DISAGGREGATED ANALYSIS OF THE SHIFTING OF THE CORPORATION INCOME TAX

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ABSTRACT

DISAGGREGATED ANALYSIS OF THE SHIFTING
OF THE CORPORATION INCOME TAX

By

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Since 1934, the corporation income tax has accounted for 12.6 to 38.1 percent of the federal receipts from the public. In 1965, this source of federal receipts amounted to 21.3 percent of the total; exceeded only by the individual income tax. Despite its predominance, no other tax has raised as much controversy over who actually assumes the burden. Is it the stockholder, the consumer, or the wage earner? The answer is germane to any analysis of our entire tax structure.

This study attempts to measure the degree of shifting that is accomplished by seventeen, two-digit (SIC) industries in the manufacturing sector of our economy during the period 1947-1963. Using time series regression analysis for each industry, the before-tax rate of return on gross assets is regressed on several explanatory variables, one of which is the tax liability as a percent of gross assets. The regression equation is based upon the behavioral assumption that the firm attempts to take compensatory action to recoup as much of the tax burden as possibly by either shifting the burden forward in higher price or backwards in lower payments to labor. According to the specification of the model, the

measure of shifting becomes the regression coefficient of the tax variable.

As part of the analysis, various theories of the firm are examined by comparing their shifting predictions with the empirical results. The traditional models of pure competition and monopoly, the Baumol sales-maximizing model, and the Williamson expense preference model all predict a limit of 100 percent shifting in the long-run. Only the Krzyzaniak and Musgrave model, with its "signal" theory of business behavior, can predict more than 100 percent shifting.

The empirical results indicate that nine of the seventeen industries shift no significant amount of the tax burden; eight show shifting measures significantly greater than zero; and one of the eight (Tobacco Manufactures) shows a shifting measure significantly greater than 100 percent.

The measures of shifting are then correlated by industry, using rank correlation, with concentration ratios, changes in total assets, and percentage changes in average weekly earnings of production workers in each industry. The most significant inference is that wages advanced less in those industries which shift more of the tax, implying the possibility that the burden is shifted backwards upon the wage earner.

The findings of this study cannot adequately substantiate any discrimination among the various models. Although the Krzyzaniak and Musgrave model is the only model which

can support the results of the Tobacco Manufactures industry, one industry out of seventeen is comparatively weak evidence upon which to base such a crucial judgement. Further study is needed to test the applicability of the various theories of the firm to the shifting problem, and if possible, on a more disaggregated basis once the data are available.

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CHAPTER I

INTRODUCTION

Background

The corporation income tax was enacted in 1909 under the protective guise of an excise on the privilege of doing business as a corporation. To this day, it is a proportional income tax levied on the accounting profits of all legally defined, non-exempt corporations. Exemptions, partial or whole, are granted to some qualifying, non-profit corporations; e.g., charitable, educational, religious, and literary organizations.[1] Since 1934, it has accounted for 12.6 to 38.1 percent of the federal receipts from the public. In 1965, this source of federal receipts amounted to 21.3 percent of the total; exceeded only by the individual income tax, which contributed 40.8 percent.

Despite its predominance, no other tax has provoked as much controversy and disagreement about who actually assumes the burden. Opposite conclusions have been reached by many economists who have studied the tax and its operation. Some believe that it is borne by the corporations, and, hence by the stockholders. Others conclude that it is paid by the consumer through higher prices,

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[1]Section 7701 (a) (3) of the Internal Revenue Code of 1954.

while still others argue that the burden is shifted back upon the workers in the form of lower wages. Lastly, there is a group who believes that the burden of the tax is borne jointly by the three groups--stockholders, consumers, and wage earners.

This study attempts to measure the degree of shifting that is accomplished by various industries in the manufacturing sector of our economy during the period 1947-1963. The seventeen years of the analysis encompassed three corporation income tax rate changes as presented in Table 1. Thus, it was possible to select a test period which was relatively short and yet provided acceptable tax rate variability, especially since effective tax rates are used in the regression model.

TABLE 1

HISTORY OF FEDERAL CORPORATION INCOME TAX RATES

Year	Exemptions, Brackets, or Type of Tax	Rate
1946	First $25,000	21-25
	$25,000 to $50,000	53
	over $50,000	38
1950	Normal Tax 23	42
	Surtax (over $25,000 surtax exemptions) 19	
1951	Normal Tax 28 3/4	50 3/4
	Surtax (over $25,000 surtax exemptions) 22	
1952	Normal Tax 30	52
	Surtax (over $25,000 surtax exemptions) 22	

Source: Joseph A. Pechman, Federal Tax Policy (Washington: The Brookings Institute, 1966), p. 245.

Instead of the entire manufacturing sector as a unit, seventeen industries are studied.[2] The numerous differences between the characteristics of each industry indicate the advantages to be gained from a more disaggregated approach. Unfortunately, only a few of these distinguishing characteristics can be quantified, and an effort will be made to determine their relative influence upon the observed performance in each industry.

Definition of the Shifting Concept

The uncertainty about the burden of the corporation income tax has been complicated by the ambiguity of the terms used in the analysis. In the classical system, where planned savings and investment are equal and full-employment is maintained automatically, the concepts of impact, shifting, and the incidence of the income tax are clearly delineated. The impact is the initial imposition of the tax on some person or business entity; shifting is the transfer of this obligation to others by whom it is actually assumed; and the incidence is the settlement of the burden on the ultimate taxpayer, or the result of shifting. A fourth definition, effects of pressure, encompasses all secondary consequences of the impact, shifting, or incidence of a tax. Thus, shifting refers only to the process; incidence denotes the result, and

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[2]Seventeen of the possible twenty major industries which are classified by the Standard Industrial Classification are used in this study.

effects are a residual, including both changes in output and income distribution which are not considered a part of the direct money burden.

In a system where variations in aggregate demand may originate from changes in the desire to spend available funds, and where such variations may give rise to changes in the level of employment as well as in prices, the traditional distinction between direct incidence and indirect effects involves an arbitrary separation between various elements of the total change. Shifting the impact of the tax through higher prices or lower payments to factors of production may initiate a chain of subsequent adjustments which make the concept of locating the ultimate burden of little significance. The changes must all be considered as interdependent parts of the adjustment, proceeding in one and the same system of general equilibrium. The indirect effects of price and/or output variations must be included in the concept of shifting.

Consequently, the most useful concept of shifting should be concerned with the result instead of the adjustment process. This more inclusive definition eliminates the troublesome task of differentiating between direct and indirect effects of a change. The important consideration becomes whether there is a difference between impact incidence and effective incidence, with the degree of shifting measured by the amount of the inequality.[3]

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[3]Musgrave's distinction between effective and impact

In the case of the corporation income tax, shifting describes the results of particular actions taken by the corporation in response to an increase in the income tax. The motive is to pass forward to its customers or backward upon its employees as much of the impact incidence as possible. In the short-run, when capacity is constant, forward shifting is accomplished by price increases. Backward shifting is imposed by the downward pressure on wages and/or on the payments to owners of other productive factors (including equity owners).

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incidences will be used in this study. See Richard A. Musgrave. The Theory of Public Finance (New York: McGraw-Hill Book Company, 1959), p. 230. Professor Musgrave defines effective incidence as "the actual change in distribution that results as a given tax is imposed or tax substitution is made," and impact incidence as "the change that would result if the income position of a new taxpayer were reduced by the amount of tax remission, while the positions of all others remained unchanged."

CHAPTER II

THE ANALYSIS OF SHIFTING UNDER VARIOUS THEORETICAL CONDITIONS

Traditional economic theory has maintained that in the short-run it is not possible for firms under pure competition or monopoly to adjust price and output so as to shift the corporation income tax. The precision of this theory is rigorous and appealing. However, whether the traditional theoretical models of pure competition and monopoly are applicable to the examination of tax incidence remains an open question.

It is imperative that any modification of the traditional theory of the firm, which is based on the behavioral assumption of profit-maximization, be stated precisely. Specifically, any such modification should be judged on the basis of its predictive power by comparison with the traditional model. A model is a tool, and as such, it must provide a mechanism for making inferences about reality based upon incomplete data and observations which show only correlations and not the structural relationships that are sought. Because reality is obviously too complex to be fully characterized in any workable model, we must rely upon abstractions and

over-simplifications. One might perhaps accept a model as useful if it satisfies the requisites stated by William J. Baumol.

> A useful model describes an imaginary world which is sufficiently complex and similar to reality to permit us to make some legitimate inferences about the behavior of the economy, but which is at the same time sufficiently simple for us to understand and manipulate with the tools at our disposal.[1]

The degree of usefulness is influenced by the selection of the elements which are omitted from the model. The social scientist differs from the natural scientist in that the latter usually bases an experiment on controlled environmental conditions. The variables that are omitted by the economist correspond to the environmental conditions that may in principle be held constant by the natural scientist. The exclusion of certain variables from an economic model may seriously limit its general validity, and the model's usefulness may therefore be restricted to specific problems. As stated by Baumol,

> The facts of the problem on hand and the questions which are being asked must decide what we can afford to leave out and what we must put in to avoid being misled. Thus, a model can only be designed around and judged in light of a specific problem.[2]

Inherent in the selection of relevant variables is the important task of specifying the assumptions. Erroneous or irrelevant assumptions can mislead the analysis, and can contribute towards the generation of unreliable conclusions.

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[1] William J. Baumol, Business Behavior, Value and Growth (New York: The Macmillan Company, 1959), p. 2.

[2] Ibid, p. 2.

Whatever the favored methodological position, guidelines must be chosen for determining the appropriate assumptions. One position is that theoretical results from an economic model should be generally valid. Unfortunately, a theoretical model which purports to be generally valid must necessarily suffer the consequences of over-simplification and abstraction. To produce a theory which is applicable to a variety of circumstances requires certain abstractions and reliance can be placed only on those characteristics which are common to all circumstances.

Generalizations can be costly, and even though it must be admitted that results that are applicable everywhere would be valuable, the benefits must be related to the costs. In some cases, the economist is interested in problems that are influenced by variables not generally present in all situations. These unique variables are consequently omitted from the general model, and reliable inferences are not obtained.

An alternative methodological position is taken by those who desire greater realism in economic models. When realism becomes an end in itself, the complexity of the analysis challenges even the most sophisticated mathematical systems. The benefits are again offset by the costs associated with the loss of insight into the workings of the models.

It is unfortunate that the adherents to the above positions are predisposed in their over-concern about either the general usefulness of the theory or the realism of the assumptions. In contrast, Milton Friedman has

stimulated considerable thought in the area of hypothesis evaluation.[3] He stated that it is wrong to concentrate all attention on the realism of the assumptions when evaluating an economic hypothesis.

> The relevant question to ask about 'assumptions' is not whether they are descriptively 'realistic,' for they never are, but whether they are sufficiently good approximations for the purpose in hand.[4]

By rejecting the practice of assessing the quality of the assumptions, Friedman was partially obligated to propose a better method of evaluating an economic model. He did this by arguing that empiricists should not stagnate in the discussion of assumptions but should examine the predictive powers of the hypotheses. Friedman claimed that

> Theory is to be judged by its predictive power for all classes of phenomena which it is intended to 'explain.' Only factual evidence can show whether it is 'right' or 'wrong' or, better, tentatively 'accepted' as valid or rejected...the only relevant test of validity of a hypothesis is comparison of its predictions with experience. The hypothesis is rejected if its predictions are contradicted ('frequently' or more often than predictions from an alternative hypothesis).[5]

The methodological position taken in this study can best be described as a compilation of the arguments by Baumol and Friedman. Since the analysis of the corporation income tax incidence is a specific problem, as suggested

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[3]Milton Friedman, Essays on Positive Economics (Chicago: The University of Chicago Press, 1966).

[4]Ibid, p. 15.

[5]Ibid, pp. 8-9.

by Baumol, the specific variables and relationships deserve individual consideration within the general theoretical model of the firm. The assumptions associated with the traditional model should be adhered to until it can be shown that the prediction generated by the model differs from the empirical observation. Thus if the empirical results differ from the model and show that short-run shifting of the corporation income tax did occur, then the usefulness of the traditional model deserves questioning. However, the consequential rejection of the traditional theory should be tempered and carefully considered. The implication of Friedman's essay is that assumptions should be judged on the basis of their prediction ability. The severity of his methodological approach can be tempered to accommodate Baumol's argument that "one of the most convenient instruments for judging the appropriateness of our necessarily imperfectly realistic models is the examination of the plausibility of their assumptions."[6]

The synthesis involves the evaluation of the prediction ability of traditional theory when related to a particular problem, namely the corporate income tax incidence. Depending upon the degree of similarity between the predicted results and the empirical findings, the theory should be either accepted or partially or wholly rejected. When rejection is warranted, all elements of the theoretical model should be carefully analyzed. This means

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[6]Baumol, op. cit., p. 6.

that both included and excluded variables, assumptions, and the structural relationships should be examined under the restricting guidelines of the particular problem. If changes can be made to the components of the model while maintaining the basic economic concepts, then the altered economic tool is not a new theory but the same one adjusted in light of the specific problem.[7]

The proposed steps in following this methodological approach are first, to develop the short and long run traditional arguments about the feasibility of shifting the corporation income tax under conditions of pure competition and monopoly. The next step is to alter the traditional model according to specific behavioral assumptions and determine what degree of shifting, if any, is predicted by these alternative models. Finally, the empirical results should lead to both a solution of the shifting questions and an appropriate test of the altered theory compared to the traditional theory of the firm.

