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Appendix B

ASPECTS OF THE CROSS-SECTION ANALYSIS OF FINANCIAL STRUCTURE

IN ORDER TO PROVIDE a general picture of the relative size of the balance-sheet components that we studied, all items were expressed as a percentage of total assets. In addition, items whose turnover is of great interest were related to the volume of sales; these items include the various current assets and liabilities, fixed capital assets, and total assets. The degree to which the pattern of financial ratios will differ according to the basis of comparison used may be indicated by a description of the behavior of the ratio of total assets to sales, with respect to industry, size, and profitability.

RATIO OF TOTAL ASSETS TO SALES

Among minor industrial divisions[1] the ratio of total assets to sales ranges from 31 to 345 percent.[2] The median value is 94 percent, while the central half of the distribution, bounded by the first and third quartiles, lies between 74 and 120 percent.[3] While the absolute range of the ratio is wide, the range when compared with other turnover ratios is moderate.

The variation of the total assets/sales ratio, of course, reflects the joint effects of numerous factors, including profitability, the length of the production process, the degree of vertical integration, the volume of investments in affiliates (i.e., non-operating assets), differences in the proportion of value added by production, etc. For example, trade corporations have a small percentage of total assets in relation to sales since their business consists in the distribution rather than in the processing of inventories. Another factor in the case of trade corporations is, no doubt, the seasonal nature of wholesale and retail sales. For such concerns, the end of the fiscal year usually coincides with the calendar year end and represents the low ebb of operations. Since inventory is a very substantial part of total assets, the ratio of total assets to sales as indicated by year-end data will be even lower than the average for the year as a whole. Low ratios of total assets to sales (i.e., high turnovers of total assets) are recorded also by packing house products, mill products, and clothing and apparel; while at the other end of the scale (low turnovers of total assets) are airplanes, locomotives and

[1] For a list of the minor industrial divisions studied, see Appendix E.

[2] Excluding mining and quarrying "not elsewhere classified," which has an exceptionally high ratio.

[3] See Data Book (described in Chapter I, p. 2, fn. 1), Table C-28.

railroad equipment, sawmill products, chemicals proper, and petroleum and oil refinery products.

When the minor industrial divisions are classified into "producers'" and "consumers'" goods, the ratios of total assets to sales for the two groups are found to be 112 and 74 percent, respectively.[4] These ratios indicate that the turnover of total assets is considerably lower among the producers' goods industries than among the consumers' goods. The producers' goods industries are those which, on the average, have a longer period of processing and a greater proportion of fixed capital assets to total assets. They also tend to be of somewhat larger average total asset size; as analysis shows, the turnover of total assets tends to decrease significantly as average asset size of the minor industrial divisions increases. This behavior is probably related to the greater degree of vertical integration among the large concerns (to be discussed below) and to the fact that the volume of nonoperating assets (investments in affiliates) is relatively greater among the large corporations.

Among the minor industrial divisions the ratio of total assets to sales shows no significant variation with profitability. It might be expected that the more profitable the concern the more rapid would be its turnover of assets; as between industries, however, this relationship is apparently obscured by the operation of other elements such as those mentioned above—average asset size, degree of vertical integration, and proportion of investment in affiliates.

