Is This the Beginning of the End in the Competitive Trend?

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INTRODUCTION

The degree of competition in the U.S. economy and factors that influence it have for decades been of major interest to both academics and public policy makers. Market share, concentration level, entry barriers, and the degree of market control have been used to categorize each industry in one of the following:

1. Pure monopoly (near 100% share, no entry, high control);
2. Dominant firms (50-90% share, no rival nor high entry barrier, high control);
3. Tight oligopoly (four-firm concentration of above 60%, stable market share, medium to high entry barriers, cooperative pricing);
4. Effective competition (four-firm concentration ratios of less than 40%, unstable shares, flexible pricing, and low entry barriers).

Using the above information on market shares and concentration levels, combined with the data on the effectiveness of regulations and the antitrust cases, comprised the necessary information for Shepherd's (1982) analysis of the nature and causes of competition in the United States. He reached the following conclusions.

1. There was a substantial rise in aggregate market concentration in the manufacturing sector during 1939–1970. In the 1972–1977 period, however, the concentration level remained practically unchanged.
2. There was a slight rise in the degree of competition in the economy during 1939–1958 period. A substantially higher rise in the competitiveness of the economy was found for the period 1958–1980.
3. Antitrust policies, import competition, and deregulation had the most important impact on the speed and magnitude of the shift towards more competition in the U.S. economy.

Adelman (1951) measured the level of aggregate concentration in the U.S. during the post-war period using assets of 2,500 corporations. Similar to Shepherd, Adelman argued that although the American economy was highly concentrated, the extent of concentration showed no tendency to grow and may have even been declining. He also found that the assets of larger firms in that period grew slower than assets of smaller companies, perhaps hinting at the apparent trend towards more diversification of economic power.

Shepherd (1964) studied the trends of aggregate concentration in the United States since the turn of the century using the shares of the top 50, 100, and 500 firms in the economy and also measuring concentration within individual industries. Overall concentration appeared to stay approximately the same or increased slightly during the first half of the century with some reduction in the top firms' share during

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the second World War. After the war, however, there has been a definite increase in the share of the largest firms. Shepherd then argued that concentration seemed to decline among growing industries and to rise among shrinking industries.

White (1981a, 1981b) estimated the concentration level in the aggregate economy and concluded that during the period of 1955–1979, the aggregate concentration had not increased. If there was a discernable trend, it was toward more diversification.

Studies mentioned above seem to point to an apparent trend toward less concentration in the aggregate U.S. economy in the post-1970 period. Combined with other factors that influence competition, this led to Shepherd's (1982) proclamation that "Neo-Chicagoans were premature by two decades when they declared the advent of ubiquitous competition. Their view has now become more relevant. Indeed the U.S. economy is now an enormous test case for the functioning of competition in a large-scale industrial economy."

There are three major shortcomings with these studies that could invalidate their findings. First, these studies employ only one common *method* of computing the concentration level in the aggregate economy. This is the simple n-firm market share ratio (n is typically four, eight, or twenty). In this paper, we will explain different methods of computing a concentration index and argue that the n-firm market share measure is not the most effective one. Second, most of the previous studies have used only one single variable to determine the level of concentration (e.g., Shepherd, 1982 uses assets; White, 1981 uses value added). The concentration indexes computed using data on assets, sales or net income, will be different and relying on only one of these variables to measure concentration, may lead to erroneous interpretation of the concentration trend. In this study, we use all three variables to detect trends towards concentration.

Third, the time periods of these studies do not cover one of the most crucial postwar periods for the industrial organization research, specifically, the period that coincides with the Reagan Administration during which major economic, political, and legal changes influencing economic concentration and the overall competition, occurred. This study covers both the post and pre 1980 periods. We attempt to illustrate some of the drastic changes that have occurred in the 1980s to alter the degree of competitiveness of the U.S. economy. This will be accomplished by analyzing several factors that measure the competitive trends in the economy. In particular, focus is on the economic concentration levels and the changes in growth rates of different cross sections of the U.S. industrial sector.

In the next section, we will explain the different measures of concentration and substantiate our use of the "entropy" technique for investigating concentration trends.

CONCENTRATION MEASURES

Five different approaches to measuring economic concentration will be briefly addressed here.

Ogive Approach

A common measure of diversity is the ogive index that represents the deviation from an equal distribution of size (e.g., employment) in all industrial sectors (Tress, 1938; Rodgers, 1957; Conklin, 1963; Shear, 1965; Gratton, 1979; Bahl, et al., 1971).