Traditional Theoretical Models

Certain distinctions are normally made when discussing the theory of the firm. The distinctions are based upon the length of time under consideration and market

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[7]I believe it is a matter of semantics whether the adjusted model constitutes a new approach or remains the same under slightly different assumptions. The position taken in this paper is that the traditional theory remains useful and that most recent theories are nothing more or less than "variations on a theme"; the "variations" being different behavioral assumptions.

structure. Time plays an important part in differentiating between the short and the long run. The short run is generally considered that time period when the production process is constrained by the fixity of capital equipment. Output can be altered, but only within the limits governed by the quantity of fixed capital. The long run denotes the period when capital equipment can be changed and output becomes more flexible. The market structure in which the firm operates governs the degree of operational constraints and the assumed conduct of the firm. For reasons of comparative simplicity, this discussion will be limited to the analysis of shifting under conditions of pure competition and monopoly in the short and long run.

One important behavioral assumption of the traditional model is that the entrepreneur attempts to maximize profit. Thus all conduct and decisions are based on the goal of obtaining the greatest profit under the given market conditions and production possibilities, both in the short and the long run.

A. Pure Competition

An entrepreneur operating under conditions of pure competition produces a homogeneous product along with many other sellers; sells his product in a market serving many buyers who possess perfect knowledge about price, quality, and market opportunities; buys his inputs in competitive markets (and therefore must operate to satisfy a competitive

capital market).

Short-run

In the short-run, the entrepreneur attempts to maximize profits, given the inputs (x_i), the market price of inputs (r_i), and the selling price of his product (p). The total revenue (R) is given by the number of units sold (q) multiplied by the fixed unit price. The profit (π) is the difference between the total revenue and the total cost (C):

$$\pi = pq - C \tag{1}$$

where $q = f(x_1, x_2)$, and x_1, x_2 are inputs.
The total cost equation is:

$$C = r_1x_1 + r_2x_2 + r_3x_2 \tag{2}$$

where: x_1 = labor

x_2 = capital

r_1 = cost of labor

r_2 = user cost or operating cost of capital

r_3 = sunken cost of capital

Combining the cost function with the production function, the profit equation (1) can be rewritten:

$$\pi = pf(x_1, x_2) - r_1x_1 - r_2x_2 - r_3x_2 \tag{3}$$

where profit is a function of inputs x_1 and x_2. When (3) is maximized with respect to the two input variables, the first-order condition for profit maximization is that each input be utilized up to a point where the value of its marginal product equals its price. The second-order condition is

that the marginal products of both inputs be decreasing.[8]

The same type of analysis can be done with cost functions. In this case the entrepreneur must equate the marginal cost with the market price of the product as the first-order condition for profit-maximization. The second-order condition is that marginal cost must be increasing at the profit-maximizing output.[9]

Thus, for the competitive firm, profit-maximization is at the particular output where marginal cost equals the price of the product, and the marginal revenue product of each input equals its cost. Since the product is homogeneous and there are many sellers, each competitive entrepreneur will be selling his output at the prevailing market price. However, in the short-run, equilibrium for each firm will not necessarily be at an output where price equals average total cost. Time does not permit the equilibrating entry and exit of firms, and above-normal profits and/or losses may persist within an industry.

The traditional argument against the probability of short-run shifting of the income tax necessitates a clear understanding of the difference between costs which are direct returns to variable factors and costs which are returns to fixed factors and are therefore price determined.

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[8]See James M. Henderson and Richard E. Quandt, Microeconomic Theory (New York: McGraw-Hill Book Company, 1958), Chapter 3.

[9]Ibid, pp. 55-57.

In the short-run, capital stock is fixed, and the return to this fixed investment is determined by the price of the product. The excess of total revenue minus total variable cost is the return to the fixed capital or quasi-rent. This quasi-rent is subject to the income tax in the short-run. Quasi-rent differentials indicate the presence of more or less efficient firms in the industry.

Only in the long-run, when it is possible to alter the stock of capital, must the entrepreneur consider the necessary return sufficient to attract and maintain capital. In the long-run this necessary return becomes a cost and shows up as the difference between total costs and total variable costs. Instead of labeling this differential, which is no longer price determined, quasi-rent, the entrepreneur considers this return the normal profit. Profit above normal profit in the long-run is economic rent or economic profit.

It is important to emphasize that all profits are taxed, whether quasi-rents, normal profits, or economic rents. In the short-run, since the income tax does not affect marginal revenue or marginal cost, the profit maximizing output will not change as a result of the tax. The burden of the tax falls fully upon the return to capital.

However, the conclusion that a corporate income tax will not be shifted in the short-run is dependent upon the presumption that taxable profits are a return to a fixed

amount of invested capital. Profits are considered to be net of all variable costs; i.e., total revenue minus total costs. Since output and prices remain the same, the tax-reduced rate of return on invested capital cannot be increased. The neglected consideration is that not all invested capital, whether equity or debt, is fixed in the short-run. Working capital; i.e., work in process, inventory, and cash on hand, is relatively flexible and can be adjusted as the needs arise. Thus, the return on this more liquid form of capital can be deemed a variable cost included in profits. The capacity to increase the rate of return on total invested capital in the short-run becomes a function of the ratio of working capital to total capital; the higher the ratio, the easier it becomes to increase the after-tax rate of return by reducing the amount of working capital.

Long-run

As a result of the reduction in the normal profit due to the income tax, in the long-run, some capital will leave the taxed industry. Since the proportional corporation income tax does not apply to all sectors of the economy, capital can find alternative investment opportunities. The mobility of capital will eventually equate the yield on all comparable types (risk classes) of investments. This decrease in the stock or in the growth rate of capital will have an effect upon the total output. Output will be reduced,

and the resultant market price will be higher in the long-run due to the effect of the income tax. The conclusion is that the tax will be shifted in the long-run, but not in the short-run by the competitive firm. Due to the competitive forces of the industry, no firm is capable, in the long-run, of shifting forward more than 100 percent of the tax burden.[10]

B. Monoply

The market conditions of the monopolist are different from those experienced by the competitive firm. The product is differentiated; he is the only seller in a market serving many buyers; and he has the capacity of setting the market price. Even so, traditional theory predicts no shifting of the income tax in the short-run by a profit-maximizing monopolist.

Short-run

The production decisions are essentially the same for the monopolist as they are for the competitive firm.[11] Since the monopolist can determine the price, he chooses a price and output which will maximize the difference between total revenue (R) and total cost (C).

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[10]For the immediate purposes of this chapter, 100 percent shifting is defined as the end result of compensatory action taken by the firm to recover the entire burden imposed by the tax.

[11]It is assumed that the monopolist purchases his input factors in competitive markets, and his individual demand has negligible effect upon the input costs.

Given the demand function for the monopolist, $p = p(q)$ and the average total cost function $c = c(q)$, total revenue equals

$$R(q) = pq = p(q)q, \tag{4}$$

and total cost equals

$$C(q) = cq = c(q)q, \text{ [12]} \tag{5}$$

where $C(q)$ does not include the return to capital in the short-run. As with the competitive firm, the return to capital is price determined in the short-run.

First and second-order conditions are assumed to be satisfied in the allocation of inputs.

Profit equals the difference between total revenue and total cost:

$$\pi = R(q) - C(q) \tag{6}$$

To maximize profit set the derivative of (6) with respect to q equal to zero:

$$\frac{d\pi}{dq} = R'(q) - C'(q) = 0$$

$$R'(q) = C'(q) \tag{7}$$

or marginal revenue equals marginal cost.

An income tax requires that the monopolist pay a certain proportion of the difference between total revenue and total cost. Thus, (6) can be restated:

$$\begin{aligned} \pi^* &= R(q) - C(q) - t\left[R(q) - C(q)\right] \\ &= (1 - t)\left[R(q) - C(q)\right] \end{aligned} \tag{8}$$

where t equals the tax rate and $0 < t < 1$. The tax t is

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[12]See Musgrave, op. cit., p. 278, n. 1.

levied on total profits and π^* is after-tax profits. Maximizing (8) by setting the derivative with respect to q equal to zero gives:

$$\frac{d\pi}{dq} = (1 - t)\left[R'(q) - C'(q)\right] = 0 \qquad (9)$$

Since $0 < t < 1$,

$$R'(q) - C'(q) = 0$$

and

$$R'(q) = C'(q) \qquad (10)$$

The output position implied by equation (10) is the same as that implied by equation (7). Therefore, the imposition of an income tax upon a monopolist will have no effect on output and price in the short-run.[13] The only way that a monopolist can reduce the profits tax is by reducing before-tax profits (and this would entail a reduction of after-tax profits as well). Thus as long as the tax rate is less than 100 percent, it is advantageous for the monopolist to continue to equate marginal revenue with marginal cost and produce at the same output and price as before the tax change.

Long-run

The traditional view holds that in the before-tax equilibrium, the monopolist employs capital at that rate such that the marginal revenue product is equal to the cost of capital. Then when a tax is imposed, to the extent that

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[13]Henderson and Quandt, op. cit., Chapter 6.

the new after-tax marginal revenue product is less than the cost of capital, output and prices will be adjusted so as to regain the equilibrium. The reduction of output is the direct result of the decrease in the capital employed in the industry.

As with the competitive firm, shifting is limited to 100 percent of the tax. More than 100 percent shifting implies that the monopoly firm was not maximizing profits before the tax change.

The first-order condition for optimum allocation of inputs for the profit-maximizer is

$$\frac{MPP_L}{MPP_K} = \frac{w}{r} \qquad (11)$$

or, that the marginal rate of technical substitution equals the ratio of input prices (where r equals the cost of capital and w equals the wage rate). The price of capital (r) can be regarded either as the appropriate return which must be paid to investors in a competitive capital market or the marginal profit rate necessary to attract and retain capital.

The profit-maximizing firm will employ units of a variable input up to a point where the marginal revenue product equals the input price (marginal revenue product is equal to marginal product multiplied by marginal revenue).

$$MRP_k = r \qquad (12)$$

Assuming diminishing marginal productivity of capital, when the quantity of capital is decreased, due to

the substitution and output effects, output will be lowered. Under conditions of monopoly pricing, the market price of the product will increase.

When the income tax is increased, after-tax profits are decreased, and the marginal revenue product of capital now is less than the cost of capital. Thus, (11) and (12) no longer hold. By decreasing the amount of capital, MPP_K and MRP_K will be increased up to a point where (11) and (12) are again in equilibrium.

Reduction of the use of capital beyond the new point of equilibrium in hopes of shifting more of the tax burden to the consumer in the form of higher prices would result in the suboptimum utilization of capital. At any point below the optimum amount, the marginal revenue product of capital would be above the market price, and the firm could increase profit by using more capital and increasing output.

The long-run adjustment process, which results in the forward shifting of the income tax by the monopolist or the competitive firm, is not without limitation. In order for 100 percent shifting to occur alternative investment opportunities must be available for the capital which is leaving the taxed industries. To the extent that this invested capital must settle for a return less than was provided before the tax, the market equilibrium in the capital market will force less than 100 percent shifting. The presumption that the exodus of capital in the long-run will equate the marginal revenue product to the unchanged

market rate of interest depends upon the existence of investment opportunities that offer net rates of return which are coincidentally higher after the tax than before or that offer gross rates of return which were previously higher than the shifting industries before the tax change. The former explanation is unlikely, and the latter is negated by the assumption of equilibrium in the capital market. Consequently, in the long-run, shifting will be somewhat less than 100 percent by both competitive and monopolistic firms.

Questionable Assumptions of Traditional Theory

The arguments that are usually reiterated by economists discussing the incidence of the corporation income tax are based on the assumptions indigenous to the models of pure competition or monopoly. When some of these assumptions are relaxed, what remains is not a new theory of the firm, but the basic relationships performing within a different framework. The new framework is constructed of assumptions concerning market structure and entrepreneurial behavior that are closely related to the specific problem of tax incidence.