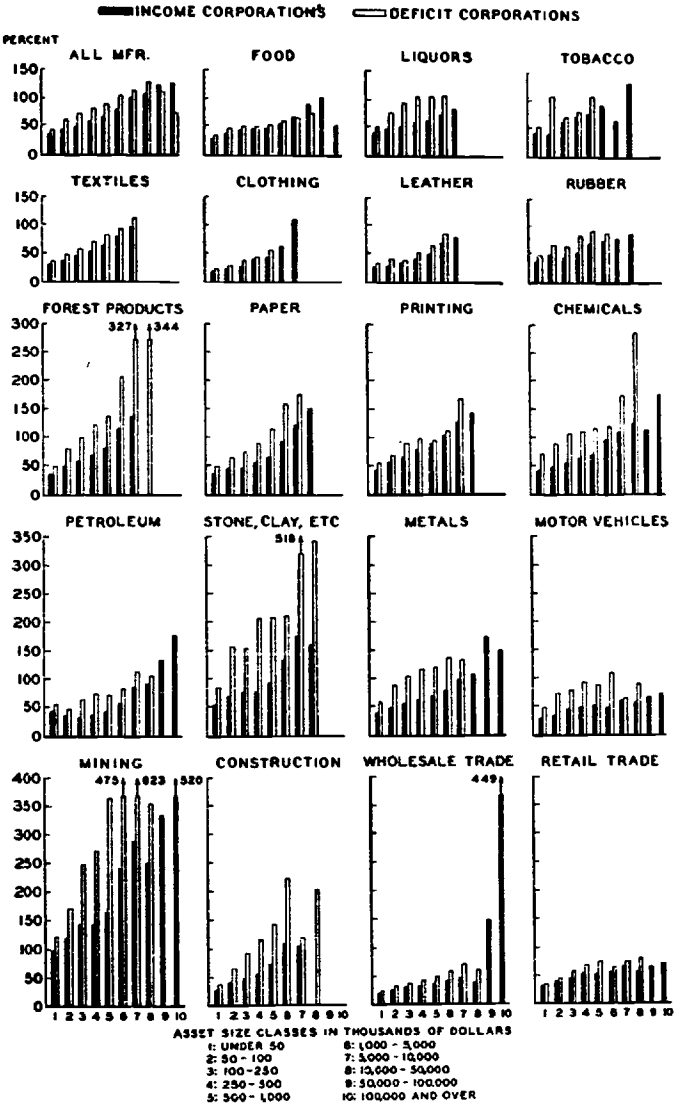
The industrial rankings of the total assets/sales ratio show a high degree of similarity between income and deficit corporations, demonstrating that the level of profitability does not alter the relative industrial rankings. Also, a high degree of similarity between 1937 and 1931 in the rankings indicates that while the absolute level of the ratio varies with the general level of business, the relative positions of different industries are fairly well maintained over short periods.

The variations of the total assets/sales ratio with size of concern, which are illustrated in Chart B-1, are of great interest, since they indicate how different the variations in size structure will be as the basis of comparison is changed. For every major industrial division[5] and for both income and deficit concerns the ratio rises as size of corporation increases. The difference in the turnover of small and large concerns is impressive, as is the substantial degree of consistency with which the ratio rises from size class to size class.

The consistent rise is explained by the behavior of the turnover of the major asset components. Two general points may be noted. (1) As size of corporation increases intercorporate investments expressed as a percentage of total assets rise substantially and thus contribute toward the rise in the total assets/sales ratio, since these assets (i.e., intercorporate investments) are of a nonoperating character. (2) The decreased turnover of inventory

[4] See Appendix E for the classification into producers' and consumers' goods.
[5] For a list of the groupings by major industries, see Appendix E.

Chart B-1—Ratio of Total Assets to Sales for Income and Deficit Groups of Major Industrial Divisions, 1937, by Asset Size*



*Based on Table C-16 in Data Book (National Bureau of Economic Research). Wholesale and retail trade figures are for the year 1938.

and fixed capital assets, as size of corporation increases, appears to be due to the greater degree of vertical integration found in large, compared with small, corporations. To appreciate the importance of this factor it is only necessary to think of the vertically integrated concern as an amalgamation of a group of firms formerly operating independently at various stages of the productive process. The integrated unit has the total assets of the combined enterprises but only the sales of the concern at the final stage of production. The less integrated the concern, therefore, other things being equal, the lower the ratio of total assets to sales. It may be noted also that the ratio of fixed capital assets to sales generally rises more sharply with size than the ratio of total assets to sales.[6] As would be expected, the turnover of total assets is substantially higher among the income than among the deficit corporations of comparable groups.

INTERACTION BETWEEN CLASSIFICATIONS

Although a three-way classification of the data permits the isolation of factors which we have labeled "industry," "size," and "profitability," it is clear that a possibility of correlation or "interaction" between these variables remains, rendering interpretation of the results ambiguous to some extent. For example, the 61 minor industrial divisions differ with respect to average size and profitability. Can we say to what extent apparent industrial differences are related to differences in size and profitability? Similarly, within major industrial groups, to what extent are variations with size possibly related to concealed minor industrial divisions of different average asset sizes or to the fact that there is a correlation between size and profitability? Even the comparison of income and deficit corporations of minor industrial divisions is not free from ambiguity, since the deficit corporations of a given division have been found to be consistently of smaller average asset size than the income corporations. On the other hand, if we compare the income and deficit corporations of given size classes among the major industrial groups, thus holding size constant, some of the differences may be due to the different industrial composition of the income and deficit groups.

