AN EMPIRICAL APPROACH TO THE PROBLEM OF DETERMINING THE INCIDENCE OF CORPORATION INCOME TAXES

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by

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PREFACE

This paper is an application of a specific statistical technique to a broad and crucial economic problem. The technique is regression and correlation analysis, and the problem is the incidence of corporation income taxes. This general topic--the incidence of these business profits taxes--is a subject of great interest and importance, having significant implications in national fiscal policy and corporation financial policy, as well as various ramifications in other areas, as accounting theory and practice. The unique contributions of this study are two: (1) this study is, to my knowledge, the first attempt to apply the statistical techniques of regression and correlation analysis to a solution of this problem; and (2) this is the first time in the United States that there have been analyzed, with regard to this problem and by individual industrial sectors, other groups of corporations besides those engaged in manufacturing. It is my sincere hope that the use of this different statistical approach and the more detailed industry coverage will provide us with additional insight.

The paper itself is divided into four parts. Part I outlines the problem, pointing out its importance and conflicting viewpoints regarding it; it also highlights the theoretical considerations underlying the differing viewpoints. Part II, in discussing the applica-

tions of statistical techniques to incidence determination, summarizes the methodology and results of six earlier empirical studies and then carefully examines the applicability of, and the procedures involved in a regression and correlation approach to this problem. In Part III are contained the results of this statistical treatment, Chapter VI for the aggregate economy and Chapter VII for the individual industrial divisions. In addition to the explanations and evaluations contained in the narrative, there are also provided twenty-two scatter diagrams and numerous tables giving detailed data, for the aggregate economy and (where appropriate) for each industrial division, on least-squares and rank order coefficients of correlation; tests of significance; equations of the line of regression, with standard error of estimates; and confidence intervals for the coefficients of regression. Basic information on revenue, income, taxes, and the like (in thousands of dollars) as well as selected intermediary statistical data are also provided, and are found principally in the several appendix tables. Part IV, the last part in our study, summarizes and evaluates the results of our findings.

Invaluable assistance was provided by many persons in the execution of this study. In the first place, I am greatly indebted to my adviser, Dr. Lawrence H. Seltzer, Chairman of the Department of Economics, for his careful guidance and his penetrating criticism. Also, it should be mentioned that it was in his fascinating seminar in problems of monetary and fiscal policies that there was developed a broad background and a realistic setting for the specific topic of this paper.

I am also indebted to another of my teachers, Dr. John M. Mattila, who both as statistical coadviser and as Chairman of the Graduate Committee of the Department of Economics devoted much time to my project. As consultant on statistical methodology he was continually examining the details of my procedure, calculations, and tabular presentations as they were being developed. In his capacity as Chairman of the Graduate Committee he expedited numerous matters of an administrative nature.

Acknowledgment is due my superiors in the Treasurer's office at Chrysler Corporation. Needless to say, access to desk calculators and other office equipment--on nights, Saturdays, Sundays, and holidays--was invaluable in the completion of the statistical analyses. Appreciation is also expressed for numerous other courtesies extended throughout the undertaking of this project.

With regard to the "No. 1 person" in my life, it would be trite to the point of insult to say that my wife's assistance on this project--proofreading statistical data with me, typing both the draft and the final copy, and performing other tedious but necessary chores incident to such a study--was invaluable. Far closer to the truth would it be to say that, without her willingness to shoulder practically the entire load of maintaining the house and bringing up the children, with little assistance from me in the performance of her chores but rather with the necessity of her performing a large portion of mine; without her willingness to give up, for several years, a normal social life; without her willingness completely to subordinate to my academic pursuits, outside activities as a vocal soloist;--without her willingness to accept these responsibilities, together with the making of other

sacrifices the full extent of which I may never be aware, not only would I never have been able to complete this thesis;--I would never have been able even to have finished my first graduate course.

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Dearborn, Michigan
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PART I

THE PROBLEM OF INCIDENCE

CHAPTER I: IMPORTANCE OF TOPIC

> The corporate income tax is probably the most controversial element in the American tax structure. This tax has been criticized on the ground that it places a severe brake upon business incentives and economic expansion, that it constitutes a barrier to the establishment of new businesses, and that it favors one kind of capital structure over another. It is also widely claimed that the corporate income tax is inequitable. This contention arises mainly from the fact that corporations pay a substantial tax on earnings, and stockholders also pay full personal income taxes on their dividends.... Thus, the income of corporations is said to be subject to "double taxation."
>
> Whether these criticisms are valid depends in large measure on who bears the tax.
>
> Lewis H. Kimmel[1]

The subject of taxation, it has been said by one of America's most distinguished tax economists, is explosive, and "discussions of it tend to produce heat rather than light."[2] Even in trying to approach the subject in a detached and objective manner, we find ourselves confronted with a wide diversity of viewpoints in many areas of taxation. One of these areas, that of federal corporation income taxes, seems to be particularly subject to a multiplicity of opinions, attitudes, and interpretations. Every feature of these taxes--even their very existence--is under question. Thus, we might read in one source that cor-

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[1]Lewis H. Kimmel, Taxes and Economic Incentives (Washington, D. C.: The Brookings Institution, 1950), p. 17. Italics supplied.

[2]Comment of Roy Blough, as reported in National Industrial Conference Board, The Need for Federal Tax Revision ("Studies in Business Economics," No. 11; New York, 1947), p. 48.

poration profits may be a proper object of higher taxation.[3] A second source, on the other hand, may advise an early reduction in these taxes.[4] Or we may even be told that corporation profits taxes should not exist at all.[5] Furthermore, those who believe that corporation income taxes should, under certain conditions, be reduced may arrive at their conclusions for diametrically opposite reasons.[6] Then, we

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[3]See "The CIO's Views on Taxation," from testimony before the Senate Finance Committee, July 16, 1951, on behalf of the Congress of Industrial Organizations, by Stanley H. Ruttenberg, Director, Department of Education and Research, CIO, as reprinted in Clifton H. Kreps, Jr. (ed.), Federal Taxes ("The Reference Shelf," Vol. XXIV, No. 2; New York: The H. W. Wilson Company, 1952), pp. 111-21, especially pp. 118-20.

[4]See, for example, Taxes and Economic Progress (Statement of Machinery and Allied Products Institute for presentation to the Committee on Ways and Means of the House of Representatives, to be presented by George Terborgh, Research Director; Chicago: Machinery and Allied Products Institute, 1950), especially pp. 16 and 43.

[5]"Corporations as such should not be taxed; only individuals should be taxed." Comment of Bradford B. Smith, as reported in National Industrial Conference Board, op. cit., p. 22. See also Henry C. Simons's "Eighth Proposal" in his Federal Tax Reform (Chicago: The University of Chicago Press, 1950), p. 40.

[6]Note, for example, the difference in approach and thinking of the Machinery and Allied Products Institute and of Harvard University Economics Professor Seymour E. Harris on this point. In Taxes and Economic Progress we read the following:

> It is against this background that the effect of the corporate income tax must be appraised. It erodes the only source of capital funds from which most companies can grow, hence slows down growth itself. In so doing it slows down the rate at which companies with new ideas, techniques, and products can expand their position in the market. By retarding the growth of the innovative and efficient, it lessens the intensity and effectiveness of competition, in effect holding an umbrella over the incompetent who would otherwise be eliminated. The result is an impairment of the dynamism and vitality of the economy and a drag on progress.--Machinery and Allied Products Institute, op. cit., p. 13.

Professor Harris, writing in 1947, presents a strikingly contrasting reason for a possible reduction in corporation income taxes:

learn that still another basic problem of taxes on corporate income is not only that it might improperly--but deliberately--hurt stockholders, or consumers, or business expansion, or corporate financial structure, but rather that, once the tax is levied, its burden may not at all fall where it was intended, wherever that may have been.[7] Finally, as an example of the more extreme confusion that may exist on this point, we understand that corporation income taxes are sometimes said even to result in both "double taxation" of dividend income and an increase in prices to consumers by the amount of the tax![8]

> If, on this assumption of incidence [i.e., the shifting of these taxes to consumers], corporations were to reduce prices in response to cuts in the corporate taxes, there would be a valid case for reduction of corporate taxes.--Seymour E. Harris, The National Debt and the New Economics (New York: McGraw-Hill Book Company, Inc., 1947), p. 214.

[7]William H. Anderson has made this observation:

> The question of tax incidence is of particular significance in business taxation, because unless the tax remains where it is intended, it fails as a business tax. If it is shifted forward, it becomes a tax on consumers; if it is shifted backward, it becomes one on the factors of production. Furthermore, the social and economic effects of the tax become different from the effects intended.--William H. Anderson, Taxation and the American Economy (New York: Prentice-Hall, Inc., 1951), p. 303.

The same point has also been made by Philip E. Taylor:

> One of the more serious sins of omission in business tax theory is its failure to relate tax incidence to tax justification. Business taxes whose incidence finally falls upon consumers of the products of business can hardly be justified in terms of special business benefit or ability.... We see here a demonstration of the importance of a fact so frequently reiterated throughout this book--that unless incidence is reasonably accurately determinable, the consequences of a particular tax may be quite foreign to theoretical intent.--Philip E. Taylor, The Economics of Public Finance (Revised Edit.; New York: The Macmillan Company, 1953), pp. 465-66.

[8]Both Professors Thomas M. Hill and M. A. Adelman of the Massachusetts Institute of Technology have pointed this out in recent articles.

The problem of the incidence of corporation income taxes is thus seen to be one of tremendous importance. The validity of the entire "double-taxation" controversy, for example, hinges on specific assumptions as to who bears these taxes.[9] Also, fundamental answers to the whole problem of new equity financing for corporations revolve in great part around this question.[10] Both federal fiscal policy and corporation financial policy are profoundly influenced by the kinds of assumptions held, perhaps unconsciously, by the policy makers as to the incidence of corporation income taxes.[11]

Professor Hill writes:

> One does in fact hear reference to the "double taxation" of corporate earnings, sometimes from the same persons who maintain that the corporate tax is a cost to be passed on to the customer.--Thomas M. Hill, "Some Arguments against the Inter-period Allocation of Income Taxes," The Accounting Review, XXXII (1957), 357.

In a similar vein Professor Adelman notes:

> Business opinion appears to be that the tax is largely shifted to consumers in higher prices; this is not easily reconciled with the accompanying belief that the tax has had undesirable effects on business performance and investment. --M. A. Adelman, "The Corporate Income Tax in the Long Run," The Journal of Political Economy, LXV (1957), 151.

[9]See Richard Goode, The Corporation Income Tax (New York: John Wiley & Sons, Inc., 1951), p. 45. See also John F. Due, Government Finance--An Economic Analysis (Homewood, Illinois: Richard D. Irwin, Inc., 1954), p. 231. For a somewhat fuller approach to the "double-taxation" controversy, see Richard Goode, op. cit., pp. 24-26. For a brief but strong statement "against" the "double taxation" of dividend income, see Roswell Magill, "What Business Wants in the Tax System," Commercial and Financial Chronicle, February 6, 1947, p. 769.

[10]See Dan Throop Smith, Effects of Taxation--Corporate Financial Policy (Cambridge, Massachusetts: The Riverside Press, 1952), pp. 85-104.

[11]It might be mentioned that this problem extends beyond the disciplines of economics and business management. Accounting literature, for example, currently contains numerous discussions which ultimately

revolve heavily around the issue of tax incidence. Refer, in the July, 1957, issue of The Accounting Review, to the following two articles as illustrations of these discussions:

(1) Thomas M. Hill, op. cit., pp. 357-61; and

(2) Robert T. Sprouse, "The Significance of the Concept of the Corporation in Accounting Analyses," pp. 369-78.

CHAPTER II: CONFLICTING VIEWPOINTS ON THE INCIDENCE OF CORPORATION INCOME TAXES

> Corporate taxes are simply costs. The method of their assessment does not change this fact. Costs must be paid by the public in prices, and corporate taxes are thus in effect concealed sales taxes.
>
> Enders M. Voorhees[1]

> ...the [federal income] tax on the corporation is, in the final analysis, a tax on its individual stockholders....
>
> Guaranty Survey[2]

> The final, and most likely, course is a combination of the first three [i.e., shifting forward, shifting backward, and absorbing the tax].
>
> Wall Street Journal[3]

> I wish simply to record myself among the skeptics on the subject of the incidence of the corporation income tax.
>
> Dan Throop Smith[4]

As we can readily see from the above quotations, there is no general agreement as to the incidence of corporation income taxes. Economists in general freely admit their difficulty with this problem.[5]

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[1]Comment of Enders M. Voorhees, as reported in New York Times, October 10, 1943, sec. 5, p. 11.

[2][Anon.], "The Future of the Income Tax," Guaranty Survey, June, 1957, p. 2.

[3][Anon.], "Taxes, Taxes, Taxes," Wall Street Journal, April 15, 1957, p. 1.

[4]Dan Throop Smith, Effects of Taxation--Corporate Financial Policy (Cambridge, Massachusetts: The Riverside Press, 1952), p. 93.

[5]Lewis H. Kimmel has commented: "Perhaps the best way of describing the present situation is to say that, insofar as the corporate income tax is concerned, incidence theory is in a state of flux." Lewis H. Kimmel, Taxes and Economic Incentives (Washington, D. C.: The Brookings Institution, 1950), p. 27.

Furthermore, this difficulty has also been experienced by businessmen: "The uncertainties of economists," wrote one tax authority, "are fully matched by those of businessmen."[6]

In first briefly surveying opinions of businessmen on this issue, we may take note both of explicit statements on this problem and of discussions on related topics in which assumptions regarding incidence are of crucial importance. In so doing we find business opinion, both explicit and implied, on both sides of the issue. With reference to the position that corporation income taxes are shifted, we may note, in addition to the statement of Mr. Voorhees at the beginning of this chapter, the following comments in an article in the Monthly Letter of the National City Bank of New York, under the sub-heading "Business Taxes Are Passed On":

> Most types of taxes come in time to be regarded as part of the regular costs of doing business and are passed on to the purchaser whenever possible. While the ability to do this varies greatly, of course, from company to company, and is affected by such conditions as changing demand and price controls, in the end prices generally must be adjusted to

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See also Richard Goode, The Corporation Income Tax (New York: John Wiley & Sons, Inc., 1951), p. 44; John F. Due, Government Finance--An Economic Analysis (Homewood, Illinois: Richard D. Irwin, Inc., 1954), p. 232; and O. H. Brownlee and Edward D. Allen, Economics of Public Finance (2nd Edit.; New York: Prentice-Hall, Inc., 1954), p. 233.

The following two statements by Professor Harris, both from The National Debt and the New Economics, however, leave me somewhat perplexed:

> (1) The incidence of the corporation income tax in particular is not clear.--Seymour E. Harris, The National Debt and the New Economics (New York: McGraw-Hill Book Company, Inc., 1947), p. 47; and
>
> (2) Although there is fairly general agreement on the incidence of the corporate income tax, the incidence of other taxes arouses much controversy.--Ibid., pp. 216-17.

[6]Dan Throop Smith, op. cit., p. 93.

> costs if business is to remain healthy and have incentive to go ahead.[7]

Next, for an example of a discussion on a different aspect of taxation but containing the underlying assumption that corporation income taxes are shifted, we read in the March, 1957, issue of Chrysler Magazine, a company publication for employees, the following statement:

> On a car delivering to the consumer for an average of around $2,000, more than $500 of the purchase price consists of tax, $146 of it federal excise tax.[8]

The figure "more than $500" was presumably gotten from data prepared by the Automobile Manufacturers' Association and printed in a table on the following page. In this table, which shows a total tax figure per car of $559.83, there is placed immediately ahead of the federal excise tax figure of $146.00, an item for $150.00 entitled "Estimated income and other taxes paid by auto manufacturer, exclusive of Federal excise tax."[9] Thus, the whole of the income tax is apparently considered shifted forward in the product price.

In contrast to the above viewpoint on the incidence of corporation income taxes, the Guaranty Survey, as noted at the beginning of this chapter, clearly contends that the burden of the tax falls on the pro-

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[7] [Anon.], "Tax Payments by Large Corporations," Monthly Letter on Economic Conditions and Government Finance, National City Bank of New York, July, 1951, p. 78. In the next paragraph of the Monthly Letter an attempt is apparently made to demonstrate the veracity of this contention by the citing and analyzing of certain corporation profit and income tax data and ratios for the two years 1929 and 1949.

[8] [Anon.], "The Ghost That Cripples," Chrysler Magazine, March, 1957, p. 3. The "ghost" in this "ghost story" is the federal excise tax.

[9] Ibid., p. 4.

prietary equity. This position is dramatically maintained--but by implication--in the "Statement" of the Machinery and Allied Products Institute mentioned earlier in this study.[10] In this document we observe the following paragraph:

> Let me illustrate the effect of the income tax on the growth of a hypothetical corporation. Suppose that in the absence of the tax it could make 15 per cent per annum on its net worth, paying out one-third in dividends and plowing back the remaining 10 per cent into expansion. After 20 years of this reinvestment the increase in net worth would equal 5.7 times the original amount. With an income levy of 38 per cent, however, the rate of profit after tax is reduced to 9.3 per cent of net worth. Assuming again that dividends are one-third of earnings, the remainder to be plowed back shrinks to 6.2 per cent. Consistent reinvestment at this rate over 20 years will expand net worth by only 2.3 times the starting sum. Thus over this comparatively brief period of two decades the tax reduces the growth of the company by 60 per cent. Over 50 years, the reduction is of course more striking still, 83 per cent.[11]

If we carefully follow through the calculations indicated in the above quotation, we shall discover that neither in the short run nor in the long run is there considered to be any possibility of the firm's recovering any portion of the tax. The incidence falls entirely--and apparently for all time--on the proprietary equity.

Disagreement on the issue of incidence, as stated earlier, is not peculiar to the business community, but is shared by professional economists. Thus, we see that Otto von Mering gives general--but not unqualified--support to the shifting hypothesis:

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[10] Taxes and Economic Progress (Statement of Machinery and Allied Products Institute for presentation to the Committee on Ways and Means of the House of Representatives, to be presented by George Terborgh, Research Director; Chicago: Machinery and Allied Products Institute, 1950).

[11] Ibid., p. 14.

> The foregoing discussion has shown that income taxes can be shifted and that the opposite opinion is an illusion. The shifting, it is true, will not be so immediately effected and it will not, as a rule, go so far as in the case of commodity taxes. Moreover, it can be traced only with great difficulty, and it will be a good deal less intentional than the transfer of other tax burdens. Nevertheless, some shifting does take place in most cases of income taxation.[12]

In contrast to this viewpoint we may note the opinion of Philip E. Taylor, who wrote in 1953 as follows:

> We adopt, therefore, the commonly held conclusion that taxes imposed on net income are not shiftable.[13]

In concluding this discussion on conflicting viewpoints, it will be worth our while to observe an interesting contrast in the interpretation of certain aggregative corporate financial and tax data, with specific regard to the incidence problem, as afforded in the writings of two eminent Harvard University faculty men. Commenting upon the corporation profit-tax relationship of the World War II period, Economics Professor Seymour E. Harris states:

> Some facts suggest the likelihood that income taxes and corporate income taxes are passed on. If, for example, corporations bear the burden of corporate income taxes, the rise of corporate profits in the war period from 4 billion dollars to between 9 and 10 billion dollars (after taxes) needs explanation. Corporations were apparently able to increase their profits after taxes by between 5 and 6 billion dollars despite the fact that corporate income and excess profits taxes rose from 1 billion dollars up to 16 billion dollars.

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[12]Otto von Mering, The Shifting and Incidence of Taxation (Philadelphia: The Blakiston Company, 1942), p. 214.

[13]Philip E. Taylor, The Economics of Public Finance (Revised Edit.; New York: The Macmillan Company, 1953), p. 274. Professor Taylor recognizes "the possibility of long-run exceptions to the general rule that net income and excess profits taxes are not shifted." These exceptions would arise, however, only where the tax is not general, that is, if it were limited to a narrow geographical area and/or to certain types of business. P. 463.

> The figures indicate that not only did they pass on the additional taxes but they also increased their net profits by between 125 and 150 per cent--and that despite the additional obstacle of price control. Our wartime experience suggests that corporate income taxes may well be passed on, or at least that, in the short run, the orthodox theory of incidence is not borne out.[14]

Putting a different interpretation on the data of roughly this same period, Finance Professor Dan Throop Smith writes:

> The period since 1939, during which we have had continued high corporate tax rates, has been a peculiarly difficult one in which to test any hypotheses about the incidence of the corporation income tax or against which to consider the desirability of alternative policies. A war with its inevitable inflation and a major defense effort with further inflation arising to a considerable extent from neglect and temporizing have led to a sustained high level of activity and recurring inflationary wage increases. These forces have produced a continued seller's market, interrupted only infrequently and to minor degrees. Under these conditions, a shifting of the tax would be more nearly possible than under almost any other conditions.
>
> And quite apart from tax shifting, gross profits could become so high that even with higher tax rates, net profits could rise greatly. The fact of higher net profits in spite of the increase in the corporation income tax, as was stated earlier, neither proves nor disproves anything about shifting. When the underlying economic conditions are such as to make public relations a principal determinant of price and profit policy (as has been the case in those industries with persisting shortages and abnormal dealer profits), an analysis of pricing in traditional equilibrium terms is inadequate.[15]

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[14]Seymour E. Harris, op. cit., p. 214.

[15]Dan Throop Smith, op. cit., pp. 93-94. Italics supplied.

CHAPTER III: THEORETICAL CONSIDERATIONS UNDERLYING THE DIFFERING VIEWPOINTS

> A general tax on net profits can never be shifted. If profits represent the surplus above cost of production, a general tax on this surplus cannot influence the cost of production. Price cannot be altered, and the interests of the consumer cannot be affected. It is the producer who bears the tax, both immediately and ultimately.
>
> Edwin R. A. Seligman[1]

> Thus the argument in support of nontransference of the burden of corporate income [taxes] is weak on all three counts [i.e., the marginal-firm argument, the marginal-unit argument, and the no-change-in-resource-allocation argument].
>
> Seymour E. Harris[2]

The theory of the incidence of corporation income taxes has been treated fairly extensively in economic literature; it would, therefore, serve little purpose to reproduce it here in any great detail. Furthermore, our present study is principally empirical in nature, focusing on the application of a specific statistical technique. Our discussion of the theoretical foundations of the conflicting viewpoints will consequently be very brief, and will be intended primarily to provide a background for the summarization, analysis, and interpretation of various statistical approaches to this problem.

A. The Traditional Theory

The traditional or orthodox theory holds that corporation income

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[1]Edwin R. A. Seligman, The Shifting and Incidence of Taxation (5th Edit., Revised; New York: Columbia University Press, 1926), p. 362.

[2]Seymour E. Harris, The National Debt and the New Economics (New York: McGraw-Hill Book Company, Inc., 1947), p. 216.

taxes cannot be shifted either by a firm operating under competitive conditions or by a monopolist. With reference to a firm operating in a context of competition, it is asserted that, on the supply side, prices are determined principally by the costs of the marginal or no-profit firm. Since the output of these firms is necessary to fulfill demand requirements, the equilibrium price will cover their costs. But since these firms make no profit, they pay no income taxes, and thus have none of these taxes to shift forward or backward in their prices. The cost (and price) structure of the marginal firms not being in any way affected by these taxes, the (single) price for the industry can undergo no change. Corporation income taxes are therefore not an element in cost but rather a distribution of profit, and no shifting is possible by any firm in the industry.

There is another line of reasoning which explains why corporation income taxes cannot be shifted. This line of reasoning not only supplies an additional argument against the possibility of shifting in a competitive situation but also provides the basic argument against this possibility by a monopolist. Prior to the time a tax on corporate profits is imposed (or increased), it is reasoned, each firm (or the monopolist) would be producing up to the point where marginal cost is equal to marginal revenue. Now, on this marginal unit of the firm there can be, by definition, no profit; hence, after the income tax is imposed, no tax liability can be incurred on this unit. Thus, even if we treat the tax as a cost, the point of maximum profit is not changed by the imposition of the tax, as "a unit of output that

was marginal before taxes will be marginal after taxes."[3] With a given demand schedule, any price change--either by a monopolist or by all the firms in a competitive industry--cannot possibly benefit but can only hurt the profit picture of the firms involved. The owners will therefore have to bear the entire burden of the tax (or tax increase).[4]

B. The Newer Theory

In opposition to the theory that corporation income taxes can never be shifted, either by a firm operating in a competitive context or by a monopolist, proponents of the newer theory, as we might call it, contend that these taxes may well be shifted, either in part or in their entirety. Let us immediately note that the newer theory does not categorically state that corporation income taxes are promptly shifted in total in every instance. What it essentially does is to object to the positiveness of the traditional theory and to suggest that there is a tendency for the taxes to be reflected in price, possibly even being completely shifted in many circumstances.[5]

One of the main objections of the "newer" theorists to the tradi-

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[3]Ibid., p. 215. This quotation is taken from a listing by Professor Harris of the fundamental tenets of the traditional theory. Professor Harris, of course, does not adhere to this theory. (See quotation at the beginning of this chapter.)

[4]For the two general arguments discussed above Duncan Black has given the succinct and appropriate designations "Marginal Firm argument" and "Marginal Unit argument". Duncan Black, The Incidence of Income Taxes (London: Macmillan and Co., Limited, 1939), pp. 6-7.

[5]See Lewis H. Kimmel, Taxes and Economic Incentives (Washington, D. C.: The Brookings Institution, 1950), p. 27.

tional theory is its heavy dependence upon the role of the "marginal producer" in price determination. In the first place, it is argued, the theoretical marginal firm is not a no-profits firm; it "may, at the moment or in the short run, be earning no profits; but it may also be a firm which is earning large profits; or perhaps even large negative profits, that is, be making a considerable loss."[6] Actually, the marginal firm is one "which is just undecided as to whether or not it should continue in its present line of production: a slight increase in the favourable factors would determine it to continue, and a slight diminution, to cease production."[7] The marginal firm, then, is more closely allied to the Marshallian "representative firm", a firm which, among other characteristics, has had a "fairly long life, and fair success."[8] And it is the costs of this representative firm, the argument continues, not those of the no-profits firm, which are basic in the determination of normal supply price.[9]

An argument which may be taken in conjunction with the one just described is that the profit used as the tax base is not all profit in the economists' sense but includes economic costs. These costs, con-

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[6]Duncan Black, op. cit., p. 12.

[7]Ibid., pp. 11-12.

[8]Alfred Marshall, Principles of Economics (8th Edit.; London: Macmillan and Co., Limited, 1920), p. 317.

[9]Professor Harris makes an interesting additional comment on this point, stating that prices may be determined at one time by the no-profit firm, at another time by the Marshallian representative firm, and, "In war or in prosperous times, for example, prices on many markets may be determined by firms with substantial profits." Seymour E. Harris, op. cit., p. 215.

sisting of interest and insurance on equity capital and the gross earnings of management (including insurance against loss), are all part of the normal supply price of the representative firm used in traditional competitive price analysis.[10] Thus, an incidence theory intending to explain a situation where profit consists in part of necessary costs cannot be based upon a pricing theory which employs a much narrower definition of profit.[11]

A third objection to the orthodox incidence theory centers on the complete reliance of that theory upon the assumptions of pure and perfect competition underlying traditional competitive price theory. Actually, this pure and perfect competition is hardly ever found in reality, there being all types and degrees of imperfections and mono-

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[10]See Duncan Black, op. cit., p. 13; also Alfred Marshall, op. cit., pp. 313 and 342-43.

[11]Lewis Kimmel points out, as do others, that there may be still other elements in taxable profits that are not true economic profits. One of these elements, the "paper profits" arising from a changing price level, is a particularly popular subject of discussion at the present time, undoubtedly in large part because of its dramatic portrayal as "phantom income" by United States Steel Corporation in its 1956 Annual Report. See Lewis H. Kimmel, op. cit., p. 22; also United States Steel Corporation, Annual Report--1956, p. 27.

It may profitably be pointed out at this time that Richard Goode, speaking strictly about short-run effects, holds that taxable profit is not a broader but actually a narrower concept than economic profit:

> The costs that are relevant for determination of output in the short run are direct costs--outlays that vary with the volume of current production.... The tax law permits deduction of all short-run variable costs, and more, in arriving at net income.... Thus it appears that in the short run the tax definition of costs in the Federal income tax law is broader than the economic delimitation of necessary costs that determine output. Hence it follows that the corporate tax is in fact a levy on economic surplus in the short period. --Richard Goode, The Corporation Income Tax (New York: John Wiley & Sons, Inc., 1951), pp. 53-54.

polistic elements. In fact, in certain significant sectors of the economy a situation exists which is just opposite that assumed by traditional price theory: prices are fixed in advance of production (administered pricing) rather than being the result of the free play of market forces. Because of the existence of these widespread imperfections and monopolistic elements, the price-determining mechanism might well take into account the income tax factor in order that there may be realized a certain planned return on equity capital.[12]

Supplementary to the objection just discussed is the viewpoint that business firms may not in practice try to obtain maximum profits as their financial goal but rather set some standard of "satisfactory profits" or "fair profits" as the objective to be reached.[13] If this is true, the "marginal-unit argument" of the orthodox theory looses much of its force.[14] For, if upon the levying of the tax the firm is not operating at the point of intersection of the marginal cost and

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[12]In considering the significance of this objection raised by the "newer" theorists, one need just think of such familiar pricing phenomena as oligopoly pricing, price leadership, price discrimination, basing-point pricing, resale price maintenance, and price control through patent licensing arrangements--all important practices at one time or another in the history of American corporations--to appreciate that certainly the applicability of traditional price theory to this problem of determining the incidence of corporation income taxes must be seriously questioned.