Consider first a modification of market structure. Many authorities feel that the industrial market structure in the United States does not conform to the descriptive characteristics of either pure competition or monopoly. The extent or absence of competition in any particular

industry can in principle be measured relative to other industries on a scale bounded by these two extremes. In the manufacturing sector of the United States many economists feel that industries can be described as oligopolies of varying degree.

Two important assumptions of the competitive model are consequently altered. The first is that of homogeneous products. Product differentiation is a generally accepted requisite for successful distribution, and substantial resources are spent in creating physically or psychologically distinguishing features. The second altered assumption, consequent upon the alteration of the first, is that the firm faces a demand schedule that is less than perfectly elastic. Thus the firm has pricing discretion within the limits of its demand curve.

Besides the product and market structure qualifications, many students of incidence have questioned other premises of traditional theory. The following discussion is not a list of universally accepted qualifications, but simply a recognition of some of the problems encountered by the analyst.

In the short-run, profit-maximizing behavior of the monopolist may well be subordinated to long-run objectives. Maximum immediate gains may be foregone in order to insure market control, good-will, and/or consumer acceptance that will facilitate long-run profit targets. Subject to the monopolist's discretionary pricing policies,

profits and prices can be kept below the current (or short-run)profit-maximization level, which will make price increases more feasible in the short-run to recoup tax payments. However, this compensatory pricing behavior would be tempered by long-run profit considerations.

Market policy and pricing may be influenced by the considerations of government antitrust action, public reaction to its conception of excess profits, or the effect upon wage negotiations. Consequently, market opportunities may not be fully exploited, leaving room for future tax-motivated price increases which will not necessarily lead to retaliatory action because they can be readily defended against accusations by government, labor, and the public.

Under conditions of oligopoly, the market price is even less clearly defined. Assuming that the pricing mechanism borders on the limits of "conscious parallelism," or is, at least, characterized by conditions of mutual interest, the prevailing price will fluctuate between the monopoly and competitive normative levels.[14] The market structure and the possible presence of a dominant firm may

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[14]Cf. Edward H. Chamberlin, The Theory of Monopolistic Competition (8th ed; Cambridge, Massachusetts: Harvard University Press, 1962), pp. 47-48. "When a move by one seller evidently forces the other to make a counter move, he is very stupidly refusing to look further than his nose if he proceeds on the assumption that it will not... For one competitor to take into account the alterations of policy which he forces upon the other is simply for him to consider the indirect consequences of his own acts."

lead to an administered price, which tends to be above the competitive equilibrium. What this means for shifting of the corporation income tax is dependent upon whether the tax affects normal profits or only reduces economic profits.

Profit Maximization Qualifications

The assumption of profit maximizing conduct as essential to the theory of the firm is not immune to qualification. The suspicion that other goals motivate the entrepreneur and influence his behavior has been suggested by both past and present economists; the latter critics have been able to add creditability to their criticism by being more specific. Where Alfred Marshall had to rely upon an intuitive description when he stated that "everyone who is worth anything carries his higher nature with him into business; and, there as elsewhere, he is influenced by his personal affections, by his conceptions of duty and his reverence for high ideals. And it is true that the best energies...are stimulated by a noble emulation more than by a love of wealth for its own sake."[15] Contemporary economists who have modified the assumption of profit maximization have rigorously developed theoretical models to support their contentions.[16]

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[15]Alfred Marshall, Principles of Economics (8th ed; London: Macmillan and Company, Ltd., 1961), p. 14.

[16]For an excellent coverage of the more recent revisions to the theory of the firm see: Oliver E. Williamson, The Economics of Discretionary Behavior: Managerial Objectives in the Theory of the Firm (Englewood Cliffs, New Jersey:

The modern corporation is characterized by the divestiture of management responsibilities from the ownership of the assets. The development and perpetuation of a unique group of salaried managers may have created a schism between the short-run objectives of the share-holders and those of the managers. The more diversified the ownership and the less control the owners have over the operations of the company, the greater may be the disagreement. Conversely, the more intimately the ownership participates in the operation of the corporation, the more dominant will short-run goals become, and these objectives will serve as guidelines for action.

The distinguishing difference between the stockholder and the manager is that the stockholder is best defined as a profit-maximizer; whereas the manager is also motivated by additional considerations. The stockholder is more interested in maximization of the present value of the firm's assets which will possibly increase the yield on his investment or lead to the market appreciation of his stock. Reduction in the present yield will only be accepted if it is attributed to the reinvestment of profits in order to insure continued growth and profitability in the future. The intentional limitation of the profits for the more subtle reasons associated with increasing market power and successfully

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Prentice-Hall, Inc., 1964), Chapters 2 and 3. For the purposes of this study it suffices just to highlight the pertinent arguments and to suggest how they weaken the normative assumption of profit maximization.

merchandising the product in the long-run is not accepted as a substitute for present earnings.

This inherent reluctance on the part of the stockholder to be motivated by the same stimuli as the manager is quite rational. The position of stockholder is ancillary to the investor's behavior in society. The return on his investment provides the means by which he can satisfy his materialistic desires, while the accomplishment of his more subjective goals is relegated to opportunities outside the corporation. Consequently, it is only logical that the stockholder would favor any action taken by the firm which will enhance the maximization of the present value of his investment. His pursuit of other social and economic goals is not connected with maximizing income.

The manager, as an individual, may be motivated by the same personal desires as the stockholder. However, his behavior in the organization is influenced by the fact that alternative means of satisfying his "social" needs are limited to the constrictions of the corporation environment. If we accept the premise that the "social" and "economic" man can function in the corporation matrix of alternatives, then we must alter the theory of the firm in compliance with this modification. Profit maximization as a determinant of managerial behavior becomes one of several weighted considerations which govern performance, and positive economic analysis must include in the subset of behavioral assumptions

some recognition of the diversity of goals.[17]

If profit-maximization is not the dominant impetus behind business conduct, is there some other motivational force which can be generally assumed? The behavioral approach to the theory of the firm attempts to answer many questions about business conduct by substituting various alternative goals in place of profit-maximization without discarding the fundamental concepts associated with optimum allocation of inputs given an output constraint. The behavioralist studies the determination of output on the basis of goals in addition to short-run profit-maximization.

Alternative Hypotheses

Several behavioral models have been proposed[18] as variants of a profit-maximization model. William J. Baumol

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[17]Proponents of Organization Theory have made noble attempts at solving the problems associated with measuring discretionary behavior of managers. For example, Williamson, op. cit., concludes that there are four managerial motives: salary, security, dominance, and professional excellence. He develops the notion of expense preference as a means of making the connection between motives and economic activity, and examines the significance of these non-pecuniary objectives and their influence on behavior. Expense preference is a method of quantifying management's attitude toward all classes of expenses, and is a way of modifying conventional economic theory which assumes that managers are neutral toward costs.

[18]For additional models see W. W. Cooper, "Theory of the Firm: Some Suggestions for Revision," The American Economic Review, XXXIX (December 1949), pp. 1204-1222; J. Margolis, "The Analysis of the Firm: Rationalism, Conventionalism, and Behaviorism," The Journal of Business, XXXI (July 1958), pp. 187-199; and Richard M. Cyert and James G. March, A Behavioral Theory of the Firm (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1963).

suggests an explanation of firm behavior based upon the assumption that firms attempt to maximize total revenue rather than profits. The goal of maximum sales or revenue is limited by the firm's concern for a minimum level of profits.[19] However, once this level is achieved, sales maximization becomes of major importance.[20]

Oliver E. Williamson developed a managerial discretion model[21] of business behavior which focuses on the egocentric responses of corporate managers. Because of the previously discussed gap between the material rewards and the psychological needs of the hired executive, there is a tendency for nonessential management perquisites to increase beyond the level required for effective operation of the firm. These nonessential perquisites are termed "management slack", and are part of the firm's cost function.

In response to demand and/or tax changes, management will adjust the discretionary level of management slack while maintaining profits sufficiently high enough to retain effective control of the firm.

A third alternative model was proposed by Krzyzaniak and Musgrave.[22] They acknowledged the businessman's approach

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[19]As stated by Baumol, "the firm's usual rate of return on investment played an explicit and very fundamental role in these deliberations." op. cit., p. 49.

[20]Baumol, op. cit., Chapter 6. In this chapter, Baumol gives some justifications of this hypothesis.

[21]Oliver Williamson, op. cit.

[22]Marian Krzyzaniak and Richard A. Musgrave,

to the corporation income tax, and based a behavioral function upon the anticipated response to a tax change. The businessman is assumed to regard the income tax as a cost when determining prices. Accordingly, a change in the tax rate leads to adjustments in price, wage, or output so as to compensate for the increased cost. Krzyzaniak and Musgrave realized that this price policy is not consistent with the usual concepts of profit maximization, but found that their statistical results were compatible with the stated model.

Finally, a popular variant of the traditional model is that the firm practices markup pricing. The procedure calls for increasing average total cost by a predetermined percentage to arrive at the selling price. The calculation of the markup percentage depends upon the desired profits and required taxes related to a particular forecasted level of sales. The markup hypothesis and its relevance to shifting of the corporation income tax has been tested by Robert J. Gordon.[23] He found that the degree of shifting was very slight over the test period 1925-62. A full discussion of his model and results is presented in Chapter III.

Baumol's model of sales maximization with a profit

The Shifting of the Corporation Income Tax (Baltimore: The John Hopkins Press, 1963).

[23]Robert J. Gordon, "The Incidence of the Corporation Income Tax in U. S. Manufacturing, 1925-62," American Economic Review, LVII (September 1967), p. 731.

constraint is an adaptation of traditional theory with a few modifications designed to fit certain assumptions. One major modification is that Baumol's production function separates the inputs into two basic categories, resources and expenditures on advertising and service competition. The function can be written:

$$X = f(x_1 \ldots x_m, x_{m+1} \ldots x_n), \tag{13}$$

where

$$\sum_{i=1}^{m} x_i p_i = C \quad \text{and} \quad \sum_{j=m+1}^{n} x_j p_j = A$$

$$x_i = 1,2,\ldots m$$

$$x_j = m+1,\ m+2,\ldots n$$

The costs of production are given by C, and the other inputs are grouped together under the general classification of advertising A. Each component of total cost can be changed independently of the other, and each type of expenditure is reflected in the product price, P. However, emphasis is given to the restriction that total revenue, which is quantity multiplied by price, be greater than total cost by a predetermined amount.

It is assumed that sales can be increased by additional expenditures on advertising, where sales maximization refers to the maximization of total dollars and not to physical volume. However, this relationship must be restricted to

$$\frac{dR}{dA} < 1 \tag{14}$$

i.e., total revenue can be increased by spending money on advertising and other related service expenditures, but an extra dollar spent on advertising will increase costs more rapidly than total revenue.[24]

With a profit constraint, maximized revenue becomes

$$(R - C - A) \geq K_1 \qquad (15)$$

where K_1 is the absolute level of minimum profits. The profit constraint can also be designated as a minimum return on investment:

$$\frac{(R - C - A)}{I + k_c C + k_a A} \geq K_2 \qquad (16)$$

where K_2 equals the net rate of return and investment is considered to be a linear function of the two types of costs, A and C. In (16), total investment is an amount I, which is the amount of capital stock that is not a function of C and A, plus a certain proportion of total expenditures on C and A. Baumol assumes that there is a relationship between costs and the amount of required investment over and above the amount of I.

It is noteworthy to recognize the similarity between

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[24]See Kalman J. Cohen and Richard M. Cyert, Theory of the Firm (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1965), pp. 378-379. Cohen and Cyert present a mathematical proof that the necessary conditions for revenue maximization are:

$$\frac{dR}{dS} < 1 \text{ , where } S = A$$

and

$$\frac{dR}{dX} < \frac{dC}{dX}$$

Baumol's profit constraint and the more common "target-rate-of-return."[25] Both are discretionary profit minimums deemed necessary to attract and maintain capital investment. Both result in firm behavior different from that predicted by the assumption of profit-maximization.

At the optimum price-output combination of the profit maximizer, MR = MC. Since MC is always positive, MR must be positive at the optimum output. It follows that R can be increased by increasing the quantity sold even though profits decrease. The relationship between advertising and total revenue implies that total revenue can be continually increased to its maximum by additional expenditures on advertising until the profit constraint is met. However, MR<MC at the usual sales maximization output.

The interesting implication is that the constraint of (16) can never turn out to be an inequality at the optimum point. This follows from the goal of sales maximization and the assumption that total revenue can be increased by additional expenditures on advertising up to a maximum, given the profit constraint.