In an attempt to determine whether apparent variations with industry, size, and profitability could conceivably be related to one another, the rankings of each ratio according to industry were compared with the

[6] The explanations of the variations in the total assets/sales ratio which have been given would seem to apply most forcefully to corporations of fairly large size. Yet the same type of variation is found as between concerns with $50,000 and $500,000 total assets. A consideration of specific industries, however, indicates a basis for integration effects even among such narrow size ranges. The smallest concerns in the clothing industry, for example, are engaged in producing part of a garment on a subcontracting basis. They operate in a hand-to-mouth manner, passing the product upon which they are working, as soon as it is completed, to the next higher stage of manufacture. They hold no sizable stocks of inventory, as all work is done to order. A similar explanation probably applies to such industries as textiles, motor vehicles, metals, and printing. In addition to integration other factors, such as intercorporate investments, operate to some degree even among the smaller size classes.

industrial rankings by asset size and by profitability.[7] Also, size variations within major industrial groups were examined to see whether they might be due to concealed minor industrial divisions of different average asset size; and data on profitability by size classes within the major industrial groups were used to determine whether variations of ratios with size are also associated with variations in profitability.

For data on the relationship between corporate size and profitability we relied on tabulations for the year 1936 made by Professor Crum.[8] We defined profitability as the ratio of net income to average net worth. (See Table C-25 in Data Book.) If a given ratio varied erratically with size, we examined the corresponding profitability data to see if they could account for the variations. If the size variations of a given ratio were regular and consistent, an examination was made of the corresponding profitability data to see whether the variations were consistent with each other. Income corporations exhibit relatively little variation, although profitability shows a tendency to decline slightly with size. Among deficit corporations profitability rises sharply with corporate size, particularly for corporations with total assets of less than $1,000,000. If a given ratio showed a similar variation for both income and deficit classes, its variation with size was considered to be independent of profitability. Generally, the financial ratios that do vary systematically with size behave in the same manner in both income and deficit divisions. The fact that the profit ratio varies differently in these two groups provides evidence that apparent size variations are not associated with profitability differences.

Since differences in average asset size and profitability among the minor industrial divisions are substantial, the question naturally arises whether some of the industrial variations may be related to these factors.[9] We have found that the correlation between average asset size and profitability

[7] These "tests" by inspection are, to be sure, of a crude sort. Only direct correlations are observed. That is, we do not consider to what extent, if any, industrial variations are related in part to average asset size and in part to average profitability. The rankings of minor industrial divisions according to average asset size and profitability are given in Table C-27 in Data Book.

[8] See W. L. Crum, *Corporate Size and Earning Power* (Cambridge, Mass., 1939). For our study figures for 1937 would have been preferable; but since such data were not readily available, we used the 1936 figures, as the relationship between profitability and size has been found to be highly stable over short periods of time.

[9] Cases in which statistically significant relationships appear are listed below:

Relationship with Size	
Direct	*Inverse*
Capital assets/total assets	Cash/total assets
Surplus/total assets	Receivables/total assets
Net worth/total assets	Current assets/total assets
Inventory/sales	Notes payable/total assets
Capital assets/sales	Current liabilities/total assets
Current assets/sales	
Total assets/sales	

(concluded on next page)

among the minor industrial divisions is negligible. This fact is important, since the interpretation of relationships would be ambiguous otherwise. Several relationships are of particular interest. The larger the average size of an industry and the higher its profitability, the smaller the proportion which notes payable form as a percentage of total liabilities. In the case of the notes payable/sales ratio there is also an inverse relationship with profitability. Cash and marketable securities are a smaller fraction of assets in the less profitable industrial divisions but are not affected by differences in average asset size. The larger the average size of corporation, the lower is the inventory turnover. On the other hand, differences in the level of profitability among industries are not reflected in differences in rates of turnover. The larger the average asset size and the more profitable an industry is, the larger is the proportion of surplus and of net worth as a whole to total liabilities.

