

Michigan Business Studies

VOLUME VII

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PUBLIC UTILITY FINANCING

1930-35

BY

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UNIVERSITY OF MICHIGAN
SCHOOL OF BUSINESS ADMINISTRATION
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ANN ARBOR
1936

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AUTHOR'S NOTE

The author's interest in public utility finance began to develop in 1920 when, as an employee of a public utility company, he participated in "customer ownership" campaigns and watched the financial development of his employer company. During this period contacts and acquaintances were made, and later, circumstances permitted their expansion to a circle of utility executives without whose friendly assistance the writer's research in problems of public utility finance would have been quite impossible. The "friendly assistance" was seldom accompanied by complete agreement in ideas, but equally seldom was it a medium for conveying false information or a barrier to facts. Patient and time-consuming co-operation on the part of utility executives, in interviews and by correspondence, has aided materially in the preparation of this study and in other research projects.

Equally co-operative and helpful were investment bankers whose interest in the subject matter of this study was in common with the writer's. Mere acknowledgment is small payment for the assistance rendered by the business men in the utility industry and in the banking field.

The staff of the Bureau of Business Research performed its usual indispensable functions in the preparation of manuscript, editing, and proofreading. Particular acknowledgment is due to Mr. Roy Lyon, Research Assistant in the Bureau, for his careful work on the technical task of compiling the statistical evidence used in the treatment of the subject of diversification in Chapter 5, and for assisting in the laborious task of classification which is the basis for discussion in the earlier chapters. Colleagues on the faculty of the School of Business Administration were more than helpful with their suggestions and criticisms.

The author assumes all responsibility for the reasoning and conclusions contained in this study. It should be emphasized at the outset, however, that these conclusions constitute no more than suggested lines of reasoning which attempt

an orderly and logical presentation of the questions involved. They are not intended to apply categorically to the financial practices of all utilities nor to the policies of all holding companies. If they serve as an outline for discriminating study of specific problems and situations, their enumeration has not been in vain.

MERWIN H. WATERMAN

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APPENDIX I

DESCRIPTION OF THE STATISTICAL METHODS USED IN CHAPTER 5

This presentation describes in detail the statistical methods and reasoning used in Chapter 5 to reach conclusions concerning the effects of geographical diversification on the revenues and profits of holding company systems. Three types of variation in utility profits are considered: (1) cyclical changes, (2) residual fluctuations, and (3) secular growth and decline.

I. CYCLICAL CHANGES

Variations in gross revenues and profits arising from the influences of the business cycle were measured by the deviations of the actual reported figures from the computed lines of trend¹ as shown on Charts 2 to 6. These deviations are a combination of both cyclical and residual variations, but inasmuch as the cyclical element predominates, no effort was made to eliminate the residual influences in the supplementary mathematical tests described below.

The ultimate test of the stabilizing effects of holding company combination of operating units upon the combined system revenues and profits was confined to the visual interpretation of Charts 2 to 6, although previous mathematical tests were applied to a sufficient number of series to assure the adequacy of reliance upon visual interpretation. These mathematical tests added little or nothing to the visual evidence contained in the charts, and were therefore not included in the study. The case of the American Gas and Electric Company system is here included to demonstrate the adequacy of dependence on visual interpretation.

The profit figures of American Gas and Electric Company units for the period 1919 to 1934 were compared with their respective trend values, and the deviations from the trend lines were expressed in percentage form. From these deviations, the standard deviation of each operating company's profits was

¹ See Part 3 of this appendix.

determined.² These standard deviations were then averaged, and the average was compared with the similarly determined standard deviation of the combined system earnings. This comparison measures roughly the extent to which deviations cancelled each other in the process of combination, and thus provides a measure of the stabilization so effected.

Strictly speaking, the percentage deviations should have been weighted with some suitable weights, such as the trend values of the various companies' profits for the year in question, because a deviation of a constituent company's earnings is only as important in influencing the combined earnings as the weight of the constituent company's earnings in dollars. This weighting could have been accomplished only by unjustifiably laborious calculation. The test for cyclical stability was not designed as a refined one in the sense that residual variations were eliminated first, but rather it was designed to provide only an indication of the *direction* of earning movements during swings of the business cycle. Furthermore, no operating company in any of the systems under analysis was so overwhelmingly large as to distort the results greatly even though weighted elements were not employed.

The table on page 137 shows the application of the above method and theory to the American Gas and Electric Company situation. Here it is seen that the average of the company deviations, taken together, is about the same as the standard deviation for the combined system. This fact indicates that, during a business cycle, the *direction* of earnings above or below trend is about the same for the "combined system" and its constituents; all of which is perfectly evident from a glance at Chart 2.

It might be argued that there is evidence of the stabilizing influence of combination in the fact that the standard

² The formulas used for measuring cyclical changes (unadjusted for residual variations) are as follows:

$$\text{Percentage Deviation from Trend} = \frac{\text{Actual}}{\text{Trend}} (100) - 100$$

$$\text{Standard Deviation } (\sigma) = \sqrt{\frac{\sum x^2}{N} - \left(\frac{\sum x}{N}\right)^2}$$

where x is the percentage deviation, and N the number of years (16).

