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The Effects of Size and Diversification on Forecasts of Conglomerate Earnings

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Forecasts of Conglomerate Earnings

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Abstract

Presumably, investors can use sub-entity data to improve projections of total-entity profits. This study investigated the proposition that differences between consolidated (CN) and segmented (SG) income forecasts may be contextual. CN-SG differences in predictive ability were analyzed in a variety of forecasting contexts based on two composition characteristics of conglomerates: size and diversification.

Quarterly ARIMA models were used to project both quarterly and annual earnings. Earnings data were used to estimate these extrapolative models. Simulated mergers of existent autonomous firms provided comparable CN-SG data.

The results indicate that while differences in predictive ability were generally not observed, there were some differences apparently due to size effects. For step-area quarterly forecasts, conglomerates with the smallest segments exhibited CN-SG differences. Due to the small population of single-product firms (N=60), however, the results should be interpreted as preliminary evidence. Additional research, perhaps relaxing the sampling constraints, should investigate further these apparent contextual differences.

THE EFFECTS OF SIZE AND DIVERSIFICATION ON
FORECASTS OF CONGLOMERATE EARNINGS

Recent merger activity has served to highlight some of the reporting problems associated with accounting for diversified companies. When companies diversify into unrelated industries it becomes more difficult for investors to assess interfirm differences in profitability, growth and risk [Mautz, 1968, p. 127]. Consequently, the accounting profession has revised its reporting requirements for diversified firms [FASB, 1976, 1977; SEC, 1977, 1978]. These requirements prescribe various sub-entity disclosures including segmented sales, assets, and earnings.

Presumably, investors can use segmental data to improve projections of total-entity profits. Kinney [1971], Kochanek [1974], Collins [1976], Fried [1978], Ang [1979], Barnea and Lakonishok [1980], and Silhan [1980], among others, have investigated this proposition. Interestingly, the evidence is mixed with respect to the predictive benefits of reporting segmented earnings.

PREVIOUS CN-SG COMPARISONS

Previous research regarding the comparative accuracies of consolidated (CN) versus segmented (SG) income forecasts provides evidence that CN forecasts are generally inferior to SG forecasts [Kinney, 1971; Collins, 1976]. These results lend support to the

segmental disclosure policies of the Financial Accounting Standards Board and the Securities and Exchange Commission.

There is also evidence, however, which implies that CN-SG differences in predictive ability may be situation specific rather than general [Fried, 1978; Ang, 1979; Barnea and Lakonishok, 1980; Silhan, 1980]. There could be circumstances under which the SG forecasts would not be more accurate than the CN forecasts.

Barefield and Comiskey [1975] suggest that various "group characteristics" could affect CN-SG differences in forecastability. In particular, they suggest that conglomerate income forecasts may depend on the availability of information and the variability of earnings. Industry affiliation and the number of reporting segments were cited as potential determinants of income variability. They partitioned the Kochanek [1974] results by disclosure quality and number of segments (NOS). While the disclosure factor had a favorable effect on the income forecasts of financial analysts, the NOS factor had no comparable effect. ANOVA tests did not support the existence of a significant NOS effect. Sampling biases and other factors, however, may have precluded the identification of NOS and other effects related to composition characteristics.

COMPOSITION CHARACTERISTICS

Conglomerate mergers create diversified companies having a variety of composition characteristics. Merger candidates are screened for various properties because businesses are combined for various reasons. Strategies for growth and diversification lead to combinations of firms that can be described along several dimensions. Two of these, size and diversification, are key composition characteristics.

Even though large companies may appear synonymous with diversified companies, size and diversification remain separate concepts. Moreover, since large and small companies can be single-product or multi-product, conglomerates can be classified into distinct groups based on these two factors.

Size

Size can be measured in several ways. For diversified companies, size could refer to the size of the total entity or the average size of the segments. In other words, a small firm could be small because it contains few segments or because it contains small segments. In this study, only the size of segment (SOS) factor was examined. It was measured in terms of average SG earnings.