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[25]For a more complete discussion of the actual pricing practices and objectives, see: Albert A. Fitzpatrick, Pricing Methods of Industry (Boulder, Colorado: Pruett Press, Inc., 1964); Robert F. Lanzillotti, Pricing, Production, and Marketing Policies of Small Manufacturers (Pullman, Washington: Washington State University Press, 1964); Robert P. Collier, "Cost Plus Pricing and Tax Incidence," Proceedings of the Thirty-First Annual Conference of the Western Economic Association, 1956; and A. D. H. Kaplan, Joel B. Dirlam, and Robert F. Lanzillotti, Pricing in Big Business (Washington: The Brookings Institute, 1958). Baumol, op cit., pp. 65-67, explains the difference between his model and "full-cost" pricing.

When an income tax is levied on profits, (16) becomes

$$\frac{(1 - t)(R - C - A)}{I + k_c C + k_a A} \geq K_2 \qquad (17)$$

However, at the pre-tax sales-maximization output, the after-tax profit is now below the constraint. According to (14) and $dR/dX > 0$, advertising and output will be decreased until the constraint is again reached.

As with the long-run purely competitive and monopoly models, the Baumol behavior model cannot predict more than 100 percent shifting. Although Baumol is not explicit about changing the profit constraint, compensatory action by management which is solely aimed at maintaining a constant after-tax rate of return on investment is self-limiting, the limit being the tax increase. Without the specification of additional reasons for changing the profit constraint (which would complicate the isolation of the tax effect), maximum shifting of the income tax is limited to 100 percent of the tax.

Using (17) as the statement of the businessman's behavior, the tax liability is considered as a cost:

$$T = t(R - C - A), \qquad (18)$$

where t = tax rate.

Restating (17) as

$$\frac{(1 - t)(R - C - A)}{K} \geq K_2 \qquad (19)$$

where K equals aggregate capital stock, the gross rate of

return with the profit constraint becomes

$$\frac{R - C - A}{K} \geq \frac{K_2}{(1 - t)} \tag{20}$$

If 100 percent shifting is defined as

$$Y_{g,t} - Y'_{g,t} = \frac{T}{K} \tag{21}$$

where Y equals before-tax rate of return, and priming denotes the value before the tax change,

then

$$Y_{g,t} - Y'_{g,t} = \frac{t(R - C - A)}{K} \tag{22}$$

Defining

$$Y_{g,t} = \frac{(R - C - A)}{K} \tag{23}$$

and

$$Y'_{g,t} = \frac{(R - C - A)'}{K} \tag{24}$$

then

$$\frac{R - C - A}{K} - \frac{(R - C - A)'}{K} = \frac{t(R - C - A)}{K} \tag{25}$$

Solving for the rate of return after the tax change in terms of the rate of return before the tax change gives:

$$\frac{R - C - A}{K} = \frac{(R - C - A)' / 1-t}{K} \tag{26}$$

or

$$K_2 = \frac{K'_2}{1-t} \tag{27}$$

The Baumol model predicts a maximum increase of the profit constraint, or the rate of return, which is limited to 100 percent of the tax rate change in the long-run. There is no justification for more than 100 percent shifting of the corporation income tax in the long-run.

The Williamson model introduces four concepts of profits: maximum profits, π^*, which are obtained by the traditional profit-maximizing firm; actual profits, π_A, which differ from maximum profits by an amount of management slack absorbed in staff expenditures; reported profits, π_R, which differ from actual profits by an amount expended on management slack absorbed in costs; and minimum profits, π_0, which are the lowest amount acceptable for effective management control and agrees closely with Baumol's profit constraint.[26]

Thus:

$$\pi_A = \pi^* - MS \tag{28}$$

and

$$\pi_R = \pi^* - MS - M \tag{29}$$

and

$$\pi_R > \pi_{o/1-t} \tag{30}$$

where t is the tax rate.

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[26]The notation used in this discussion of the tax shift is taken from Cohen and Cyert, op. cit., pp. 356-363.

If $M > 0$, then $\pi_A > \pi_R$ and $\frac{\pi_R}{\pi_A} < 1$.

Let $\frac{\pi_R}{\pi_A} = \delta$, where $0 < \delta \leq 1$. According to the discretionary model, $\frac{\partial \delta}{\partial t} < 0$; i.e., as the tax rate is increased, management reports more of the perquisites as operating costs, and the ratio of reported profits to actual profits decreases.

In this model, the rate of return before the tax can be stated as

$$r' = \frac{\pi'_R}{K} \tag{31}$$

where $\frac{\pi'_R}{\pi_A} = \delta'$, with $0 < \delta' \leq 1$.

After levying a tax, t, the net rate of return becomes

$$r_n = \frac{(1-t)\pi_R}{K} = \frac{(1-t)\delta\pi_A}{K} \tag{32}$$

where $\pi_R = \delta\pi_A$.

According to the definition of 100 percent shifting of the corporation income tax, the firm will attempt to equate r_n and r' so that

$$\frac{(1-t)\pi_R}{K} = \frac{\pi'_R}{K'} \tag{33}$$

or

$$\frac{\pi_R}{K} = \frac{1}{(1-t)} \frac{\pi'_R}{K'} \tag{34}$$

With $\delta < \delta'$, (34) implies

$$\frac{\delta\pi_A}{K} = \frac{1}{1-t} \frac{\delta\pi'_A}{K'} \tag{35}$$

or

$$\frac{\pi_A}{K} = \frac{1}{1-t} \frac{\delta'}{\delta} \frac{\pi_A}{K'} \tag{36}$$

Therefore

$$\frac{\delta}{\delta'} \frac{\pi_A}{K} = \frac{1}{1-t} \frac{\pi'_A}{K'} \tag{37}$$

and

$$\frac{\pi_A}{K} > \frac{1}{1-t} \frac{\pi_A}{K'}$$

since $\delta/\delta' < 1$.

Thus 100 percent shifting in terms of <u>reported</u> rate of return implies more than 100 percent shifting in terms of <u>actual</u> rate of return. The only way that more than 100 percent shifting, based upon reported rate of return, would occur is if the management decided to reduce the amount of perquisites included in costs. A plausible explanation for this conduct is not included in the discretionary model since management's compensatory actions are presumed to be primarily

motivated by the desire to keep the reported net rate of return unchanged. Any reduction of perquisites which result in the lessening of actual rate of return and an increase of the reported rate of return cannot be justified by the Williamson discretionary model. Therefore, in the long-run, 100 percent shifting is the limit and can be theoretically substantiated with this model.

The Krzyzaniak and Musgrave model is based upon the functional relationship between the before-tax rate of return and the tax liability such as:

$$Y_{g,t} - Y'_{g,t} = a\frac{T}{K} \qquad (39)$$

where $Y_{g,t}$ is the before-tax rate of return, T is the tax liability, and K is the capital stock. Priming denotes the value in the absence of the tax. The behavioral assumption of (39) implies that the firm attempts to adjust its before-tax rate of return so as to recoup a given fraction, a, of the negative rate of return.

In the case of 100 percent shifting, a = 1. However, Krzyzaniak and Musgrave state the possibility of a > 1. They substantiate this assertion with two hypotheses. The first is that the tax increase may be taken as a "signal" by certain oligopolists for price increases which may include adjustments for other factors besides the tax factor. The second is that firms may be over anxious to recoup the tax burden, and they overshoot the mark. Consequently, with the

possibility that a > 1, it follows that the firm may be able to shift more than 100 percent of the tax increase.

Throughout the preceding discussion, the corporation income tax has been considered as a general tax on profits. If this were the case, then any inferences about the possibility of shifting would raise serious questions about the general equilibrium effects. In fact, if all profits were taxed at the same proportional rate, successful shifting by any particular firm, industry, or sector would be doubtful. However, the corporation income tax is not a general tax. It does not affect the unincorporated sector of the economy; nor does it apply to tax-exempt investment returns. Therefore, depending upon the time period, the mobility of capital, and the availability of alternative investment opportunities, shifting by incorporated firms of a particular industry, or by an incorporated sector of the economy as a whole is possible.

Krzyzaniak and Musgrave (by assuming the constancy of the capital stock over the twenty year period) relied primarily upon price changes to explain their shifting inferences. The traditional models of competition and monopoly and the behavioral models of Baumol and Williamson allow time for the necessary adjustments in prices and/or capital (be it interindustry movement or to the unincorporated sector) for shifting to occur.

The conditions which govern how readily the unincorporated form of business can be substituted for the

incorporated form, and how easily capital can be shifted to the unincorporated sector are very important. Successful shifting of the corporation income tax will be greatly influenced by whether these conditions encourage or retard capital movement.[27]

Conclusion

The implications of this analysis of the traditional models, the Baumol model, the Williamson model, and the Krzyzaniak and Musgrave model are that shifting of the corporation income tax in the long-run is a distinct possibility and can be accomplished within the basic framework of any/or all of the models. In the case of the Baumol hypothesis, the prediction of 100 percent shifting is more definite because of the primary objective of sales maximization. The discretionary model, presented by Williamson, predicts up to 100 percent shifting but is less definite in its conclusions. The traditional models of the competitive firm and the monopolist predict up to 100 percent shifting, but the final results are tempered by alternative opportunities and external influences of the capital market. The Krzyaniak and Musgrave model predicts income tax shifting which may exceed 100 percent.

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[27]cf. Krzyaniak and Musgrave, op. cit., pp. 4-7, M. A. Adelman, "The Corporate Income Tax in the Long-Run," Journal of Political Economy, LXV (April, 1957) pp. 151-157; and Arnold Harberger, "The Incidence of the Corporation Income Tax," Journal of Political Economy, LXX (June 1962), pp. 215-240.

When the assumption is made that business behavior is motivated by the desire to recoup the tax liability by some compensatory action, more than 100 percent shifting can be theoretically justified by only one of the models, the Krzyaniak and Musgrave model.

The task of this study is to investigate whether the tax is shifted in the long-run by analyzing statistics in the manufacturing sector of the United States. From the results, it is hoped that some inferences can be made pertaining to the applicability of either the traditional model or the variants proposed by Baumol, Williamson, and Krzyaniak and Musgrave to the shifting problem.

CHAPTER III

POSSIBLE INDICATORS OF SHIFTING AND RECENT EMPIRICAL STUDIES

The degree of confusion and disagreement over the incidence of the corporation income tax has in no way been lessened by the ability and ingenuity of the many students of the subject. Although over the past ten years there has been a gradual change away from the more generalized theoretical approach, recent empirical studies have seemingly uncovered as many questions as they have answered. Formerly the discussion concerned the relative influence of the many factors affecting the inability of the corporation to shift the tax in the short-run with little effort directed towards quantifying their importance.[1] More recently the controversy has centered on the proper method of isolating the effect of the income tax and assessing its position in the assemblage of profit determinants. The complexities of the problem and the interdependence of the influencing factors have induced students to apply econometric methods to the analysis.

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[1]An excellent review of the arguments and conclusions of the early major studies has been written by B. U. Ratchford and P. B. Han, "The Burden of the Corporation Income Tax," National Tax Journal, X (December, 1957), pp. 310-24.

Unfortunately the process of building and testing econometric models is not devoid of personal bias. The specification of the model and the determination of the explanatory variables require subjective judgement. Accordingly, a wide variety of alternative tax incidence models has been proposed. It is perhaps not surprising that in view of the range of models used, the empirical findings have often been contradictory.

One particular point of contention is over the most appropriate indicator of shifting of the corporation income tax. For the purposes of this study, "shifting" relates to the recovery of the burden imposed upon the taxpayer by the corporation income tax. The "burden" refers to the difference between the firm's profit position with the tax and what it would have been without the tax. The difference is measured by means of various "indicators" such as gross or net rate of return on invested capital, absolute profits, or capital income share. The assumption is made that when the non-tax factors are accounted for in the model, then the indicator will measure the degree of shifting.

Therefore it becomes imperative to study the various indicators, and to select the best available statistic. The choice involves careful evaluation of the advantages and limitations of each proposal within the guidelines defined by both feasibility and significance. Three possible indicators are: a) absolute level of profits, b) income share, and c) rate of return. In the first section, each indicator will

be discussed with pertinent studies mentioned as examples.

In order that this study might be evaluated in perspective, other empirical results will be presented for comparison in the last section of the chapter.