[13]See R. A. Gordon, "Short-Period Price Determination," American Economic Review, XXXVIII (1948), 271.

[14]In practice, as I have observed (and participated in) it, it is market potential studies, unit and dollar sales forecasting, profit forecasting, cash forecasting, and the like which are more fundamental in output planning than are the traditional marginal calculations. With respect to the calculation and utilization of marginal cost data in smaller firms, my personal opinion is that if the company controller can produce accurate, complete, and timely average cost data, he is doing a particularly good job.

marginal revenue curves, it may well be possible for the firm to enhance its net profits by changing the price and output level and passing some of the tax on to its customers.

The final objection to the traditional theory is that the latter does not take into consideration effects of the tax on the volume of savings, individual initiative, and labor offered. Also, there must be taken into account the changed spending patterns of the taxpayers, the government, and the recipients of government disbursements. In other words, even if we employ conventional marginal analysis, there would eventually take place considerable price and output changes and, consequently, tax shifting. For the repercussions of the tax will have effects upon both the supply and demand functions, and thus both the marginal cost and the marginal revenue curves will be affected.[15]

In view of the objections mentioned above, the newer theorists conclude that it cannot be said that taxes on corporate profits can never be shifted. Neither can it be said, however, that corporation income taxes (or an increase or decrease in these taxes) will immediately be fully shifted by every profitable firm in the economy. The extent of the shifting will depend upon several factors, as: (1) the size of change in the tax rate; (2) the nature of the capital structure of the corporation (ratio of preferred dividends to net profits); and

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[15]See Seymour E. Harris, op. cit., pp. 215-16; also Duncan Black, op. cit., pp. 30-42.

It will be noted that the supporters of the newer theory are in effect saying that the fundamental approach of partial equilibrium analysis employed by the traditional theorists is inadequate and that the use of total equilibrium analysis would yield more satisfactory results.

(3) the rate of turnover of equity capital.[16] Nevertheless, there can be said to exist a basic tendency for the tax to be shifted, the degree to which this shifting will succeed varying among different firms, among different industries, and at different times.

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[16]Carl Shoup, "Incidence of the Corporation Income Tax: Capital Structure and Turnover Rates," National Tax Journal, I (1948), 12-17.

PART II

THE APPLICATION OF STATISTICAL TECHNIQUES

TO INCIDENCE DETERMINATION

CHAPTER IV: SURVEYS AND OTHER EMPIRICAL STUDIES

> The interpretation of the statistics suggested by Sir Alan is simple and unforced. He uses in support of the view of the business men, the same set of statistics as Mr. Coates had used to discredit it. This illustrates the dangers which beset economists when they are dealing with a complicated piece of theory involving a number of variables, and they have to place reliance on the evidence of statistical series.
>
> Duncan Black[1]

> Thus a healthy pessimism with respect to empirical tests of the effects of tax shifting is a good thing. But it would certainly be stretching the point to draw the conclusion that the problems of tax shifting are incapable of solution or that the theory of tax shifting is the product of a fruitless, merely logical, exercise.
>
> Otto von Mering[2]

Although the literature on the theoretical aspects of incidence determination is fairly extensive, not too much in the nature of empirical or statistical work has been done on this problem. In this chapter we shall briefly review six empirical-type studies made in this field. One of the six, and the earliest by date of publication, involves firms in Great Britain, while the other five concern corporations here in the United States.

A. The Coates Memorandum

The first publication of an empirical nature appeared in Great Britain in 1927 as Appendix XI to the Report of the Committee on

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[1]Duncan Black, The Incidence of Income Taxes (London: Macmillan and Co., Limited, 1939), p. 29.

[2]Otto von Mering, The Shifting and Incidence of Taxation (Philadelphia: The Blakiston Company, 1942), p. 9.

National Debt and Taxation.[3] Commonly referred to as the "Coates Memorandum", it is a vigorous and in many ways very detailed statistical endeavor to validate the traditional theory. The data used were based on samples drawn from over a quarter of a million trading accounts voluntarily furnished to the Inland Revenue Department, where Mr. Coates held the position of Director of Statistics and Intelligence at the time of the statistical investigation.[4] The specific statistic employed as variable was the percentage of profit to sales.[5] The periods of time selected were the income tax years 1920-21, 1922-23, and 1912-13; the seven industrial groups individually examined were: (1) cotton; (2) wool; (3) iron and steel; (4) metals; (5) food; (6) wholesale distribution; and (7) retail distribution.

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[3]W. H. Coates, "Memorandum by Mr. W. H. Coates, LL. B., B. Sc. (Econ.), on The Incidence of Income Tax," Appendices to the Report of the Committee on National Debt and Taxation (Appendix XI; London: His Majesty's Stationery Office, 1927), pp. 65-114. The "Committee" mentioned is frequently called the "Colwyn Committee", in honor of its chairman, the Rt. Hon. Lord Colwyn.

[4]Duncan Black, op. cit., p. 19; W. H. Coates, op. cit., pp. 71-72.

[5]The term "profit" as used in the Coates Memorandum is similar to our American concept "profit from operations". According to Mr. Coates,

> Trade profit for any year...means, broadly speaking, the difference between the gross receipts of the business from all trade sources and the expenses incurred wholly and exclusively in carrying on the business.... The Income Tax Acts...prohibit...the deduction of certain charges .... Such charges include any interest on borrowed money, annuity or other annual payment payable out of the profit, and any royalty in respect of a patent.--W. H. Coates, op. cit., p. 110.

Likewise, Mr. Coates's "sales" or "turnover", as he prefers to call it, is analogous to our "operating revenue":

> The turnover tabulated represents the total receipts of the business from the sale of goods or from remuneration paid in respect of services. It excludes any receipts from rents or property let, interest on loans, dividends on investments, etc.--Ibid., p. 111.

The statistics are interpreted in two separate ways as proving that corporation income taxes cannot be shifted. In the first place, Mr. Coates asks whether this variable, for any year, shows a high degree of concentration around a central point, or whether, on the other hand, it is widely dispersed over a broad range. If the former situation exists, then we can accept the hypothesis that the tax is shifted: for there will truly be a "representative firm" whose normal cost of production will determine price. If, however, the results show a wide dispersion of the variable, then the marginal or no-profit firm will be more significant in price determination, with the result that the tax cannot be shifted. Mr. Coates's data do show this wide variability, both in the pre-war and the post-war years selected.[6] Thus, he states, "The existence of marginal concerns is clearly indicated", with the result that "The absorption by the State of a portion of the profit area in the form of a percentage rate of tax on profits exerts practically no pressure on any of the forces [i.e., supply and demand] producing the resultant position drawn in the diagram.[7]

The second way in which it is believed to be empirically demonstrated that the tax is not shifted lies in a comparison of changes in tax rates and changes in the profit statistic before income taxes. If, when the tax rate increased, the before-tax profit rate increased sufficiently to allow the after-tax profit rate to be maintained at

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[6]"The final and most relevant characteristic of these statistics is the general dispersion of the variable." Ibid., p. 84. See also his Graphs I and II, p. 92.

[7]Ibid., pp. 85 and 91, respectively.

its prior level, then the tax can be considered shifted. Inasmuch as a comparison of the data for the two specific income tax years 1912-13 and 1922-23 does not indicate this type of effect, the argument against the shifting of the tax is believed to be reinforced.[8]

B. The National Industrial Conference Board Publications of 1928 and 1930

An intensive study of this problem was undertaken in the United States in the late twenties by the National Industrial Conference Board, the results of which were published in 1928 and 1930 in two volumes.[9] The first volume contains a detailed statistical analysis of significant financial data of selected manufacturing and mercantile corporations, as well as the results of a mail survey attempting to get corporation executives' opinions, attitudes, and experiences on this subject. In the second volume a statistical study is made of corporations in the construction, extractive, financial, and public service areas of the economy; also, there is a statistical approach to the study of various longer-term "effects" of the corporation income tax.

With reference to the statistical study of tax shifting through product prices, which aspect constitutes the bulk of the study, the Conference Board, through the cooperation of the Joint Congressional Committee on Internal Revenue Taxation, secured from the Bureau of Internal Revenue transcripts of the income tax returns of 4,644 cor-

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[8] Ibid., p. 96.

[9] National Industrial Conference Board, The Shifting and Effects of the Federal Corporation Income Tax (New York: Vol. I--1928; Vol. II-1930).

porations for the years 1918 through 1925.[10] From these data numerous ratios were computed by corporation, by industry groups, by year, and by rate-of-profit classes. The general hypothesis underlying the analysis, and against which the data were to be tested, was stated by the Board as follows:

> A strong presumption will therefore be established in favor of the view that general tax on profits can not be shifted, directly or indirectly, if the conditions and tendencies of corporate business activity...may fairly be considered to indicate: (1) that under competitive conditions production or sales tend to increase to the point where profits disappear...; (2) that there is no evidence in actual business conditions of the existence or maintenance of any normal profit rate to which investment enterprise or production in any industry is adjusted; and (3) that an income tax does not affect the relative production in different industries and the relative supply of different commodities as a result of the comparative risks of the industry and the rate and stability of the return on capital invested.[11]

The results of the Board's statistical analysis appear to provide affirmative answers to all three of these criteria: price determination, not considering the case of a monopolist, appears to be dominated by production and sale at small profit and no profit; wide variations in the profits of individual concerns from year to year indicate that "normal profits" are not a business actuality; and there appears to be no evidence of relationship between increase in capital investment

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[10] Ibid., I, 141. "This group of companies," the Conference Board relates, "includes all the corporations actively engaged in business throughout this period, which in any one of these years reported net incomes of $100,000 or more, and which did not lose their identity by reorganization, merger or consolidation during this period or go into liquidation." Loc. cit.

[11] Ibid., I, 87.

by industry and variability of profit rate by industry.[12] Thus, on the basis of the data used, the treatment of these data, and the interpretation of the results, it is concluded that, in general, the federal corporation income tax is not shifted to consumers through higher prices but remains a burden upon the stockholders.[13]

With reference to the mail survey conducted by the Conference Board, the results of which were published in Volume I, a questionnaire was submitted to the chief executive of each of 10,000 corporations distributed throughout the United States and having a capitalization of one million dollars or more.[14] In this questionnaire the executives were asked, in the letter of transmittal, to present their personal opinions on corporation income tax shifting as well as to discuss related aspects of costs, market prices, ability to shift the tax in their respective industries, and the like. In addition they were asked to provide, on the basis of the actual practices and experiences of their respective firms, answers to a list of specific questions relating to this general subject.[15] Of the replies, after eliminating many which were not subject to statistical tabulation or which did not give any answer at all to this question, approximately 22 per cent stated that their respective firms shifted all or part of

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[12] Ibid., I, 152; II, 160-62.

[13] See ibid., II, 160.

[14] See ibid., I, pp. 114-22; also Tables 36 to 44, inclusive, pp. 237-45.

[15] For a copy of the letter of transmittal and the detailed questions, see ibid., I, 249-51.

the tax. Specifically, of the 577 corporation executives giving a definite affirmative or negative reply, 128 indicated that tax shifting was believed to take place, at least in part, in their firms, while 449 stated that they had never at any time been able to shift the corporation income tax.[16] Because of this preponderant opinion in all industries against the possibility of shifting, as revealed both in the above data and in further tabulations of the results of the mail survey, the Conference Board believed that the conclusion stated earlier that the tax is not generally shifted is confirmed.[17]

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[16] Ibid., I, 115-16. A breakdown of the replies by the Conference Board's industrial groupings is as follows:

Industry	Taxes Shifted (No. of Replies)	Taxes Not Shifted (No. of Replies)	Per Cent Affirmative to Total
Agriculture and Related Industries	-0-	6	-0-
Mining and Quarrying	1	20	5
Manufacturing	104	346	23
Local Transportation, Cartage, and Storage	-0-	10	-0-
Trade	23	61	27
Service	-0-	6	-0-
	128	449	22

Source: Compiled from data in ibid., Table 36, p. 237.

[17] See ibid., I, 118 and 157. In observing and evaluating the data derived from the mailed questionnaire, it is well to keep in mind inherent difficulties involved in the use of this technique:

> ...when the probabilities of including each member of the population in the sample are not known, one is unable to insure results of known precision, and biases of unknown and often of unsuspected character may distort the survey estimates.--Morris H. Hansen, William N. Hurwitz, and William G. Madow, Sample Survey Methods and Theory (New York: John Wiley & Sons, Inc., 1953), I, 70.

Nevertheless, we present these results as an example of a significant empirical attempt to throw light on this problem.

C. The Conference Board Survey of 1941

A second mail survey involving this problem was conducted by the National Industrial Conference Board in the late autumn of 1941.[18] Although the principal purpose of this survey was to gain information on effects of federal taxes upon corporate production and expansion policies, one section was devoted to effects of these taxes upon price policies.[19] In this section corporation executives were asked, among other things, whether a conscious influence on their price policies was exerted by (a) the normal corporation income tax (or the new surtax); (b) the declared-value-excess-profits tax; and (c) the excess-profits tax (effective on 1940 and 1941 income). To each of these three questions a substantial majority of corporation executives replying stated that price policies were not affected by these taxes.[20]

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[18]National Industrial Conference Board, Effects of Taxes upon Corporate Policy (New York, 1943). The questionnaire was sent out on November 26, 1941, with a follow-up letter sent out on January 10, 1942. The completed report was published in July, 1943. See ibid., pp. 79 and 90.

[19]See ibid., p. 7. For a complete copy of the questionnaire see pp. 80-87. Section C, "Effects of Federal Taxes upon Price Policies," is on pp. 82-83.

[20]A tabular presentation of the replies, by question, is as follows:

Tax	Affirmative (No. of Replies)	Negative (No. of Replies)	Per Cent Affirmative to Total
Normal corporation income tax	58	162	26
Declared-value-excess-profits tax	30	182	14
Excess-profits tax	56	160	26

Total number of questionnaires submitted by the Board: 1,325
Source: ibid., pp. 8 and 57; percentages computed by author.

Accordingly the Conference Board concluded that, on the basis of these results, taxes on corporate income are, in general, not shifted to consumers in higher prices.[21]

D. The Brookings Survey of 1948

To obtain a post-World War II picture of the views of businessmen, the Brookings Institution included the following in a questionnaire mailed in June, 1948, to 1,000 manufacturing corporations: "Has the corporate income tax consciously influenced your pricing policies?"[22] The replies, in contrast to those of the earlier surveys, indicate that the majority believed there was such an effect: 125 out of 209 companies replying to this question, or approximately 60 per cent, answered in the affirmative, while 84, or 40 per cent, gave negative replies.[23] These results, the Brooking Institution is quick to point out, should not be interpreted as meaning "that the tax is always

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[21]This conclusion can also apparently be considered to apply to most industry groups individually. Although an analysis of the results by industrial grouping is not furnished, the following comment is made in this regard:

> "No" answers predominated in the replies from executives in all industries, although opinion is more evenly divided among those reporting for corporations engaged in Textile Manufacturing, Utilities, and Trade, than among the other industries.--Ibid., p. 57.

[22]Lewis H. Kimmel, Taxes and Economic Incentives (Washington, D. C.: The Brookings Institution, 1950), p. 27.

[23]Ibid., pp. 27-28. It is interesting to note the variation in proportion of affirmative replies by manufacturing sub-groups. Five out of five glass manufacturing corporations and six out of seven automobile and accessory manufacturing corporations replied in the affirmative while, at the other end of the scale, only three out of eight building materials manufacturing corporations and two out of five rubber manufacturing corporations gave an affirmative answer. Ibid., p. 28.

fully recovered by so large a proportion of companies. Rather, [they indicate] that there is a strong tendency to recoup the tax, if this is at all possible."[24]

E. The Lerner-Hendriksen Study

In the September, 1956, issue of National Tax Journal there appears an interesting and illuminating article on the effects of corporation income taxes on rates of return on investment for profit-making corporations engaged in manufacturing.[25] Using data from the Statistics of Income of the United States Treasury Department's Internal Revenue Service for the years 1927 to 1952, inclusive, Messrs. Lerner and Hendriksen examine empirically both the immediate impact of tax changes and their long-run effects on these rates of return. The analyses--both short and long-run--are made for nine specific manufacturing sub-groups separately as well as for all profit-making manufacturing corporations taken as a single group.

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[24]Ibid., p. 27. The replies to a related question asked the 1,000 manufacturing corporation executives are also of interest. To the inquiry whether their answers would have been the same if the tax rate for 1946 to 1948 had been "one fourth or one third the actual rate..." 101, or approximately 81 per cent, of the 125 corporation executives giving an affirmative answer to the earlier question "...replied that their answer would have been different if the tax rate had been at the lower level." Ibid., p. 29.

[25]Eugene M. Lerner and Eldon S. Hendriksen, "Federal Taxes on Corporate Income and the Rate of Return on Investment in Manufacturing, 1927 to 1952," National Tax Journal, IX (1956), 193-202. In this study investment is defined as net worth plus long-term indebtedness. Consequently profit data are likewise adjusted for interest payments, so that the figures for "return" represent returns to all suppliers of "investment". See ibid., p. 194. The authors' definition of "investment", it may be noted, is the same as that of "invested capital" in the Accountants' Handbook. See W. A. Paton (ed.), Accountants' Handbook (3rd Edit.; New York: The Ronald Press Company, 1943), p. 79.

With reference to the short-run or "immediate-impact" analysis, the authors formulate the hypothesis that the tax is completely passed on in the short run. Accordingly, they say: "If the rate of return [after income taxes] stays the same or rises in an industrial area between two years during which tax rates rise, this evidence was taken to be consistent with the hypothesis...."[26] If, however, a tax-rate change and the rate of return move in opposite directions, the evidence conforms to the theoretical expectation that the tax is not shifted. After making a brief analysis of the entire period, the authors indicate that it is the experience of five particular years--1941, 1942, 1943, 1946, and 1951--that is of special significance; for "during each of these years the entire schedule of tax rates facing a firm shifted substantially."[27] In looking at the relevant data of these specific years, the authors point out that in only one of these years --the year 1941--did the effective tax rate and the rate of return after taxes move in the same direction; in each of the other four years the movement was quite strikingly in opposite directions. Thus, the conclusion is reached that "...the empirical data are not consistent with the hypothesis that a change in the corporate income tax is

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[26]Eugene M. Lerner and Eldon S. Hendriksen, op. cit., p. 195.

[27]Ibid., p. 198. The analysis of the entire period referred to above covers the following steps:

(1) computing the changes in effective tax rates by year for manufacturing as a whole;

(2) observing, again by year, the number of manufacturing subgroups in which the tax rate and the rate of return changed in the same direction, changed in the opposite direction, or in which there was no appreciable change in the effective tax rate; and

(3) noting the over-all relationship, by year, of rate-of-return and tax-rate changes for all manufacturing corporations.

completely passed on in the short run. The evidence is in the other direction, consistent with tax theory."[28]

In turning to the longer-run effects of the income tax, the authors lay considerable stress on the observation that there is a complete absence of a strong trend, either upward or downward, in the annual rates of return on investment (after income taxes) during this twenty-five year period in spite of the general upward drift in the tax rate.[29] If the burden of income tax changes had actually fallen entirely on the proprietary equity, the after-tax rate of return would have decreased with a rise in the tax rate. The basic reason that this downward trend did not materialize lies, according to the authors, in the increase in turnover rates in manufacturing during this period.[30] Thus, an increase in the turnover rate, one of the two algebraic components of the rate of return on investment, might have the effect of offsetting the rising tax rate and of maintaining a level rate of return on investment, in which case corporation income taxes are shifted to the extent that gains made through higher turnover ratios are not

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[28] Ibid., p. 202. In this connection it is very interesting to note that, according to the authors' own figures in Table 2, p. 197, there are three years which had a higher absolute tax rate change than the 3.4 change of 1943. These three years, with their respective rate change figures, are: 1940, with 11.5; 1945, with -4.6; and 1950, with 8.1. If we include these three years with the other five and make the same test, we discover that in four cases (including the three just added) the evidence is consistent with the hypothesis and in the other four it is not.

[29] Ibid., p. 199. The authors indicate that the slope of the least squares trend line through this series of rates of return is plus 0.03, which, they continue, has even an upward bias because of the changing price level.

[30] Ibid., pp. 199-201.

reflected in (relatively) lower selling prices and before-tax profit margins.[31]

F. The Adelman Article

In Section I of a recent article Professor M. A. Adelman, using Department of Commerce data on corporation profits for the eight-year period 1922-29 inclusive and the ten-year period 1946-55 inclusive, points out that, in spite of very much higher corporation profits taxes in the latter period, the ratio of corporate profits (including both interest and the inventory valuation adjustment) before taxes to total income originating in corporations did not differ appreciably between these two periods: the average percentage for each period as a whole is about 23, and the average range for each period is about 6.[32] This, the author states, is contrary to what one would expect if he accepted the shifting hypothesis; for, "given a large increase in corporate income taxes, and assuming shifting of the tax, the fraction must increase substantially."[33] He concludes, therefore, that

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[31]The authors do not explicitly say that this observation supports the argument for tax shifting. They do, however, make this comment:

> These broad expectations of how firms which showed profits would react if they considered taxes as a cost in the long run are supported by the empirical evidence: technological innovation has taken place, turnover ratios have risen, profit margins before taxes have fluctuated around a level trend, and profit margins after taxes have fallen.--Ibid., p. 202.

[32]M. A. Adelman, "The Corporate Income Tax in the Long Run," The Journal of Political Economy, LXV (1957), 151-57. See especially Table 1, p. 152. The depression years and the war years were both deliberately omitted from the analysis.

[33]Ibid., p. 152.

"there is no evidence here that any perceptible part of the increase in the tax burden was shifted either forward to consumers in higher prices or backward to employees in lower wages."[34]

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[34]Ibid., pp. 152-53.

CHAPTER V: METHODOLOGY AND SCOPE OF THIS STUDY

> The piling up of evidence, quantitative or otherwise, is not the object of investigation, nor does indiscriminate accumulation necessarily provide a basis for wise decisions. The warranted assertions that are sought in all inquiry are achieved through the rational use of evidence--the use of empirical data in making generalizations that go beyond the limits of observation, in testing hypotheses, in modifying hypotheses when they fail to accord with relevant observations. The play of reason in formulating theories is checked by reference to the data of observation; the accumulation and manipulation of such data are controlled and guided by reason.
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> Frederick C. Mills[1]

This study is a statistical approach to the problem of the determination of the incidence of corporation income taxes. In it we employ a specific technique, that of regression and correlation analysis, in an attempt to shed additional light on this perplexing problem. Our basic data are drawn from the Statistics of Income and are taken as representing the aggregate dollar amounts of selected income-statement items for all profit-making corporations in the United States.[2] With these data analyses will be made for the aggregate economy and for each of the Internal Revenue Service's eight industrial divisions; and all analyses will cover the twenty-six-year period 1928 through 1953.[3]

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[1]Frederick C. Mills, Statistical Methods (3rd Edit.; New York: Henry Holt and Company, 1955), p. 5.

[2]United States Treasury Department, Internal Revenue Service, Statistics of Income (for each year from 1928 to 1953 inclusive; Washington, D. C.: Government Printing Office).

[3]These eight industrial divisions are as follows: (1) Agriculture, forestry, and fishery; (2) Mining and quarrying; (3) Construc-

The variables selected are (1) the per cent of total taxable net income to total taxable revenue, as the dependent variable; and (2) the effective tax rate, defined as the ratio of total federal taxes on income to total taxable net income, as the independent variable.[4] Our

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tion; (4) Manufacturing; (5) Public utilities; (6) Trade; (7) Finance, insurance, real estate, and lessors of real property; and (8) Services. A ninth division, a catch-all classification entitled "Nature of business not allocable", is not considered in this study.

[4]These percentages were derived in the following manner: (1) with regard to the per cent of total taxable net income to total taxable revenue, the numerator of the fraction, total taxable net income, is the Internal Revenue Service's "Net Income", or its "Compiled Net Profit" less its "Wholly Tax-Exempt Receipts", while the denominator, total taxable revenue, is the Service's "Total Compiled Receipts" less its "Wholly Tax-Exempt Receipts"; and (2) the independent variable, the effective tax rate, is the ratio of total federal taxes on income, including the various excess profits taxes, to total taxable net income, as defined above.

A slight exception to these formulas occurs in the percentages for the years 1941, 1942, and 1943. For these years the Internal Revenue Service has deducted from compiled net profit, receipts "Subject to Surtax Only" as well as wholly tax-exempt receipts, to arrive at net income. For the sake of consistency I have also included these receipts "Subject to Surtax Only" in my deductions from total compiled receipts to arrive at total taxable revenue for these three years. These additional deductions were made for the aggregate economy and for each industrial division.

It may be noted at this point that I have shifted from the Internal Revenue Service's use of the term "receipts" to "revenue". I personally do not like to use the term "receipts" in discussions on income inasmuch as the accrual method appears to be so predominant in corporation accounting. The term "receipts" connotes receipt of cash; it implies, for example, a basic function of the corporate treasurer: the management of cash balances, receipts, and disbursements. The term "revenue", on the other hand, is consistent in its connotation regarding accruals with our use of the terms "income" and "taxes on income". Cash, of course, does not have to be <u>received</u> for revenue to be booked; if it did, there would be no such thing as accounts receivable. To complete our analogy to the corporate treasurer and his function involving receipts and disbursements (on a cash basis), we might say that a prime function of the corporate controller is, in contrast, the reporting of revenue, income, and expenses (on an accrual basis).

The basic data used in the computation of these ratios, as well

basic hypothesis is that a lack of correlation between the population values of these two variables--a lack of evidence that the before-tax profit ratio increases in a statistically significant manner with a rise in the effective tax rate--indicates that federal corporation income taxes are not shifted but rest upon the proprietary equity. Conversely, we postulate that a correlation shown to be statistically significant indicates that at least part of these taxes are passed on to other parties.[5] Furthermore, we shall accept the numerical value of the regression coefficient as representing the average increase in the before-tax profit rate brought about by a specified change in the effective tax rate.[6] Thus, if a test of significance of the sample coefficient of correlation indicates no significant correlation in the population, we shall conclude that these taxes are not shifted. If on the other hand, the correlation coefficient indicates that the sample was drawn from a population where the two variables are correlated, we

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as the ratios themselves, are given, by year, in Table I, p. 51, for the aggregate economy, and in Appendix Tables V to XII inclusive for the individual industrial divisions.

[5]It will be noted that we are not concerned in this paper with the direction of possible tax shifting, that is, whether it is forward, backward, or in some combination of the two, but only with the problem whether it is shifted at all. Similarly, we are not considering, in case we conclude that these taxes are not shifted, the question of distribution of the tax burden among the various proprietary equity components. Conceivably the imposition of such a tax could result in a (relative) decrease in dividend payments, retained earnings, common stock prices, or some combination (or all) of the three.

[6]Technically speaking we shall be using, for purposes of inference, the 99% confidence interval of the coefficient of regression rather than the precise value of the coefficient itself. This point will be discussed in more detail later in our study.

shall reject the null hypothesis, thereby admitting the possibility that, in the first place, corporation income taxes are shifted and, in the second place, a quantitative measure of this shifting can be derived from the regression coefficient.[7]

In examining this statistical approach in greater detail, we must first of all critically evaluate the applicability of our technique to the problem involved. The principal argument which might be made against our procedure, it seems to me, is that (1) this approach is based on the assumption that any course of action taken by American corporate management to shift these taxes (either consciously or unconsciously) would necessarily involve an increase in the before-tax profit rate; and (2) that this assumption is erroneous. In other words, we are specifically not considering the possibility of a shifting of these taxes by means of corporations' refraining from lowering prices and before-tax profit rates in response to a rise in their turnover ratios. That tax shifting may actually have occurred in this manner (in the manufacturing sector of our economy) has been suggested, as we noted in the previous chapter, by Messrs. E. M. Lerner and E. S. Hendriksen in a provocative article in the National Tax Journal.[8]

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[7]With regard to the significance of the regression coefficient, it will be recalled that, in simple linear regression and correlation analysis, the regression coefficient is statistically significant if the correlation coefficient is shown to be significant, and vice versa. As stated by Walker and Lev, "...when $\rho = 0$, $\beta_{yx} = 0$ and when $\beta_{yx} = 0$, $\rho = 0$, so the hypotheses $\rho = 0$ and $\beta = 0$ are really the same."--Helen M. Walker and Joseph Lev, Statistical Inference (New York: Henry Holt and Company, 1953), p. 251. The β in the quotation is the population regression coefficient.

[8]Eugene M. Lerner and Eldon S. Hendriksen, "Federal Taxes on Corporate Income and the Rate of Return on Investment in Manufacturing,

In considering this aspect of the possible influence of turnover ratios, I must conclude that I am not at all convinced that these rates, which could be defined as the ratio of sales to either (1) "investment" or (2) total assets, have increased over the years. I know of no evidence that indicates this is so, nor would I know how to go about making such a calculation. The difficulty lies in the computation of the denominator--the "investment" or the total assets element--in the fraction. For balance-sheet items beyond figures for current assets and creditors' equity may not be at all representative of the economic value of the assets involved, even in the case of a single firm. Particularly in the case of fixed assets, which generally exert a very heavy influence on the totals, may there be no relationship whatsoever between book value and economic value. In the first place, the original historical cost figure is given in terms of a different--and probably considerably lower--price level than that which would be used in computing current economic value. Secondly, an allowance for depreciation has been gradually accumulating in a contra-asset account, with the result that the book value of any particular asset may be reduced to a point which is ridiculously low when compared to the economic value of the asset.[9] Thus, it is found to be a difficult and intricate

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1927 to 1952," National Tax Journal, IX (1956), 193-202.