Consider a set of *n* industrial classes, and let P_i ($i = 1, 2, 3, \ldots n$) denote the percentage of employment in the ith industry class. The ogive concentration index (C) can be defined as:

$$(1) \qquad C(P_1, P_2, \ldots P_n) = n \sum_{i=1}^{n} (P_i - 1/n)^2.$$

The minimum value of C (C = 0) is attained when employment is equally distributed among industries.

The National Average Approach

The national average employment or value-added figures in each industry can serve as measures of economic diversity (Florence, 1943; Steigenga, 1955; Borts, 1961; Bahl et al., 1971).

Let M_i equal national average employment in the ith industry, and α equals the power to which deviations will be raised ($\alpha = 1$ for Florence; $\alpha = 2$ for Steigenga and Borts). Then the concentration index (C) is computed by:

$$(2) \qquad C(P_1, P_2, \ldots P_n) = \sum_{i=1}^{n} (P_i - M_i)^{\alpha}/M_i.$$

Perfect diversification occurs simply by duplicating the national average.

Portfolio-Theoretic Approach

Based on the financial portfolio theory, Conroy (1972a, b; 1975a, b), developed a technique to examine the effect of industrial diversification on the stability of a region's employment. Every region expects a stream of returns in the form of employment, income, or a weighted subset of these, from investment of factor resources in individual industries. The variance of returns may serve as an aggregate measure of risk that is associated with the industrial structure of the region. Portfolio variance is defined as:

$$(3) \qquad \sigma_p^2(P_1, P_2, \ldots P_n) = \sum_{i=1}^{n} \sum_{j=1}^{n} P_i P_j \sigma_{ij},$$

where p-subscript refers to "portfolio"; P_i and P_j are the percent of regional resources (employment, income, or output) allocated to industries i and j; and s_{ij} denotes the covariance of these resources over time for the ith and jth industries. Using σ_p^2 (the portfolio variance) as an index of diversity, it is argued that (Conroy, 1972; Barth et al, 1975) the smaller the variance, the more stable is the region. The portfolio measure estimates both the individual instability of a given industry and the degree to which its fluctuations are correlated with the fluctuations of other industries.

McLaughlin's Approach

McLaughlin (1930) was the first to apply the five-industry and twenty-industry market share statistics to measure economic concentration and market (or monopoly) power. All other n-firm or n-industry ratios used in analyzing market structure (eg. Shepherd, 1982; Adelman, 1951; White, 1982), are derivatives of this method. McLaughlin's approach has probably been used most extensively in the industrial organization literature.

Entropy Approach

Theil (1967, 1972) introduced the concept of entropy to economic analysis. Entropy measures diversity of an industry (or a group of firms in different industries) against a uniform distribution of economic activities where the norm is equiproportionate in all sectors (or among all firms). The entropy measure of diversity D ($E_1, E_2, \ldots E_n$) is defined as follows:

$$D(E_1, E_2, \ldots E_n) = - \sum_{i=1}^{n} E_i \log_2 E_i,$$

where n is the number of firms and E_i is the share of the ith firm relative to the total. Thus, E_i, $i = 1, \ldots, n$ simply represents the market share of firm i in real terms. The base of the logarithm is arbitrary. Logarithm in base 2 is used due to its binary property. The maximum value of D, $D_{max} = \log_2 (n)$, is obtained when all firms have equal market shares. The minimum value of D, $D_{min} = 0$, is achieved when the market is represented by one monopolist. For all practical purposes, however, $0 = D_{min} < D < D_{max} = \log_2 (n)$. In this study, Fortune 500 manufacturing firms are selected, so for each year, n = 500. It is worth noting that as entropy (D) increases, concentration declines. The entropy measure is an overall index of

economic diversity over time. It can however, be decomposed to identify concentration patterns and structural changes evolving *within* a group of firms and *between* any number of groups of firms. In this study, we will investigate the concentration trend not only *within* the Fortune 500 companies but also *between* five subgroups of Fortune 500 firms as will be illustrated below.