Diversification

Intuitively, diversification, can be viewed as the adding of unrelated products in order to reduce risk (perhaps defined in terms of income variability). Needham [1964] suggests that firms should add new products if such diversification promises higher returns than other forms of expansion. Managers would add dissimilar products until profit-enhancing opportunities were no longer attractive at the margin.

In statistical terms, diversification can be viewed as (1) a means of reducing income variability or (2) a means of achieving efficient risk-return combinations of assets. Finance theorists maintain that risk-return combinations should be used to evaluate portfolios of assets and conglomerates [Rubinstein, 1973].¹

Diversification in the current study is defined solely in terms of dissimilar product lines, i.e., the intuitive view. The NOS factor was used to achieve industry diversification; SIC codes helped delineate the component industries.

CORPORATE MERGERS

Periods of increased merger activity have been observed throughout the history of American enterprise. During these "merger movements" the level of merger activity becomes unusually high for a variety of reasons. Interestingly, economic and legal

conditions sometimes favor particular types of mergers. Recently, antitrust policies may have contributed to the popularity of conglomerate mergers [Kamerschen, 1970].

In many respects, a merger decision is simply a decision to expand. However, unlike other expansion decisions, merger decisions involve a series of complex interfirm negotiations which can be crucial to the firms involved.

Theories of corporate merger have focused on motives for merging. Operating synergies [Bain, 1956], financial synergies [Lewellen, 1971], growth [Baumol, 1962], diversification [Piccini, 1970], market power [Stigler, 1968], bankruptcy avoidance [Higgins and Schall, 1975], and personal motives [Reid, 1968] are some of the principal motives that have been advanced in the literature. The first four motives have direct implications for conglomerate income forecasting.

Operating and Financial Synergies

Existing evidence suggests that operating synergies, which are usually created by merging related entities, are not expected for conglomerate mergers. Diverse products, markets and technologies would preclude the realization of production and marketing synergies. While certain management efficiencies could be realized

[Dean, 1970], these would probably not have significant effects on profits.

Financial synergies appear more likely than operating synergies due to some potential for better capital rationing, better capital mobilization, lower capital costs, and better financial controls.² These effects, however, would not necessarily affect the underlying time series behavior of earnings. Post-merger financial policies would have to change significantly for this to happen.³

Growth and Diversification

Theories of corporate growth and diversification posit that business organizations can be identified and analyzed in terms of growth stages. Organizations, which develop in response to changing environments and changing strategies, evolve from simple into complex structures. Growth and diversification, which con- note survival, are often viewed as implicit objectives of the corporation.

Chandler [1962], Wrigley [1970], Scott [1973], and Rumelt [1974], among others, have developed theories of corporate growth. In essence, strategies for change evolve from single-product orientations to multiple-product orientations, and companies concentrate on volume before diversification. Efforts to expand

volume through market development and horizontal integration precede efforts to diversify into unfamiliar markets. Consequently, advanced companies tend to be large and diversified. Moreover, they typically diversify into unrelated fields [Leontiades, 1980, p. 18].

CONGLOMERATE EARNINGS

Since earnings are the focus of financial reporting in the United States [FASB, 1978], it is important to understand the earnings process. Past earnings provide a foundation for evaluating the profitability of businesses. Since conglomerates are entities consisting of unrelated sub-entities, the problem of analyzing profits becomes somewhat more complex for these firms. In diversified companies, the component income streams may be varied enough to warrant concern over the inherent predictiveness of the consolidated income stream. Moreover, details of SG profits might provide insights into the nature of CN profits. On the other hand, conglomerate earnings could be "stabilized" due to size and diversification effects.

Size Effects

As companies grow, earnings tend to become less variable as offsetting income components reduce earnings variability. Since within-segment activities become more diverse as operations grow,

large companies, e.g., General Motors, exhibit stable earnings relative to small companies, e.g., American Motors. A priori, segments should exhibit similar tendencies. The largest segments should have the most stable income streams, ceteris paribus.

