale of plant.

Footnotes

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1/ See: [6,7].

2/ Appendix Table A lists the 280 industries included in the study.

3/ Equation (1) is of the form:

(2) $CR72 = b_1 + b_2\ CR67 + \sum_{i=1}^{n} b_i X_i + e'$ where X_i represents all other independent variables. Mueller and Hamm [10] estimated a similar equation, except that their dependent variable was $\Delta CR = CR2 - CR1$, and the specificantion of several of their dependent variables was slightly different.

Equation (2) is similar to the following equation:

(3) $(CR72 - CR67) = c_1 + c_2\ CR67 + \sum_{i=1}^{n} c_i X_i + e''$ except for two factors:

$$c_2 = (b_2 - 1)$$

and:

$e'' \neq e'$. Indeed, R^2 for equation (2) will invariably be much higher than R^2 for equation (3). Otherwise, the results of the two equations are identical:

$$\sum_{i=3}^{n} b_i X_i = \sum_{i=3}^{n} c_i X_i$$

In the equations estimated in table 2, the coefficient of CR lies between .93 and .98, a result in accord with Mueller and Hamm's finding that $c_2 < 0$. In the present equation, if the dependent variable were

$\Delta CR = CR72 - CR67$, then

$$-.07 < c_2 < -.02.$$

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APPENDIX TABLE A
280 4-Digit SIC Industries Used In this Study

2011	2284	2791	3322	3611
2013	2292	2793	3331	3612
2021	2293	2794	3332	3613
2022	2294	2812	3333	3621
2023	2295	2813	3334	3622
2024	2296	2816	3341	3623
2026	2298	2822	3351	3624
2031	2321	2823	3357	3631
2032	2328	2824	3361	3632
2033	2341	2831	3362	3633
2034	2351	2833	3391	3634
2035	2352	2834	3392	3635
2036	2363	2841	3411	3636
2041	2381	2843	3421	3641
2043	2384	2844	3425	3643
2044	2387	2851	3431	3644
2045	2393	2861	3432	3651
2046	2394	2892	3441	3652
2051	2396	2893	3442	3661
2052	2397	2895	3443	3662
2061	2411	2911	3444	3671
2062	2421	2951	3446	3672
2063	2441	2952	3451	3673
2071	2491	2992	3452	3674
2072	2514	3011	3471	3691
2073	2515	3031	3479	3692
2082	2521	3111	3491	3693
2083	2522	3131	3493	3694
2084	2531	3142	3494	3711
2085	2541	3151	3497	3713
2086	2542	3161	3498	3715
2091	2591	3171	3511	3721
2092	2611	3211	3531	3731
2094	2621	3221	3532	3732
2095	2631	3231	3533	3811
2096	2641	3241	3534	3822
2097	2642	3251	3535	3841
2098	2643	3253	3536	3842
2111	2645	3255	3537	3843
2121	2646	3261	3541	3851
2131	2647	3262	3542	3861
2141	2651	3263	3544	3914
2211	2652	3264	3545	3931
2221	2653	3271	3551	3942
2231	2654	3273	3552	3951
2241	2655	3274	3553	3952
2251	2661	3275	3554	3953
2253	2711	3281	3555	3955
2254	2721	3291	3562	3961
2261	2731	3295	3564	3962
2262	2732	3296	3565	3963
2271	2753	3297	3567	3964
2272	2761	3312	3576	3991
2281	2771	3313	3581	3993
2282	2782	3317	3582	3994
2283	2789	3321	3586	3996