[9]An extreme example of what can happen in the area of depreciation allowances is the case where an asset, or group of assets, is "written off" two, three, or more times; that is, the balance(s) in the contra-asset account(s) for allowance for depreciation for some specific asset(s) may be numerically two, three, or more times as large as the balance(s) in the basic account(s). This sort of thing could occur in a complex multi-plant operation where the firm and the Internal Revenue Service previously agreed on some arbitrary rate or

task for the financial personnel of an individual firm to construct, for analytical purposes, a truly meaningful statement of "investment" or of total assets for their own company, even when detailed ledgers, property record cards, and other subsidiary data are all available to them. This being so, it appears totally impossible for us to secure meaningful balance-sheet data--beyond current assets and creditors' equity--for all corporate enterprises in the nation combined.

The conclusion which we have just drawn has been stated many times. As long ago as 1920, for example, Professor A. C. Pigou made the following remark:

> If we were to push our analysis to the end, we should need to note that, since price levels are different in different times, the practice of estimating capital investments merely by reference to their money value at the time they were made is incorrect. A real investment of 1000 days' labour will be called £1000 if it is made in one year, while an exactly identical real investment will be called £2000 if it is made in another year.[10]

Likewise, in his statistical study of the incidence of British business profits taxes, W. H. Coates determined that profit data could not be compared with balance-sheet totals:

> The comparability of pre-war pounds of business capital and pounds invested since the outbreak of war has disappeared. The use of capital, expressed in the monetary units current in relation to real values at the date of investment, as the independent variable to which can be related the variable of

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formula to be used company-wide in computing depreciation expense. At the time such assets are retired, the amount of "overdepreciation" is, of course, credited on the books of the firm, (as a reduction of expense or an addition to income).

[10]A. C. Pigou, The Economics of Welfare (London: Macmillan and Co., Limited, 1920), p. 328.

> profit would therefore yield results which would defy interpretation.[11]

In the present decade similar comments on the relative unreliability of a nationwide consolidation of balance-sheet data are also made. Thus, in a study of the National Bureau of Economic Research published in 1950, we note the following:

> Only under the valuation appropriate to the status type balance sheet is it possible to make a meaningful comparison of the assets of different groups of units and their shares in national wealth. The conclusion, therefore, is that generally the unit balance sheets to be consolidated should be of the status type, i. e., all assets, liabilities, and equities are valued at the market price, or the closest possible approximation.[12]

On the basis of the above comments as well as a familiarity with general accounting principles and with the actual accounting practices of numerous specific firms, I take the position, stated earlier, that (1) a nationwide consolidation of corporation balance sheets (beyond current assets and creditors' equity), even by industrial groupings, is likely to be so erroneous as to be worthless; and that (2) it cannot therefore be said that evidence exists which points to changes in turnover ratios.[13]

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[11]W. H. Coates, "Memorandum by Mr. W. H. Coates, LL. B., B. Sc. (Econ.), on The Incidence of Income Tax," Appendices to the Report of the Committee on National Debt and Taxation (Appendix XI; London: His Majesty's Stationery Office, 1927), p. 108.

[12]National Bureau of Economic Research, Studies in Income and Wealth (New York, 1950), XII, 56-57.

[13]It must be pointed out that Messrs. Lerner and Hendriksen make these comments concerning changing price levels: "...part of the rise in the turnover ratio is an accounting fiction. Sales are quoted in current inflated dollars while investment is recorded at its historic cost." However, they continue, "...when prices level off, new investment acquired at the new price level will gradually cause total invest-

If we grant, then, the impossibility of procuring meaningful national balance-sheet data, at least at the present time, we must now question the accuracy of nationwide consolidated income-statement figures. Arguments against the use of such data, although less common than those against the use of national balance-sheet items, are sometimes heard.[14] Since we are basing our entire study on income-statement data, we shall have to pay attention to this point.

An examination of the structure and nature of the income statement readily shows us that price-level difficulties do arise in an exact

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ment and sales to be quoted at the same price level and the turnover ratio will return to its previous figure." Thus, not too much importance is attached to this problem; also, the difficulty involving depreciation allowances is not considered. See Eugene M. Lerner and Eldon S. Hendriksen, op. cit., p. 201.

[14]A vigorous attack against the use of any kind of financial report, balance sheet or income statement, for purposes of nationwide consolidation, was recently made by Oswald W. Knauth in an article in The Journal of Accountancy. In this article Mr. Knauth observes:

> The accountant can generally conform the reports of any one company to a single system, so that they are comparable from year to year unless conditions change radically. But he cannot make the reports of two or three companies comparable to each other. Nor can he add up a number of reports to find a general total. Yet that is just what is being done. We are told that the rate of profits in one industry is higher than in another; and that profits as a total are a decreasing percentage of the national income. Such statements are widely accepted, and they may be true. Nobody knows. Yet they are based on methods and postulates that are demonstrably questionable.

Thus, Mr. Knauth points out as an example:

> ...the National City Bank, in its monthly letters, compares the rate of profit of different industries, using the book value and estimated earnings. It thus draws the conclusion that the rate of profit of the steel industry is less than the average of all manufacturing industries. Is this comparison justifiable? At best, it would seem to be questionable; at worst, misleading.--Oswald W. Knauth, "An Executive Looks at Accountancy," The Journal of Accountancy, CIII (1957), 30.

interpretation of this report. Particularly with regard to depreciation expense and inventoried materials charged into cost of sales, areas of considerable controversy at the present time, the possibility arises that accounting figures do not represent true economic costs. Admitting the veracity of this argument, we still see that the income statement and the balance sheet are, in this respect, entirely different: the income statement is much more heavily weighted by items stated in fairly current dollars than is the balance sheet. A truly "current-dollar" income statement does not, of course, exist; and the conventional statement gives us at best only an approximation to a "current-dollar" report. The balance sheet, however, and particularly a nationwide consolidation of individual balance sheets, give us nothing beyond current assets and creditors' equity. And it is exactly this group of remaining items--fixed assets in particular--which weights total assets so heavily, or even worse which, with the exception of the effect of net working capital, constitutes "investment" in its entirety.[15]

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[15]The difference in the reliability of balance-sheet and income-statement data, especially for purposes of "macroaccounting", is suggested by Professor S. C. Yu:

> Many economists have stressed the difficulty of preparing a national balance sheet and the limited usefulness of such a statement. While the difficulty of constructing the first national balance sheet must be recognized, this does not necessarily mean that such problems cannot be overcome. One will recall that the same difficulty existed in the early stage of establishing the national income accounts. After about three decades, we have today a more or less satisfactory system of national income accounts. To be sure, to prepare the first national balance sheet may be slightly more difficult than to establish the national income system. But this should not prevent us from proceeding toward the

Accepting, then, the income-statement data of the Internal Revenue Service's Statistics of Income as satisfactorily reliable for our purposes and postulating no change in turnover ratios because such a change can be neither demonstrated nor measured, we return to the fundamental hypothesis underlying our individual analyses, namely, that the existence of, and a degree of measurement of corporation income tax shifting can be ascertained by the application of regression and correlation techniques to our selected composite income-statement figures. In the execution of these individual analyses, many individual correlation and regression coefficients and significance tests will be utilized. First, we shall study both the aggregate economy and each of the eight individual industrial divisions. In addition, we shall consider, in each of these nine areas, two different temporal relationships: (1) that the before-tax profit rate is a function of the current year's effective tax rate, or $\underline{Y} = \underline{f}(\underline{X})$; and (2) that this profit rate is a function of the prior year's effective tax rate, or $\underline{Y} = \underline{f}(\underline{X}_{-1})$. Also, we are going to examine, for the aggregate economy, three different functional relationships--arithmetic, exponential, and parabolic--for each of the two temporal relationships.[16] Thus we shall be utilizing a

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construction of the national position statement.--S. C. Yu, "Macroaccounting and Some of Its Basic Problems," The Accounting Review, XXXII(1957), 267.

[16]The procedure which I originally established with regard to using the three functional approaches in the analyses of the individual industrial divisions was to employ the two nonlinear relationships only if they made a significant contribution with regard to the aggregate economy. Inasmuch as their application, as we shall see in the next chapter, did not add substantially to the results attained from the use of the linear function, they were not used in the study of the individual divisions.

The six general equations which symbolize the various temporal

total of twenty-two least-squares regression and correlation analyses; and for each of these there will be presented a scatter diagram, the coefficient of correlation, a test of significance of the correlation coefficient, and, in case the correlation proves statistically significant, the equation of the line of regression accompanied by its standard error of estimate. In the latter case the line of regression will be plotted on the scatter diagram; also, for the temporal relationship--current-year or lead-lag--exhibiting the stronger association of the variables (in the linear functions only), there will be given the confidence interval for the coefficient of regression.

In addition to the above least-squares data there will be presented Spearman's coefficient of rank correlation, a non-parametric statistic, and a test of its significance for each of the individual cases.[17]

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and functional relationships discussed above are of the following forms:

A. 26-Year Period ($\underline{N} = 26$)

1. Arithmetic $Y = a + bX$
2. Exponential $Y = ab^X$
3. Parabolic $Y = aX^b$

B. Lead-Lag ($\underline{N} = 25$)

1. Arithmetic $Y = a + b(X_{-1})$
2. Exponential $Y = ab^{(X_{-1})}$
3. Parabolic $Y = a(X_{-1})^b$

Note: The third functional relationship in each group is parabolic or hyperbolic depending upon whether the sign of the exponent $\underline{b}$ is positive or negative. See Frederick C. Mills, op. cit., p. 13.

[17]A total of eighteen rank order correlation coefficients will be given, two for the aggregate economy and two for each of the industrial

This measure will play an important role in our investigation, as these coefficients may provide us with a basis for realistically evaluating the results of our prior computations. For as refined as the least-squares method is, furnishing results of extreme mathematical precision, the entire procedure, when used for purposes of statistical inference, rests upon the assumption of a normal bivariate probability distribution. Such an assumption may be unwarrantable, for example, if some of the data--say, those of the war years--appear to be in the nature of "outlying cases."[18] Spearman's coefficient, however, escapes parametric assumptions by being based upon rank order rather than upon the exact values of the observations. Accordingly, a statistically significant rank order correlation coefficient will reinforce our confidence in a least-squares coefficient previously shown to be significant.[19]

In summarizing our discussion of the methodology employed in this study, we shall list, in somewhat technical fashion, the steps that were taken in the development of each of the individual analyses. The results of these various analyses constitute the subject matter of the next two chapters (Part III).

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divisions. Inasmuch as a ranking of the variables would be the same for natural numbers and for their corresponding logarithmic values, only two such coefficients, one for the current-year relationship and the other for the lead-lag, will be presented for the aggregate economy.

[18]For a discussion of the possible influence of "outlying cases" on least-squares regression and correlation statistics, see Edward E. Lewis, Methods of Statistical Analysis in Economics and Business (Boston: Houghton Mifflin Company, 1953), pp. 505-08.

[19]In this regard we may recall that "...the rank order correlation must be larger than the product moment correlation to achieve the same level of significance."--Helen M. Walker and Joseph Lev, op. cit., p. 282.

Steps employed in the development of each analysis:

1. A scatter diagram was constructed. In the case of the aggregate economy arithmetic, semi-logarithmic, and double logarithmic scalings were employed as the functional relationship involved was arithmetic (linear), exponential, or parabolic.

2. The null hypothesis was established that $\rho = 0$.

3. The least-squares coefficient of correlation r was computed from the sample data.[20]

4. A test of significance was made for the correlation coefficient. The definitional formula employed in making this (small-sample) test is

$$t = \frac{r - \rho}{\sqrt{1 - r^2} \Big/ \sqrt{N - 2}}$$

Since we are hypothesizing a population correlation coefficient equal to zero, this formula can be reduced to

$$t = \frac{r\sqrt{N - 2}}{\sqrt{1 - r^2}}$$

5. Spearman's rank order correlation coefficient r_r was computed and tested for significance by use of the formula

$$z = r_r \sqrt{N - 1}$$

The coefficient and the result of the test were then compared with the corresponding least-squares correlation coefficient and signifi-

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[20]Appendix Table III gives the formulas used in computing these coefficients. It will readily be noted that the six least-squares formulas listed are basically the same, the differences representing adaptations to the various temporal and functional relationships.

cance test.[21]

6. In case the null hypothesis was rejected (on the basis of the least-squares test), there was computed the equation of the line of regression, which line was then plotted on the scatter diagram. The standard error of estimate was computed and appended to the regression equation.[22]

7. For the particular temporal relationship which showed the greater amount of significant correlation between the variables (in the linear cases only), there was constructed the 99% confidence interval for the coefficient of regression. The formula used in computing the interval estimate is

$$b + \frac{SE_{Yc}}{s_X \sqrt{N - 1}} t_{\frac{1}{2}\alpha} < \rho < b + \frac{SE_{Yc}}{s_X \sqrt{N - 1}} t_{1 - \frac{1}{2}\alpha}$$

with the t-table being entered with $N - 2$ degrees of freedom.[23]

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[21]The formulas for r_r are found in Appendix Table III. The formulas for t in paragraph 4 above were taken from Frederick C. Mills, op. cit., p. 304. The z-formula in paragraph 5 was taken from Helen M. Walker and Joseph Lev, loc. cit.

[22]The formulas for the equations of the lines of regression and their respective standard error of estimates are given in Appendix Table IV.

[23]See Helen M. Walker and Joseph Lev, op. cit., pp. 241-42.

PART III

A REGRESSION AND CORRELATION APPROACH

CHAPTER VI: THE AGGREGATE ECONOMY

The presentation of the results of our statistical analyses begins with a discussion of the aggregate economy. Here we consider all profit-making corporations as a single group, thereby attempting to discover any economy-wide relationships which may exist.[1] Looking first at the three scatter diagrams displaying current-year relationships (Figures 1, 2, and 3 on pages 52, 53, and 54), we see that in each of these diagrams the observations fall into two general groupings, one at the lower left and the other at the upper right, with the single year 1940 occupying an intermediate place.[2] This particular aspect is most graphically presented in Figure 3, where the ratio scaling on the axis of abscissas produces a roughly similar horizontal spread of the observations in both groups. We also note, however, that for each of several specified effective tax rates, there is a degree of variability among the Y values.[3] Thus it appears that, on the

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[1]The basic data used in the analysis of the aggregate economy are found in Table I on the following page. In considering these data, we should, of course, keep in mind the fact that the individual industrial divisions cannot be regarded as having exerted equal influence. On the contrary, the activities of one or two divisions, like manufacturing and trade, weight the totals very heavily, while those of a division like agriculture have practically no effect on the composite results.

[2]The two numerals by each dot are the last two digits of the year involved. In the diagrams displaying the lead-lag relationships (Figures 4, 5, and 6), the year indicated is that of Y, the dependent variable.

[3]An interesting example of this is found in the spread of the dots, along a fairly straight vertical line, for each of the following groups of successive years: 1928-31; 1933-35; 1936-39; 1946-49; and 1951-53.

TABLE I: CORPORATION FINANCIAL DATA, 1928-1953, ALL INDUSTRIAL GROUPS

(Includes only Those Corporations with Net Income)

[Money Figures in Thousands of Dollars]

Year	Total Compiled Receipts	Wholly Tax-Exempt Receipts	Total Taxable Revenue	Total Taxable Net Income	Per Cent Total Taxable Net Income to Total Taxable Revenue (Y)	Total Taxes on Income	Effective Tax Rate: Total Taxes on Income ÷ Total Taxable Net Income (X)
1928	129,777,418	2,083,102	127,694,316	10,617,741	8.31	1,184,142	11.15
1929	130,064,831	2,619,694	127,445,137	11,653,886	9.14	1,193,436	10.24
1930	92,160,937	2,113,482	90,047,455	6,428,813	7.14	711,704	11.07
1931	52,267,013	1,068,566	51,198,447	3,683,368	7.19	398,994	10.83
1932	31,855,431	584,469	31,270,962	2,153,113	6.89	286,034	13.28
1933	46,906,664	594,374	46,312,290	2,985,972	6.45	423,068	14.17
1934	63,118,536	1,138,477	61,980,059	4,275,197	6.90	596,011	13.94
1935	77,638,952	1,689,768	75,949,184	5,164,723	6.80	735,105	14.23
1936	105,011,693	247,938	104,763,755	9,478,241	9.05	1,191,378	12.57
1937	109,202,739	213,643	108,989,096	9,634,837	8.84	1,276,172	13.25
1938	80,267,477	199,173	80,068,304	6,525,979	8.15	859,566	13.17
1939	105,658,338	201,151	105,457,187	8,826,713	8.37	1,232,256	13.96
1940	125,180,472	202,899	124,977,573	11,203,224	8.96	2,548,546	22.75
1941	175,181,820	205,006*	174,976,814	18,111,095	10.35	7,167,902	39.58
1942	206,160,215	290,405*	205,869,810	24,052,358	11.68	12,256,396	50.96
1943	240,676,898	287,517*	240,389,381	28,717,966	11.95	15,925,582	55.46
1944	252,962,944	233,022	252,729,922	27,123,741	10.73	14,884,050	54.87
1945	239,045,611	201,757	238,843,854	22,165,206	9.28	10,794,750	48.70
1946	265,597,448	200,432	265,397,016	27,184,592	10.24	8,874,840	32.65
1947	343,273,851	187,082	343,086,769	33,381,291	9.73	10,981,482	32.90
1948	379,309,471	157,150	379,152,321	36,273,250	9.57	11,920,260	32.86
1949	350,168,722	189,196	349,979,526	30,576,517	8.74	9,817,308	32.11
1950	430,687,780	215,215	430,472,565	44,140,741	10.25	17,316,932	39.23
1951	479,243,451	247,630	478,995,821	45,333,173	9.46	22,082,117	48.71
1952	486,441,344	273,759	486,167,585	40,431,697	8.32	19,147,694	47.36
1953	506,450,081	311,473	506,138,608	41,819,445	8.26	19,869,049	47.51

*Includes receipts "Subject to Surtax Only" as well as wholly tax-exempt receipts. See footnote 4 , p. 36.

Source: The figures for total compiled receipts, wholly tax-exempt receipts, total taxable net income, and total taxes on income were taken from United States Treasury Department, Internal Revenue Service, Statistics of Income (for each year from 1928 to 1953 inclusive; Washington, D. C.: Government Printing Office). The remaining figures were computed by the author.

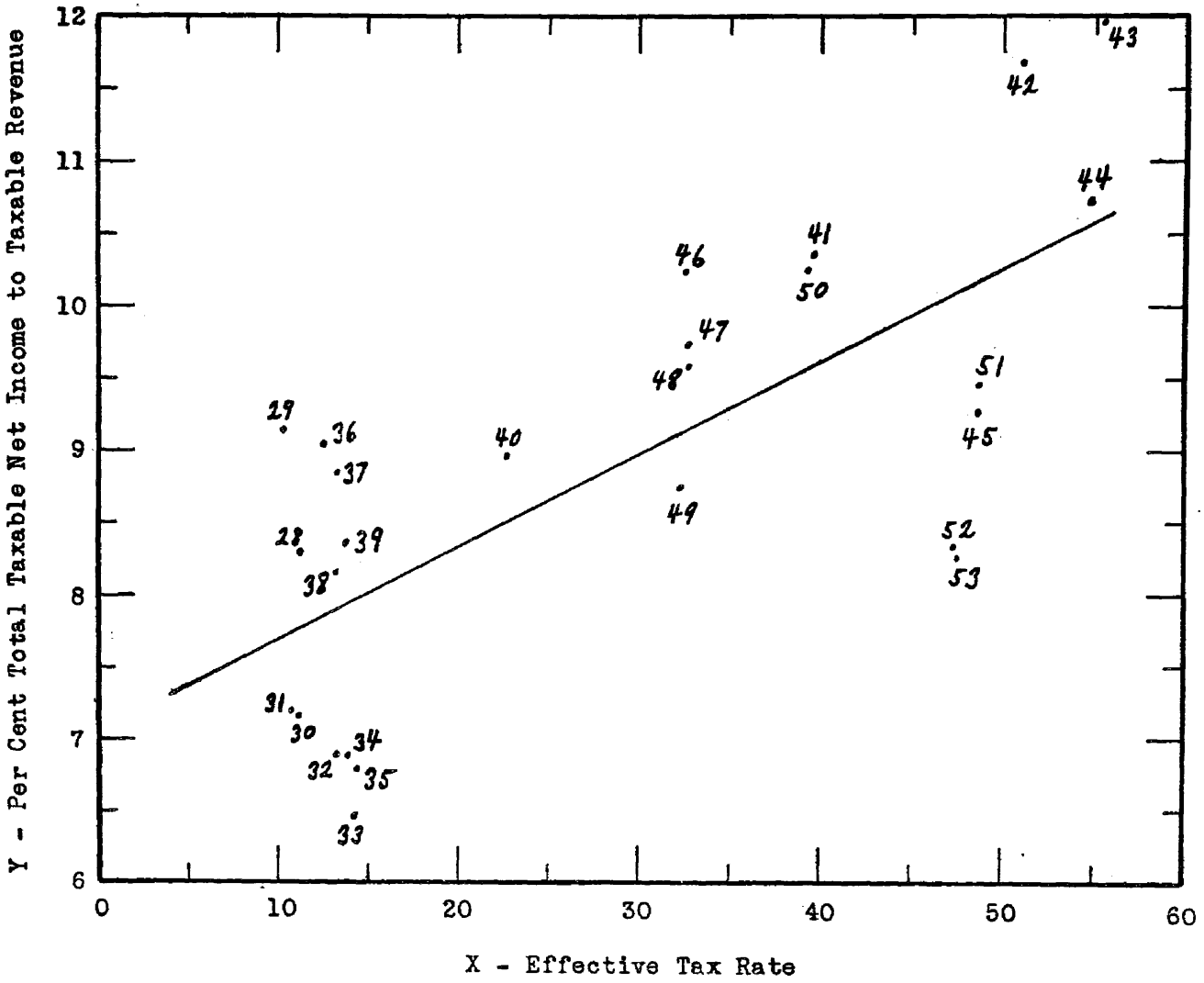

Fig. 1. Scatter Diagram of Effective Tax Rate and Per Cent Total Taxable Net Income to Total Taxable Revenue, with Line of Regression, for All Corporations with Net Income, All Industrial Groups, 1928 - 1953.
Source: Table I.

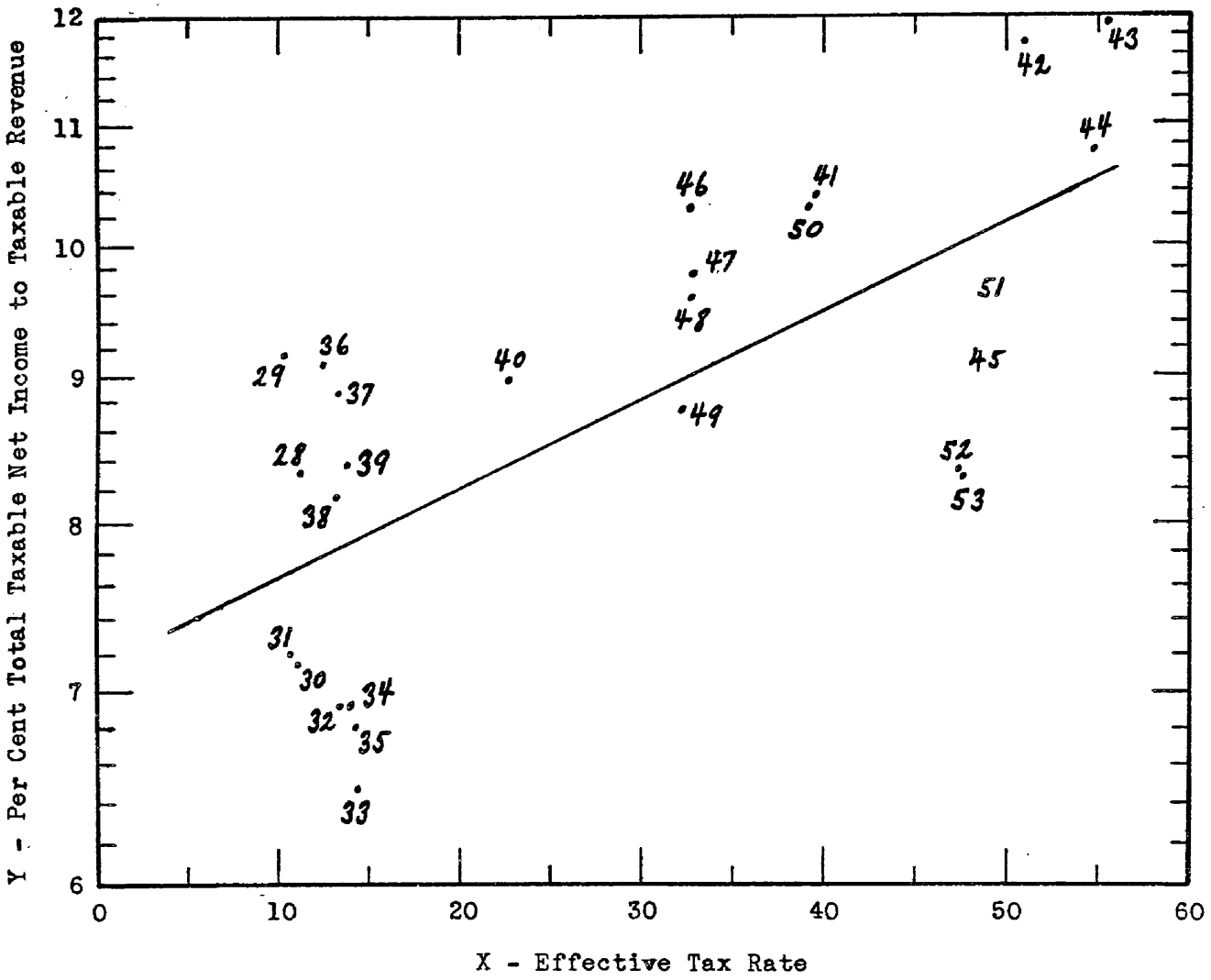

Fig. 2. Scatter Diagram of Effective Tax Rate and Per Cent Total Taxable Net Income to Total Taxable Revenue, with Line of Regression, for All Corporations with Net Income, All Industrial Groups, 1928 - 1953. Source: Table I.

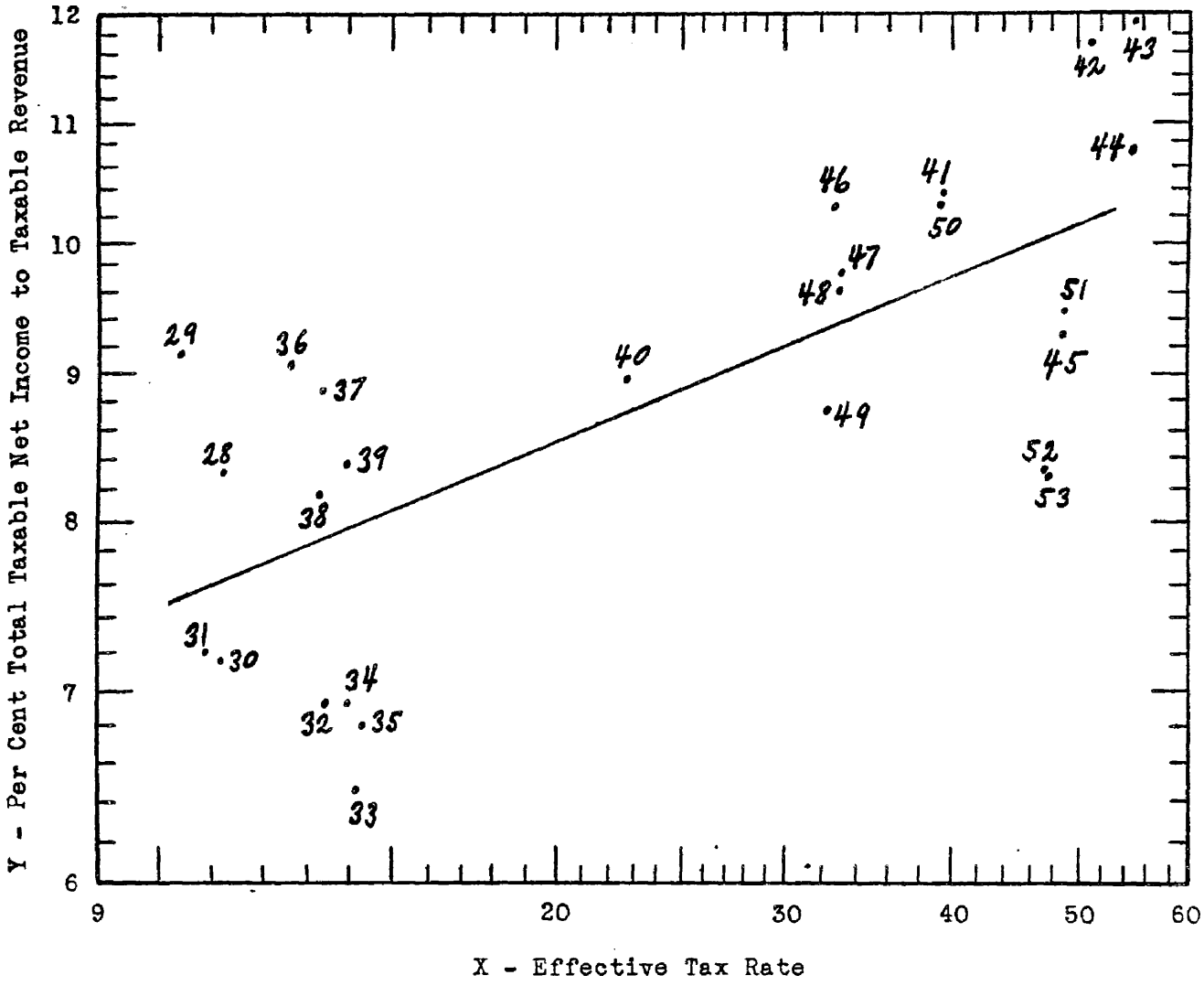

Fig. 3. Scatter Diagram of Effective Tax Rate and Per Cent Total Taxable Net Income to Total Taxable Revenue, with Line of Regression, for All Corporations with Net Income, All Industrial Groups, 1928 - 1953. Source: Table I.