Consider dividing the 500 firms into five separate groups or sets, $S_g (i \in S_g, g = 1, 2, \ldots 5$. S_1 is defined as top 100, S_2 as the next 100, etc. The total assets (or other variables of interest) of set S_g is then

$$E_g = \sum_{i \in S_g} E_i \quad g = 1, \ldots G.$$

The entropy index of diversity *within* each of the G sets can be measured by:

$$(4) \qquad D_{within}S_g = - \sum_{i \in S_g} E_i/E_g \log_2 E_i E_g.$$

Representing each set's relative share of the total assets by E_g/E_s, where E_s is total assets of the 500 firms, the entropy measure of diversification *between* the G sets may then be expressed as:

$$(5) \qquad D_{between} = \sum_{g=1}^{G} E_g/E_s \log_2 E_g/E_s.$$

Weighting the result of equation 2 by the relative shares of each set yields:

$$(6) \qquad D_G = - \sum_{g=1}^{G} E_g/E_s \left\{ - \sum_{i \in S_g} E_i/E_g \log_2 E_i/E_g \right\},$$

which is the total measure or summation of diversity within the G sets.

The total of the entropy measure of economic diversity of the Fortune 500 firms can be obtained by summing equations 5 and 6.

$$(7) \qquad E(D) = - \sum_{g=1}^{G} E_g/E_s \log_2 E_g/E_s + \sum_{g=1}^{G} E_g/E_s \left\{ - \sum_{i \in S_g} E_i/E_g \log_2 E_i/E_g \right\}.$$

This disaggregation of entropy into its between-set and within-set aspects, where $G = 5$, is carried out in this research.

Comparison of Different Concentration Measures

Because of its superiority over other techniques, as will be briefly explained, Theil's (1967, 1972) entropy measure is employed in this study to compute concentration trends. Entropy is a more flexible and analytically powerful measure of economic diversity than either the national average measure, the portfolio measure, or McLaughlin's. The rectangular (uniform) distribution of economic activities used as a comparative norm in the entropy method, is more objective and conceptually consistent with the intuitive notion of diversification or the absence of concentration. All other measures of concentration are absolute measures (Attaran, 1984).

The national average technique assesses the deviation of the regional distribution of economic activity from the national distribution as the comparative norm. This comparative norm however, changes over time. Thus this measure does not determine whether the distribution of economic activity has become more (or less) diversified within a region itself. Since the comparative norm of the entropy measure is fixed, the deficiency of the national average technique is eliminated.

The portfolio measure (that is related only indirectly to economic diversity), has a number of shortcomings. First, since the size of the covariance is a function of the units of measurement, this measure tends to bias the result against larger regions that have a greater portfolio variance. Secondly, the use of variance as the norm is not even conceptually consistent with the intuitive notion of diversification (St. Louis, 1980). It may well be that a given area has a better industrial mix than the nation as a whole. In this

case, a movement toward duplicating the national pattern may worsen the area's stability or its rate of growth.

The ogive and entropy measures are conceptually similar in that both approaches compare actual distribution of variables to a hypothetical uniform distribution representing the "balanced" industrial composition (equal percentage in each group). However, the entropy measure is more complete since it can estimate the level of concentration both *within* a region or an industry and between subsets of regional or industrial groups. In other words, the entropy technique not only provides an overall index of economic diversity over time, but it can also be decomposed to analyze the nature of such diversity.

The n-firm ratio approach simply measures the trend in the relative market share of the top "n" firms (or industries) in a particular industry (or in the economy). As was mentioned earlier, this is the most widely used technique for detecting economic concentration. Compared to entropy, this technique has three shortcomings. First, the correct size of "n" is ambiguous and has typically ranged from four to twenty in the literature. Second is the basic issue that there is no "fixed" measure against which we can compare these n-firm market share ratios. Finally, this measure does not lend itself to decomposition as does the entropy technique.

We have argued here that the entropy technique is at least as good as any other available measure of economic concentration. In addition, it can be decomposed to evaluate both "within" and "between" concentration levels, which renders the entropy technique a more complete and desirable measure of aggregate economic concentration.

DATA SOURCES AND THEIR ANALYSIS

We first looked at the aggregate concentration levels and the concentration trend for the period of 1970–86. Following Adelman (1951), assets of the Fortune 500 were used to measure the concentration level. To satisfy those who prefer sales (Fischer *et al*, 1985), this measure was also employed to estimate concentration. For our own interest, equity concentration level was also computed.

By applying the entropy function to sales, assets, and equity of the Fortune 500, it will be possible to determine the changes in concentration or diversification trends occurring within these 500 firms as a whole, within given subsets of the 500, and between subsets of the 500. The next sections present the data, findings, and analysis.