Operating Company	Standard Deviation from Trend %
Atlantic City Electric Company	32.34
Indiana General Service Company	19.71
Indiana and Michigan Electric Company	34.45
Ohio Power Company	20.21
Scranton Electric Company	37.73
Wheeling Electric Company	23.47
Average (Arithmetic mean)	27.99
Combined system	24.19

deviation of "combined system" earnings was 24.19 whereas the standard deviations of the constituents ranged from 19.71 to 37.73. But reasoning based on this premise overlooks the obvious fact that holding company system performance is a weighted average and, as such, is bound to lie between the respective performances of the constituents. True cyclical stability of any consequence would exist only where the standard deviation of the combined system was materially less than that of the average of all units in the system; in other words, earnings moving in different directions should largely cancel out when combined, leaving nothing but the trend in the holding company earnings. Such was not the situation in any of the cases to which the tests were applied in the process of this study.

2. RESIDUAL FLUCTUATIONS

When the deviations from trend were plotted, the earnings of the several companies in each system showed simultaneous cyclical movements. However, these movements were interrupted by irregularities due to many causes, some of which are outlined in the study proper. It was decided to isolate these variations to determine the extent to which combination might effect their cancellation, with resulting stability to combined system profits.

The isolation of the residual variations involved the construction of a five-year weighted moving average to be used as a base from which to measure the deviations representing the residual variations. For each operating company, the five-year moving average was computed from the actual dollar

earnings, weighted by the coefficients obtained from the expansion of the binomial $(a + b)^4$, which coefficients are 1, 4, 6, 4, 1. To illustrate, the five-year average for a company for 1921 was computed as follows:

1919 earnings	weighted	1 time	= x_1
1920	"	4 times	= x_2
1921	"	6 times	= x_3
1922	"	4 times	= x_4
1923	"	1 time	= x_5

$$\text{Average for 1921} = \frac{x_1 + x_2 + x_3 + x_4 + x_5}{16}$$

For 1922, the 1919 earnings were dropped off, and the 1924 earnings added, and the 1920 earnings were given a weight of 1, the 1921 earnings a weight of 4, etc.

The binomial-weight average, as compared with an un-weighted moving average, has the advantage of allowing for trend and also for the business cycle. The cyclical allowance is illustrated by the fact that, if the 1929 earnings had not been heavily weighted, the earnings for 1930 and 1931 entering into the average would have had undue weight in the typical or average earnings figure for 1929; hence the 1929 average would not have represented the cyclical value of 1929 earnings, and deviations figured from this computed base would not have had the cycle eliminated from them.

The residual variations were measured by taking percentage deviations from the moving average. Charts 7 to 10 show these deviations in graphic form. The standard deviation for each series was computed by the use of the formula given above, and the degree of cancellation of residual variations moving in opposite directions is indicated by comparison of the average of the standard deviations for the companies in each system with the standard deviation of the holding company system itself. These standard deviations are shown in Charts 7 to 10. Here it is seen that the variability of the combined system is reduced by cancellation of residual variations in the component series. The financial significance of this cancelling influence was tested by a comparison of the

deviations from moving average with the "times-fixed-charges-earned" ratios, presented in the main part of the study.

3. SECULAR TREND

The secular trend (either growth or decline over a long period) is a statistical summary or an average. It represents, in the form of a line or a curve, what would be the behavior of a series of earnings over a period of years if there were no variations due to the business cycle or to fortuitous causes. Stated differently, the trend is the resultant of forces which persist for a considerable period in spite of the operation of cyclical or chance causes in the meantime.

In the series of revenues and profits used in this study, the compound-interest curve was chosen to represent the trend, this appearing to give the best description of the true long-time growth for the period 1919 to 1934 as a whole. Since Charts 2 to 6 are ratio or logarithmic charts, the compound-interest curves there appear as straight lines. Actual fitting was done mathematically by the method of least squares, the type equation being:

$$y = ab^x$$

It should be stated that the compound-interest curve as used in this study describes the secular trend of dollar earnings from 1919 to 1934 only, and is in no sense to be interpreted as being suitable for extrapolation into the future for purposes of estimating capital needs or for other purposes. The compound-interest curve is much too optimistic for these purposes; further, while price changes due either to company concessions or to public authority may not be as important to a utility as to an industrial company because of the relative stability of prices for periods of time, nevertheless allowance for them should be made either through the use of volume statistics (i.e., kilowatt-hours) or through the use of price index numbers. In short, the determination of future growth or decline for a utility or for any other industry involves more than the mere application of a mathematical law to series of earnings for a sixteen-year period, and much common-sense reasoning inexpressible in mathematical terms is necessary.