Diversification Effects

In addition, as new segments are added, between-segment diversification becomes important. Since the income streams of unrelated businesses are almost never perfectly correlated, the variability of conglomerate earnings is reduced due to segment covariabilities. Portfolios of segments would thus produce income patterns that are stable relative to the individual patterns of the segments. These effects would resemble, to some extent, the effects of financial diversification on portfolios of financial assets.⁴

RESEARCH DESIGN

The design of this study is based on the possibility that size and diversification may affect CN-SG differences in conglomerate forecasting performance. Simulated mergers of existent autonomous firms [Silhan, 1982] were used to create various combinations of characteristics and to provide comparable CN-SG data for Box-Jenkins analysis [Box and Jenkins, 1970]. Since the same forecasting approach was used across competing data sets,

CN-SG comparisons were not subject to data x model interactions. It also became feasible to use quarterly earnings in a segmentation context. These data are not currently required for most conglomerates.⁵

Simulated Mergers

A set of n-segment conglomerates was created by aggregating the earnings of single-product companies. These conglomerates were void of segment ambiguities, intersegment transfers, common cost allocations, tax allocations, and changes in reporting entity (due to company acquisitions and divestitures).

By merging autonomous firms, the allocation problems of segment reporting were avoided. By design, allocation was unnecessary since there were no common costs to be allocated among the surrogate segments. Conglomerate earnings were derived by adding together the income streams of the component firms. This "summation aggregation" represents a pooling of interests.

Accounting treatment. Depending on the circumstances, a given merger can be treated by accountants as either a purchase (the acquisition of one entity by another) or a pooling of interests (the joining together of separate entities). APB Opinion No. 16 [APB, 1970] sets forth criteria used to determine the singly appropriate treatment in each case.

The pooling-of-interests treatment was used to account for the simulated mergers. Poolings are accounted for by simply adding together the results of the merged firms. By simulating poolings, instead of purchases, it was possible to avoid various assumptions regarding valuations, exchange ratios, and goodwill.

Since all conditions for poolings could be assumed without undue conjecture, compliance with APB Opinion No. 16 seemed reasonable, realistic, and appropriate for purposes of the research. There are twelve conditions which must be met for any merger to qualify as a pooling of interests: two involve the independence of the combining entities; seven involve the impact of the merger on ownership interests; three involve the absence of planned transactions. Clearly, the independence conditions were satisfied, since the merged firms were autonomous and unrelated; also, the remaining conditions were not a problem, since these conditions do not affect consolidated earnings.

Variable of interest. Net income (earnings after taxes, extraordinary items, and discontinued operations) was selected as the variable of interest because it was (1) reported on a quarterly basis, (2) available on the COMPUSTAT industrial tape, and (3) reported consistently over time. Since definitions of extraordinary items had changed during the sample period (1967-78), the

choice of an income figure before such items would have resulted in data that were definitionally inconsistent.⁶

Existent Autonomous Firms

The selection of merger candidates began by identifying an "opportunity set" of single-product firms that individually satisfied certain criteria. Firms with complete income data (1967-I to 1978-IV) were screened to include only domestically registered corporations that were neither holding companies nor owned subsidiaries. These firms each had fewer than four 3-digit SIC codes. Seventy firms survived these constraints.

Next, combinations of firms were screened to ensure adequate conglomerate diversification. Firms were ranked by size (measured in terms of average earnings) in descending order to produce subgroups which could be considered as potential segment portfolios. Only firms of approximately the same size were merged together in order to control for confounds due to differences in proportions.

Firms were reviewed sequentially from largest to smallest. Combinations of segments were screened for (1) industry diversification, (2) product singularity, and (3) component data consistency. Each firm in a given n-segment conglomerate was required to have a set of SIC codes unique to the conglomerate

(to ensure industry diversification); each firm was required to have nonsignificant product-line disclosures (to ensure product singularity);⁷ each income series was inspected for large divergencies from average earnings (to ensure data consistency); and each firm was reviewed for major acquisitions during the sample period (to ensure reporting consistency). After several iterations, sixty firms were selected for merging.

ARIMA Forecasts

By using the simulated-merger approach, the choice of prediction models was not limited to annual models [e.g., Kinney, 1971; Collins, 1976] or models based on income components [e.g., Fried, 1978; Ang, 1979]. In the process of selecting a forecasting method, data availability, model complexity, computer time, predictiveness, seasonality, and summation effects were considered.