Other types of interaction, particularly between size and industry, can be cited. The effect of size upon capital structure may vary from industry to industry. Some major industrial groups exhibit sharper and more consistent size variations than others. In certain cases the ratios of the major industrial groups tend to converge with increasing corporate size, indicating that industrial differences are less important among large concerns with a more complicated product structure. Finally, the output of a $50,000 concern in a major industrial group is in all probability greatly different from that of a $10,000,000 concern in the same industry; if so, size and industrial differences are associated. An extreme example of interaction is found in the "service" industry which contains at least two broadly distinct subdivisions: (1) relatively small personal service corporations such as accountants, advertising firms, and other professional groups; (2) large service corporations such as hotels and motion picture distributors.

SIGNIFICANCE AND STABILITY OF THE RESULTS

Throughout the analysis it was necessary to appraise the significance of statistical results in an objective fashion. Certain of the statistical tools that were employed are described here briefly.

Use was made frequently of the *coefficient of rank correlation*, which provides a measure of the degree to which there is similarity in the rankings

[9] (concluded)

Relationship with Profitability	
Direct	*Inverse*
Cash/total assets	Receivables/total assets
Marketable securities/total assets	Notes payable/total assets
Intercorporate investments/total assets	Notes payable/sales
Current assets/current liabilities	
Surplus/total assets	
Net worth/total assets	

The values of the rank correlation coefficients on which this list is based are given in Appendix D.

of the minor industrial divisions according to two balance-sheet characteristics: for example, according to inventory holdings and notes payable, or to inventory holdings and average asset size. A summary table of the rank correlation coefficients that were computed will be found in Appendix D.

Tests of significance, in the form of the *analysis of variance*,[10] were carried out to provide an objective comparison of the variation of the ratio *between* classes as against the variation *within* classes.[11] When the difference between classes was sufficiently great, compared with the variation within classes, to contradict the assumption that the ratios in the two classes might have been selected at random from a population of ratios, the difference was considered significant.[12] The significance of industry, size, and profitability classifications for a number of ratios was tested in this manner. Using the analysis of variance, we also tested a rough classification of the minor industrial divisions of the Internal Revenue data according to producers' and consumers' goods industries. The test of a division according to perishable and durable goods also would have been of interest, but such a test requires a more detailed industrial classification than was available.

The appraisal of variations in balance-sheet ratios among different size classes presents certain difficulties, since size variations must be considered not only with respect to their consistency but also with respect to their range. To introduce objectivity into the appraisal of size variations within the major industrial groups, a ratio's movement was called erratic if it changed its direction three or more times out of eight possible changes. In the absence of formal tests of the significance of mean differences between size classes, no specific criteria were adopted with respect to the significance of the range of variation of ratios. Variations were described as "extreme," "moderate," "mild," etc., without objective definitions of these adjectives.

In describing the industrial variations in financial structure, it often was found useful to summarize the minor industrial groups as if they formed a frequency distribution and to state the first and third quartiles and, occasionally, the range of variation. The first and third quartiles were taken as the fifteenth and forty-fifth industrial divisions, when the minor industrial divisions were ranked from low to high according to a given ratio. In giving the range of variation, very extreme items which represent unimportant

[10] For a description of this method, see R. A. Fisher, *Statistical Methods for Research Workers* (London, 1936) Chapter 8, or F. C. Mills, *Statistical Methods* (New York, revised edition, 1938) Chapter 15.

[11] It was impossible to test in a formal manner the significance of differences of ratios between the various classifications of the Bureau of Internal Revenue since data on individual corporations are lacking. We carried out tests, however, using the frequency distributions of individual corporations published in *Statistics of American Listed Corporations*, Part 1, issued by the Securities and Exchange Commission. For a detailed discussion of this source see Appendix A.

[12] In appraising results a 5 percent level of probability was used. That is, the difference between the mean ratios of two classes was considered significant if the probability that they would differ from each other as much as they did—assuming that the group of ratios is a random sample—was less than five in one hundred.

industrial divisions, such as commission merchants, were omitted when their values were far out of line with the other industrial divisions. To secure an objective measure of the degree of industrial variation, an index of relative variation was computed by expressing the interquartile range as a percentage of the median ratio for a given industrial group. (See Table 2, p. 10.)