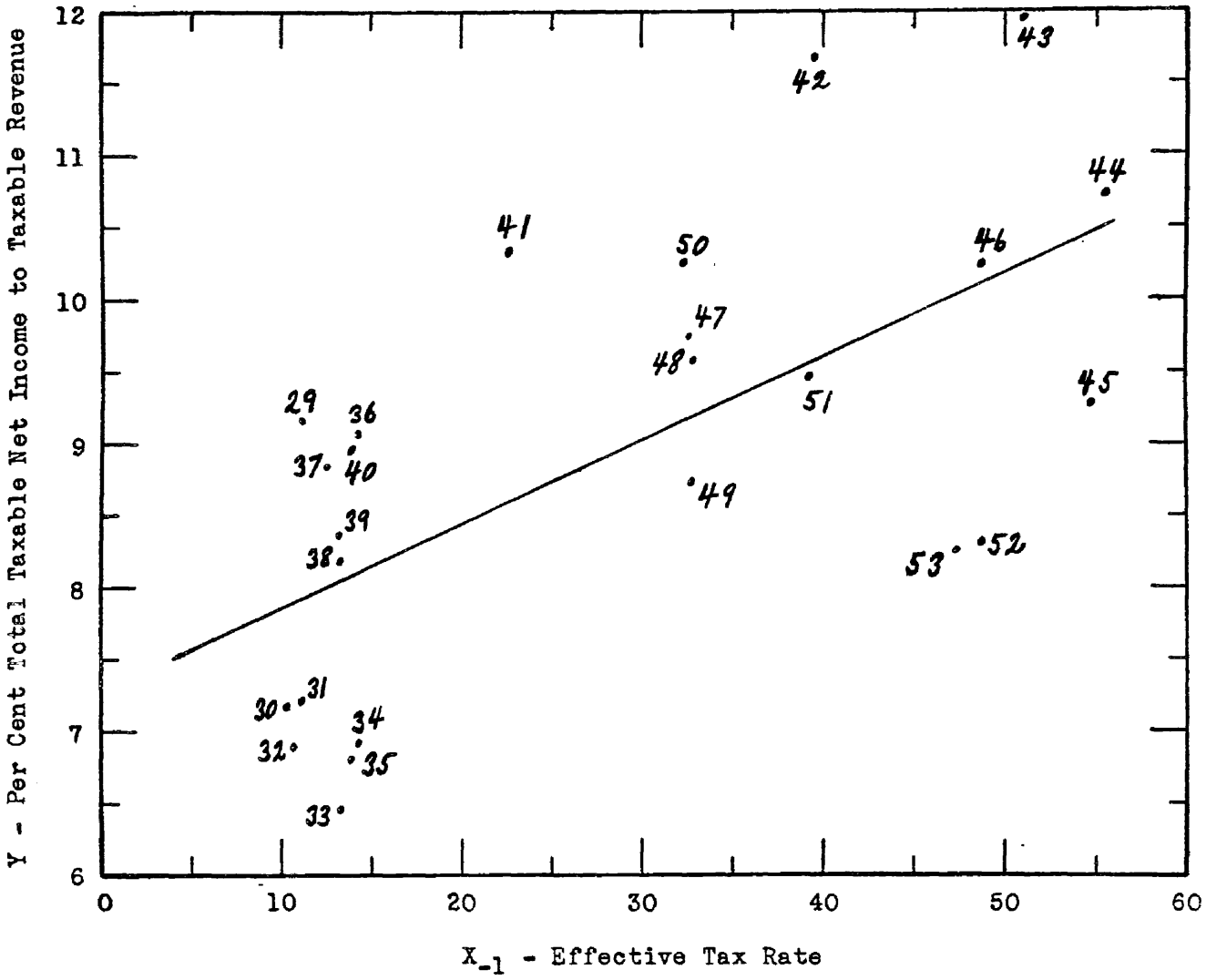

Fig. 4. Scatter Diagram of Effective Tax Rate, Lagged One Year, and Per Cent Total Taxable Net Income to Total Taxable Revenue, with Line of Regression, for All Corporations with Net Income, All Industrial Groups, 1929 - 1953. Source: Table I.

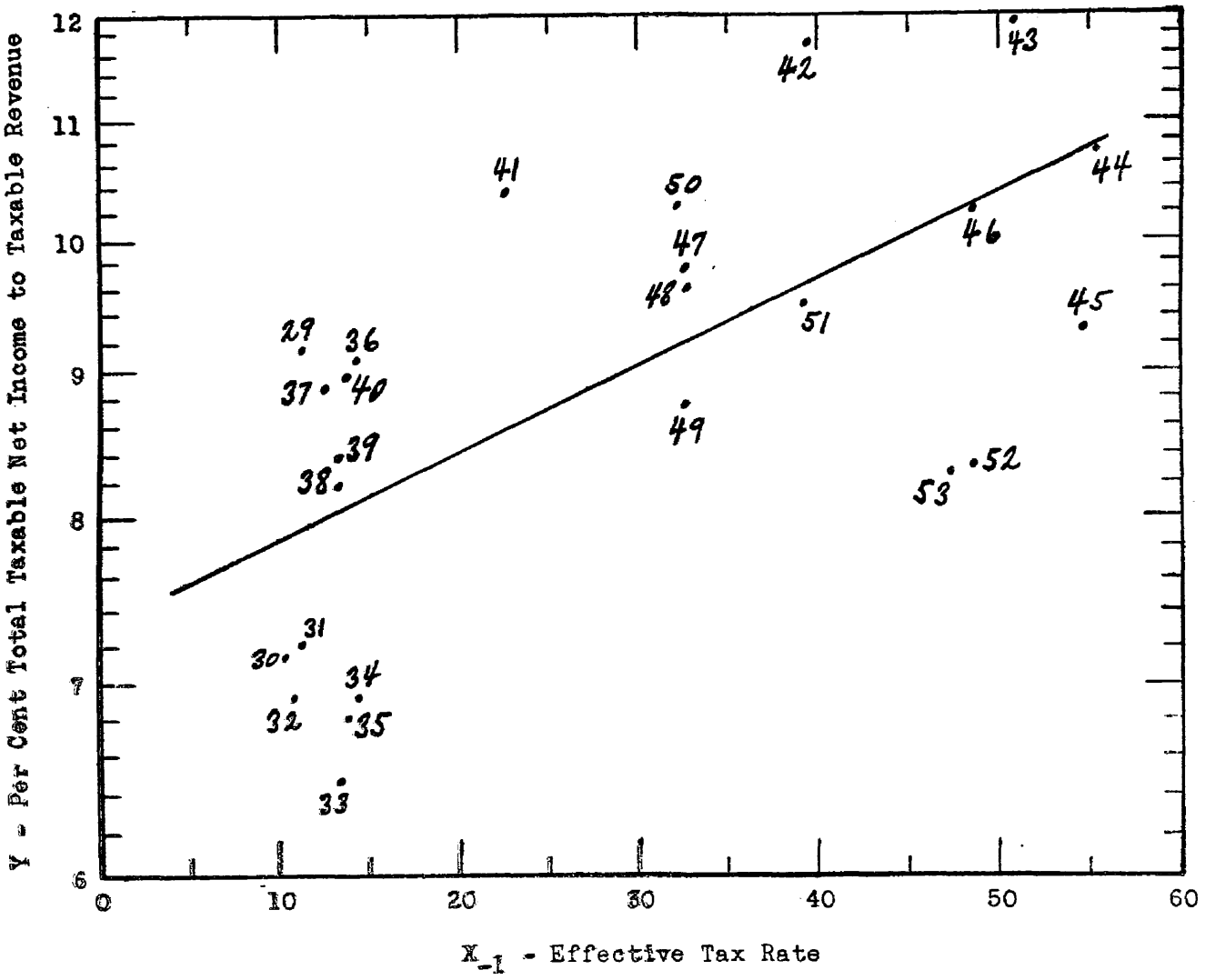

Fig. 5. Scatter Diagram of Effective Tax Rate, Lagged One Year, and Per Cent Total Taxable Net Income to Total Taxable Revenue, with Line of Regression, for All Corporations with Net Income, All Industrial Groups, 1929 - 1953. Source: Table I.

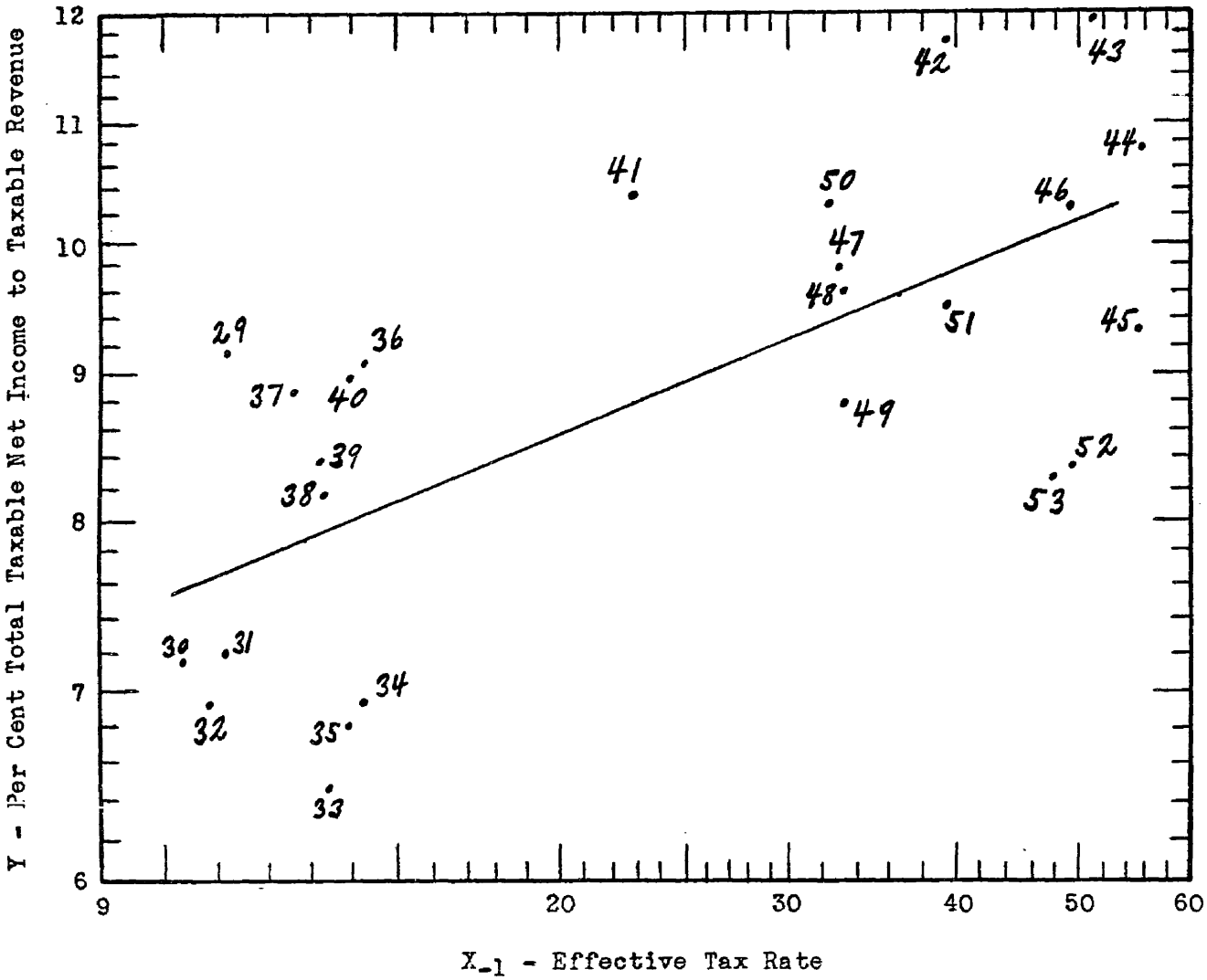

Fig. 6. Scatter Diagram of Effective Tax Rate, Lagged One Year, and Per Cent Total Taxable Net Income to Total Taxable Revenue, with Line of Regression, for All Corporations with Net Income, All Industrial Groups, 1929 - 1953. Source: Table I.

basis of our assumptions, there may well be, as is graphically portrayed by the slopes of the regression lines or "lines of average relationship", a shifting of at least part of federal corporation income taxes over a longer period of time; but it is also evident that this shifting does not take place in a smooth or automatic fashion.

Figures 4, 5, and 6, which portray a lead-lag relationship of one year, do not seem to add anything to the observations already made. The two general groupings reappear, but the year 1941 does not occupy quite as intermediary a position as did the year 1940 in Figures 1-3. Again, however, we note a general upward drift of the data, a characteristic which is depicted, as in the first three diagrams, by the slopes of the least-squares lines of regression.

Turning now to the use of more refined techniques of measurement, we note, in Table II on the following page, the value of the least-squares coefficient of correlation for each of the six sets of relationships (that is, the six involving the least-squares method of computation). In addition, Spearman's rank order coefficient is given for each of the two temporal relationships. The values of these various coefficients, it will be noted, range from a high of .722 for the least-squares coefficient for the arithmetic (functional) and current-year (temporal) relationships to a low of .632 for the Spearman coefficient depicting the one-year lead-lag relationship. In Table III on pages 60 and 61 are presented the results of the tests of significance of these eight coefficients. For evaluation purposes the critical values of t, for the least-squares data, and of z, for the Spearman data, are given for three different levels of significance, namely,

TABLE II: COEFFICIENTS OF CORRELATION, ALL INDUSTRIAL GROUPS

Type of Relationship	Value of Coefficient
A. 26-Year Period (N = 26)	
1. Arithmetic relationship of variables	.722
2. Exponential relationship of variables	.711
3. Parabolic relationship of variables	.706
4. Spearman's rank order coefficient	.634
B. Lead-Lag (N = 25)	
1. Arithmetic relationship of variables	.640
2. Exponential relationship of variables	.638
3. Parabolic relationship of variables	.677
4. Spearman's rank order coefficient	.632

Note: See Appendix Table III, p. 111, for formulas used in computing the coefficients given above.

TABLE III: TESTS OF SIGNIFICANCE OF CORRELATION COEFFICIENTS, ALL INDUSTRIAL GROUPS

A. Least-Squares Coefficients

1. 26-Year Period

a. Computed values of $\underline{t}$ ($\underline{N}$ = 26)

(1) Arithmetic relationship of variables	5.119
(2) Exponential relationship of variables	4.957
(3) Parabolic relationship of variables	4.890

b. Critical values of $\underline{t}$ for selected levels of significance ($\underline{n} = \underline{N} - 2 = 24$)

$$t_{.995} = 2.797$$

$$t_{.990} = 2.492$$

$$t_{.975} = 2.064$$

2. Lead-Lag

a. Computed values of $\underline{t}$ ($\underline{N}$ = 25)

(1) Arithmetic relationship of variables	3.996
(2) Exponential relationship of variables	3.976
(3) Parabolic relationship of variables	4.406

b. Critical values of $\underline{t}$ for selected levels of significance ($\underline{n} = \underline{N} - 2 = 23$)

$$t_{.995} = 2.807$$

$$t_{.990} = 2.500$$

$$t_{.975} = 2.069$$

TABLE III--Continued: TESTS OF SIGNIFICANCE OF CORRELATION COEFFICIENTS, ALL INDUSTRIAL GROUPS

B. Spearman's Rank Order Coefficients

1. Computed values of $\underline{z}$

a. 26-year period ($\underline{N}$ = 26)	3.171
b. Lead-lag ($\underline{N}$ = 25)	3.098

2. Critical values of $\underline{z}$ for selected levels of significance

$$z_{(A = .495)} = 2.576$$

$$z_{(A = .490)} = 2.326$$

$$z_{(A = .475)} = 1.960$$

for probabilities of .01, .02, and .05, for both of the temporal relationships.[4]

In analyzing these various statistics, we draw the following conclusions:

1. All six least-squares correlation coefficients prove to be significant, even when tested against the most rigorous critical value given. For at $\underline{t}_{.995}$ ($\underline{n} = \underline{N} - 2 = 24$), there is a probability of only .01, or one time out of one hundred, that the computed value of $\underline{t}$ will equal or exceed 2.797 if the population coefficient of correlation, in the current-year relationship, is zero. Actually, as we see from the table, the computed values of $\underline{t}$ exceed this critical value by a considerable margin: 5.119, 4.957, and 4.890, representing the computed $\underline{t}$ values for the arithmetic, exponential, and parabolic relationships, respectively, are appreciably in excess of $\underline{t}_{.995} = 2.797$. Similarly, for the lead-lag relationship, a value as great as 2.807, at $\underline{t}_{.995}$ ($\underline{n} = \underline{N} - 2 = 23$), would occur only one time out of one hundred, as a result of chance fluctuations of sampling, with the true value of ρ equal to zero. Again, this critical value is less than any of the three computed $\underline{t}$ values. Thus, we reject the null hypothesis and thereby accept the possibility that, for the economy as a whole,

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[4]It may be mentioned at this point that certain intermediary statistical data on the aggregate economy have been included in the appendixes for supplemental information and reference purposes, and also for providing a handy basis for possible further mathematical manipulations of the original data. Specifically, Appendix Table I contains all the basic statistical summations used in the computational work involving the aggregate economy, while Appendix Table II gives the formulas and the numerical values for the eight pairs of descriptive measures (arithmetic means and standard deviations) needed in subsequent calculations.

(some) shifting of federal corporation income taxes does occur.

2. With the exception of the parabolic for the lead-lag relationship, the use of the exponential and parabolic functions add nothing to our study. And even in the exception noted, the contribution is not significant: for the parabolic function does not uncover any relationship not brought out by the arithmetic. Because, then, of this lack of significant contribution, in combination with the fact that computational work involving logarithmic transformations is particularly time-consuming, only the linear functional relationship is used in the analyses of the individual industrial divisions (Chapter VII).

3. The lead-lag relationship, where the before-tax profit rate is a function of the prior year's effective tax rate, appears weaker than that of the current year. This is true with regard to the Spearman data as well as the least-squares, though to a much smaller extent.

4. The amount and nature of the divergence between the Spearman and the least-squares coefficients are noteworthy. Although seemingly still high, the lower values of the Spearman statistics indicate that we should be very cautious in making inferences based on the least-squares calculations unless such inferences are reinforced by positive results in significance tests involving this distribution-free measure. The Spearman coefficients, as indicated in Table III, prove to be significant for both temporal relationships, even when tested against a significance level of $\underline{z}(\underline{A} = .495)$, that is, at a probability of .01. Because of this fact, we consider that our acceptance of the least-squares correlation coefficients as significant is confirmed; and we thereby reject the null hypothesis with increased assurance.

Having thus accepted the possibility of association between the two sets of variables, we shall now focus attention on the "regression" portion of our regression and correlation analysis. In Table IV on the following page there is presented the equation of the line of regression for each functional and temporal relationship, together with the standard error of estimate. Also, there are given both the logarithmic and the natural forms of the equations for the two non-linear functions. These several equations are all expressions of average relationships between the variables and, as such, were the measures used in plotting the straight (regression) lines on the six scatter diagrams discussed earlier in this chapter.[5]

Our present interest in these regression equations centers on the regression coefficients, for it is this statistic--the coefficient of regression--which provides a quantitative measure of the extent of tax shifting.[6] Thus, in the first equation in the table, which depicts the linear function for the current-year relationship, there is indicated a regression coefficient of .064. This is interpreted as meaning that, for the economy as a whole, an increase of one per cent in effec-

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[5]As is pointed out in Note 2 of Table IV there cannot properly be presented, in the natural form of the equations expressing exponential and parabolic functional relationships, a value for the standard error of estimate; rather, the confidence intervals should be stated. For the sake of providing a quick approximation, as well as for uniformity of presentation, we have allowed the antilogarithm of the corresponding term in the equation in logarithmic form to appear as the standard error of estimate in the natural form of the equation.

[6]It will be recalled from the discussion in the preceding chapter that, in the cases we are considering, the regression coefficient is also statistically significant when the correlation coefficient is significant. See footnote 7 , page 38.

TABLE IV: EQUATIONS OF THE LINE OF REGRESSION, WITH STANDARD ERROR OF ESTIMATES, ALL INDUSTRIAL GROUPS

Type of Functional Relationship	Equation
A. 26-Year Period	
1. Arithmetic	$Y = 7.050 + .064X \pm .998$
2. Exponential	
a. Logarithmic form	$\log Y = .853\ 8187 + .003\ 1221X \pm .050\ 0260$
b. Natural form	$Y = 7.142(1.007)^{X} \pm 1.122$
3. Parabolic	
a. Logarithmic form	$\log Y = .684\ 8663 + .187\ 4668(\log X) \pm .050\ 3715$
b. Natural form	$Y = 4.840(X)^{.187} \pm 1.123$
B. Lead-Lag	
1. Arithmetic	$Y = 7.283 + .058X_{-1} \pm 1.128$
2. Exponential	
a. Logarithmic form	$\log Y = .863\ 8866 + .002\ 8769X_{-1} \pm .055\ 7618$
b. Natural form	$Y = 7.309(1.007)^{X-1} \pm 1.137$
3. Parabolic	
a. Logarithmic form	$\log Y = .692\ 8619 + .183\ 9331(\log X_{-1}) \pm .053\ 3359$
b. Natural form	$Y = 4.930(X_{-1})^{.184} \pm 1.131$

Notes: (1) See Appendix Table IV for formulas used in computing equations of the line of regression.

(2) The values for standard error indicated in the four equations converted to natural form are antilogs of the corresponding term in logarithmic form. Given only as memorandum items, they are of no value in statistical inference, as confidence intervals constructed upon the basis of such antilogs would be erroneous. Actually, the confidence interval must first be stated in logarithmic form. Then, if desired, the confidence limits can be converted into natural numbers. See Mordecai Ezekiel, Methods of Correlation Analysis (2nd Edit.; New York: John Wiley & Sons, Inc., 1941), p. 135.

tive tax rate results in an average increase of around .064 per cent in the before-tax profit rate. To state it in another way, as the effective tax rate rises ten percentage points, American corporate management attempts, perhaps unconsciously, to shift this additional tax by increasing its percentage of total taxable net income to taxable revenue--its "percentage spread", let us say--in an amount in the vicinity of .64 percentage points.[7]

With regard to the exponential relationship of the variables, where the line of regression indicates Y values arranged in a geometric series and the corresponding X values arranged in an arithmetic series, we note that an increase of one per cent in the effective tax rate--let us say, from 5 to 6 per cent, or from 38 to 39 per cent--results in an average rate of increase in the before-tax profit rate of approximately .007, where (1.007 - 1 = 0.007 = .7%) is the rate of increase of a series growing in accordance with the compound interest law. Thirdly, looking at the regression coefficient in the equation expressing the parabolic functional relationship, where $b = \frac{\Delta Y}{Y} \div \frac{\Delta X}{X}$ = .00187 ÷ .01 = .187, we see that an increase of (.01 = 1%) in the effective tax rate, arranged in a geometric series, brings about an average rate of increase of .187 in Y, the before-tax profit rate.

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[7]This does not mean, of course, that for any specific year there was an increase of .064 percentage points in the profit rate for each increase of one per cent in the effective tax rate. It does indicate, however, that on the basis of our sample, .064 is taken to represent the average increase in Y corresponding to a unit increase in X. Even this "average" figure, moreover, is subject to a sampling error, at a confidence level of .99, of .0344. Table X, on page 99 in the next chapter, and the related discussion analyze in some detail the problem of confidence intervals for the coefficients of regression.

The interpretation of the regression coefficients in the three equations expressing the lead-lag time relationship is the same as that for the current-year relationship except, of course, that the percentage of taxable net income to revenue is made a function of the prior year's effective tax rate. Thus we note regression coefficients (in natural numbers) of .058, 1.007, and .184, indicating that an average increase of around .058 per cent in the before-tax profit rate, or an average rate of increase of .007 in this percentage figure, is associated with a unit increase in the effective tax rate, with the latter expressed in an arithmetic series; and that an increase of approximately .184 in the before-tax profit rate is associated with a unit increase in the effective tax rate, when both variables are arranged in geometric series. All these measures, as in the current-year case, represent different ways of measuring the extent to which federal corporation income taxes have been shifted by profit-making corporations in the period 1928-1953.

Having thus completed our discussion of the aggregate economy, where the data from all types of industrial activity are merged in an attempt to find a general economy-wide pattern, we now turn to our analyses of the eight individual industrial divisions. These analyses, and the comparison of their results with one another and with those of the aggregate economy, constitute the subject of the next chapter.[8]

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[8]It may be worthwhile to recall that we shall discontinue use of the exponential and parabolic functional relationships at this point. It will, therefore, be only linear least-squares and Spearman data which will be carried forward from this chapter and utilized for comparative purposes in the next. Both the current-year and the lead-lag time relationships will be used in the following discussion.

CHAPTER VII: THE INDIVIDUAL INDUSTRIAL DIVISIONS

Our study of the Internal Revenue Service's eight industrial divisions, like that of the aggregate economy, begins with an examination of the scatter diagrams, which graphically portray the relationships between the two variables over the time period under discussion.[1] Sixteen such diagrams are presented, one for each of the two temporal relationships for each industrial division. These diagrams are found on the next sixteen pages, while comments on them are given in the discussion beginning in the following paragraph.[2]

1. Figures 7 and 8 portray the current-year and lead-lag relationships, respectively, for those profit-making corporations engaged

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[1]The basic data used in the computation of the variables as well as the percentages themselves are presented, by industrial division and by year, in Appendix Tables V-XII, inclusive. These tables, it will be noted, include precisely the same type of information as does Table I (in Chapter VI), which contains the data for the aggregate economy.

[2]It might be mentioned at this point that care should be taken in comparing the scatter diagrams of the different industrial divisions, as in no two divisions was the same scaling used on the axis of ordinates. The scalings employed were constructed so as to portray in the best possible manner the data of each separate division. Thus, for example, the value of this graphic device would have been greatly minimized, if not entirely lost, if we had plotted the data for the dependent variable for Trade (Figures 17-18), which range from 2.52 to 6.15, in a diagram employing a scale that would also have accommodated the corresponding data for Finance, Insurance, Real Estate, and Lessors of Real Property (Figures 19-20), which range from 9.99 to 40.31. Also, there are three different scalings employed for the axis of abscissas, one for Manufacturing (Figures 13-14), another for Finance, etc. (Figures 19-20), and a third for the other six divisions.

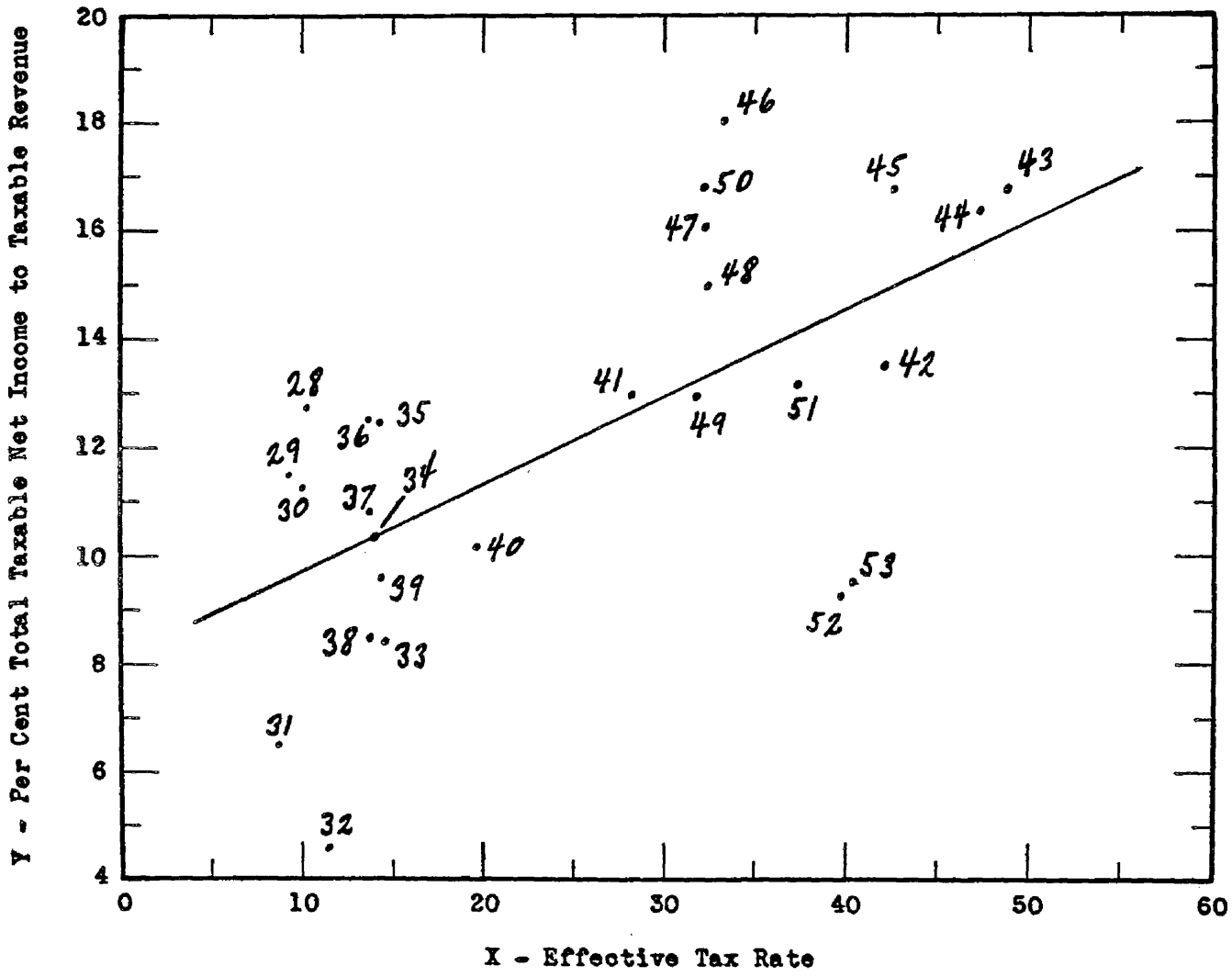

Fig. 7. Scatter Diagram of Effective Tax Rate and Per Cent Total Taxable Net Income to Total Taxable Revenue, with Line of Regression, for All Corporations with Net Income Engaged in Agriculture, Forestry, and Fishery, 1928-1953. Source: Appendix Table V.