The Data

The raw data for this research were collected from the annual Fortune magazine's directory of the top 500 manufacturing companies. The data on annual sales, assets, and equity in actual dollars were compiled for the seventeen-year period of 1970–1986. Equation 7 was used to compute the total *within* entropy index for assets, sales, and equity of Fortune 500 companies. Equation 5 was employed to calculate the *between* entropy index of five subsets of Fortune 500 companies.

Results

Similar to Shepherd (1982), we found that the aggregate concentration level for both assets and sales did not change at all during the 1970–1980 period. For assets, the average change for that period is only about 0.04% per year towards *diversification*. In the period 1981–1986, on the other hand, the average change is 0.71% per year towards *concentration*. The 1983 and 1984 years alone showed large changes of 1.26 and 1.53 percentage points towards concentration, respectively.

Sales concentration ratios were more consistent since they showed a continuous trend towards concentration at a very low level of .35% per year—for the year 1970–1980 period. The concentration change over the 1981–1986 period, at 0.35% per year, was identical to the average for the earlier years. The concentration level for equity during the 1970–1980 period was practically constant, with a slight trend toward *diversification* at an average rate of 0.09% per year. During the period 1981–1986, however,
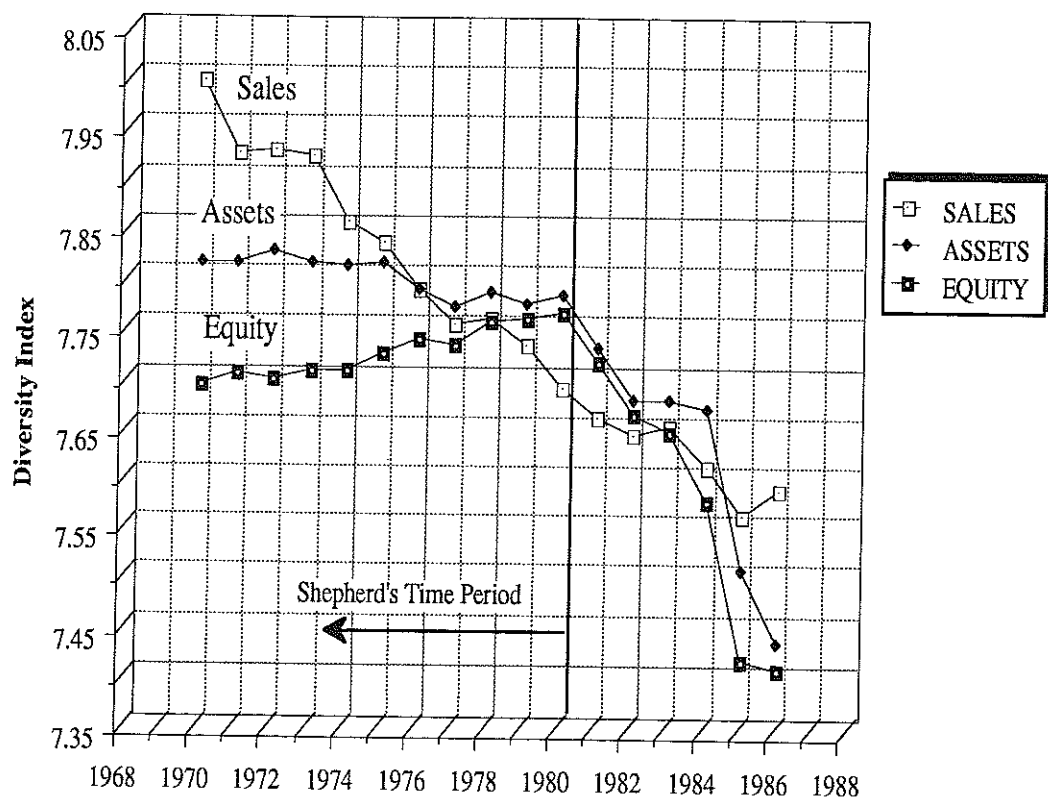
Figure 1. Diversity Index of Fortune 500 Firms.

the trend changes towards *concentration* at an average per-year rate of 0.7%. Figure 1 shows the diversification levels (sales, assets, and equity) for the Fortune 500 firms during the 1970–1986 period. The sudden shift towards concentration in the 1980s is evident for all three variables.