Univariate autoregressive-integrated-moving average (ARIMA) models were selected because they are purely extrapolative and inherently favor neither CN nor SG forecasts. The Box-Jenkins approach considers a family of potential models before identifying a model specific to the time series data.

In essence, an ARIMA model statistically represents time series data as a system of inputs (past observations) and outputs (future observations). Data are analyzed to determine a "generating process" that describes adequately the behavior of the

data. No attempt is made to rationalize the derived process. In effect, the model represents a "black box" which converts inputs (e.g., past earnings) into outputs (e.g., future earnings).

In this study, multiplicative seasonal ARIMA models were used.⁸ They are sometimes referred to as (p,d,q)x(P,D,Q) models.

Performance Measures

The predictiveness of CN forecasts versus SG forecasts was evaluated for a three-year holdout sample (1976-78). Errors were defined solely in terms of forecasting performance during this period. All forecasts were based on 36 quarterly observations beginning in the first quarter of the first calendar year. Mean errors were computed for step-ahead quarterly and step-ahead annual forecasts. Thus, forecasts were rolled forward and the step-ahead quarterly forecasts were for the first quarters of the three calendar years in the holdout sample. Annual predictions were derived from quarterly predictions for the calendar years.

Mean errors. Mean absolute relative errors (MAREs) were computed for both the quarterly and the annual forecasts. MAREs were computed as follows:

$$\text{MARE} = \frac{1}{3N} \sum_{i=1}^N \sum_{t=76}^{78} \left| \frac{P_{it} - A_{it}}{A_{it}} \right|$$

where

P_{it} = predicted earnings of conglomerate i for period t ,

A_{it} = actual earnings of conglomerate i for period t ,

N = number of conglomerates indexed by i .

Because MAREs were subject to outlier effects, they were truncated at 1.00. Foster [1977] also used 100 percent relative errors as outlier limits in his work on quarterly earnings and income predictions.

Absolute differences. Differences between CN forecasts and SG forecasts were computed by subtracting the absolute value of the SG MARE from the absolute value of the CN MARE. These signed absolute differences (SADIFFs) were used to assess CN-SG differences relative to "zero-error" forecasts. Positive SADIFFs indicated SG superior results.

Average ranks. In addition, average ranks were computed for each SOS-NOS grouping. The average ranks measure gives some recognition to relative errors in excess of the outlier threshold. In the study, the average ranks represented the proportion of SG superior forecasts. They were computed by assigning a value of 0 to CN superior comparisons and a value of 1 to SG superior comparisons.

Research Proposition

Performance measures were selected to investigate the proposition that CN-SG differences could depend on forecasting contexts. Two factors, size and diversification, were used to differentiate conglomerates on the basis of key composition characteristics. Income forecasts were classified by segment size, segment diversification, and level of aggregation.

RESULTS

In general, the results indicate that composition effects can generate CN-SG differences in predictive ability. There were performance differences between large-SOS and small-SOS firms, as well as performance differences between quarterly and annual step-ahead forecasts.

As Table 1 indicates, disaggregation gains (positive SADIFFs) were more prevalent for small-SOS firms than for large-SOS firms when predicting quarterly earnings.⁹ The average ranks measure, in particular, shows that SG superior results were observed across all NOS groups. For large-SOS firms, however, CN forecasts appeared to be equivalent to SG forecasts.

As Table 2 indicates, annual forecasting performance was generally more accurate than quarterly forecasting performance. Intertemporal aggregation apparently reduced composite errors.

For small-SOS firms, however, the results were not skewed toward SG superiority as they had been for the quarterly results. The average ranks for both large-SOS and small-SOS groups indicated an equivalence in performance of CN forecasts to SG forecasts. For each CN superior comparison this was an SG superior comparison. The SADIFFs were positive, but not as positive as they were for the small-SOS quarterly results.

IMPLICATIONS

The results of this study imply that the reporting of quarterly SG profit data may improve only step-ahead quarterly income forecasts. Forecasts of annual profits based on quarterly ARIMA models, through the fourth quarter of the preceding year, were not improved. Average ranks indicate that except for small-SOS conglomerates, CN forecasts were equivalent to SG forecasts in MARE performance.