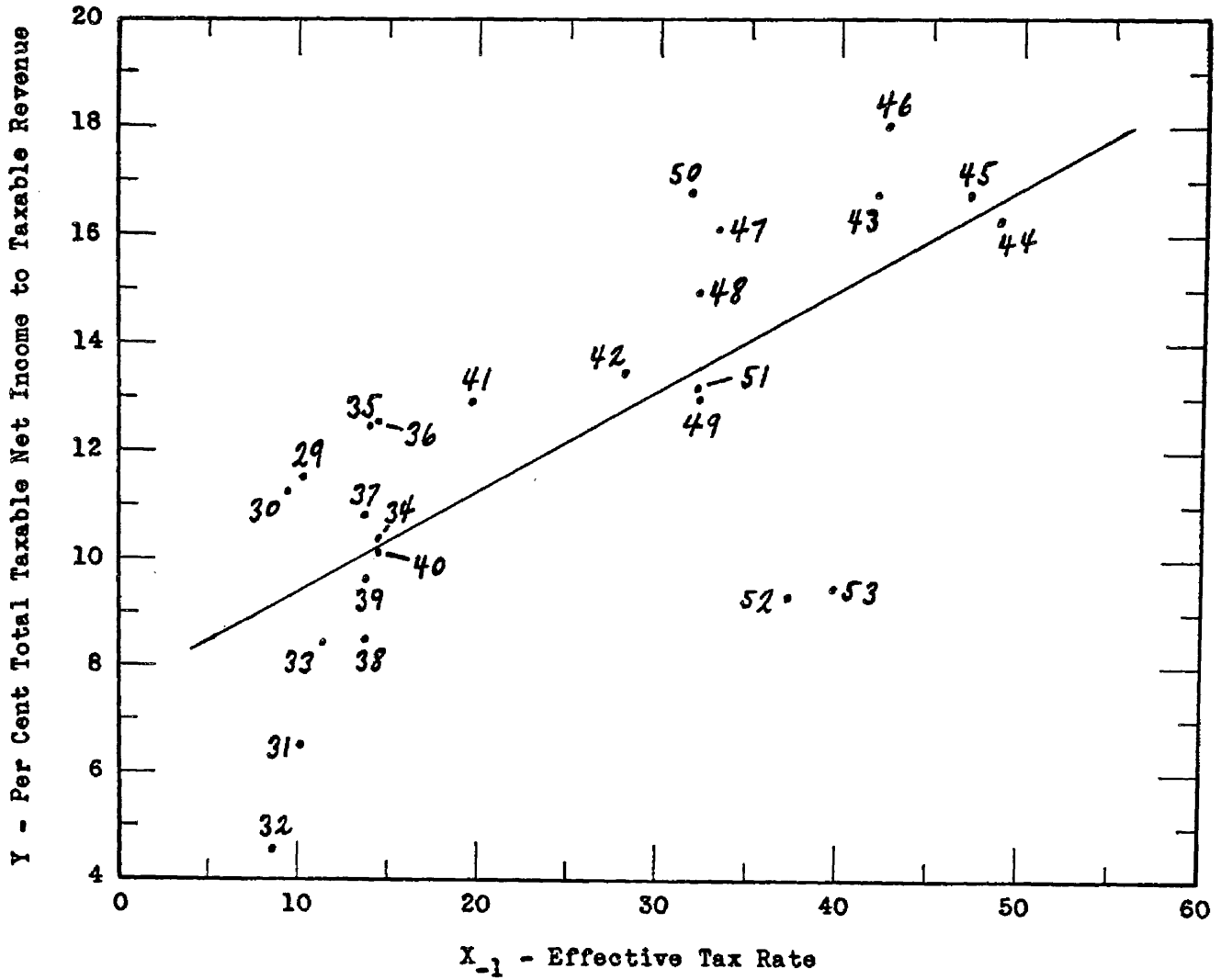

Fig. 8. Scatter Diagram of Effective Tax Rate, Lagged One Year, and Per Cent Total Taxable Net Income to Total Taxable Revenue, with Line of Regression, for All Corporations with Net Income Engaged in Agriculture, Forestry, and Fishery, 1929-1953. Source: Appendix Table V.

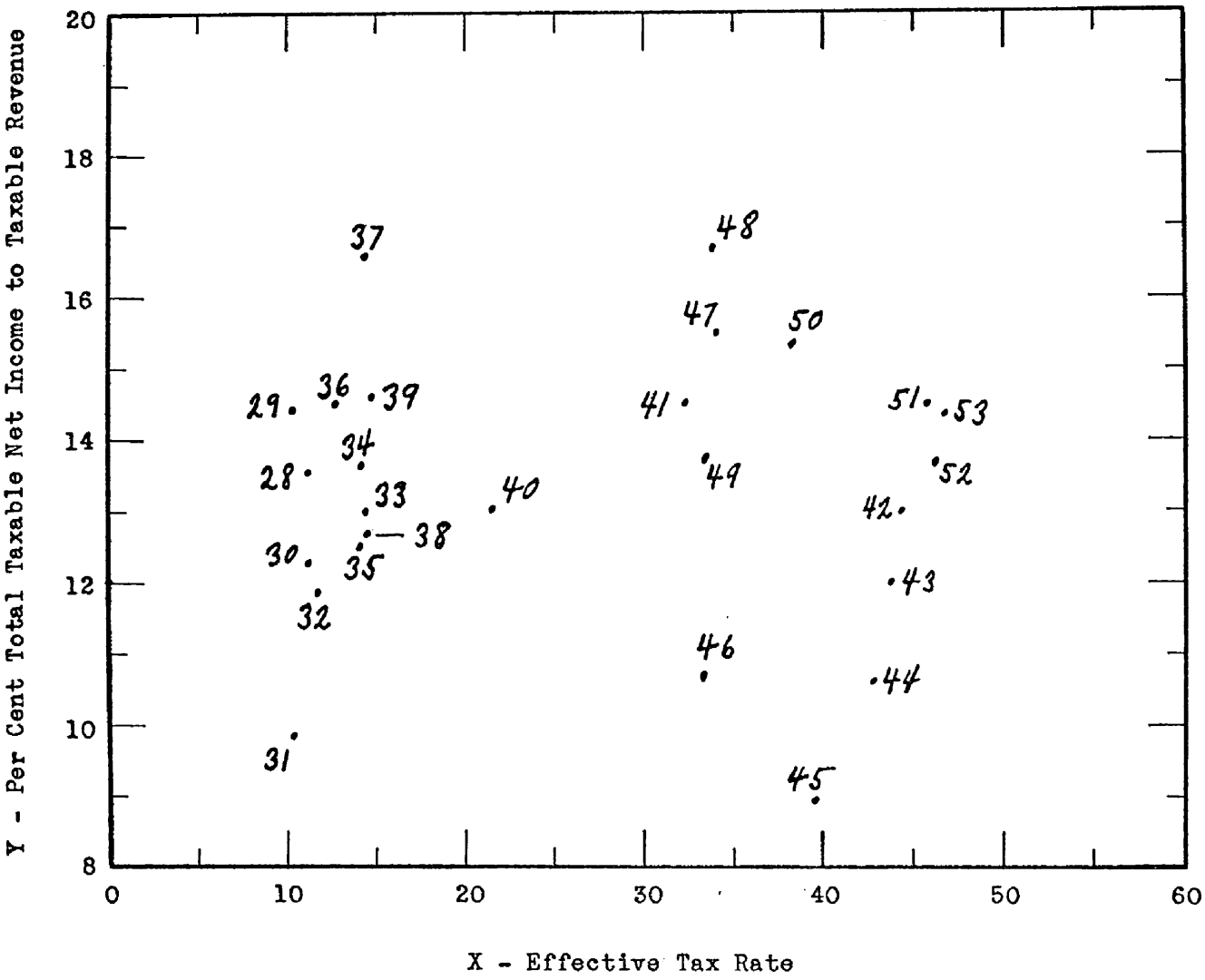

Fig. 9. Scatter Diagram of Effective Tax Rate and Per Cent Total Taxable Net Income to Total Taxable Revenue for All Corporations with Net Income Engaged in Mining and Quarrying, 1928-1953. Source: Appendix Table VI.

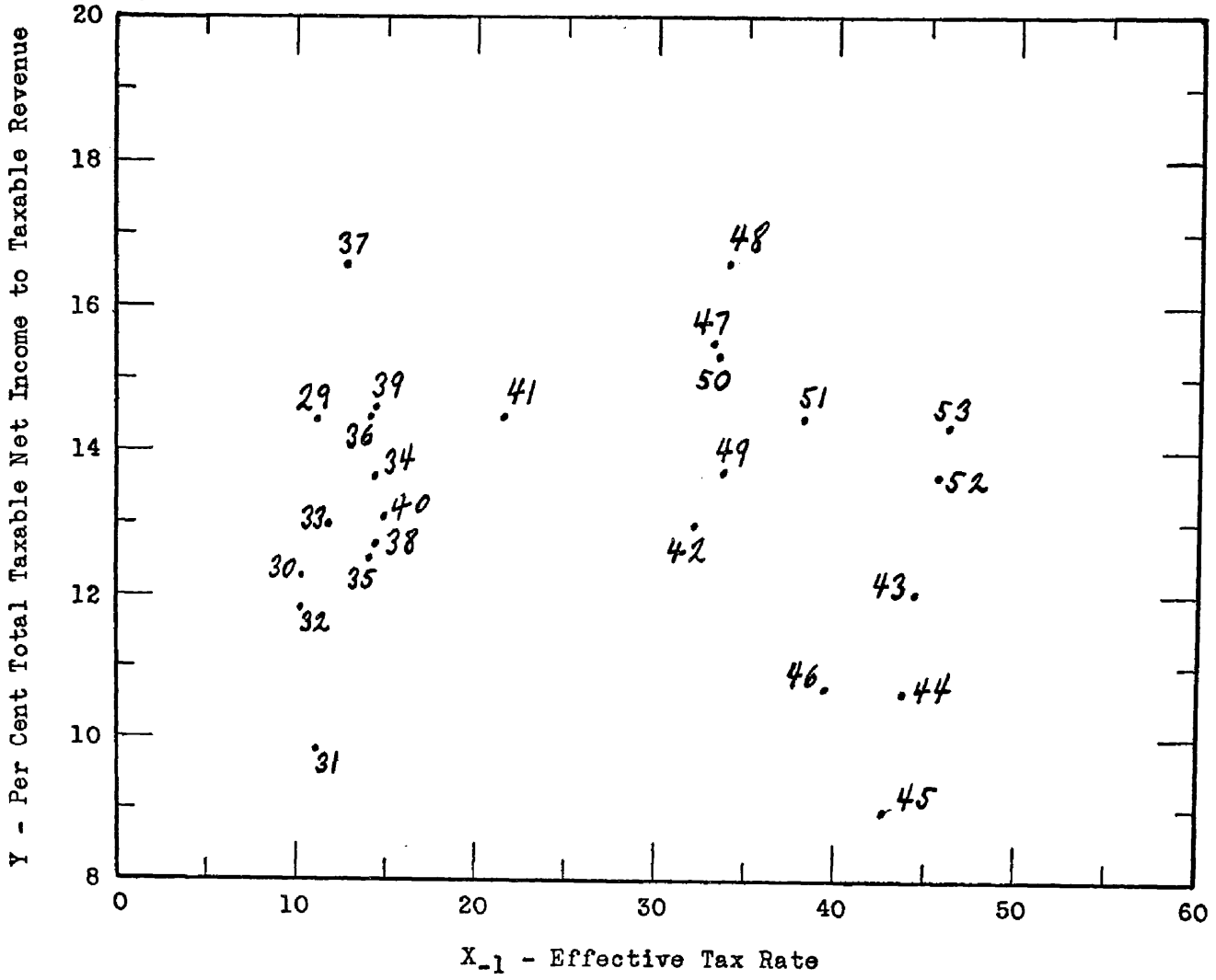

Fig. 10. Scatter Diagram of Effective Tax Rate, Lagged One Year, and Per Cent Total Taxable Net Income to Total Taxable Revenue for All Corporations with Net Income Engaged in Mining and Quarrying, 1929-1953. Source: Appendix Table VI.

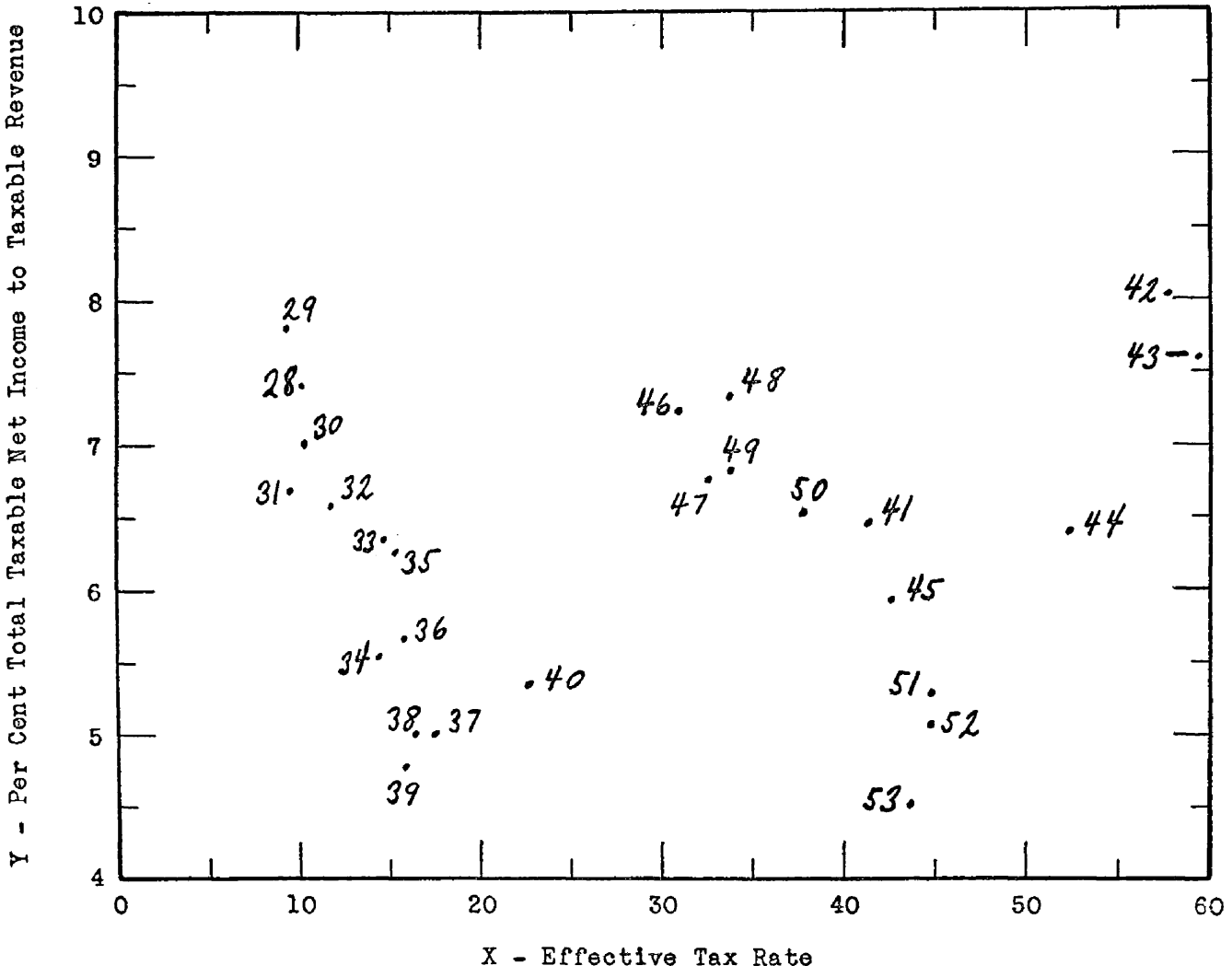

Fig. 11. Scatter Diagram of Effective Tax Rate and Per Cent Total Taxable Net Income to Total Taxable Revenue for All Corporations with Net Income Engaged in Construction, 1928-1953. Source: Appendix Table VII.

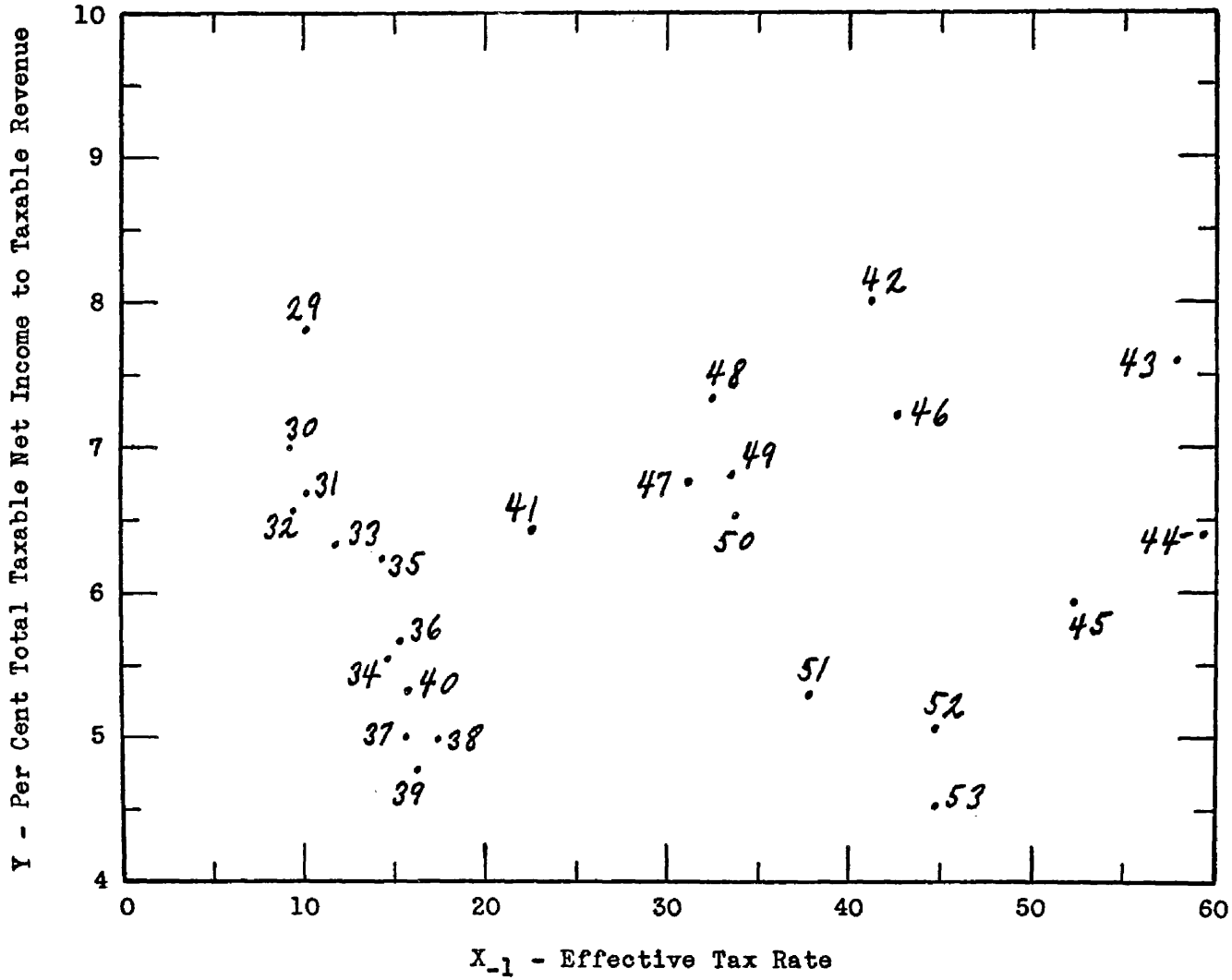

Fig. 12. Scatter Diagram of Effective Tax Rate, Lagged One Year, and Per Cent Total Taxable Net Income to Total Taxable Revenue for All Corporations with Net Income Engaged in Construction, 1929-1953. Source: Appendix Table VII.

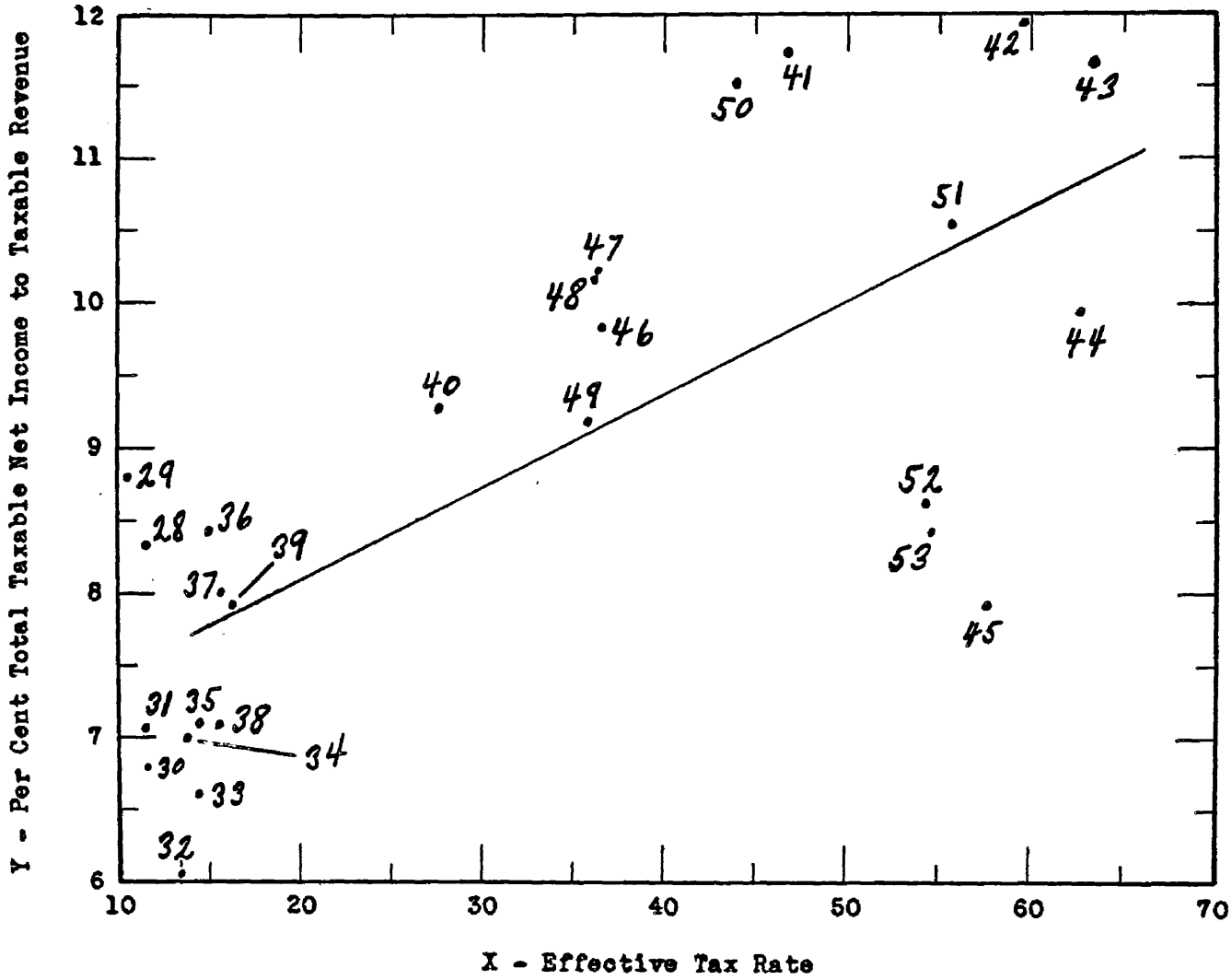

Fig. 13. Scatter Diagram of Effective Tax Rate and Per Cent Total Taxable Net Income to Total Taxable Revenue, with Line of Regression, for All Corporations with Net Income Engaged in Manufacturing, 1928-1953. Source: Appendix Table VIII.

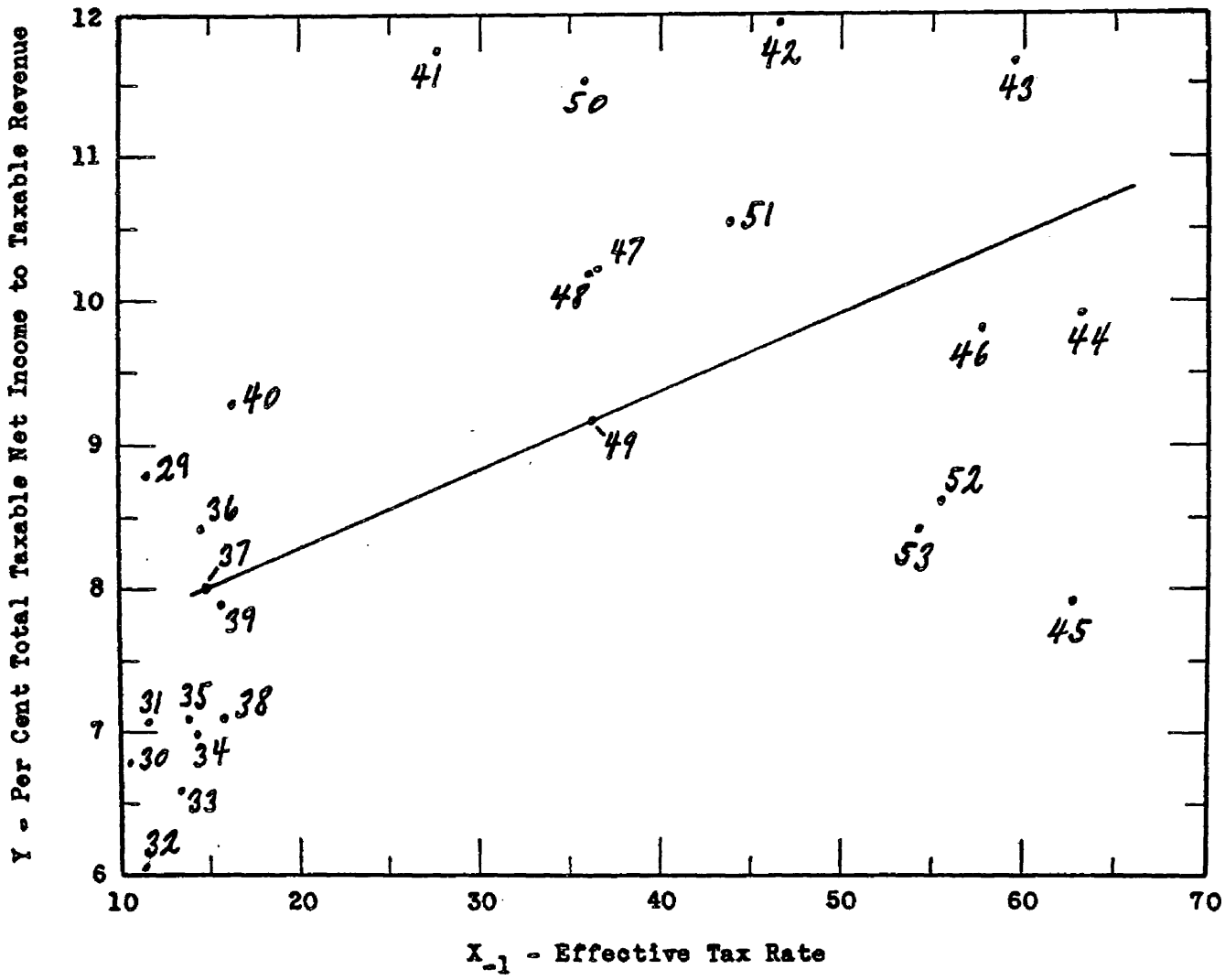

Fig. 14. Scatter Diagram of Effective Tax Rate, Lagged One Year, and Per Cent Total Taxable Net Income to Total Taxable Revenue, with Line of Regression, for All Corporations with Net Income Engaged in Manufacturing, 1929-1953. Source: Appendix Table VIII.