APPENDIX II

CHARACTERIZATION BY SIZE, INDUSTRY, AND LOCATION OF HOLDING COMPANY SYSTEMS ANALYZED IN CHAPTER 5

In the following characterizations of the subsidiary companies included in the several holding company systems, the "Industry" and "Location" descriptions are representative of conditions in 1934. The "Size" column evidences the range of gross revenues during the period 1919 to 1934.

AMERICAN GAS AND ELECTRIC COMPANY SYSTEM

Subsidiary	Size (range of gross revenue, in millions of dollars)	Industry				Location
		Electric (% of gross)	Gas (% of gross)	Trans- porta- tion (% of gross)	Other* (% of gross)	
Atlantic City Electric Company	1- 8	99	—	—	—	New Jersey (Atlantic City)
Indiana General Ser- vice Company	1- 4	95	—	—	5	Indiana (Marion, Muncie)
Indiana and Michigan Electric Company	1- 8	100	—	—	—	Indiana (South Bend, Elkhart)
Ohio Power Company	10-20	99	—	—	1	Ohio (Lima, Canton, Portamouth, Steuben- ville, Ironton)
Scranton Electric Company	1- 8	93	—	—	7	Pennsylvania (Scranton)
Wheeling Electric Company	1- 3	100	—	—	—	West Virginia (Wheeling)

* "Other" includes steam heating.

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AMERICAN POWER AND LIGHT COMPANY SYSTEM

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Subsidiary	Size (range of gross rev- enue, in millions of dollars)	Industry				Location
		Electric (% of gross)	Gas (% of gross)	Trans- porta- tion (% of gross)	Other* (% of gross)	
Central Arizona Light and Power Company	1- 4	82	18	—	—	Arizona (Phoenix)
Kansas Gas and Elec- tric Company	1- 6	100	—	—	—	Kansas (Wichita, Pittsburg)
Montana Power Com- pany	5-10	84	13	†	3	Montana (Butte, Helena, Great Falls, Billings)
Nebraska Power Com- pany	1- 7	100	—	—	—	Iowa (Council Bluffs); Nebraska (Omaha)
Northwestern Electric Company	1- 4	99	—	—	1	Oregon (Portland); Washington (Vancouver)
Pacific Power and Light Company	1- 5	98	—	—	2	Washington (Walla Walla, Astoria)
Portland Gas and Coke Company	1- 5	—	100	—	—	Oregon (Portland); Washington (Vancouver)
Superior Water, Light and Power Company	0.6- 1	38	30	—	32	Wisconsin (Superior)
Texas Power and Light Company	1-10	100	—	—	—	Texas (Waco)
Washington Water Power Company	1-10	85	—	10	5	Washington (Spokane)

* "Other" includes water and steam.

† 1932 last year for transportation; amount negligible.

COMMONWEALTH AND SOUTHERN CORPORATION SYSTEM

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Subsidiary	Size (range of gross revenue, in millions of dollars)	Industry				Location
		Electric (% of gross)	Gas (% of gross)	Trans- porta- tion (% of gross)	Other* (% of gross)	
Alabama Power Com- pany	10-20	98	†	1	1	Alabama (Anniston, Birmingham, Gadsen, Mobile, Montgomery)
Central Illinois Light Company	1-10	66	25	9	Illinois (DeKalb, Pekin, Peoria, Springfield, Sycamore)
Consumers Power Company	10-30	76	23	1	Michigan (Battle Creek, Bay City, Flint, Grand Rapids, Jackson, Kalamazoo, Lan- sing)
Georgia Power Com- pany	10-30	79	1	17	3	Georgia (Atlanta, Augusta, Columbus, Macon, Rome)
Southern Indiana Gas and Electric Company	1- 4	66	18	12	4	Indiana (Evansville, Mount Vernon)

* Includes heating, water, and ice revenue.

† Gas properties sold during 1929, when gas revenue amounted to 1 per cent of gross.

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Subsidiary	Size (range of gross revenue, in millions of dollars)	Industry				Location
		Electric (% of gross)	Gas (% of gross)	Trans- porta- tion (% of gross)	Other (% of gross)	
Baton Rouge Electric Company	0.1- 1	64	25	9	2	Louisiana (Baton Rouge)
El Paso Electric Company	1- 4	78	—	19	3*	Texas (El Paso, Van Horn); New Mexico (Hillsboro, Las Cruces)
Key West Electric Company	0.3- 0.1	100	—	—	—	Florida (Key West)
Ponce Electric Company	0.1- 0.4	100	—	—	—	Porto Rico
Puget Sound Power and Light Company	10-20	83	1	11	5†	Washington (Olympia, Seattle)
Savannah Electric and Power Company	1- 3	82	—	18	—	Georgia (Savannah)
Virginia Electric and Power Company	10-20	67	6	26	1	Virginia (Norfolk, Richmond, Suffolk); North Carolina (Columbia, Plymouth)

* Revenue from bridge over Rio Grande.

† Steam heat.

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