The data was next divided into five subsets of 100 firms each: the top 100 Fortune companies, second 100 of Fortune 500 companies, . . . and the bottom 100 of Fortune 500 companies. This breakdown was done for assets, sales and net equity; equation 5 was then used to investigate the relative position of these five subsets over time. The diversity index computed between subsets, showed a consistent and universal trend toward concentration. The entropy index computed between subsets, changed by nearly ten percent for assets, over thirteen percent for sales and seven percent for equity, all indicating higher levels of concentration.

To reconfirm this point and also to test Adelman's earlier finding that the assets of larger firms grew slower that those of the smaller companies, we looked at the breakdown of the Fortune 500 companies and found that the top 100 companies (highest assets, highest sales, and highest equity), have done much better (or less worse) than the bottom 100 firms in the 1981–1986 period.

The implication of this finding is straightfoward. The big companies, in general, became bigger and their financial power increased *relative* to the smaller ones, so that the gap between the two groups widened. This is even more evident when one compares the pre- and post-1980 periods. In the latter period, the disparity between large and small companies has obviously increased substantially. This conclusion holds for sales (flow), assets (stock) measures of size and economic power, and for equity. Table 1 shows the changes in real assets, sales, and equity of these companies (in 1970 dollars).

Finally, we look at what some researchers (e.g., Shepherd, 1982) believe is necessary to preserve the

TABLE 1
Percent Change in Real

Time Period	Assets		Sales		Equity	
	Top 100	Bottom 100	Top 100	Bottom 100	Top 100	Bottom 100
1970–1974	2.50%	2.50%	10.00%	7.70%	1.70%	0.90%
1975–1980	2.20	−0.50	3.10	3.40	0.40	0.20
1981–1986	2.05	−6.70	−2.50	−4.80	0.40	−12.00

level of competition that was achieved by 1980. Since the emergence of "Reaganomics" in recent years, the government seems to have eased its antimerger campaign. This trend is reported even in popular publications such as *Fortune* magazine (1986) and *Business Week* (1988). It is important to note that Scherer (1980) finds a definite, positive contribution of mergers to economic concentration.

Concurrently, the import barriers, whether voluntary such as the Japanese auto imports, or involuntary, such as imports quota on textiles, and U.S. threats to foreign trade partners, have substantially increased in the 1980s. Indeed, the United States is the only major industrial country that in this decade has actually increased its import barriers. These two parallel events acted against competition, while increased deregulatory activities (in the telecommunications industry, for example) helped improve the competitive environment. However, the latter, according to Shepherd (1982), has the lowest impact on competition. In general, one may conclude that the environment is not as conducive to competition now as it was in the 1939–1980 period, which has been analyzed in previous research.

Combining the above facts with the seemingly sharp rise in the concentration levels and the change in the power structure of companies, could mean the beginning of the decline for the "optimal laboratory for observing competitive behavior," the U.S. economy. Whether this trend will continue or is simply a temporary adjustment in the economy, will remain to be seen in the future.

CONCLUSIONS

Although equivocal in its judgement on the pre-1970 trend towards economic concentration, previous research attests that the U.S. economy is now moving towards less concentration and more competition. It is our position that this conclusion has been reached by researchers largely because of their measurement techniques, the variables they employed, and the time horizon of their studies which, for the most part, have ignored the Reagan era. We have undertaken to remedy the above shortcomings in various ways. We used the entropy technique instead of the widely used n-firm market share ratios. We used assets, sales and equity to measure size and concentration instead of only one variable typically used in most of the previous research. We also extended the time horizon of previous research to cover one of the most sensitive periods of the history of industrial organization, the 1980s.

Our findings confirm the earlier results of Shepherd (1982) and White (1981a,b) with respect to the concentration trend within a group of firms for the pre 1980 period. This could perhaps imply that the McLaughlin and entropy measures are consistent or that using all techniques would yield the same results. However, we found that the use of variables is crucial and the results can be quite variable-dependent. For example, as Figure 1 shows, for the 1970–1977 period, researchers using sales, assets and equity, would have concluded that the aggregate economy was becoming more concentrated, was staying the same, or even that it was leaning towards diversification.

The time period of study was found to be crucial. While in some cases, the trend was toward less concentration in the 1970s, in the 1980s, there is a definite movement towards concentration. Even among the Fortune 500 companies, the *between*-subsets concentration index reveals that the larger companies are getting even larger and the disparity between the top Fortune 100 of Fortune 500 companies and the bottom 100 is widening.

Finally, although the claim of those who maintain that the U.S. economy is highly diversified and highly competitive is still valid, the trends seem to point to a different direction. This situation should be monitored closely by both academics and public policy makers.

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