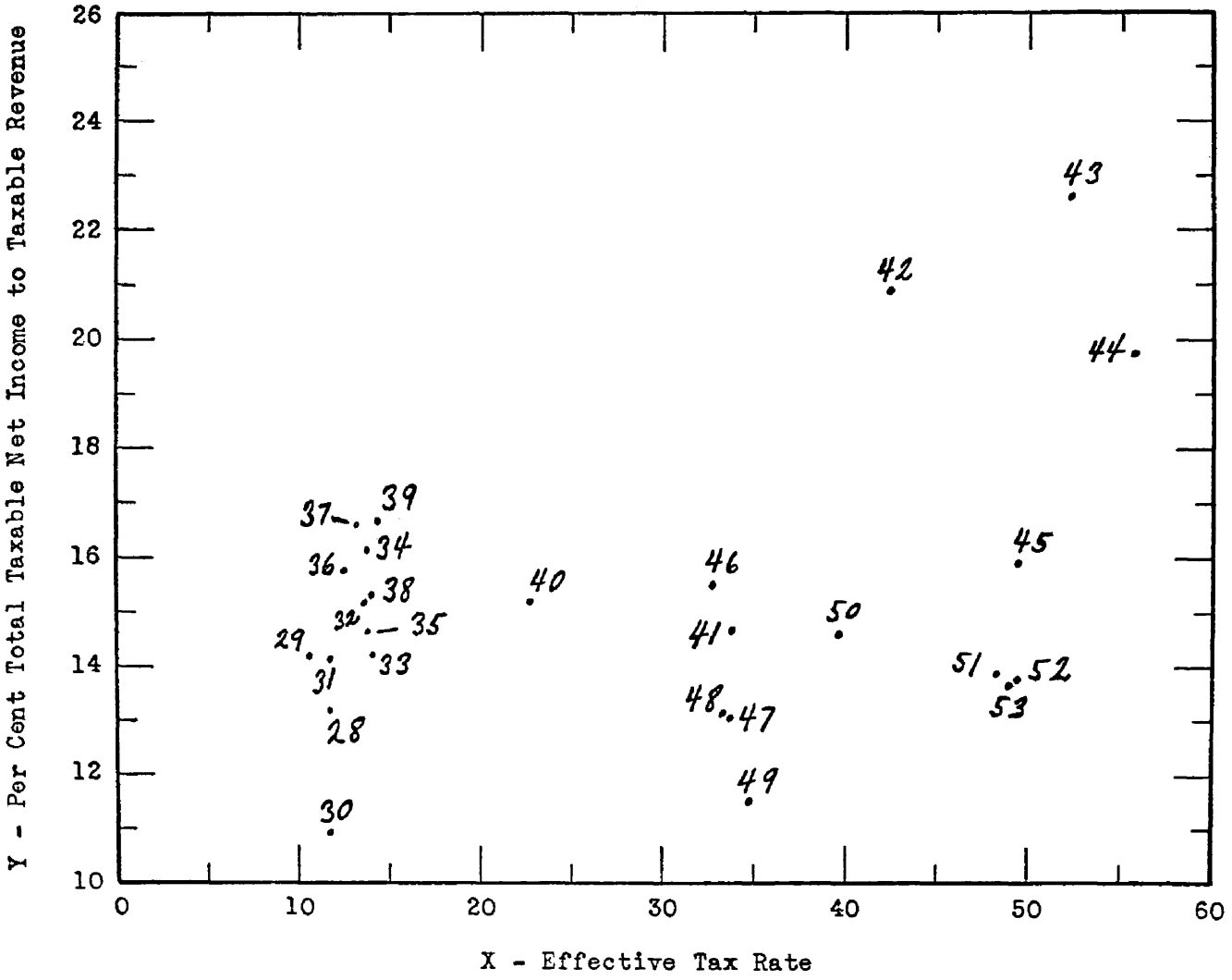

Fig. 15. Scatter Diagram of Effective Tax Rate and Per Cent Total Taxable Net Income to Total Taxable Revenue for All Corporations with Net Income Classified as Public Utilities, 1928-1953. Source: Appendix Table IX.

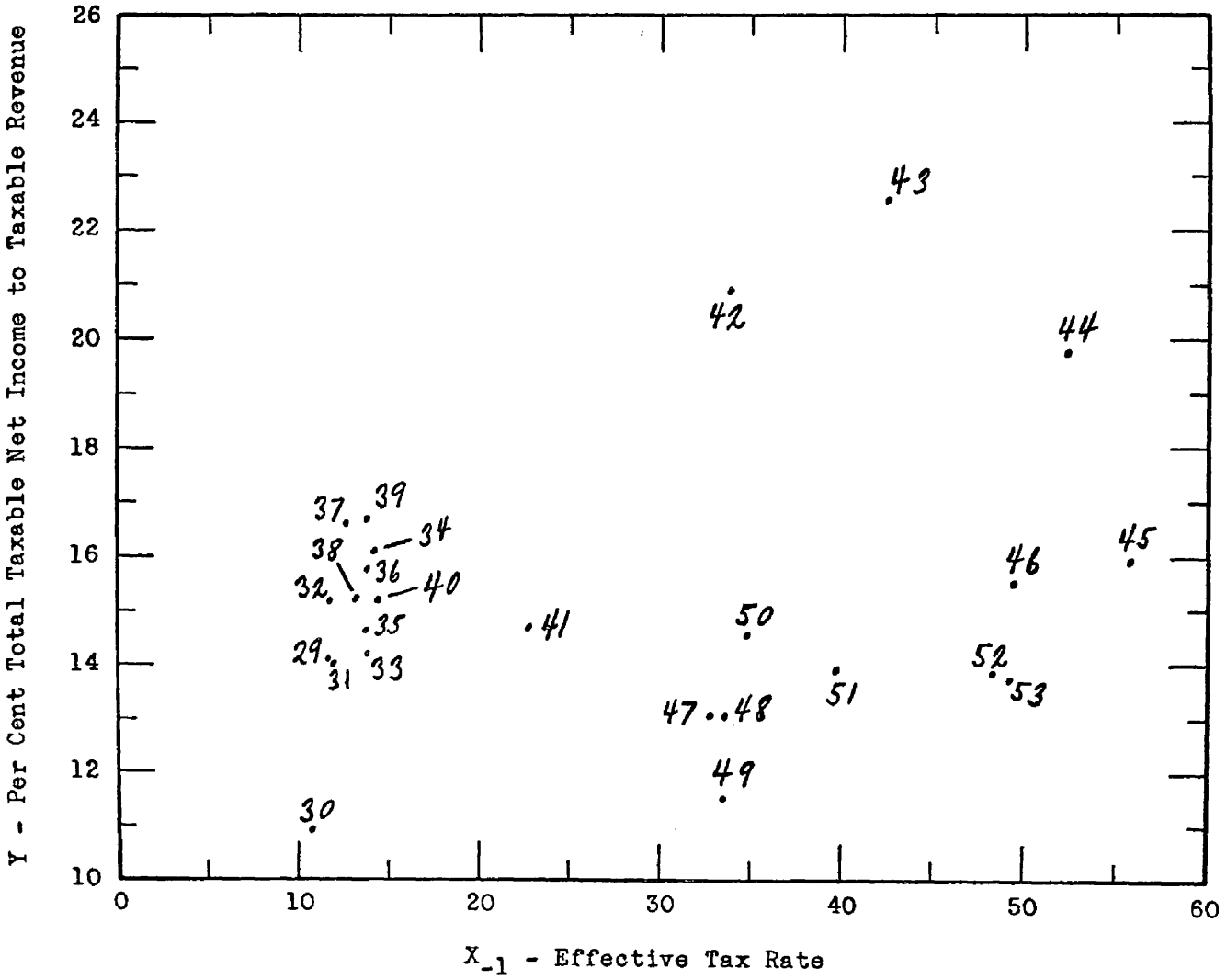

Fig. 16. Scatter Diagram of Effective Tax Rate, Lagged One Year, and Per Cent Total Taxable Net Income to Total Taxable Revenue for All Corporations with Net Income Classified as Public Utilities, 1929-1953. Source: Appendix Table IX.

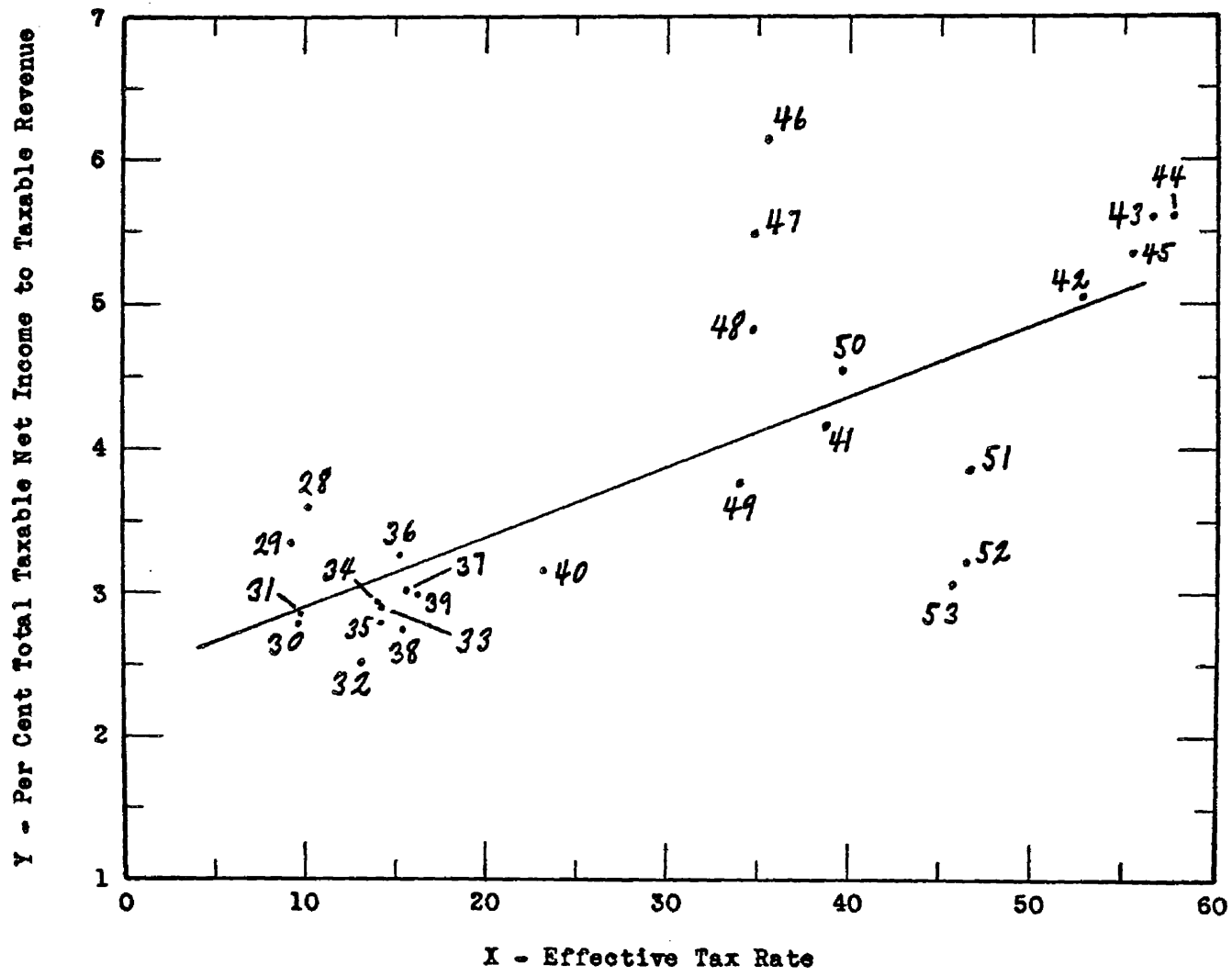

Fig. 17. Scatter Diagram of Effective Tax Rate and Per Cent Total Taxable Net Income to Total Taxable Revenue, with Line of Regression, for All Corporations with Net Income Engaged in Trade, 1928-1953. Source: Appendix Table X.

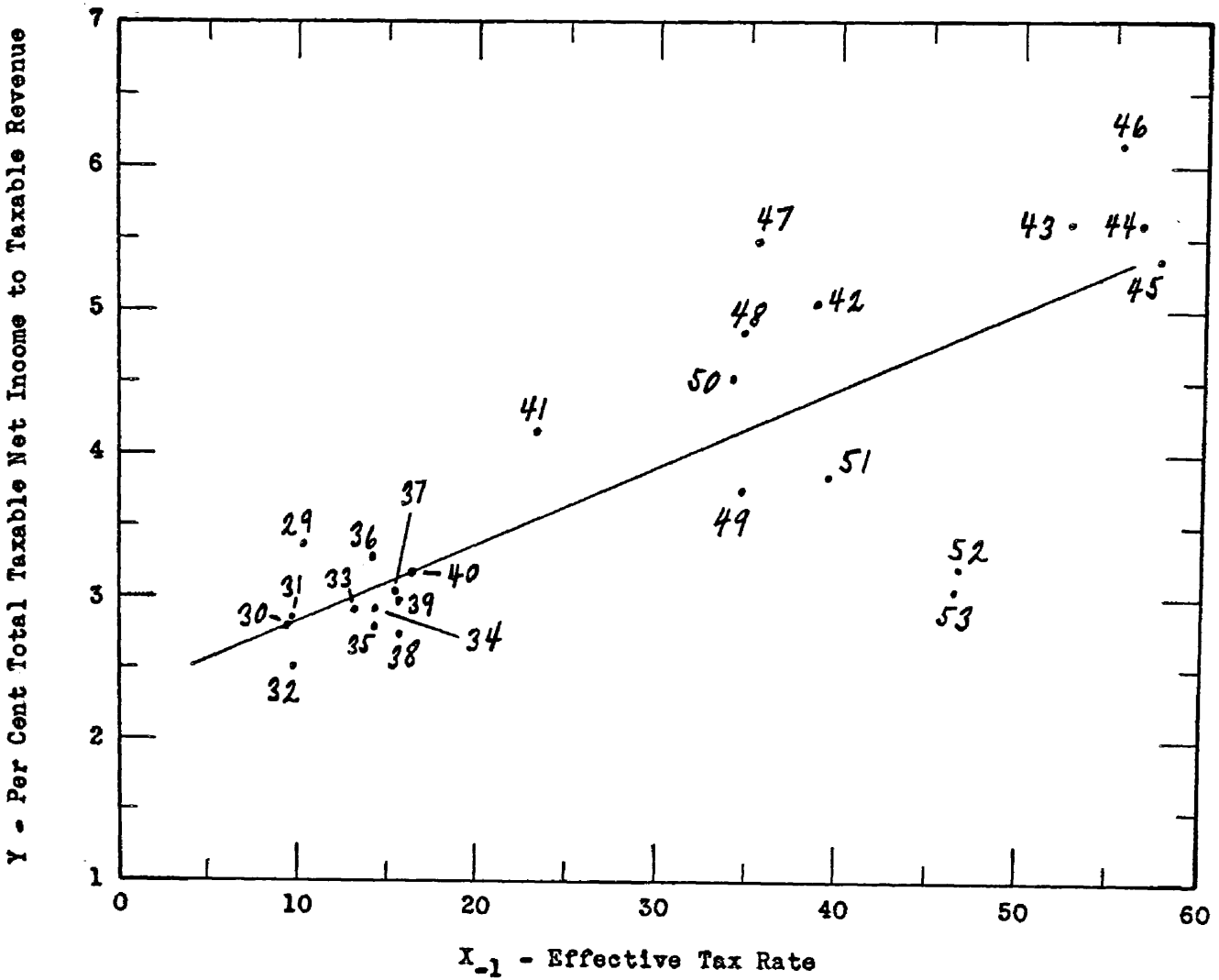

Fig. 18. Scatter Diagram of Effective Tax Rate, Lagged One Year, and Per Cent Total Taxable Net Income to Total Taxable Revenue, with Line of Regression, for All Corporations with Net Income Engaged in Trade, 1929-1953. Source: Appendix Table X.

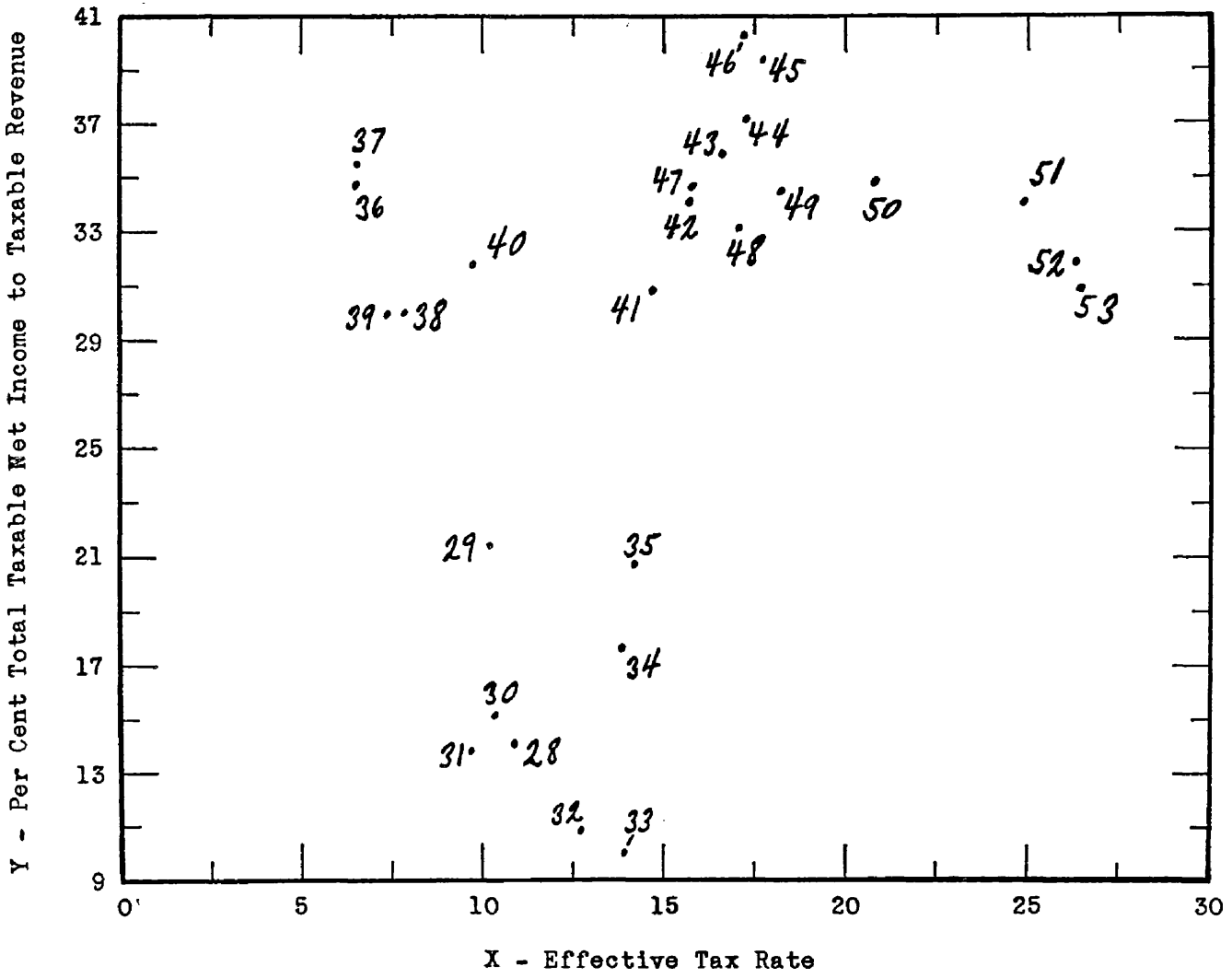

Fig. 19. Scatter Diagram of Effective Tax Rate and Per Cent Total Taxable Net Income to Total Taxable Revenue for All Corporations with Net Income Classified as Finance, Insurance, Real Estate, and Lessors of Real Property, 1928-1953. Source: Appendix Table XI.

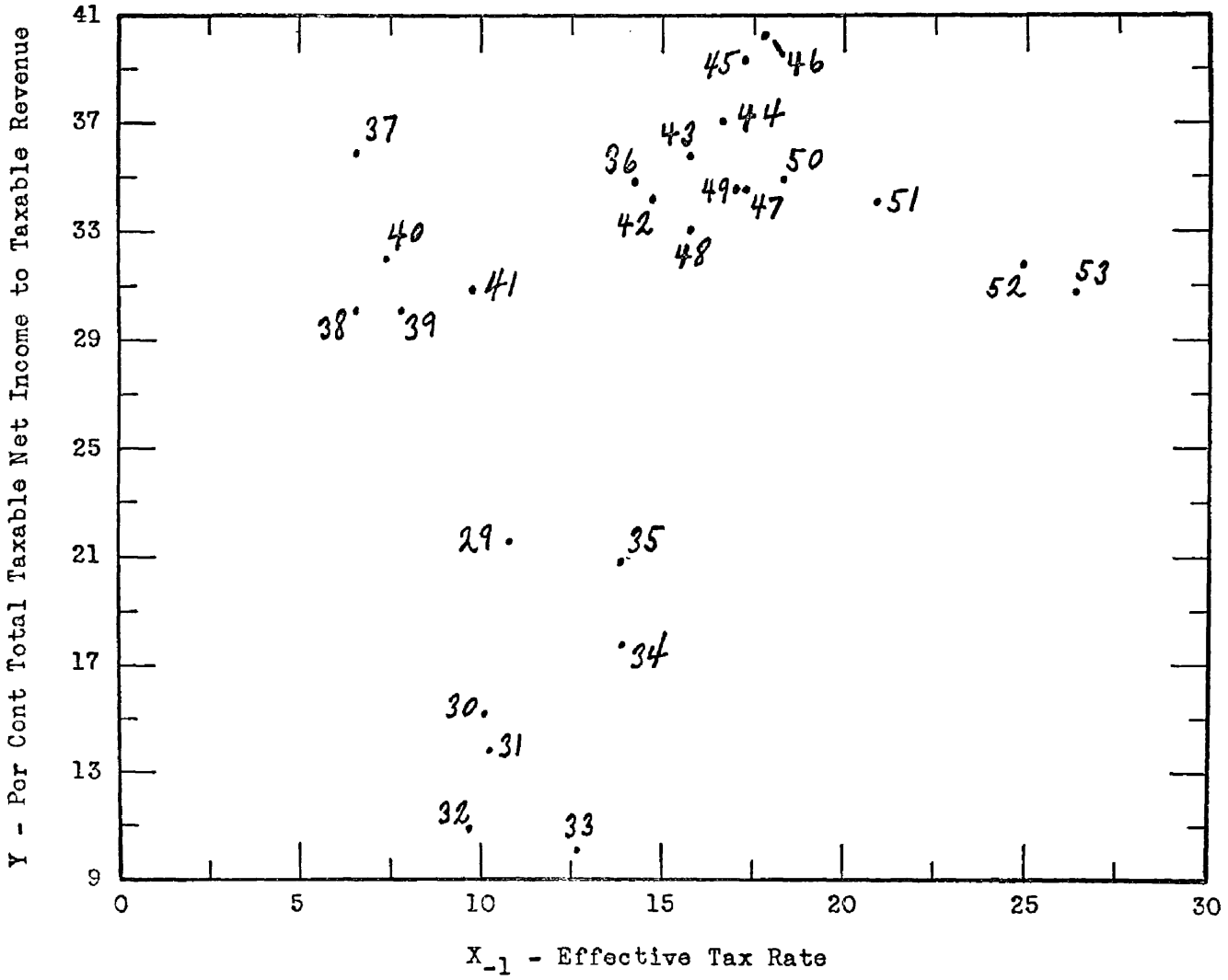

Fig. 20. Scatter Diagram of Effective Tax Rate, Lagged One Year, and Per Cent Total Taxable Net Income to Total Taxable Revenue for All Corporations with Net Income Classified as Finance, Insurance, Real Estate, and Lessors of Real Property, 1929-1953. Source: Appendix Table XI.

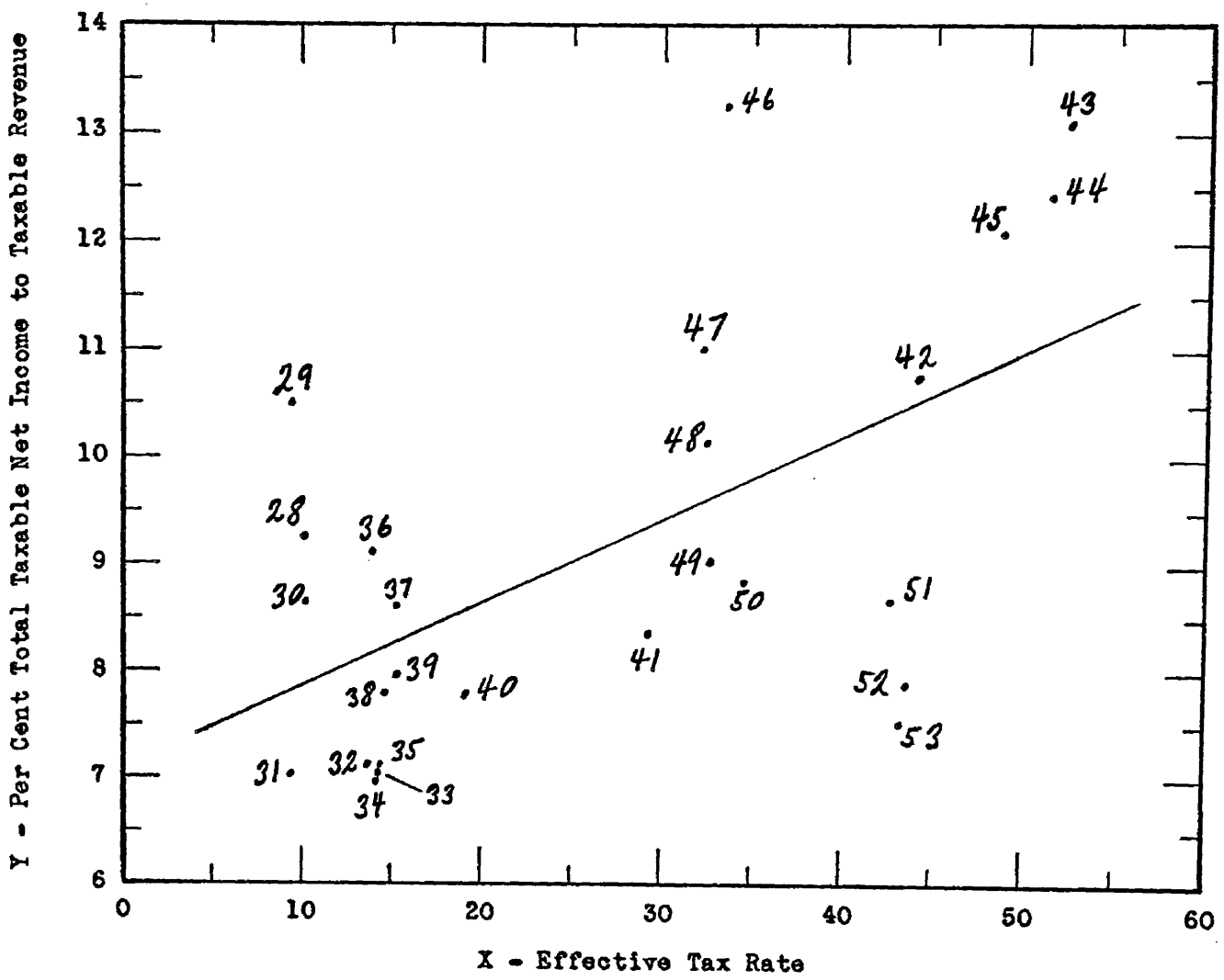

Fig. 21. Scatter Diagram of Effective Tax Rate and Per Cent Total Taxable Net Income to Total Taxable Revenue, with Line of Regression, for All Corporations with Net Income Classified as Services, 1928-1953. Source: Appendix Table XII.