Possible Indicators of Shifting

A. Absolute Level of Profits

The comparison of the necessary assumptions associated with each indicator is instructive and helps to narrow the selection. First is the change in the absolute level of profits, expressed either in net or gross terms. The premise is that all non-tax influences on the level of absolute profits are absent on balance; i.e., negative and positive effects offset one another. Thus any change in the indicator represents the effect of the income tax. If before-tax profits increase over a period when the tax rates have advanced, then it follows that the burden has been shifted either forward upon the consumer or backward upon the payment to input factors. Conversely, if the before-tax income remains constant after the tax rate increase, then the tax is assumed to have been absorbed by the capital owners. The reliability of this indicator is negated by the untenable assumption that non-tax factors are absent throughout the period, and that changes in capital stock have no effect upon the absolute level of profits. This latter influence could be partially neutralized by restricting the analysis to the short-run when capital stock is assumed to remain constant;

however, the conclusions would still be dependent upon the more restrictive ceteris paribus conditions implied by the test specifications.[2]

B. Profit Share

The income share approach has been utilized by several economists over the past few years.[3] Depending upon the specification of the model, the degree of shifting is indicated directly by the change in the capital income share[4] or indirectly from a fitted production function.[5] As commonly defined, the capital income share is the ratio of profits to Gross National Product. In the case where the analysis is restricted to the manufacturing sector, the capital income share equals the ratio of profits to income originating in the manufacturing sector; specifically, profits to value added in the sector.[6] The assertion is made that an

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[2]Consequently, the use of this indicator as a measure of shifting has been restricted to statements about its inadequacies, cf., Marian Krzyzaniak and Richard A. Musgrave, op. cit., pp. 13-14.

[3]See M. A. Adelman, "The Corporation Income Tax in the Long Run," Journal of Political Economy, LXV (April, 1957), pp. 152; Challis Hall, Jr., "Direct Shifting of the Corporation Income Tax in Manufacturing," American Economic Review, LIV (May, 1964), p. 258; Arnold C. Harberger, "The Incidence of the Corporation Tax," Journal of Political Economy, LXX (June, 1962), p. 215; and Robert J. Gordon, op. cit., p. 731.

[4]Adelman, op. cit.

[5]Hall, op. cit.

[6]The precise definition of profits varies from one economist to the other. It can be specified as before or after tax; it can include depreciation, interest on debt, and/or inventory valuation adjustments; and when aggregated, it

increased before-tax capital income share can be attributed to the ability of the corporation to shift the burden in the short-run by raising prices.

The limitations of this type of analysis can be illustrated by examining two previous studies.[7] The first was completed by M. A. Adelman. On the basis of his hypothesis that the best indicator of no shifting would be constancy of corporation profits before taxes as a fraction of all income originating in corporate enterprises, he concluded that "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."[8] Profits included both interest on debt capital and inventory valuation adjustments in order to compensate for possible changes in the debt-equity ratio and inventory profits arising from price level fluctuations.

The weakness of this type of indicator stems from its inclusiveness and the presumption that non-tax factors have a neutral effect upon the income share of capital. Stability in the ratio could arise from the offsetting effect of a change in the input mix, which could compensate for the

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can either include or exclude loss corporation. The selection depends upon the model specification and the degree of inclusiveness judged best to describe the influence of the corporation income tax.

[7]Adelman, op. cit., and Hall, op. cit.

[8]Adelman, op. cit., pp. 152-53.

higher pre-tax return attributed to shifting.[9]

A more sophisticated approach was taken by Challis Hall[10] in his recent study of the income tax incidence. He questioned whether there had been short-run shifting of the tax during the period of 1919-1959, and he made the qualified conclusion that "profits taxation had not been shifted in the short-run."[11] The method consisted of deriving a production function, corrected for technical change, under three different shifting assumptions, and then examining the internal consistency of these relationships as estimators of output and property income. The degree of consistency would imply the reliability of the shifting assumption included in the production function specification.

In the derivation of the production relationship from time series, certain adjustments were made to compensate for the influence of technology. The first step was to calculate a residual measure of the change in output per

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[9]See Arnold Zellner, "Rejoiner," Journal of Political Economy, LXVI (October, 1958), p. 448. Also, John R. Moroney, "The Share of Corporate Income, 1922-61," The Quarterly Review of Economics and Business, IV (Winter 1964), p. 72. In this article, Moroney discusses the problems of aggregation and their effects upon the consistency or changes in distributive shares. Accordingly, Adelman's constancy of aggregated shares could be explained by offsetting shifts in subsector shares. The partial solution to the problem would be a disaggregated study of corporate taxes within individual industries. Nevertheless, the substantial problem of changes in factor proportions and technological progress as potential determinants of relative shares remains in this sort of analysis.

[10]Hall, op. cit.

[11]Hall, op. cit., p. 271.

man-hour due to technical progress. The procedure was a modified application of the method formulated by Robert M. Solow.[12] Solow's estimating equation was

$$\frac{\dot{A}}{A} = \frac{\dot{q}}{q} - w_k \frac{\dot{K}}{K} \qquad (1)$$

where A was the technical change index, q was the output per man-hour, K was the capital per man-hour, and w_k was the share of capital. The dots indicated time derivatives.

Hall adjusted the share of capital according to the three separate shifting assumptions. Each time the inferred capital share varied according to the underlying shifting specification. The inferred share which was based upon a "no-shift" hypothesis was the largest, and was comparable to Solow's w . The one calculated on the basis of a "full wage shift" was the lowest. With each measure of the inferred capital share, Hall determined the approximate relative increase in output per man-hour due to technical change. The formulation was

$$Z = \frac{\Delta q}{q} - s \frac{\Delta k}{k} \qquad (2)$$

where s equaled the inferred marginal product of capital times capital per unit of output (the inferred capital share). The index of technical change fluctuated inversely

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[12]Robert M. Solow, "Technical Change and the Aggregate Production Function," Review of Economics and Statistics, Vol. XXXIX (August, 1957), pp. 312-20.

with the value of s, which was a function of a particular shifting hypothesis.

Annual output was deflated by the appropriate index of technical change. The alternative tax-shifting assumptions were evaluated by comparing the closeness of fit of deflated output per man-hour with capital per man-hour. In order to do this, the production relationship derived from the Cobb-Douglas function,

$$\frac{O}{L} = \frac{K}{L}^{b} \qquad (3)$$

was fitted by least-squares to the logarithms of the variables for all years in the 1919-59 period. Here, O = Q/A, where A was given by the value of z, and b was capital's contribution to output. The variance in deflated hourly output was best explained with the "no-shift" hypothesis. Therefore, Hall concluded that the traditional assumption of no-shifting deserved credence.

Two restrictive assumptions were pertinent to the Hall analysis. First, there was the asserted assumption that technical change was Hicks neutral throughout the test period. Technological progress is defined as any change in the production function which allows the same output to be produced with less inputs or enables the same level of inputs to produce a greater output. Hicks defined technological change as neutral if the marginal rate of substitution of labor for capital remained unchanged at the original

capital-labor ratio. Hall defended his assumption by relying upon the empirical work of Professor Robert M. Solow, who showed that technological change for the whole non-farm economy was neutral and could be isolated for the examined period of 1909-1949.[13] However, this conclusion is far from unanimous. There is some evidence that technological change in the United States has been labor-using.[14] Other evidence implies that technical change has been labor-saving over roughly the same period, 1899-1960.[15] Whether technical change was neutral or non-neutral over the period is still an unanswered question. Aggregated production functions have been estimated by many scholars but no single one has been unanimously accepted.

The second assumption was implied by the use of the Cobb-Douglas production function as the test relationship.

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[13]Solow, op. cit.

[14]See Murray Brown and John S. de Cani, "Technical Changes in the United States, 1950-1960," Productivity Measurement Review, May, 1962, pp. 26-39; and C. E. Ferguson, "Substitution, Technical Progress, and Returns to Scale," American Economic Review, Papers and Proceedings, LV (1965), pp. 296-305.

[15]P. David and T. van de Klundert, "Biased Efficiency Growth and Capital-Labor Substitution in the U.S., 1899-1966," American Economic Review, LV (June 1965), pp. 357-94. They found technological progress to be labor-saving in the non-farm, private, domestic economy during 1899-1960, and the elasticity of technical substitution was $0 < \sigma < 1$. In a more recent study, John R. Moroney found that over the period 1942-1957 six industries out of the thirteen tested were characterized by labor-saving technical progress. One industry manifested a capital-saving bias, and the rest displayed neutral technological progress; "Technological Progress, Factor Proportions, and the Relative Share of Capital in American Manufacturing, 1942-1957," Western Economic Journal (forthcoming, 1968).

Since (3) is equivalent to

$$Q = K^{b} L^{1-b} \qquad (4)$$

it follows from (4) that there will be constancy of relative shares. A necessary and sufficient condition for constancy of relative shares with no technical progress or Hicks neutral technical change is unitary elasticity of substitution. This restrictive assumption influences the interpretation of the results. If the elasticity of substitution is equal to one, then any change in the profit/wage ratio is precisely offset by the same percentage change in the capital/labor ratio, leaving relative shares the same. Therefore, it becomes easier to interpret the constancy of the gross capital share/labor share ratio during a period of tax increase as indicative of the inability of the corporation to shift the income tax.

If, however, the elasticity of substitution is less than one, then a decrease in the profit/wage ratio due to a relative increase in the wage rates would result in a less-than-proportionate increase in the capital/labor ratio, altering the relative shares in favor of labor. Empirical evidence has shown that this is what has happened in the manufacturing sector of the United States over the postwar period.[16]

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[16]See J. W. Kendrick and Ryuzu Sato, "Factor Prices, Productivity, and Growth," American Economic Review, LIII (December, 1963), pp. 974-1003; I. B. Kravis, "Relative Income Shares in Fact and Theory," American Economic Review,

When the assumptions of neutral technological change and unitary elasticity of substitution are relaxed, Hall's results may be interpreted differently. He found that in the shift cases the consistency between deflated hourly output and hourly capital broke down into two subperiods, 1919-41 and 1942-59. Deflated hourly output was lower for equivalent combinations of capital and labor in the latter period. With technical change classified as labor-using and the elasticity of substitution less than unity, the relative drop in the deflated hourly output could be explained with the shift model. In fact, Hall admits that the hypothesis that the profits tax was shifted is consistent with technological change which lowers the marginal productivity of capital relative to that of labor, or is labor-using in the Hicksian definition.

These two studies by Adelman and Hall serve to point out the difficulties inherent in any shifting analysis based upon a capital share approach. The problem of isolating the effect of the income tax from non-tax influences is only intensified by the questionable measures of technical change and elasticity of substitution. The relative inadequacies of the income share approach encourage the development of a

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XLIX (December, 1959), p. 917; and Robert M. Solow, "The Constancy of Relative Shares," American Economic Review, XLVIII (September, 1958), p. 618. Kendrick and Sato estimated the elasticity of substitution to be approximately 0.6; Kravis estimated an "historical" elasticity of substitution of 0.64; and Solow implied an elasticity of substitution of 2/3 in his study on the constancy of relative shares.

better, less restrictive indicator.

C. The Rate of Return

The rate of return on invested capital is another possible indicator of shifting which has been used by various economists.[17] Traditionally, theorists used the rate of return as the cornerstone in their discussion of short and long-run shifting possibilities. Under the assumption of profit maximization, short-run shifting by the firm was judged an improbability because price increases could only result in lower profits from reduced sales. The imposition of an income tax has no effect upon marginal revenue or marginal costs except in the case where marginal cost is affected by the reduction in working capital. Consequently, the burden of the tax would fall upon the capital owners in the short-run. This resultant reduction in the rate of return on invested capital in the short-run would presumably affect future investment. With a competitive capital market and investment a function of the rate of return, capital would flow from one industry to another or to non-corporate investments until the return became equalized.[18] The relative

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[17]See Krzyzaniak and Musgrave, op. cit.,; Gordon, op. cit.; Robert W. Kilpatrick, "The Short-Run Forward Shifting of the Corporation Income Tax," Yale Economic Essays, Vol. 5 (Fall, 1965), pp. 355-420; and John G. Cragg, Arnold C. Harberger, and Peter Miezkowski, "Empirical Evidence on the Incidence of the Corporation Income Tax," Journal of Political Economy, LXXV (December, 1967), pp. 811-821.

[18]Equalization of rates of return includes compensation for risk differentials.

decrease in the stock of capital in the taxed industry would reduce output and indirectly shift the tax through the higher equilibrium prices. In this way, it was theoretically possible (and indeed, inevitable under competitive conditions) for the firm to shift the income tax in the long-run.

The indigenous assumptions of the traditional theory of the firm have been questioned. The first question concerns the hypothesis of profit maximization in the short-run; and the second concerns the importance of the rate of return as an explanatory variable in the investment function.[19] If the short-run rate of return is not dependent upon profit maximizing behavior, then the explanation of the annual changes in the rate become less restricted. Discretionary conduct by management, motivated by many other goals in addition to maximizing profits, becomes an important determinant of the rate of return. When the corporation income tax is changed, compensatory action may be taken to shift the burden of the tax. By isolating the effects of the non-tax factors, the residual changes in the rate of return become the basis of a tax shifting measure.