Since quarterly SG data are not required in most cases, the findings of the study suggest that SG profit data used alone would, if required, not yield improved projections of annual earnings. On the other hand, with respect to quarterly income forecasts, conglomerates having the smallest segments (measured in terms of earnings) may provide some opportunities for improved forecasting.

The design of the study assumes that SG profit data would be used to extrapolate enterprise profits, and the implied loss

function is linear with respect to forecast errors. The findings are thus limited to time series projections and the metrics employed. The study does, however, offer evidence that is not attainable in the current reporting environment. In essence, pro-forma presentation was used to generate quarterly SG data for CN-SG comparisons.

While quarterly SG profits may be useful for other purposes (e.g., the assessment of risks), such data do not appear useful for income forecasting in general. Since annual SG profit data have exhibited similar results (see Hopwood et al., [1981]), the benefits of reporting SG profit data for annual income forecasts in particular seem doubtful in a univariate context.

Footnotes

¹For portfolio analyses of conglomerate performance, see Smith and Schreiner [1966], Westerfield [1970], Weston et al. [1972], and Mason and Goudzwaard [1976].

²See Levy and Sarnat [1970], Lewellen [1971], and Lee [1977] for discussions of financial synergies.

³See Dopuch and Watts [1972] for a discussion of factors influencing time series behavior.

⁴See Sharp [1970] for a discussion of portfolio theory.

⁵Segmental data are not required for interim statements not presented in conformance with generally accepted accounting principles [FASB, 1977].

⁶Extraordinary items, however, did not become a forecasting problem since firms were screened to exclude firms having material income fluctuations.

⁷Firms reporting SG data were deemed single-product if they reported product lines which seemed closely related or not significant for predictive purposes.

⁸Unlike Silhan [1980], ARIMA models were identified using automated BJ procedures [Hopwood, 1980] rather than manual procedures.

⁹Although Wilcoxon signed-ranks indicated that these differences could be attributable to chance, the average ranks suggest potential for forecasting improvements through disaggregation.

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Table 1

HARE Results for Quarterly Income Forecasts (1976-78)

Number of Segments	Largest Segments ^a				Smallest Segments ^b				Conglomerates in Each Subsample
	CN	SC	SADIFF	Average Rank	CN	SC	SADIFF	Average Rank	
2	.2808	.2493	+.0315	.47	.4463	.4120	+.0343	.71	15
3	.2505	.2150	+.0355	.53	.4140	.3875	+.0265	.70	10
4	.1913	.1663	+.0250	.57	.3703	.3228	+.0475	.71	7
5	.1488	.1529	-.0041	.50	.3372	.3137	+.0235	.56	6
6	.1878	.1841	-.0037	.53	.4006	.2284	+.1722	.80	5
Average	.2118	.1935	+.0183	.52	.3937	.3329	+.0608	.70	
Wtd. Average ^c	.2141	.1925	+.0216		.3925	.3409	+.0516		

^a Quarterly earnings averaged \$2.1 million (between 5.5 and .8 million)

^b Quarterly earnings averaged \$4 million (between .8 and .2 million)

^c Weights based on Arthur Andersen [1978] survey of diversified companies.