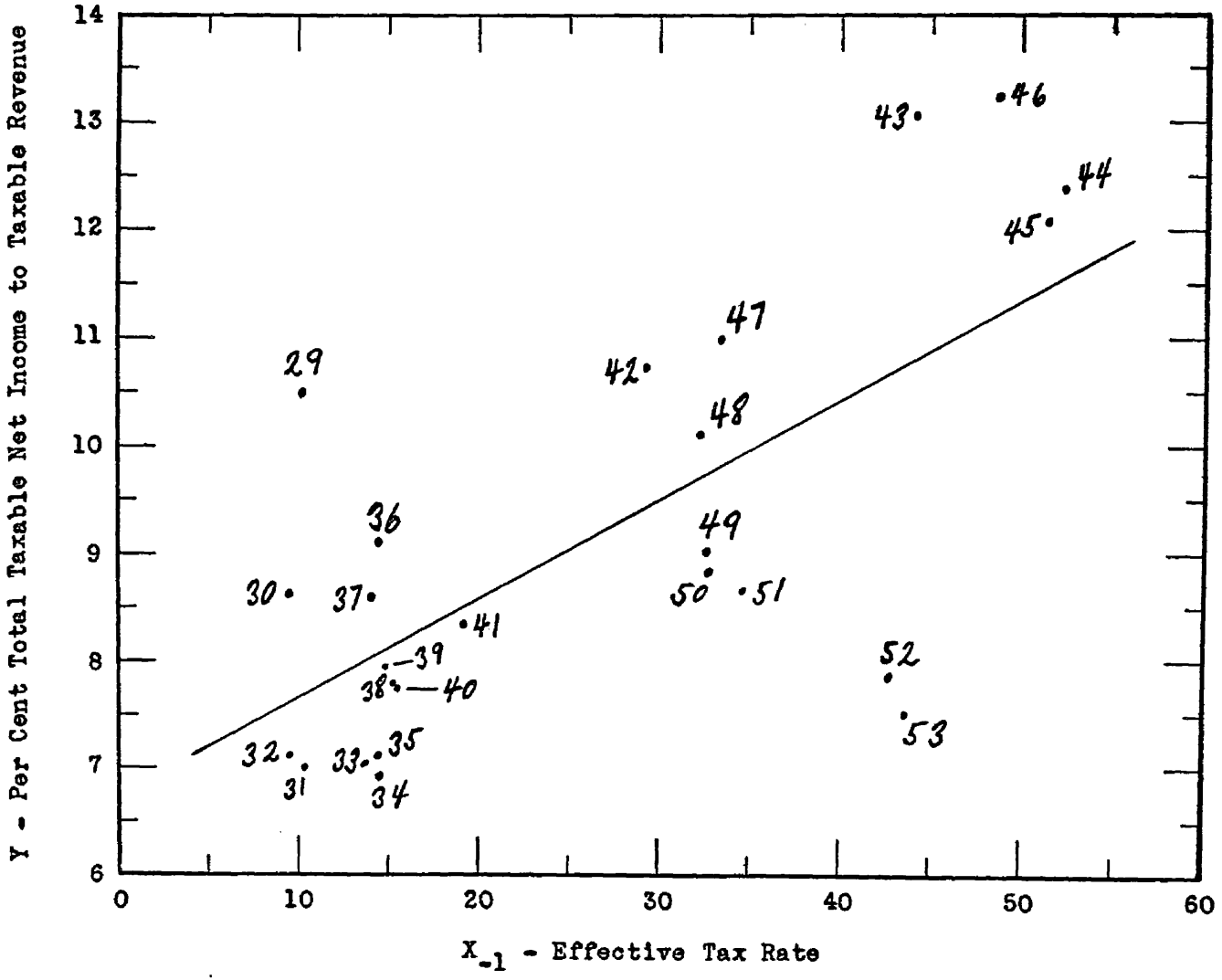

Fig. 22. Scatter Diagram of Effective Tax Rate, Lagged One Year, and Per Cent Total Taxable Net Income to Total Taxable Revenue, with Line of Regression, for All Corporations with Net Income Classified as Services, 1929-1953. Source: Appendix Table XII.

in agriculture, forestry, and fishery. We note here, as in the case of the aggregate economy, a general upward drift of the data, but with the lead-lag relationship appearing to give a "better fit".[3]

2. With regard to the mining and quarrying sector of the economy, we notice an altogether different relationship from that indicated for agriculture, forestry, and fishery. In neither Figures 9 nor 10 does there appear to be any association whatsoever between the variables: a line of regression, had one been computed and plotted, apparently would have been parallel to the axis of abscissas, indicating that in no way can $\underline{Y}$ be considered a function of $\underline{X}$ or $\underline{X}_{-1}$.

3. As in mining and quarrying, there appears to be no relationship of the variables in the diagrams for the construction industry (Figures 11-12), Also, the range of the $\underline{Y}$ values appears to be about the same for both low and high values of $\underline{X}$ and $\underline{X}_{-1}$.

4. The diagrams for manufacturing, Figures 13-14, appear to indicate a relationship of the variables. In contrast to the situation in agriculture, forestry, and fishery, but like that for the aggregate economy, the relationship appears stronger in the diagram portraying the current-year relationship than in that depicting the lead-lag.

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[3]As will be noted later in our discussion on the use of more refined mathematical methods, the correlation is better in this division for the lead-lag relationship than for the current-year. See Table V on p. 88. With respect to the lines of regression plotted in these two diagrams, it may be mentioned that the least-squares equations of these lines are given, together with those for the other cases where the correlation is statistically significant, in Table IX on p. 97. Regarding the industrial division under discussion, we might note from Table IX that the standard error of estimate for the current-year relationship is $\pm$ 2.608, while that for the lead-lag is $\pm$ 2.383, thus giving support to the observation made above that there is a somewhat better fit of the data in the lead-lag relationship.

5. Surprising as it may at first seem, the diagrams for the public utility sector of the economy (Figures 15-16) appear to indicate no significant relationship between the variables. The reason for this may lie in a substantial time lag between rises in corporation income tax rates and approval by regulatory commissions of utility rate increases.

6. The diagrams for profit-making corporations engaged in trade indicate a general upward swing, with the data expressing the lead-lag relationship seemingly giving a closer fit (Figures 17-18).

7. With regard to those corporations classified as finance, insurance, real estate, and lessors of real property, the scatter diagrams appear to indicate nothing in the way of a significant relationship of the variables (Figures 19-20). This conclusion appears equally valid for both time relationships presented.

8. The diagrams for service corporations (Figures 21-22) seem to point to a relationship. This association, however, is definitely weaker than that for trade discussed above.

9. Looking now at all the diagrams for those industrial divisions which appear to indicate a significant relationship, we note, in addition to the general upward trend, the existence of what might be called two clusters of the observations, one at the lower left and the other at the upper right. Also, we note in the upper cluster that the observations for the World War II years are, in general, near the top, while those for the two years 1952 and 1953 are distinctly at or near the bottom.

10. Summarizing the comments made in the above nine paragraphs,

we note a striking variability in the relationships of the variables among the different industrial divisions. Also, we note that in certain years, like those of World War II, the Y values may go very high in those divisions indicating a relationship, with high values of X, while in other years, like 1952 and 1953, the values of the dependent variable, with similarly high values of X, may be conspicuously low. These conclusions seem to lend support to the contention of the "newer theory" of the incidence of federal corporation income taxes, which holds, as was stated in the concluding sentence of Chapter III, that "Nevertheless, there can be said to exist a basic tendency for the tax to be shifted, the degree to which this shifting will succeed varying among different firms, among different industries, and at different times."[4]

Turning our attention away from the graphic-type presentation discussed above and considering a more rigorous mathematical approach, we shall first examine measures of the degree of association of the variables in each of the two temporal relationships for each of the eight industrial divisions.[5] Table V, on the following page, lists the values of both the least-squares and the Spearman rank order correlation coefficients for each of these sixteen cases. For comparative purposes the corresponding data for the aggregate economy have

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[4]See above, p. 19.

[5]As was the case in the chapter on the aggregate economy, there is again provided, for purposes of reference and assistance in possible further calculations, intermediary statistical data on summations and descriptive measures. These are found in Appendix Tables XIII and XIV respectively.

TABLE V: COEFFICIENTS OF CORRELATION,
THE AGGREGATE ECONOMY AND EACH INDUSTRIAL DIVISION

Industrial Division	Current-Year Relationship		Lead-Lag Relationship	
	Least-Squares Coefficient	Spearman's Coefficient	Least-Squares Coefficient	Spearman's Coefficient
AGGREGATE ECONOMY	.722*	.634*	.640*	.632*
Agriculture, forestry, and fishery	.631*	.579*	.718*	.689*
Mining and quarrying	- .002	.125	- .096	.022
Construction	.101	- .088	.112	- .042
Manufacturing	.724*	.716*	.583*	.663*
Public utilities	.341	.188	.229	.164
Trade	.743*	.721*	.805*	.792*
Finance, insurance, etc.	.329	.390	.364	.476**
Services	.599*	.498**	.686*	.599*

* Indicates a statistically significant coefficient at a probability of .01. See Table VIII.

**Indicates a statistically significant coefficient at a probability of .02. See Table VIII.

also been included. Statistically significant coefficients are indicated by asterisks, those which are significant at a probability of .01 being indicated by single asterisks while those which are significant at a probability of .02 but not .01 being pointed out by double asterisks. There was no case, it is interesting to note, of a coefficient which was significant at a probability of .05 but not at a probability of .02 or .01. Thus, on the basis of this last statement, plus the facts that (1) all those least-squares coefficients which were significant were found to be so at a probability of .01 and that (2) out of a total of eleven significant Spearman coefficients there were only two which were significant at a probability of .02 but not .01, we may already draw the inference that there are vast differences among the several industrial divisions with regard to their ability to shift these taxes. Accordingly, agricultural, manufacturing, trade, and service corporations definitely appear able to do so while those engaged in mining and quarrying, construction, public utilities, and financial-type enterprises do not.[6] In addition, we may also conclude that the picture presented for the aggregate economy is the result either of an averaging of the broadest sort or of heavy weighting by one or two specific industrial divisions. That the latter is the case can be immediately verified by noting the great differences among the

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[6]When reviewing my pencil copy of Table V, Dr. John M. Mattila made the casual comment that apparently the corporations in those sectors of the economy which can more easily shift these taxes are those which sell most of their products to consumers, while those which appear unsuccessful in shifting are, in general, those which sell heavily to other businesses. If this is so, the professional buyer or purchasing agent is evidently a much "harder buyer" than the American housewife!

various industrial divisions in the dollar figures for revenue, income, and the like, as presented in Appendix Tables V-XII, inclusive.

Besides tabulating the values of these coefficients and indicating their significance, Table V also provides us with another important type of information. For it will be noted that the values of the Spearman data are strikingly close to those of the least-squares, with inferences regarding statistical significance of the coefficients being identical for both members (least-squares and Spearman) in each of the eighteen pairs of data, with only two exceptions.[7] Thus, we shall have increased confidence in our least-squares computations; for it appears that any non-normality in the distribution of the population parameters, if it exists at all, will not affect our conclusions significantly.

Table VI, on the following page, presents these same coefficients, but in a different way. Having confirmed the validity of our least-squares calculations by comparing them with the corresponding rank order coefficients, we are now interested in a comparison of the values by time relationship. In other words, we are asking the question: Does the industrial division which shows, for example, the strongest relationship between the variables for the current-year time relationship also have the strongest for the lead-lag? Accordingly we have ranked the divisions, for each of the two temporal relationships, by numerical size of the least-squares coefficients. The ranks

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[7]These exceptions, as can be seen from the table, are (1) the current-year relationship for services and (2) the lead-lag relationship for finance, insurance, etc. Even in these two cases, however, the deviations from the general pattern are quite moderate.

TABLE VI: COEFFICIENTS OF CORRELATION, THE AGGREGATE ECONOMY AND EACH INDUSTRIAL DIVISION, RANKED BY SIZE OF LEAST-SQUARES CORRELATION COEFFICIENTS

Current-Year Relationship					Lead-Lag Relationship				
	Least-Squares		Spearman's			Least-Squares		Spearman's	
Industrial Division	Rank	Value	Rank	Value	Industrial Division	Rank	Value	Rank	Value
Trade	1	.743*	1	.721*	Trade	1	.805*	1	.792*
Manufacturing	2	.724*	2	.716*	Agriculture, etc.	2	.718*	2	.689*
AGGREGATE ECONOMY	3	.722*	3	.634*	Services	3	.686*	5	.599*
Agriculture, etc.	4	.631*	4	.579*	AGGREGATE ECONOMY	4	.640*	4	.632*
Services	5	.599*	5	.498**	Manufacturing	5	.583*	3	.663*
Public utilities	6	.341	7	.188	Finance, etc.	6	.364	6	.476**
Finance, etc.	7	.329	6	.390	Public utilities	7	.229	7	.164
Construction	8	.101	9	- .088	Construction	8	.112	9	- .042
Mining and quarrying	9	- .002	8	.125	Mining and quarrying	9	- .096	8	.022

* Indicates a statistically significant coefficient at a probability of .01.

**Indicates a statistically significant coefficient at a probability of .02.

and numerical values of the Spearman coefficients are also given as supplemental information. The latter groups of rankings correspond very closely with those for the least-squares statistics.

Highlights of the data in Table VI are summarized, for simplification of analysis, in Table VII (page 93).[8] Here we observe a general tendency for the lead-lag relationship to be stronger: note, for example, the data in the third column for trade; for agriculture, forestry, and fishery; and for services. In manufacturing, however, the tendency is the reverse: the current-year relationship, with a least-squares correlation coefficient of .724, is much stronger than the lead-lag relationship, for which the least-squares coefficient is .583.[9] Thus, perhaps because of superior cost accounting systems or greater imperfections in the competitive pricing structure in the manufacturing sector of the economy, or because of some combination of these two factors, manufacturing corporations seem to be able to adjust more quickly to a change in corporation income tax rates than do incorporated firms in the trade, agricultural, and service sectors.

Table VIII, pp. 94-95, presents the results of the tests of significance for each of the least-squares and Spearman rank order correlation coefficients. As was the case in the presentation of these data for the aggregate economy (in Chapter VI), there is pro-

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[8]Of the industrial divisions given we are at this particular point interested only in those with statistically significant correlation coefficients, as any indicated correlation in the others may be the result of chance fluctuations of sampling.

[9]The very heavy influence of the data for the manufacturing division probably accounts for the fact that, for the economy as a whole, the current-year relationship again appears stronger than the lead-lag.

TABLE VII: ANALYSIS OF DIFFERENCES IN THE LEAST-SQUARES RESULTS BETWEEN THE CURRENT-YEAR AND THE LEAD-LAG TEMPORAL RELATIONSHIPS

Industrial Division	Comparison of Rankings of Correlation Coefficients by Temporal Relationship		Difference in r: Current-Year minus Lead-Lag
	Current-Year	Lead-Lag	
Trade	1	1	- .062*
Manufacturing	2	5	+ .141*
AGGREGATE ECONOMY	3	4	+ .082*
Agriculture, etc.	4	2	- .087*
Services	5	3	- .087*
Public utilities	6	7	+ .112
Finance, etc.	7	6	- .035
Construction	8	8	- .011
Mining and quarrying	9	9	+ .094

*Indicates the difference between two statistically significant correlation coefficients (at a probability of .01).

TABLE VIII: TESTS OF SIGNIFICANCE OF THE COEFFICIENTS OF CORRELATION

A. Least-Squares Coefficients

1. Computed Values of t

Industrial Division	Current-Year Relationship	Lead-Lag Relationship
AGGREGATE ECONOMY	5.119*	3.996*
Agriculture, etc.	3.981*	4.951*
Mining and quarrying	- .010	- .464
Construction	.499	.542
Manufacturing	5.137*	3.444*
Public utilities	1.780	1.127
Trade	5.437*	6.511*
Finance, etc.	1.708	1.873
Services	3.667*	4.517*

2. Critical Values of t

Level of Significance	Current-Year Relationship	Lead-Lag Relationship
$t_{.995}$	2.797	2.807
$t_{.990}$	2.492	2.500
$t_{.975}$	2.064	2.069

*Indicates a value greater than the relevant critical value of t for a probability of .01.

TABLE VIII--Continued: TESTS OF SIGNIFICANCE OF THE COEFFICIENTS OF CORRELATION

B. Spearman's Rank Order Coefficients

1. Computed Values of z

Industrial Division	Current-Year Relationship	Lead-Lag Relationship
AGGREGATE ECONOMY	3.171*	3.098*
Agriculture, etc.	2.897*	3.377*
Mining and quarrying	.624	.106
Construction	- .439	- .207
Manufacturing	3.581*	3.248*
Public utilities	.942	.803
Trade	3.605*	3.881*
Finance, etc.	1.950	2.333**
Services	2.491**	2.936*

2. Critical Values of z

Level of Significance	Value
$z_{(A = .495)}$	2.576
$z_{(A = .490)}$	2.326
$z_{(A = .475)}$	1.960

* Indicates a value greater than the critical value of z for a probability of .01.

**Indicates a value greater than the critical value of z for a probability of .02 but less than that for a probability of .01.

vided in this table, for evaluation purposes, the critical values of t and of z for probabilities of .01, .02, and .05. Recalling an observation made earlier in this chapter, we note that, with respect to the significance of the correlation coefficients, there are few borderline cases; in general, these coefficients prove to be either decidedly significant or not at all so. Furthermore, as we have also already seen, the tests of the rank order coefficients lend strong support to the conclusions drawn regarding the least-squares statistics.

Considering now the regression phase of our study, we note, in Table IX on the following page, the equations of the lines of regression for the aggregate economy and for those four industrial divisions where the least-squares correlation coefficients prove significant.[10] Used earlier in the plotting of the lines on the scatter diagrams, these equations now become of interest to us as expressing, through the sample coefficients of regression, the extent of corporation income tax shifting by the several industrial divisions. In making such an analysis, we shall first eliminate from each pair of equations the one which was shown to have the weaker relationship.[11] Accordingly, we find ourselves dealing with the current-year relationship for manufacturing (as well as for the aggregate economy) and with the lead-lag relationship for the agricultural, trade, and service sectors. Next, we shall

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[10] A regression line for a division in which there is no significant association or relationship between the variables would, of course, be meaningless.

[11] See the third column of Table VII, discussed earlier.

TABLE IX: EQUATIONS OF THE LINE OF REGRESSION, WITH STANDARD ERROR OF ESTIMATES, FOR THE AGGREGATE ECONOMY AND FOUR INDUSTRIAL DIVISIONS*

Industrial Division	Current-Year Relationship	Lead-Lag Relationship
AGGREGATE ECONOMY	$Y = 7.050 + .064X \pm .998$	$Y = 7.283 + .058X_{-1} \pm 1.128$
Agriculture, etc.	$Y = 8.140 + .160X \pm 2.608$	$Y = 7.548 + .187X_{-1} \pm 2.383$
Manufacturing	$Y = 6.781 + .065X \pm 1.175$	$Y = 7.206 + .054X_{-1} \pm 1.408$
Trade	$Y = 2.411 + .049X \pm .732$	$Y = 2.307 + .054X_{-1} \pm .661$
Services	$Y = 7.055 + .078X \pm 1.515$	$Y = 6.749 + .092X_{-1} \pm 1.405$

*The four divisions listed are those with statistically significant least-squares correlation coefficients.

have to ascertain whether the population values of b, that is, the corresponding values of β, do actually differ from one another, or whether any differences in b are only the result of sampling fluctuations and are thus not significant. For only after performing this operation shall we be able to draw valid inferences concerning the differences in the degree of tax shifting among these five areas (that is, the aggregate economy and the four industrial divisions involved.) The specific statistical approach used to evaluate these differences consists of (1) the construction of interval estimates, at a 99% level of confidence, for each of the five regression coefficients under discussion, and (2) an examination of the degree of overlapping of these estimates. For we know that the computed value of b, the sample coefficient of regression, cannot be assumed precisely to represent β, the population regression coefficient. On the contrary, the best that we can do is to calculate two confidence limits for each regression coefficient and say that we are ninety-nine per cent confident that the interval delineated by these limits includes the constant value β.

Table X, on the following page, indicates the confidence intervals for β for these five cases. There are also given the absolute values of the sampling errors, as well as a listing of the sample regression coefficients and temporal relationships involved. An examination of these interval estimates indicates a great amount of overlapping, there being only one instance--one combination out of a possible ten--where there is no overlapping whatsoever, namely, the combination of the agricultural division and the trade. The intervals for manufacturing

TABLE X: CONFIDENCE INTERVALS FOR THE COEFFICIENTS OF REGRESSION FOR THE AGGREGATE ECONOMY AND FOUR INDUSTRIAL DIVISIONS

(All Interval Estimates Given at a 99% Level of Confidence)

Industrial Division	Regression Coefficient	Sampling Error	Interval Estimate	Temporal Relationship
AGGREGATE ECONOMY	.064	.0344	$.030 < \beta < .099$	Current-year
Agriculture, etc.	.187	.1041	$.083 < \beta < .292$	Lead-lag
Manufacturing	.065	.0345	$.030 < \beta < .099$	Current-year
Trade	.054	.0228	$.031 < \beta < .077$	Lead-lag
Services	.092	.0557	$.036 < \beta < .147$	Lead-lag

and the aggregate economy, we note, coincide perfectly (at three places beyond the decimal); and the interval for trade falls completely within the two just mentioned. The confidence interval for services covers the larger portion of each of the intervals for manufacturing, trade, and the aggregate economy, as well as a substantial part of that for agriculture, forestry, and fishery. Based on the above observations, our conclusions regarding the extent to which income taxes have been shifted by corporations in different sectors of the American economy can be enumerated as follows:

1. The manufacturing and trade sectors appear to shift these taxes to about the same degree, that is, by increasing the before-tax profit rate in the area of .03 to around .08 or .10 per cent for each unit increase in the effective tax rate.

2. Corporations engaged in agriculture, forestry, and fishery have responded to rising corporation income tax rates by increasing their "percentage spread" in the area of .083 to .292 for each percentage increase in the tax rate. This interval covers considerably higher values than do those for manufacturing and trade corporations; the time relationship, however, like that in trade, involves a lag of one year.

3. With regard to service corporations, we are unable to say that these firms react in a way significantly different either from those in manufacturing and in trade or from those in agriculture, forestry, and fishery. The confidence interval covers too great a portion of each of those for the other three sectors for any inference concerning unique behavior to be made.

4. The picture presented for the aggregate economy appears to be the result of the activity of the manufacturing and trade sectors. This is in line with earlier observations made concerning the heavy weighting of the composite results by the data of these two divisions.

PART IV

CONCLUSION

CHAPTER VIII: CONCLUSION

Our ultimate objective in this study, as was stated at the beginning of Chapter V, is to attempt to shed a little more light on the complex but highly important problem of the incidence of federal corporation income taxes. To accomplish this objective we have employed a statistical technique which, to my knowledge, has never been used in this area before. Using the Internal Revenue Service's Statistics of Income for the years 1928 to 1953, inclusive, as our source of data, we computed, by year and by industrial division (including, of course, the aggregate economy), the percentages of total taxable net income to total taxable revenue and the effective tax rates. Then, postulating that a lack of correlation between the population values of these variables indicates that federal corporation income taxes are not shifted but rest upon the proprietary equity, we examined the results of twenty-two regression and correlation analyses, six for the aggregate economy and two for each of the eight industrial divisions. Omitting in these concluding remarks the statistical details of these individual analyses, we shall recapitulate our findings in a brief and generalized way in the following paragraphs.

1. For the economy as a whole, there seems to be a definite tendency for at least part of corporation income taxes to be shifted. This shifting takes place by means of corporations' increasing, over

a period of time, their before-tax profit rate by from .03 to .10 per cent for each percentage increase in the effective tax rate. These conclusions regarding the aggregate economy, however, reflect to a very heavy degree the activities of the two industrial divisions of manufacturing and trade.

2. The individual industrial divisions differ widely in their ability to shift these taxes. Corporations engaged in agriculture, forestry, and fishery, in manufacturing, in trade, and in services appear able to shift at least a portion of them, while those classified as mining and quarrying, as construction, as public utilities, and as finance, insurance, real estate, and lessors of real property do not appear able to do so. In particular, the seemingly gross inability of those in mining and quarrying and in construction is quite striking. The conclusion regarding public utility corporations may also be at first glance somewhat surprising.

3. This shifting, where it does occur, does not take place in an even and systematic fashion. Some years, like those of World War II, appear particularly suited for the shifting of these taxes, while for certain other years, like 1952 and 1953, the evidence indicates widespread difficulty in the attempt to pass them on.

4. From among those corporations which are able to shift some of their income taxes, only those engaged in manufacturing show a stronger relative preference for effecting this shifting in the current year as compared to the following year.

5. With regard to the degree to which profit-making corporations are able to adjust their before-tax profit percentages in order to ab-

sorb (by the proprietary equity) as little of the tax as possible, those engaged in agriculture, forestry, and fishery are able to increase this percentage spread by a larger amount than those in manufacturing, in trade, and in services. Firms engaged in trade are able to increase their before-tax profit rate to about the same degree as those in manufacturing.

In conclusion, all the evidence indicated above seems to challenge the fundamental tenet of the traditional theory of the incidence of corporation income taxes that these taxes can never be shifted but must fall entirely and permanently upon the proprietary equity. On the contrary, our study seems clearly to indicate that, in the economy as a whole, some shifting does take place. It also, however, clearly points to a great variability as to the extent and even the very possibility of this shifting as among different industrial groupings and at different times.

APPENDIX TABLES

APPENDIX TABLE I: SUMMATIONS OF DATA, ALL INDUSTRIAL GROUPS

A. 26-Year Period ($\underline{N} = 26$)

$$\Sigma X = 737.51$$

$$\Sigma Y = 230.75$$

$$(\Sigma X)^2 = 543,921.0001$$

$$(\Sigma Y)^2 = 53,245.5625$$

$$\Sigma X^2 = 27,755.2455$$

$$\Sigma Y^2 = 2,102.1109$$

$$\Sigma XY = 6,985.1529$$

$$\Sigma \log Y = 24.501\ 8563$$

$$(\Sigma \log Y)^2 = 600.3409\ 6214\ 584\ 969$$

$$\Sigma \log Y^2 = 23.2217\ 3011\ 268\ 505$$

$$\Sigma X \log Y = 716.354\ 044\ 383$$

$$\Sigma \log X = 35.714\ 7597$$

$$(\Sigma \log X)^2 = 1275.5440\ 6042\ 874\ 409$$

$$\Sigma \log X^2 = 50.9295\ 0195\ 420\ 245$$

$$\Sigma \log X \log Y = 34.0074\ 2794\ 229\ 468$$

APPENDIX TABLE I--Continued: SUMMATIONS OF DATA, ALL INDUSTRIAL GROUPS

B. Lead-Lag ($\underline{N}$ = 25)

ΣX_{-1} = 690.00

ΣY = 222.44

$(\Sigma X_{-1})^2$ = 476,100.0000

$(\Sigma Y)^2$ = 49,479.5536

$\Sigma (X_{-1})^2$ = 25,498.0454

ΣY^2 = 2,033.0548

$\Sigma X_{-1} Y$ = 6,516.7942

$\Sigma \log Y$ = 23.582 2553

$(\Sigma \log Y)^2$ = 556.1227 6503 437 809

$\Sigma \log Y^2$ = 22.3760 6411 348 405

$\Sigma X_{-1} \log Y$ = 669.438 163 104

$\Sigma \log X_{-1}$ = 34.037 9747

$(\Sigma \log X_{-1})^2$ = 1158.5837 2167 784 009

$\Sigma (\log X_{-1})^2$ = 48.1178 9401 797 745

$\Sigma \log X_{-1} \log Y$ = 32.4340 8608 875 386

APPENDIX TABLE II: DESCRIPTIVE MEASURES--
FORMULAS AND VALUES, ALL INDUSTRIAL GROUPS

A. 26-Year Period ($\underline{N} = 26$)

1. $\overline{X} = \frac{\Sigma X}{N} = 28.37$

2. $s_X = \sqrt{\frac{\Sigma X^2}{N} - \overline{X}^2} = 16.21$

3. $\overline{Y} = \frac{\Sigma Y}{N} = 8.88$

4. $s_{Yo} = \sqrt{\frac{\Sigma Y^2}{N} - \overline{Y}^2} = 1.44$

5. $\frac{\Sigma \log X}{N} = 1.373\ 6446$

6. $s_{\log X} = \sqrt{\frac{\Sigma \log X^2}{N} - \left(\frac{\Sigma \log X}{N}\right)^2} = .268\ 1930$

7. $\frac{\Sigma \log Y}{N} = .942\ 3791$

8. $s_{\log Yo} = \sqrt{\frac{\Sigma \log Y^2}{N} - \left(\frac{\Sigma \log Y}{N}\right)^2} = .071\ 1695$

APPENDIX TABLE II--Continued: DESCRIPTIVE MEASURES--
FORMULAS AND VALUES, ALL INDUSTRIAL GROUPS

B. Lead-Lag ($\underline{N}$ = 25)

1. $\overline{X}_{-1} = \frac{\Sigma X_{-1}}{N} = 27.60$

2. $s_{X_{-1}} = \sqrt{\frac{\Sigma(X_{-1})^2}{N} - (\overline{X}_{-1})^2} = 16.07$

3. $\overline{Y} = \frac{\Sigma Y}{N} = 8.90$

4. $s_{Y_o} = \sqrt{\frac{\Sigma Y^2}{N} - \overline{Y}^2} = 1.47$

5. $\frac{\Sigma \log X_{-1}}{N} = 1.361\ 5190$

6. $s_{\log X_{-1}} = \sqrt{\frac{\Sigma(\log X_{-1})^2}{N} - \left(\frac{\Sigma \log X_{-1}}{N}\right)^2} = .266\ 4241$

7. $\frac{\Sigma \log Y}{N} = .943\ 2902$

8. $s_{\log Y_o} = \sqrt{\frac{\Sigma \log Y^2}{N} - \left(\frac{\Sigma \log Y}{N}\right)^2} = .072\ 4302$

APPENDIX TABLE III: FORMULAS USED IN COMPUTING COEFFICIENTS OF CORRELATION

Type of Relationship	Formula
A. 26-Year Period ($N = 26$)	
1. Arithmetic relationship of variables	$r = \frac{N\Sigma XY - \Sigma X\Sigma Y}{\sqrt{N\Sigma Y^2 - (\Sigma Y)^2}\sqrt{N\Sigma X^2 - (\Sigma X)^2}}$
2. Exponential relationship of variables	$r = \frac{N\Sigma X \log Y - \Sigma X \Sigma \log Y}{\sqrt{N\Sigma \log Y^2 - (\Sigma \log Y)^2}\sqrt{N\Sigma X^2 - (\Sigma X)^2}}$
3. Parabolic relationship of variables	$r = \frac{N\Sigma \log X \log Y - (\Sigma \log X)(\Sigma \log Y)}{\sqrt{N\Sigma \log Y^2 - (\Sigma \log Y)^2}\sqrt{N\Sigma \log X^2 - (\Sigma \log X)^2}}$
4. Spearman's rank order coefficient	$r_r = 1 - \frac{6\Sigma d^2}{N(N^2 - 1)}$, where d = (rank of Y) - (rank of X)
B. Lead-Lag ($N = 25$)	
1. Arithmetic relationship of variables	$r = \frac{N\Sigma X_{-1}Y - \Sigma X_{-1}\Sigma Y}{\sqrt{N\Sigma Y^2 - (\Sigma Y)^2}\sqrt{N\Sigma (X_{-1})^2 - (\Sigma X_{-1})^2}}$
2. Exponential relationship of variables	$r = \frac{N\Sigma X_{-1} \log Y - \Sigma X_{-1} \Sigma \log Y}{\sqrt{N\Sigma \log Y^2 - (\Sigma \log Y)^2}\sqrt{N\Sigma (X_{-1})^2 - (\Sigma X_{-1})^2}}$
3. Parabolic relationship of variables	$r = \frac{N\Sigma \log X_{-1} \log Y - (\Sigma \log X_{-1})(\Sigma \log Y)}{\sqrt{N\Sigma \log Y^2 - (\Sigma \log Y)^2}\sqrt{N\Sigma (\log X_{-1})^2 - (\Sigma \log X_{-1})^2}}$
4. Spearman's rank order coefficient	$r_r = 1 - \frac{6\Sigma d^2}{N(N^2 - 1)}$, where d = (rank of Y) - (rank of X_{-1})

Note: The formulas for r are adapted from a formula in Helen M. Walker and Joseph Lev, Statistical Inference (New York: Henry Holt and Company, 1953), p. 234. Spearman's formula, in somewhat different form, was originally given in Charles Spearman, "The Proof and Measurement of Association Between Two Things," American Journal of Psychology, XV (1904), 87.