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[19]See Bert G. Hickman, Investment Demand and U.S. Economic Growth, (Washington, D.C.: The Brookings Institute, 1965); and R. E. Hall and D. W. Jorgenson, "Tax Policy and Investment Behavior," American Economic Review, LVII (June, 1967), pp. 391-414. Both of these studies indicate that net or gross investment in capital stock is more responsive to increases in the flow of internal funds and/or the utilization of existing capacity than to any change in the rate of return on capital. Granting the fact that these empirical results and others have not removed all doubt, their findings may raise doubts concerning the traditional neo-classical theory.

Throughout the analysis of shifting it is important to keep in mind that the process of shifting can involve many direct and indirect changes which result in the burden of the tax being borne by someone other than the taxpayer. In a general equilibrium system it is difficult to isolate the chain of events. Consequently, reliance must be placed upon a broad description of shifting which is concerned with the result rather than the process of adjustment. The result is measured by the difference between the legislative intent and the actual incidence of the tax.

A possible indicator of the successful accomplishment of shifting is the relationship between income tax rate changes and the resultant rate of return on invested capital. The rate of return is a final measure of the shifting process because it quantifies the cumulative effect of output, price, and factor-proportion changes. Therefore, the answer to the questionable incidence of the corporation income tax relies upon the capacity to isolate the explanatory variables, in addition to the income tax, which influence the rate of return.

D. Conclusion

The reliability of any regression analysis using the rate of return as the regressand depends upon the quality of the regressors. The quality, in turn, depends upon the available data and the ability to disaggregate variables which may affect one another. The possible weaknesses of

the rate of return as a dependent variable do not destroy its usefulness, but simply warn the analyst to interpret with caution. Nevertheless, the influence of the corporate income tax on the rate of return seems clearly to be the most appropriate technique for making inferences about shifting of the tax. Consequently, the remainder of this thesis is concerned with the specification and estimation of econometric models in U.S. two-digit manufacturing industries in which the rate of return is utilized as the dependent variable.

Recent Empirical Results

Since 1957 there have been several attempts by noted economists to isolate the incidence of the corporation income tax and to determine whether it has been shifted in the short-run and in the long-run. The difficulty of isolating the many factors which influence business profits is compounded by the perplexing problem of selecting an appropriate analytical technique.

The most recent empirical studies are summarized in the following table. Although tabular representation is limited in depth, a chronological description of the studies does provide a basis for comparison.

TABLE 2

RECENT EMPIRICAL STUDIES

Name and Years Studied	Indicator	Description of Method	Conclusion and Remarks
M. A. Adelman (1957) 1922-29 1946-55	Before-tax capital share of income	Calculated average gross capital share for each period.	In L-R, capital owners absorbed the income tax.
A. C. Harberger (1962) N.A.	After-tax capital share	General equilibrium model of two sectors (corporate and non-corporate). Incidence of tax depended upon the values of three elasticities of substitution between inputs, products, and sectors.	Based upon plausible values of the elasticities, capital's share of tax burden was 90-120 percent in the L-R.

TABLE 2--Continued

Name and Years Studied	Indicator	Description of Method	Conclusion and Remarks
Krzyzaniak Musgrave (1963) 1935-42 1948-59	Before-tax rate of return on capital	Time-series regression analysis of the rate of return and selected explanatory variables, one of which is the corporate income tax. Other variables are change in consumption, ratio of inventories to sales, ratio of tax accruals to GNP, and ratio of government purchases to GNP.	In the S-R, 134 percent of the income tax was shifted forward by manufacturing corporations. Disaggregated analysis into five 2-digit industries and thirty firms. Shifting was accomplished by firms designated as price-leaders, and by each industry.
C. Hall (1964) 1919-59	Gross capital share	Using the Cobb-Douglas production relationship, deflated output was fitted to K/L. Output was deflated by a measure of disembodied technological change which included three possible shifting assumptions.	Concluded that there was no shifting of the tax over the period.

TABLE 2--Continued

Name and Years Studied	Indicator	Description of Method	Conclusion and Remarks
R. W. Kilpatrick (1965) 1947-57	Percentage change in the ratio of before-tax profits to net worth	Cross-section regression analysis. Change in the profit ratio was regressed on a concentration measure and the change in the deflated value of shipments. Over 100, 3 and 4 digit industries were used in the study.	Shifting did occur in the S-R, and was directly related to degree of concentration. Was the most disaggregated of all studies.
R. E. Slitor (1966) 1935-42 1948-59	Before-tax rate of return on capital	Re-estimated the K-M model. Used an explanatory variable denoted as "economic pressure" in place of all other variables except the tax variable.	Adjusted shifting measure indicated less S-R shifting than shown by K-M.

TABLE 2--Continued

Name and Years Studied	Indicator	Description of Method	Conclusion and Remarks
R. J. Gordon (1967) 1925-62	Gross rate of return on capital; gross profit as percent of sales	Time-series regression. Independent variable derived from model which relies upon markup pricing behavior. Regression is non-linear, with fitted coefficients measuring the incident of the corporation income tax.	Results show that, on the average, the corporations suffered the full burden of the tax. The analysis is disaggregated into ten 2-digit industries. Found that the small degree of shifting which took place by some individual industries was significantly correlated with industry concentration ratios.
J. G. Cragg, A. C. Harberger, P. Mieszkowski (1967) 1935-42 1948-59	Gross rate of return on capital	Reworked K-M with two additional variables: employment rate and dummy variable for mobilization and war years of 1941-42, 1950-53.	Estimates imply that capital bears approximately 100 percent of the burden of the tax. Study was not disaggregated into industries or firms.

Relying upon different methods, Adelman, Harberger, Hall, Gordon, and Cragg-Harberger-Miezkowski concluded that the corporation income tax had not been shifted. Slitor, K-M, Kilpatrick, and this study deduced that the tax had been shifted. However, the degree of shifting varied from one study to the other.

As is the case with any "first", K-M has been subjected to close examination and intensive criticism. Their study was the first empirical work which challenged the time-honored belief that the corporation income tax could not be shifted in the short-run. The technique of attack has varied. Some critics (Slitor, Cragg-Harberger-Miezkowski) substantiated their arguments by reworking the K-M model with different predetermined variables. Others, notably Hall and Gordon, have come forth with tests differing from the one used by K-M and deserve closer scrutiny. (See comments on Hall's model in the previous section.)

A recent study of the incidence of the corporation income tax in the manufacturing sector was completed by Robert J. Gordon. By using regression analysis, he evaluated the relative influence of the tax and non-tax factors on both the income share of capital and the rate of return. He concluded that short-run shifting did not occur during the period extending from 1924-1962, and that the corporation suffered the entire burden of the tax.

The first step was to estimate the level of profits in the absence of the corporation income tax. On the basis

of the assumption that businessmen practice markup pricing, Gordon formulated two descriptions of profits; one expressed as the rate of return on capital and the other in terms of the income share.

$$\frac{Z'_t}{K_t} = \alpha_1 \frac{R_t}{h_t K_t} + \alpha_2 \frac{R^*_t}{h_t K_t} + \alpha_3 \frac{\Delta p_t}{p_t} + \alpha_4 \frac{\Delta Q_t}{Q_t} + u'_t \qquad (5)$$

$$\frac{Z'_t}{R_t} = \alpha_1 \frac{1}{h_t} + \alpha_2 \frac{R^*_t}{h_t R_t} + \alpha_3 \frac{\Delta p_t}{p_t} + \alpha_4 \frac{\Delta Q_t}{Q_t} + u'_t \qquad (6)$$

Notations used by Gordon in equations (5), (6), and (8)

$R_t = p_t Q_t$

p_t output price; average total cost times markup fraction

Q_t output

R^*_t capacity real output times p

Z_t cash flow; difference between total revenue and operating costs

K_t total assets

h_t ratio of industry wholesale price index to wholesale price index for manufacturing aggregate

u_t stochastic term

Note: The prime represents the absence of taxes.

The degree of shifting was denoted by α_5 in

$$\frac{\pi^g_t}{K_t} = \frac{\pi^{g'}_t}{(1 - \alpha_5 v_t)\, K_t} \qquad (7)$$

where v_t was the tax rate and π^g was profits. To avoid the difficulty imposed by the presence of the parameter α_5 in the denominator, Gordon estimated directly by an iterative method which he claimed was more efficient than the instrumental variable technique used by K-M.

Defining Z'_t as $\pi^{g'}_t + D_t$, where D_t was depreciation, depletion, and interest paid, (5) and (6) were substituted into (7), and α_5 was estimated from (8) after the equation was linearized by means of a Taylor series expansion around an arbitrary initial set of parameters. (Restated equation (6) is not given below.)

$$\begin{aligned}\frac{\pi^g_t}{K_t} = {} & \alpha_1 \frac{R_t}{(1 - \alpha_5 v_t) h_t K_t} + \alpha_2 \frac{R^*_t}{(1 - \alpha_5 v_t) h_t K_t} \\ & + \alpha_3 \frac{\Delta p_t}{(1 - \alpha_5 v_t) p_t} + \alpha_4 \frac{\Delta Q_t}{(1 - \alpha_5 v_t) Q_t} \\ & - \frac{D_t}{(1 - \alpha_5 v_t) K_t} + u'_t \end{aligned} \qquad (8)$$

Gordon estimated α_5 on the basis of the rate of return and the income share formulation. In both cases, the tax shifting coefficient was very low and not significantly different from zero for the total corporate manufacturing sector.

In addition to the above analysis, Gordon disaggregated his study into ten 2-digit manufacturing industries. He found evidence of some short-run shifting in seven out of the ten industries, but nevertheless, the weighted average rate of shifting remained not significantly different from zero.

The most popular explanation of short-run shifting, if and when it did occur, has been that it was the direct result of unilateral action taken by firms which possess market power.[20] When asked to define market power, most economists have relied upon the extent of industrial concentration as a proxy for the existence of market power.[21] Therefore, following this line of reasoning, the degree of shifting should be directly associated with the level of industrial concentration.

Both Kilpatrick and Gordon evaluated the relationship between concentration and the degree of shifting. Kilpatrick's study involved a cross-section analysis of 100 manufacturing industries (3-digit and 4-digit Standard Industrial

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[20]See Krzyzaniak and Musgrave, op. cit.; and Robert W. Kilpatrick, op. cit. However, this explanation does not consider the possibility of shifting by competitive firms in the short-run as the result of varying the amount of working capital which is a variable factor of production, and its payment is a variable cost.

[21]cf., Joel B. Dirlam and Alfred E. Kahn, Fair Competition: The Law and Economics of Antitrust Policy (Ithaca, New York: Cornell University Press, 1954). In their book, the authors advocate the dependency upon the analysis of conduct with the recognition of the market structure in assessing the presence of market power.

Classification). By multiple regression, he related the percentage change from a base year in the rate of return on net worth to several independent variables, one of them being the change in the concentration percentage. The others were the base period profit rate and the percentage change in deflated shipments. The concentration ratios were calculated on the basis of total shipments accounted for by the four largest firms in each industry. His conclusion was that there was a direct relationship between the degree of concentration and the amount of corporation income tax which was shifted over a period of approximately five to six years.

Gordon reexamined Kilpatrick's findings and agreed with the positive relationship between tax shifting and the concentration ratio. However, he was quick to qualify his statement by emphasizing that the relationship on an average rate of shifting for all manufacturing industries was not significantly different from zero. The difference between the two empirical studies could be attributable to differences in the data utilized. Kilpatrick's shifting parameters were estimated from data spanning eleven years, with the concentration ratio limited to the same period. Gordon's conclusions were based upon the regression of his shifting estimates, which were calculated from data covering thirty-four years, on the average of concentration ratios for three years spanning only the last twelve years. The question might be posed as to the effect of concentration during the early years of Gordon's study. Unfortunately complete concentration

data for the period 1925-1945 are not available, and Gordon had to rely on the existing information.

An additional limitation of Gordon's estimates of capital income shares arises from changes in the degree of vertical integration, ceteris paribus, and how this altered the precision of the industry measures.

The present analysis attempts to take an approach which travels the middle ground between the two previous studies. By rank correlation analysis, the relationship between the degree of shifting and the concentration ratio was estimated for the relevant 2-digit industries. Instead of relating the shifting measure to an average of the concentration percentages, three separate rank correlations were calculated; one based upon the concentration data of 1947, one on the data of 1954, and the third one based upon the recent data of 1963.

Due to the individual characteristics of each study, it is difficult and of questionable value to summarize the conclusions with a definitive statement. It is the assumptions and techniques which are significant, and how each economist attempted to analyze the corporation income tax incidence warrants thoughtful consideration.

CHAPTER IV

THE COMPLETE REGRESSION MODEL

This chapter sets forth the method for measuring the existence and magnitude of shifting of the corporation income tax. The test of the shifting hypothesis and the measurement of the degree to which it is accomplished will initially be developed from a relationship specified between the rate of return and the tax variable.[1] The test involves a multiple regression analysis of the factors that may influence the rate of return, the tax rate being one of the predetermined variables in the regression. Annual observations will be taken over a period during which there were changes in the statutory and effective income-tax rates. The estimated coefficients of the independent variables are tested for the statistical influence of these factors on the rate of return. The regression coefficient of the tax variable enables a comparison of the actual rate of return with an estimate of what the rate of return would be in the absence of the income tax. This comparison provides the basis for the measurement of shifting if and when it occurred.