Table 2

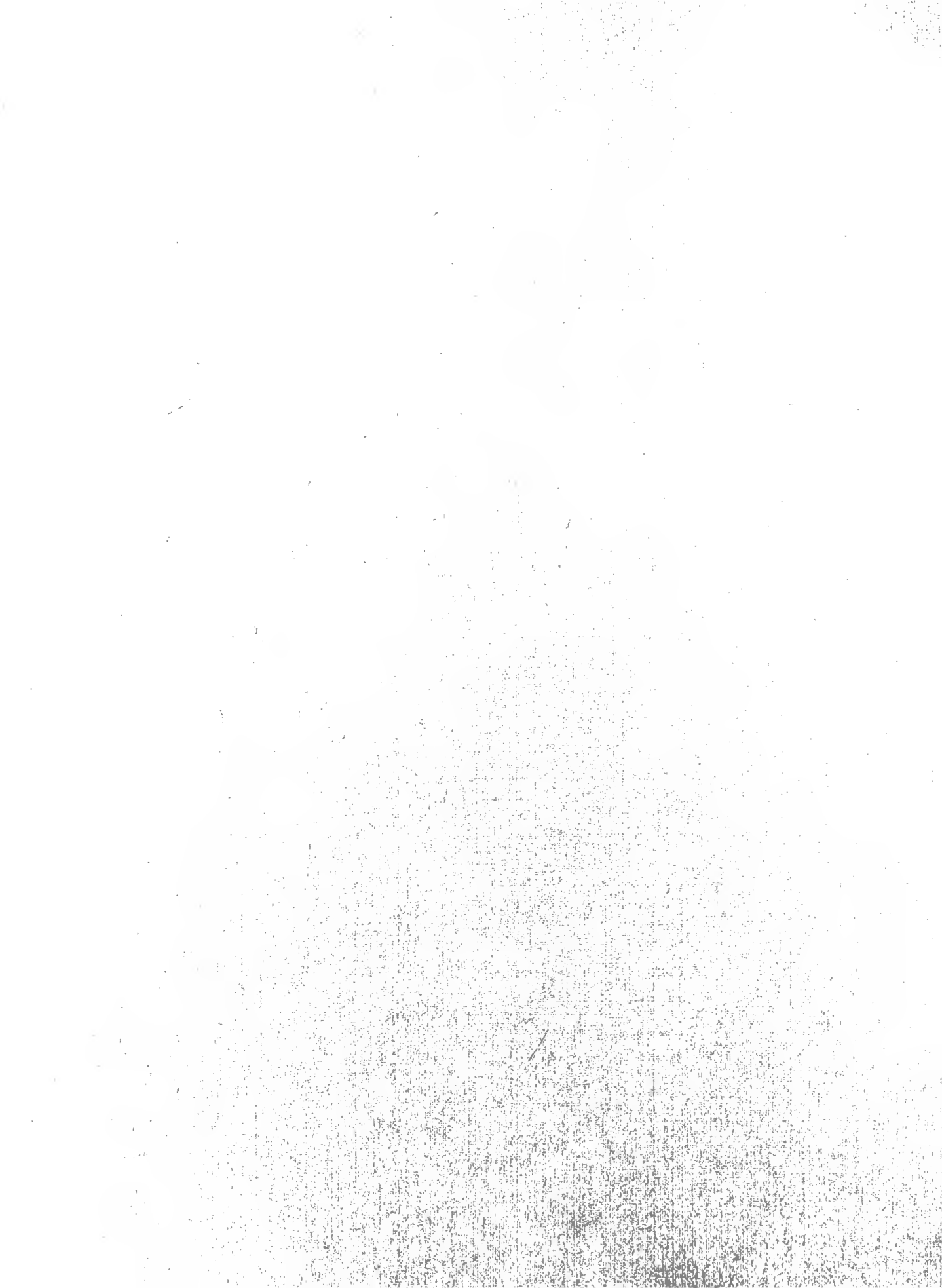
MARE Results for Annual Income Forecasts (1976-78)

Number of Segments	Largest Segments ^a				Smallest Segments ^b				Conglomerates in Each Subsample
	CN	SG	SADIFF	Average Rank	CN	SG	SADIFF	Average Rank	
2	.2261	.2210	+ .0051	.42	.3189	.2844	+ .0345	.55	15
3	.2543	.2110	+ .0433	.60	.2743	.2572	+ .0171	.53	10
4	.1786	.1664	+ .0122	.43	.2542	.2344	+ .0198	.57	7
5	.1566	.1421	+ .0145	.56	.2526	.2408	+ .0118	.44	6
6	.2212	.1956	+ .0256	.53	.2141	.2438	- .0297	.33	5
Average	.2074	.1872	+ .0202	.51	.2628	.2521	+ .0107	.48	
Mtd. Average ^c	.2099	.1872	+ .0227	---	.2637	.2504	+ .0133	---	

^a Annual earnings averaged \$8.4 million (between 22.1 and 3.2 million)

^b Annual earnings averaged \$1.7 million (between 3.2 and .9 million)

^c Weights based on Arthur Andersen [1978] survey of diversified companies.





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