APPENDIX TABLE IV: FORMULAS USED IN COMPUTING EQUATIONS OF THE LINE OF REGRESSION, WITH STANDARD ERROR OF ESTIMATE

Type of Relationship	Formula
A. 26-Year Period	
1. Arithmetic	$Y - \overline{Y} = r \frac{s_{Yo}}{s_X} (X - \overline{X})$, with $SE_{Yc} = s_{Yo}\sqrt{1 - r^2}$
2. Exponential	$\log Y - \frac{\Sigma \log Y}{N} = r \frac{s_{\log Yo}}{s_X} (X - \overline{X})$, with $SE_{\log Yc} = s_{\log Yo}\sqrt{1 - r^2}$
3. Parabolic	$\log Y - \frac{\Sigma \log Y}{N} = r \frac{s_{\log Yo}}{s_{\log X}} \left(\log X - \frac{\Sigma \log X}{N}\right)$, with $SE_{\log Yc} = s_{\log Yo}\sqrt{1 - r^2}$
B. Lead-Lag	
1. Arithmetic	$Y - \overline{Y} = r \frac{s_{Yo}}{s_{X_{-1}}} (X_{-1} - \overline{X}_{-1})$, with $SE_{Yc} = s_{Yo}\sqrt{1 - r^2}$
2. Exponential	$\log Y - \frac{\Sigma \log Y}{N} = r \frac{s_{\log Yo}}{s_{X_{-1}}} (X_{-1} - \overline{X}_{-1})$, with $SE_{\log Yc} = s_{\log Yo}\sqrt{1 - r^2}$
3. Parabolic	$\log Y - \frac{\Sigma \log Y}{N} = r \frac{s_{\log Yo}}{s_{\log X_{-1}}} \left(\log X_{-1} - \frac{\Sigma \log X_{-1}}{N}\right)$, with $SE_{\log Yc} = s_{\log Yo}\sqrt{1 - r^2}$

Note: The first regression equation listed above was taken from Frederick C. Mills, Statistical Methods (3rd Edit.; New York: Henry Holt and Company, 1955), p. 289, while the remaining five are adaptations of this formula. For the basic equation for the standard error of estimate, see ibid., p. 277.

APPENDIX TABLE V: CORPORATION FINANCIAL DATA, 1928-1953, TOTAL AGRICULTURE, FORESTRY, AND FISHERY

(Includes only Those Corporations with Net Income)

[Money Figures in Thousands of Dollars]

Year	Total Compiled Receipts	Wholly Tax-Exempt Receipts	Total Taxable Revenue	Total Taxable Net Income	Per Cent Total Taxable Net Income to Total Taxable Revenue (Y)	Total Taxes on Income	Effective Tax Rate: Total Taxes on Income ÷ Total Taxable Net Income (X)
1928	637,385	5,390	631,995	80,476	12.73	8,217	10.21
1929	636,787	4,397	632,390	72,801	11.51	6,783	9.32
1930	363,908	3,169	360,739	40,484	11.22	4,041	9.98
1931	215,202	894	214,308	14,002	6.53	1,201	8.58
1932	133,128	1,277	131,851	5,979	4.53	675	11.29
1933	178,313	1,222	177,091	14,894	8.41	2,156	14.48
1934	297,647	2,580	295,067	30,572	10.36	4,278	13.99
1935	360,105	8,192	351,913	43,901	12.47	6,196	14.11
1936	524,299	307	523,992	65,837	12.56	8,983	13.64
1937	532,223	268	531,955	57,320	10.78	7,838	13.67
1938	363,895	169	363,726	30,968	8.51	4,300	13.89
1939	420,131	159	419,972	40,461	9.63	5,825	14.40
1940	484,176	65	484,111	49,269	10.18	9,736	19.76
1941	630,777	132*	630,645	81,747	12.96	22,945	28.07
1942	701,525	138*	701,387	94,722	13.50	39,783	42.00
1943	765,215	180*	765,035	128,219	16.76	62,576	48.80
1944	822,592	174	822,418	134,453	16.35	63,306	47.08
1945	893,856	153	893,703	149,892	16.77	63,727	42.52
1946	1,138,035	125	1,137,910	205,244	18.04	67,955	33.11
1947	1,486,572	160	1,486,412	239,190	16.09	76,778	32.10
1948	1,642,670	86	1,642,584	245,694	14.96	79,060	32.18
1949	1,616,005	144	1,615,861	209,591	12.97	66,637	31.79
1950	1,907,678	140	1,907,538	320,571	16.81	102,779	32.06
1951	2,192,596	255	2,192,341	288,619	13.16	107,158	37.13
1952	2,090,020	270	2,089,750	194,358	9.30	77,436	39.84
1953	1,911,644	241	1,911,403	180,926	9.47	72,839	40.26

*Includes receipts "Subject to Surtax Only" as well as wholly tax-exempt receipts.

APPENDIX TABLE VI: CORPORATION FINANCIAL DATA, 1928-1953, TOTAL MINING AND QUARRYING

(Includes only Those Corporations with Net Income)

[Money Figures in Thousands of Dollars]

Year	Total Compiled Receipts	Wholly Tax-Exempt Receipts	Total Taxable Revenue	Total Taxable Net Income	Per Cent Total Taxable Net Income to Total Taxable Revenue (Y)	Total Taxes on Income	Effective Tax Rate: Total Taxes on Income ÷ Total Taxable Net Income (X)
1928	2,509,534	53,968	2,455,566	332,679	13.55	36,751	11.05
1929	3,040,330	56,635	2,983,695	430,527	14.43	44,319	10.29
1930	1,617,848	35,440	1,582,408	194,118	12.27	21,474	11.06
1931	735,041	11,314	723,727	71,154	9.83	7,211	10.13
1932	540,171	9,966	530,205	62,675	11.82	7,445	11.88
1933	558,159	6,517	551,642	71,686	13.00	10,201	14.23
1934	1,166,147	20,707	1,145,440	156,063	13.62	21,883	14.02
1935	1,336,878	33,021	1,303,857	162,936	12.50	22,915	14.06
1936	2,072,083	2,753	2,069,330	300,048	14.50	38,612	12.87
1937	2,582,688	2,903	2,579,785	427,621	16.58	60,859	14.23
1938	1,578,026	1,205	1,576,821	199,621	12.66	28,706	14.38
1939	1,713,324	860	1,712,464	250,590	14.63	37,270	14.87
1940	2,416,369	910	2,415,459	314,948	13.04	67,556	21.45
1941	3,110,359	1,416*	3,108,943	450,123	14.48	144,232	32.04
1942	3,434,941	651*	3,434,290	445,926	12.98	197,643	44.32
1943	3,221,996	703*	3,221,293	387,649	12.03	169,840	43.81
1944	3,480,815	450	3,480,365	368,801	10.60	157,527	42.71
1945	3,352,021	184	3,351,837	299,656	8.94	118,368	39.50
1946	3,745,073	146	3,744,927	400,555	10.70	132,620	33.11
1947	5,552,564	122	5,552,442	859,544	15.48	292,195	33.99
1948	7,337,631	185	7,337,446	1,221,825	16.65	413,678	33.86
1949	5,863,422	202	5,863,220	804,561	13.72	267,682	33.27
1950	7,662,486	432	7,662,054	1,175,237	15.34	447,481	38.08
1951	8,462,731	7,225	8,455,506	1,225,061	14.49	560,737	45.77
1952	8,047,731	403	8,047,328	1,101,093	13.68	507,389	46.08
1953	7,685,868	1,478	7,684,390	1,101,205	14.33	513,351	46.62

*Includes receipts "Subject to Surtax Only" as well as wholly tax-exempt receipts.

APPENDIX TABLE VII: CORPORATION FINANCIAL DATA, 1928-1953, TOTAL CONSTRUCTION

(Includes only Those Corporations with Net Income)

[Money Figures in Thousands of Dollars]

Year	Total Compiled Receipts	Wholly Tax-Exempt Receipts	Total Taxable Revenue	Total Taxable Net Income	Per Cent Total Taxable Net Income to Total Taxable Revenue (Y)	Total Taxes on Income	Effective Tax Rate: Total Taxes on Income ÷ Total Taxable Net Income (X)
1928	2,320,324	10,950	2,309,374	170,906	7.40	17,175	10.05
1929	2,294,832	15,194	2,279,638	178,376	7.82	16,519	9.26
1930	2,176,965	25,907	2,151,058	150,548	7.00	15,210	10.10
1931	1,215,568	7,965	1,207,603	80,699	6.68	7,625	9.45
1932	470,555	3,341	467,214	30,691	6.57	3,639	11.86
1933	376,085	3,363	372,722	23,638	6.34	3,440	14.55
1934	576,675	3,088	573,587	31,694	5.53	4,548	14.35
1935	791,256	3,714	787,542	49,260	6.25	7,482	15.19
1936	1,309,754	751	1,309,003	74,136	5.66	11,773	15.88
1937	1,688,827	776	1,688,051	84,463	5.00	14,617	17.31
1938	1,255,862	452	1,255,410	62,682	4.99	10,159	16.21
1939	1,470,616	335	1,470,281	70,244	4.78	11,168	15.90
1940	1,903,570	337	1,903,233	101,702	5.34	22,914	22.53
1941	3,089,455	414*	3,089,041	199,564	6.46	82,067	41.12
1942	4,452,894	390*	4,452,504	357,310	8.02	206,823	57.88
1943	3,873,640	300*	3,873,340	294,555	7.60	174,639	59.29
1944	2,699,979	248	2,699,731	172,738	6.40	90,176	52.20
1945	2,458,988	153	2,458,835	146,070	5.94	62,134	42.54
1946	3,732,496	320	3,732,176	269,994	7.23	83,675	30.99
1947	6,367,029	299	6,366,730	430,150	6.76	139,873	32.52
1948	8,518,903	248	8,518,655	625,246	7.34	210,111	33.60
1949	8,676,131	205	8,675,926	591,250	6.81	200,106	33.84
1950	9,963,007	249	9,962,758	651,035	6.53	246,711	37.90
1951	12,360,392	316	12,360,076	652,506	5.28	292,445	44.82
1952	13,494,727	345	13,494,382	683,685	5.07	306,633	44.85
1953	13,869,087	568	13,868,519	626,313	4.52	273,421	43.66

*Includes receipts "Subject to Surtax Only" as well as wholly tax-exempt receipts.

APPENDIX TABLE VIII: CORPORATION FINANCIAL DATA, 1928-1953, TOTAL MANUFACTURING

(Includes only Those Corporations with Net Income)

[Money Figures in Thousands of Dollars]

Year	Total Compiled Receipts	Wholly Tax-Exempt Receipts	Total Taxable Revenue	Total Taxable Net Income	Per Cent Total Taxable Net Income to Total Taxable Revenue (Y)	Total Taxes on Income	Effective Tax Rate: Total Taxes on Income ÷ Total Taxable Net Income (X)
1928	57,549,165	536,471	57,012,694	4,744,261	8.32	544,937	11.49
1929	59,967,615	641,033	59,326,582	5,216,016	8.79	544,053	10.43
1930	41,117,307	520,267	40,597,040	2,757,508	6.79	316,992	11.50
1931	21,011,555	246,872	20,764,683	1,464,619	7.05	165,311	11.29
1932	12,729,733	134,148	12,595,585	757,501	6.01	99,949	13.19
1933	22,341,338	171,679	22,169,659	1,460,632	6.59	207,362	14.20
1934	27,491,176	242,276	27,248,900	1,906,104	7.00	265,940	13.95
1935	35,454,270	493,550	34,960,720	2,482,773	7.10	356,882	14.37
1936	48,395,592	21,594	48,373,998	4,072,531	8.42	607,662	14.92
1937	51,484,912	16,704	51,468,208	4,127,465	8.02	652,271	15.80
1938	34,129,378	11,540	34,117,838	2,421,385	7.10	376,531	15.55
1939	49,994,914	11,588	49,983,326	3,948,328	7.90	634,077	16.06
1940	60,660,270	10,043	60,650,227	5,631,949	9.29	1,552,895	27.57
1941	90,335,521	9,710*	90,325,811	10,601,366	11.74	4,945,848	46.65
1942	115,443,852	9,266*	115,434,586	13,809,135	11.96	8,228,017	59.58
1943	143,439,413	11,535*	143,427,878	16,728,107	11.66	10,543,083	63.03
1944	151,218,292	13,265	151,205,027	15,007,518	9.93	9,391,328	62.58
1945	133,402,830	6,418	133,396,412	10,576,548	7.93	6,112,228	57.79
1946	128,928,639	6,805	128,921,834	12,680,628	9.84	4,628,015	36.50
1947	171,416,746	3,606	171,413,140	17,516,231	10.22	6,319,452	36.08
1948	185,981,909	3,303	185,978,606	18,928,473	10.18	6,821,585	36.04
1949	167,534,041	3,405	167,530,636	15,342,017	9.16	5,497,255	35.83
1950	210,033,648	3,760	210,029,888	24,223,918	11.53	10,636,866	43.91
1951	241,530,606	4,675	241,525,931	25,492,126	10.55	14,163,463	55.56
1952	244,424,014	4,203	244,419,811	21,081,015	8.62	11,419,132	54.17
1953	263,970,665	6,542	263,964,123	22,251,202	8.43	12,160,679	54.65

*Includes receipts "Subject to Surtax Only" as well as wholly tax-exempt receipts.

APPENDIX TABLE IX: CORPORATION FINANCIAL DATA, 1928-1953, TOTAL PUBLIC UTILITIES

(Includes only Those Corporations with Net Income)

[Money Figures in Thousands of Dollars]

Year	Total Compiled Receipts	Wholly Tax-Exempt Receipts	Total Taxable Revenue	Total Taxable Net Income	Per Cent Total Taxable Net Income to Total Taxable Revenue (Y)	Total Taxes on Income	Effective Tax Rate: Total Taxes on Income ÷ Total Taxable Net Income (X)
1928	14,285,646	528,252	13,757,394	1,813,088	13.18	211,681	11.68
1929	15,612,317	828,049	14,784,268	2,092,654	14.15	222,483	10.63
1930	12,961,897	692,655	12,269,242	1,334,229	10.87	156,573	11.74
1931	6,820,837	425,659	6,395,178	902,635	14.11	105,585	11.70
1932	4,863,999	205,096	4,658,903	708,168	15.20	98,118	13.86
1933	4,794,898	180,574	4,614,324	657,272	14.24	92,581	14.09
1934	5,909,946	209,847	5,700,099	919,298	16.13	126,926	13.81
1935	6,533,866	211,140	6,322,726	927,144	14.66	128,697	13.88
1936	8,765,849	8,952	8,756,897	1,376,520	15.72	173,428	12.60
1937	9,041,389	7,189	9,034,200	1,503,021	16.64	198,179	13.19
1938	7,869,427	3,386	7,866,041	1,200,243	15.26	166,844	13.90
1939	9,134,548	2,106	9,132,442	1,523,801	16.69	216,881	14.23
1940	10,441,901	1,848	10,440,053	1,592,069	15.25	361,730	22.72
1941	14,175,762	1,549*	14,174,213	2,081,267	14.68	705,183	33.88
1942	17,807,766	2,083*	17,805,683	3,719,905	20.89	1,577,534	42.41
1943	20,426,894	4,409*	20,422,485	4,616,319	22.60	2,407,679	52.16
1944	21,635,269	6,762	21,628,507	4,277,770	19.78	2,389,327	55.85
1945	19,672,756	2,696	19,670,060	3,133,895	15.93	1,547,605	49.38
1946	17,574,664	2,065	17,572,599	2,726,169	15.51	898,063	32.94
1947	23,054,434	1,528	23,052,906	3,013,672	13.07	1,013,277	33.62
1948	27,482,955	614	27,482,341	3,594,232	13.08	1,204,804	33.52
1949	26,199,477	3,803	26,195,674	3,024,043	11.54	1,056,198	34.93
1950	30,360,679	1,814	30,358,865	4,446,153	14.65	1,763,748	39.67
1951	34,516,766	631	34,516,135	4,785,134	13.86	2,305,533	48.18
1952	36,459,420	904	36,458,516	5,032,841	13.80	2,479,760	49.27
1953	37,791,542	856	37,790,686	5,191,336	13.74	2,550,139	49.12

*Includes receipts "Subject to Surtax Only" as well as wholly tax-exempt receipts.

APPENDIX TABLE X: CORPORATION FINANCIAL DATA, 1928-1953, TOTAL TRADE

(Includes only Those Corporations with Net Income)

[Money Figures in Thousands of Dollars]

Year	Total Compiled Receipts	Wholly Tax-Exempt Receipts	Total Taxable Revenue	Total Taxable Net Income	Per Cent Total Taxable Net Income to Total Taxable Revenue (Y)	Total Taxes on Income	Effective Tax Rate: Total Taxes on Income ÷ Total Taxable Net Income (X)
1928	34,905,459	132,154	34,773,305	1,246,862	3.59	126,332	10.13
1929	34,275,180	59,873	34,215,307	1,149,235	3.36	107,149	9.32
1930	23,386,850	51,322	23,335,528	651,097	2.79	64,166	9.86
1931	16,117,896	31,626	16,086,270	460,035	2.86	45,708	9.94
1932	9,335,023	21,421	9,313,602	234,674	2.52	30,644	13.06
1933	14,985,112	33,509	14,951,603	435,820	2.91	62,189	14.27
1934	22,958,986	50,066	22,908,920	670,336	2.93	94,276	14.06
1935	27,590,805	69,606	27,521,199	767,428	2.79	108,805	14.18
1936	34,816,642	5,925	34,810,717	1,136,419	3.26	173,546	15.27
1937	35,060,450	2,999	35,057,451	1,064,765	3.04	168,386	15.81
1938	27,053,443	1,813	27,051,630	741,483	2.74	114,614	15.46
1939	34,501,928	1,910	34,500,018	1,031,271	2.99	166,467	16.14
1940	40,022,103	1,627	40,020,476	1,270,122	3.17	295,740	23.28
1941	53,252,745	1,850*	53,250,895	2,222,556	4.17	863,238	38.84
1942	52,596,713	1,795*	52,594,918	2,660,585	5.06	1,402,126	52.70
1943	56,132,260	2,024*	56,130,236	3,156,477	5.62	1,782,867	56.48
1944	59,074,935	1,375	59,073,560	3,318,799	5.62	1,910,157	57.56
1945	64,016,723	1,127	64,015,596	3,439,123	5.37	1,902,014	55.31
1946	92,867,195	995	92,866,200	5,714,298	6.15	2,028,250	35.49
1947	115,730,631	820	115,729,811	6,368,344	5.50	2,221,121	34.88
1948	126,237,227	678	126,236,549	6,128,574	4.85	2,127,938	34.72
1949	116,457,145	1,639	116,455,506	4,387,406	3.77	1,492,595	34.02
1950	145,424,883	661	145,424,222	6,619,727	4.55	2,618,569	39.56
1951	152,849,291	4,986	152,844,305	5,919,667	3.87	2,775,747	46.89
1952	150,826,391	1,870	150,824,521	4,858,728	3.22	2,255,861	46.43
1953	147,516,638	942	147,515,696	4,524,569	3.07	2,068,465	45.72

*Includes receipts "Subject to Surtax Only" as well as wholly tax-exempt receipts.

APPENDIX TABLE XI: CORPORATION FINANCIAL DATA, 1928-1953,
TOTAL FINANCE, INSURANCE, REAL ESTATE, AND LESSORS OF REAL PROPERTY

(Includes only Those Corporations with Net Income)

[Money Figures in Thousands of Dollars]

Year	Total Compiled Receipts	Wholly Tax-Exempt Receipts	Total Taxable Revenue	Total Taxable Net Income	Per Cent Total Taxable Net Income to Total Taxable Revenue (Y)	Total Taxes on Income	Effective Tax Rate: Total Taxes on Income ÷ Total Taxable Net Income (X)
1928	14,755,414	784,089	13,971,325	1,971,343	14.11	213,238	10.82
1929	11,162,815	959,626	10,203,189	2,197,539	21.54	222,403	10.12
1930	7,762,305	740,253	7,022,052	1,064,816	15.16	109,455	10.28
1931	4,438,641	323,033	4,115,608	570,502	13.86	55,166	9.67
1932	2,868,623	203,283	2,665,340	287,992	10.81	36,576	12.70
1933	2,800,696	192,913	2,607,783	260,569	9.99	36,352	13.95
1934	3,152,908	602,362	2,550,546	452,414	17.74	62,823	13.89
1935	3,765,113	860,124	2,904,989	603,274	20.77	85,802	14.22
1936	6,578,616	207,010	6,371,606	2,219,938	34.84	144,842	6.52
1937	6,182,569	182,167	6,000,402	2,143,795	35.73	139,786	6.52
1938	5,841,609	180,282	5,661,327	1,704,131	30.10	133,754	7.85
1939	6,084,208	183,941	5,900,267	1,776,514	30.11	132,472	7.46
1940	6,558,215	187,529	6,370,686	2,030,903	31.88	197,706	9.73
1941	7,325,262	189,289*	7,135,973	2,196,636	30.78	323,653	14.73
1942	7,684,557	275,710*	7,408,847	2,529,465	34.14	398,151	15.74
1943	8,062,413	268,074*	7,794,339	2,786,738	35.75	464,088	16.65
1944	8,834,643	210,597	8,624,046	3,200,226	37.11	553,966	17.31
1945	9,734,104	190,780	9,543,324	3,756,042	39.36	666,793	17.75
1946	10,829,109	189,712	10,639,397	4,289,105	40.31	736,663	17.18
1947	12,091,327	180,448	11,910,879	4,113,752	34.54	648,027	15.75
1948	14,548,902	151,935	14,396,967	4,761,579	33.07	813,575	17.09
1949	16,182,500	179,123	16,003,377	5,525,919	34.53	1,010,379	18.28
1950	17,382,475	207,973	17,174,502	5,993,562	34.90	1,255,723	20.95
1951	18,379,566	229,294	18,150,272	6,187,604	34.09	1,543,189	24.94
1952	21,329,647	264,913	21,064,734	6,707,560	31.84	1,765,557	26.32
1953	23,654,257	300,542	23,353,715	7,184,350	30.76	1,902,205	26.48

*Includes receipts "Subject to Surtax Only" as well as wholly tax-exempt receipts.

APPENDIX TABLE XII: CORPORATION FINANCIAL DATA, 1928-1953, TOTAL SERVICES

(Includes only Those Corporations with Net Income)

[Money Figures in Thousands of Dollars]

Year	Total Compiled Receipts	Wholly Tax-Exempt Receipts	Total Taxable Revenue	Total Taxable Net Income	Per Cent Total Taxable Net Income to Total Taxable Revenue (Y)	Total Taxes on Income	Effective Tax Rate: Total Taxes on Income ÷ Total Taxable Net Income (X)
1928	2,787,885	29,764	2,758,121	254,186	9.22	25,501	10.03
1929	3,053,024	52,866	3,000,158	314,426	10.48	29,632	9.42
1930	2,758,636	44,160	2,714,476	234,227	8.63	23,705	10.12
1931	1,699,770	20,726	1,679,044	117,925	7.02	11,081	9.40
1932	911,456	5,747	905,709	64,392	7.11	8,854	13.75
1933	870,155	4,303	865,852	60,982	7.04	8,717	14.29
1934	1,562,962	7,419	1,555,543	107,807	6.93	15,209	14.11
1935	1,804,876	10,362	1,794,514	127,448	7.10	18,243	14.31
1936	2,546,218	638	2,545,580	232,164	9.12	32,446	13.98
1937	2,626,011	634	2,625,377	225,726	8.60	34,146	15.13
1938	2,059,797	267	2,059,530	160,263	7.78	23,860	14.89
1939	2,265,662	217	2,265,445	179,973	7.94	27,332	15.19
1940	2,617,761	416	2,617,345	203,365	7.77	38,756	19.06
1941	3,107,176	406*	3,106,770	259,487	8.35	75,595	29.13
1942	3,851,971	327*	3,851,644	413,023	10.72	182,112	44.09
1943	4,553,703	210*	4,553,493	594,857	13.06	311,479	52.36
1944	5,053,519	128	5,053,391	625,563	12.38	321,359	51.37
1945	5,374,674	163	5,374,511	648,697	12.07	316,519	48.79
1946	6,600,362	233	6,600,129	874,592	13.25	293,069	33.51
1947	7,401,951	86	7,401,865	815,255	11.01	263,800	32.36
1948	7,460,049	93	7,459,956	755,282	10.12	245,907	32.56
1949	7,556,431	652	7,555,779	682,310	9.03	223,745	32.79
1950	7,855,853	142	7,855,711	693,381	8.83	240,530	34.69
1951	8,862,184	223	8,861,961	768,450	8.67	329,074	42.82
1952	9,680,232	847	9,679,385	761,988	7.87	331,965	43.57
1953	9,982,826	293	9,982,533	749,682	7.51	323,832	43.20

*Includes receipts "Subject to Surtax Only" as well as wholly tax-exempt receipts.

APPENDIX TABLE XIII: SUMMATIONS OF DATA, INDIVIDUAL INDUSTRIAL DIVISIONS

A. 26-Year Period	ΣX	ΣY	$(\Sigma X)^2$	$(\Sigma Y)^2$	ΣX^2	ΣY^2	ΣXY
Agriculture, etc.	654.26	316.56	428,056.1476	100,210.2336	21,005.1922	4,147.8426	8,694.1215
Mining and quarrying	687.68	345.85	472,903.7824	119,612.2225	23,088.2210	4,691.4801	9,146.0378
Construction	737.85	163.32	544,422.6225	26,673.4224	27,487.8099	1,050.7708	4,675.7413
Manufacturing	832.69	230.13	693,372.6361	52,959.8169	36,116.7323	2,112.3315	7,981.1741
Public utilities	732.96	395.23	537,230.3616	156,206.7529	27,061.8794	6,177.3487	11,497.3311
Trade	759.38	99.77	576,657.9844	9,954.0529	29,379.9516	413.9735	3,265.6963
Finance, etc.	382.90	737.82	146,612.4100	544,378.3524	6,447.5968	23,128.4876	11,303.9692
Services	694.92	237.61	482,913.8064	56,458.5121	24,077.6920	2,264.5905	6,779.7736

B. Lead-Lag	ΣX_{-1}	ΣY	$(\Sigma X_{-1})^2$	$(\Sigma Y)^2$	$\Sigma(X_{-1})^2$	ΣY^2	$\Sigma X_{-1}Y$
Agriculture, etc.	614.00	303.83	376,996.0000	92,312.6689	19,384.3246	3,985.7897	8,269.1373
Mining and quarrying	641.06	332.30	410,957.9236	110,423.2900	20,914.7966	4,507.8776	8,459.5041
Construction	694.19	155.92	481,899.7561	24,311.0464	25,581.6143	996.0108	4,372.8032
Manufacturing	778.04	221.81	605,346.2416	49,199.6761	33,130.1098	2,043.1091	7,380.4990
Public utilities	683.84	382.05	467,637.1456	145,962.2025	24,649.1050	6,003.6363	10,677.0883
Trade	713.66	96.18	509,310.5956	9,250.5924	27,289.6332	401.0854	3,118.8121
Finance, etc.	356.42	723.71	127,035.2164	523,756.1641	5,746.4064	22,929.3955	10,735.1614
Services	651.72	228.39	424,738.9584	52,161.9921	22,211.4520	2,179.5821	6,431.9030

APPENDIX TABLE XIV: DESCRIPTIVE MEASURES, FOUR INDUSTRIAL DIVISIONS*

26-Year Period (N = 26)	$\bar{X}$	s_X	$\bar{Y}$	s_{Y_o}
Agriculture, etc.	25.1638	13.2165	12.1754	3.3604
Manufacturing	32.0265	19.0633	8.8512	1.7029
Trade	29.2069	16.6420	3.8373	1.0942
Services	26.7277	14.5497	9.1388	1.8926

Lead-Lag (N = 25)	$\bar{X}_{-1}$	$s_{X_{-1}}$	$\bar{Y}$	s_{Y_o}
Agriculture, etc.	24.5600	13.1217	12.1532	3.4251
Manufacturing	31.1216	18.8852	8.8724	1.7335
Trade	28.5464	16.6340	3.8472	1.1147
Services	26.0688	14.4525	9.1356	1.9298

*The four divisions listed are those with statistically significant least-squares correlation coefficients.

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