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[1]The model utilized in this study is similar to one developed by Krzyzaniak and Musgrave, op. cit. Changes have been made, which will be discussed in full, and certain extensions have been calculated which permit analysis on an industry basis.

Changes in the shifting indicator become meaningful only when the causes are specified and measured, and they have little significance unless the tax effect can be isolated. The method of partitioning changes in the rate of return between tax and non-tax factors requires the use of certain proxies to describe the overall effect of many non-tax influences. The degree of precision is augmented by disaggregating the analysis into separate industrial studies. This approach permits the evaluation of the relative influence of several factors which may differ substantially between one industry and another.[2]

The Functional Relationship of Key Variables

Before the model can be constructed, the functional relationship between the dependent variables and the tax variable must be defined. The formulation is simply a statement of the assumed business behavior, and not a measure of the degree of shifting accomplished. In simple linear form, it is

$$Y_{g,t} - Y'_{g,t} = a \frac{T_{t-1}}{K_{t-1}} \qquad (1)$$

where Y_g is the gross rate of return on capital, K is the

[2]Since the problem is to determine how much of the total variation of the rate of return can be explained by the tax variable for each industry, time series is more applicable than cross-section analysis. Cross-section analysis would estimate the average influence of the tax variable for any particular year, but would not distinguish among industries within the manufacturing sector.

capital stock, and T is the tax liability. Priming denotes the value of a variable in the absence of the tax. The implied behavior is that the firm attempts to recover the negative rate of return realized in the prior year (the tax liability as a fraction of the capital stock), given by the value of "a". The adjustments made by the firm are motivated by an attempt to maintain a certain rate of return after taxes.[3] In times of increasing income tax rates, this necessitates shifting the burden of the tax.[4] The rationale and support for this particular assumption have been discussed in the second chapter of this study.

Following the behavioral assumption implied in equation (1), the tax variable becomes the tax liability, where $T = ZP$, Z is the statutory tax rate, and P equals the gross profits of the firm. The use of a lagged tax variable, $\frac{T_{t-1}}{K_{t-1}}$

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[3]The behavior assumption presented by Gordon, op. cit., p. 736, differs from the behavioral hypothesis in the second chapter of this study. Gordon presumes that the firm maintains a relatively constant profit margin during periods of increasing tax rates. "The firm sets its output p_t (price) by multiplying its average total cost by a markup fraction, m...(Then) m is applied to average cost at capacity output..."

[4]On the basis of the above formulation, we can define the extreme cases of zero and 100 percent shifting:

Indicator	Zero Shifting	100% Shifting
Rate of Return (Gross terms)	$Y_g = Y'_g$	$Y_n = (1 - Z)Y_g = Y'_g$
Absolute Profit (Gross terms)	$P_g = P'_g$	$P_n = (1 - Z)P_g = P'_g$

Where Z is the statutory tax rate on corporate income. The method of determining the degree of shifting other than zero or 100% will be discussed in a following section.

amounts to a recognition that entrepreneural adjustments to a change in tax rates are not instantaneous. In addition, the lagged tax variable decreases the severity of the estimating problems encountered by Krzyzaniak and Musgrave. The Krzyzaniak and Musgrave behavioral assumption was

$$Y_{g,t} - Y'_{g,t} = a \frac{T_t}{K_{t-1}} \qquad (2)$$

where

$$Y_{g,t} = \frac{P_{g,t}.}{K_{t-1}}$$

In this model, (2), the tax variable is not independent of the rate of return. In fact, the tax variable is a function of the rate of return because

$$\frac{T_t}{K_{t-1}} = \frac{ZP_{g,t}}{K_{t-1}} = ZY^*_{g,t} \qquad (3)$$

where $Y^*_{g,t}$ is the current-year gross profit divided by the capital stock of the preceding year. Acknowledging the inconsistency of the regression coefficients obtained from classical least squares estimation, Krzyzaniak and Musgrave utilized an instrumental variable in place of the tax liability. Gordon[5] criticized this approach and showed that the instrumental variable approach produced an unreliable estimate of the shifting parameter. To avoid this difficulty

[5]Gordon, op. cit., p. 731.

arising from the dependency of the tax variable upon the regressand, Gordon used an iterative method, which he claimed was more efficient.

The model as stated in (1) results in an autoregressive regression equation. The properties and limitations will be discussed below.

Description of Key Variables

A. Gross Rate of Return

Gross rate of return is defined as the ratio of before-tax profit to the gross stock of capital. The precise specifications of these two measures have an important bearing upon the model and the interpretation of the results.

Profits

Before-tax profits are profits from the operation of the business plus interest paid on debt. To be consistent with the definition of the gross capital stock, annual allowance for depreciation, depletion, and amortization are included in profits. By defining profits in this manner, the following problems are avoided:

a. The shifting hypothesis is based upon the premise that the firm can be instrumental in maintaining a certain rate of return from its own operations. This rate of return is defined as the ratio of annual net profits to the stock of capital, and it serves as a guideline for business decisions. The differential between a target rate of return and the rate of return generated under profit-maximizing

behavior is dependent upon the relative importance of the social and economic objectives discussed in Chapter II.

In order to maintain a net target rate of return on capital during periods of increasing tax rates, the firm must take compensatory action to increase its before-tax rate of return. It is the effect of this discretionary action by the firm, predicated upon shifting the burden of the income tax, that is of interest. Consequently, gross profits are restricted to those attributed to the operation of the firm and do not include dividends and interest received from outside investments.

b. The point is sometimes made that due to the allowable deduction of interest payments from taxable income, changes in the statutory tax rates influence the capital structures of corporations. Increasing income tax rates may influence the marginal investment decisions of corporations. Debt financing becomes more attractive because of the deductability of the interest payments from taxable income. Over an extended period, this may alter the capital structure in favor of a greater proportion of debt-financed assets. A shifting analysis which is based upon the examination of the rate of return on equity capital may be indirectly biased by the tax-induced change in the capital structure. An increased debt-equity ratio may result in a changed rate of return on equity capital and a no-shift inference, when, actually, a fraction of the income tax was shifted. The potential tax effect upon capital structures

can be accounted for by considering the total return to capital as profits before-tax plus interest on debt.

Capital Stock

The measure of capital stock is gross of depreciation, depletion, and amortization. To specify it in any other way would fail to account for the effect of various depreciation and amortization methods. If assets are measured on a net basis, there would be some difference between the rates of return of the older and new companies. Also, if assets are stated net of depreciation, we lose sight of the productivity of the fully depreciated capital stock, and the calculated rate of return overstates the true rate of return on utilized capital.

In order to be consistent with our concepts of profits originating in the enterprise, the capital stock for any firm is measured net of investments in other enterprises. Thus, the rate of return is a measure of the productivity of assets under the direct control of the firm's management.

B. The Tax Variable

In equation (1) above, the tax variable enters the formulation as an absolute measurement of the negative rate of return on capital. Two questions concerning the inclusiveness of the tax variable had to be answered. The first was whether or not to include the "no-income" corporations in the analysis and have their assets added to those of the "income" corporations. The obvious effect of the latter

procedure is to lower the negative rate of return of the industry while leaving the tax liability the same. The second question was whether or not to include the excess profits tax in the tax liability, which amounted to 17% in 1951 and 18% in 1952-53. Again, the effect would have been to increase the tax variable for these three years and would have limited the comparability of 1951-53 with the other years.

The answer to the first question was based upon an attempt to maintain all factors which are not included in the regression as constant as possible. Because there is a change in the composition of the group of no-income corporations from one year to the next, there would be a change in certain aggregated characteristics of the industry which are not considered in the regression. By including all corporations, the possibility of exogenous factors, which are associated with the no-income group, influencing the shifting inference, is reduced. Exclusion of the loss companies would introduce a degree of non-homogeneity because the group of companies examined would change over time. Also, it would be impossible to isolate completely the effect of the no-income years for any corporation because of loss-carryovers in profitable periods. Offsetting past losses against current profits reduces the actual tax liability below the statutory rate. Therefore, all corporations are included in the analysis.

The second problem was substantially reduced by the business behavior underlying the specification of equation (1). According to this formulation, the firm attempts to take corrective action to compensate for the increased income tax liability. The response by the firm to the tax burden is based upon forecasted sales and a known tax rate applicable to all profits. Since the excess profits tax is levied upon a residual income, over and above a specified base,[6] it remains more of an unknown liability. Hence, the excess profits tax cannot be estimated or compensated for ex ante. The benefit of any action taken in order to maintain a stable after-tax rate of return is limited by the specifications of the excess profits tax. Profits over a specified base are reduced by the tax. In the past, the base has been determined by the average taxable income of highly profitable years. The effect of limiting income above an already high level would tend to reduce the evidence of shifting rather than over-emphasize the successful shifting of the tax burden. Therefore, the tax variable which best describes the functional relationship of (1) is the tax rate exclusive of the liability attributed to the excess profits tax.

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[6]The excess profits tax is levied upon the residual of taxable income minus profits credit. The excess profits credit is based upon prior taxable income. For example, the excess profits credit used during the Korean Conflict, 1951-53, was based upon the average taxable income of 1946-49. Federal Excess Profits Tax (New York: Prentice-Hall, 1954).

Non-Tax Influences on the Rate of Return

A. Percentage of Capacity Utilization

Although an increase in demand in the short-run is likely to result in an increase in the rate of return, the extent of the influence is limited by the degree of capacity utilized during the period.

Above a certain rate of output, it is well-documented that marginal costs increase with increased output. The marginal cost curve determines the short-run supply curve of the purely competitive firm. If the rate of increase accelerates as the quantity produced increases, (or the second derivative of the total cost curve is positive) then it follows that the supply curve becomes more inelastic as output is expanded. The increasing degree of inelasticity of the supply curve is indicative of the difficulties inherent in expanding output above near-capacity rates. And although marginal cost is not the supply schedule of the firm under imperfect competition, in most imperfectly competitive industries it seems likely that marginal and average costs rise as output expands beyond a certain level.

Consequently, a given change in demand could increase profits and the rate of return more when the firm is operating close to capacity than when idle machinery is available. Some of the increase in the before-tax rate of return can be attributed to the inelasticity of supply rather than exclusively to the ability of the firm to shift the tax burden. The predetermined variable denoting the percentage of capacity

utilization should be positively related to the rate of return, other things equal.

Richard E. Slitor[7] criticized the Krzyzaniak and Musgrave study for not including some variable in the model that indicated the degree of pressure upon the economic system during the period of tax-shifting analysis. He states that "(as) a consequence, the burden of explaining earnings is thrust upon the corporate tax variable, itself collinear with 'economic pressure' levels which are important determinants of corporate profits."[8] To compensate for this deficiency, he both supplemented and replaced the other variables in the Krzyzaniak and Musgrave model and re-estimated the shifting parameter. As one might suppose, there was a decrease in the shifting measure.

Slitor used a "pressure" variable calculated by Knowles, which was a ratio of actual to potential GNP.[9] I have utilized, however, an industrial index calculated by Frank de Leeuw, published in the Federal Reserve Bulletin,[10]

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[7]Richard E. Slitor, "Corporate Tax Incidence: Economic Adjustments to Differentials Under a Two-Tier Tax Structure," Effects of Corporation Income Tax, ed. Marian Krzyzaniak (Detroit: Wayne University Press, 1966).

[8]Slitor, Ibid., p. 157.

[9]James W. Knowles (with assistance of Charles B. Warden, Jr.) The Potential Economic Growth of the United States, Jan. 30, 1960 (Washington: U.S. Printing Office, 1960).

[10]Frank de Leeuw (with assistance of Frank E. Hopkins and Michael D. Sherman), "A Revised Index of Manufacturing Capacity," Federal Reserve Bulletin, Vol. 52, (November 1966), pp. 1605-1615. The construction of the capacity estimates was

because Slitor restricted his investigation to the total manufacturing sector, in which an aggregated capacity measure was applicable. De Leeuw's estimates were divided into three groups called Total Manufacturing, Primary Processing Industries, and Advanced Processing Industries. They could be applied more readily in the disaggregated approach of this study. The de Leeuw estimates for the primary industries and the advanced processing industries were applied to the seventeen industries of this study according to the categorization given in his article.[11] Consistent with Slitor's results, I found a positive correlation between the rate of return and the "pressure" variable for most industries.[12]

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based upon three series: a perpetual inventory utilization measure of gross capital stock, a McGraw-Hill index of capacity, and a Federal Reserve index of production divided by a McGraw-Hill rate-of-operations measure. The mathematical representation of the relationship is given by the following equations:

$$(1)\quad X_{1/X_2} = a_1 b_1^t u_t$$

$$(2)\quad X_{1/X_3} = a_2 b_2^t v_t$$

where X_1 = Federal Reserve index of industrial production divided by McGraw-Hill estimates of end-of-year rate of operations; X_2 = McGraw-Hill capacity index; X_3 = capital stock series; a_i = the antilogarithm of the regression intercept for the i^{th} equation ($i = 1,2$); b_i = the antilogarithm of the time trend regression coefficient of the i^{th} equation ($i = 1,2$); u_t, v_t = random disturbances in the appropriate equations; and t = time in years (1954 = 1). The final capacity measure was estimated by multiplying the "calculated" values in (1) by X_2 and the "calculated" values in (2) by X_3 and averaging these two estimates.

[11] See Appendix B for the listing of the industries by classification.

[12] cf., L. R. Klein and R. S. Preston, "Some New

B. Employment Index

In their recent examination of the incidence of the corporation income tax, Cragg, Harberger, and Mieszkowski[13] recalculated the Krzyzaniak and Musgrave model for the manufacturing sector. They stated that the deficiencies of the model resulted in the coefficient of the tax variable (the shifting parameter) accounting for influences upon the rate of return not directly related to the income tax. To correct these deficiencies, they introduced two additional variables: the employment rate and a dummy variable for the mobilization and war years 1949, 1954, and 1958.

Instead of the manufacturing sector employment rate, an industry index of aggregate average weekly man-hours is used in this study.[14] This measure of employment is more sensitive to exogenous forces because it accounts for the fluctuations in production man-hours which occur before and after any change in employment takes place. As expected, there was a positive simple correlation between the rate of

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Results in the Measurement of Capacity Utilization," American Economic Review, LVII (March 1967), pp. 34-58. This study produced capacity utilization estimates that compare closely with those calculated by de Leeuw. Both series display similar turning points, however, the Klein-Preston series give slightly higher percentage utilization of capacity estimates for the years 1947-1965.

[13]John G. Cragg, Arnold C. Harberger, and Peter Mieszkowski, op. cit., Vol. 75.

[14]Employment and Earnings Statistics for the United States 1909-1962, Bulletin No. 1312-1, U.S. Department of Labor; Data for 1963 from Earnings and Employment, Vol. 10, 1964.

return and the employment index in most of the industries (11 out of 17).

C. Dummy Variable

It is not unusual for the effects of a wartime economy to alter an otherwise stable relationship. In the case where tax incidence is measured on the basis of an estimated relationship between the rate of return and selected independent variables, the extraordinary demand for war materials can bias the shifting inferences. The dummy variable is a way of accounting for the high profits and high tax rates during periods of mobilization which do not necessarily imply direct shifting of the tax burden.

The functional relation between the dependent variable and the tax variable can be redefined as

$$Y_g - Y'_g = a_1 + b \frac{T_{t-1}}{K_{t-1}} \quad \text{(wartime)} \qquad (3)$$

$$Y_g - Y'_g = a_2 + b \frac{T_{t-1}}{K_{t-1}} \quad \text{(peacetime)} \qquad (4)$$

where $a_1 > a_2$. These relations could be fitted to wartime data (3) and peacetime data (4). However, since we are making the assumption that the shifting parameter is constant throughout the testing period, (3) and (4) may be combined into one relation with the use of a dummy variable.[15]

[15]For a more complete explanation of dummy variables and the problems encountered, see J. Johnston, Econometric

Pooling wartime and peacetime observations, one may estimate

$$Y_{g,t} - Y'_{g,t} = b_1 + b_2 X + b_3 \frac{T_{t-1}}{K_{t-1}} \qquad (5)$$

where the dummy variable is

$$X = \begin{cases} 0 \text{ in each peacetime year} \\ 1 \text{ in each wartime year} \end{cases}$$

The Korean War had a substantial effect upon the level of industrial production and associated profits during the early fifties. By using the dummy variable and giving it a value of one for the four observations 1950-1953, and zero for the other observations, the possibility of wartime shifts in the intercept of the rate of return function may be accounted for.

Basic Model

The following notation and definitions are used in the statement of the model.

P_t = annual before-tax profit; including interest paid on debt

K_t = capital stock at the end of the year; gross of depreciation, depletion, and amortization

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Methods (New York: McGraw-Hill Book Company, Inc., 1963), pp. 221-222.

Y_t = before-tax rate of return = $\frac{P_t}{K_t}$

T = tax liability = ZP_t

Z = statutory tax rate

L_t = general tax variable = $\frac{T_{t-1}}{K_{t-1}}$

C_t = measure of capacity utilization

E_t = employment index; aggregate weekly man-hours for each two-digit industry; 1958 = 100

X = dummy variable; equals one (1) for 1950-1953; equals zero (0) for the other years

U_t = stochastic disturbance

A. Regression Equation and Estimating Method

The general approach of this study is to apply time series analysis to fit a function where the rate of return for each industry is the dependent variable, and the negative rate of return is one of several predetermined variables. On the basis of the regression coefficients of the tax variable, the difference between the observed rates of return and what the rates of return would have been without the tax can be estimated.

Assuming that changes in the rates of return can be explained by the tax variables and other predetermined

variables, we can determine the relative influence of the tax variables by fitting industry data to the following regression equation.

$$Y_{g,t} = a_0 + a_1 L_t + a_2 C_t + a_3 X_t + a_4 E_t + U_t \qquad (6)$$

Since

$$L_t = \frac{T_{t-1}}{K_{t-1}} = \frac{ZP_{g,t-1}}{K_{t-1}} = ZY_{g,t-1}$$

equation (6) is autoregressive, and the regression coefficients have limitations depending upon the statistical properties of the data.

First, assuming that the disturbance terms are independent, least squares applied to

$$Y_t = a_1 + a_2 Y_{t-1} + U_t \qquad (7)$$

will give an estimate of a_2, designated $\hat{a}_2$, so that $\hat{a}_2 < a_2$.[16] However, the negative bias creates no great problem because this study is primarily concerned with whether there has been any degree of shifting. The way the model is specified, a negative bias means that inferences drawn from the estimates may indicate less shifting than would be inferred from unbiased estimates.

However, autocorrelation in the disturbance may greatly affect the estimation of the coefficients when this

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[16]Johnston, op. cit., pp. 214-215; E. Malinvaud, Statistical Methods of Econometrics (Chicago: Rand McNally & Company, 1966), p. 456.

regression is calculated by least squares.[17] The simultaneous presence of autocorrelated disturbances and lagged variables produces a substantial positive bias.[18] Unfortunately, it is not possible in this study to make a reliable assessment of autocorrelation in disturbances. The commonly used Durbin-Watson Statistic is biased towards two (2), and there is always the presumption against finding evidence of positive serial correlation.[19]

As discussed by Malinvaud,[20] the introduction of exogenous variables has the effect of reducing the bias. It should be emphasized, however, that the possible presence of autocorrelation in disturbances, even with the mitigating effect of additional exogenous variables, yields regression coefficients that should be interpreted with caution.

B. The Measurement of Shifting

The specified model (7) permits one to estimate the tax variable coefficient for each industry. It remains to translate these coefficients into a measure of the degree of shifting.

With the gross rate of return used as the indicator,

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[17]Johnston, op. cit., p. 216; Malinvaud, op. cit., p. 462.

[18]Johnston, Ibid.

[19]Marc Nerlove and Kenneth F. Wallis, "Use of the Durbin-Watson Statistic in Inappropriate Situations," Econometrica, Vol. 34 (January, 1966), p. 235; Malinvaud, op. cit., p. 462.

[20]Malinvaud, op. cit., p. 463.

the conditions of zero and 100 percent shifting may be defined as

$$\text{Zero shifting} \qquad Y_{g,t} = Y'_{g,t}$$

$$\text{100 Percent shifting} \qquad Y_{g,t} - Y'_{g,t} = \frac{T_{t-1}}{K_{t-1}}$$

These two formulations suggest a measure of shifting which can be written

$$F_t = \frac{Y_{g,t} - Y'_{g,t}}{\frac{T_{t-1}}{K_{t-1}}} \tag{8}$$

The significance of F_t is that it is the ratio of the increase in the gross rate of return after the tax has been raised to the amount of the new tax liability. Since the denominator of the ratio equals $\frac{T_{t-1}}{K_{t-1}}$, F_t is the proportion of the negative rate of return attributed to the income tax which has successfully been shifted by the firm. In order to arrive at the value of F_t, we must first estimate $Y'_{g,t}$ or what the rate of return would be in the absence of the income tax. This is accomplished by estimating the regression equation (7) with $L_t = 0$ and subtracting from the first estimation of (7). Because the other variables in the equation are independent of the tax, we arrive at

$$Y_{g,t} - Y'_{g,t} = a_1 L_t \tag{9}$$

If F_t is redefined as

$$F_t = \frac{Y_{g,t} - Y'_{g,t}}{L_t} \qquad (10)$$

then

$$F_t = a_1 \qquad (11)$$

The coefficient of the tax variable in the regression equation (7) becomes the measure of shifting and is given directly by the value of the estimate. It is assumed to be constant over the time span of the analysis.

C. Time Period Considered by the Study

The years covered by this study were 1947-1963. The two foremost determinants of the selection of the years were the absence of certain exogenous forces (e.g., the stringent wartime price controls of the early 1940's and depressed economic conditions reminiscent of the 1930's), and the availability of industrial concentration data for these years. Although the Korean War did occur during this period, the consequences were minor when compared to the effect upon the economy of the Second World War. And in any case, the use of a dummy variable in the rate of return function permits a test of structural shifts attributable to the Korean period.

The peculiarities of the industrial data caused by the occasional changes in the Standard Industrial Classification necessitated many adjustments. The comparability of the adjusted data was increased by limiting the scope of the

test and restricting the examination to seventeen recent years.[21] Even though over the seventeen years included in this study there have been some changes in the compositon of the two-digit industries, it was possible to adjust the reported statistics so as to achieve much greater comparability than if the analysis had commenced in the 1920's. The adjustments are discussed in the Appendix A to this study.

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[21]Even these few industries which have changed the least are considerably different today than they were in 1925. The procedure used by Gordon was to start with the original ten, two-digit industries listed for the 1920's and combine all the subsequent changes into these ten inclusive classifications. Unless he used a very complicated weighting system, I fail to understand how his aggregated data describe the changing importance of products within a broad category and how these changes might have altered the possibility of shifting the income tax. The value of any disaggregated approach to the shifting problem is limited by the conglomerate nature of any industry data. The less the study relies upon combined data the more meaningful will be the final results.

CHAPTER V

AN EVALUATION OF EMPIRICAL RESULTS

Initially, equation (6) of the preceding chapter was used to estimate the shifting coefficients for the seventeen industries. The regression coefficients of L_t, C_t, E_t, and X_t and their standard errors are presented in Tables 3a and 3b. Since this study is primarily interested in the magnitude and significance of the coefficient of L_t, the equation was changed. The collinearity of C_t and E_t caused the estimates of L_t to have relatively high standard errors when both were used as regressors. In most cases, C_t was more highly correlated with Y_t. When E_t was dropped from the estimating equation, the standard errors of L_t were generally reduced, and the regression coefficients were more reliable.

The regression equation used for the analysis was

$$Y_t = a_0 + a_1 L_t + a_2 C_t + a_3 X_t + U_t, \qquad (1)$$

and the regression coefficients are also presented in Tables 3a and 3b.

Of the seventeen industries examined, nine possess shifting coefficients, a_1, that are not significantly different from zero at $P \leq .05$. Therefore, based upon the

TABLE 3a

REGRESSION RESULTS FOR SHIFTING INDUSTRIES

SIC	Industry	a_0 ( )	a_1 ( )	a_2 ( )	a_3 ( )	a_4 ( )	R^2	D.W.$_a$
20	Food & Kindred Products	-.0170	.2083 (.5451)	.0666 (.0493)	-.0175 (.0056)	.0007 (.0004)	.6864	1.725
		.0006	.9037 (.4022)	.0966 (.0498)	-.0162 (.0060)		.6062	1.613
21	Tobacco Manufactures	.2109	.9800 (.2805)	-.0640 (.0574)	-.0105 (.0064)	-.0007 (.0005)	.9500	2.788
		.1397	1.3247 (.1256)	-.0885 (.0563)	-.0089 (.0065)		.9423	2.720
22	Textile-Mill Products	-.1473	.8895 (.6988)	.1122 (.1829)	-.0484 (.0180)	.0011 (.0010)	.7604	1.274
		-.1951	1.6066 (.3400)	.2861 (.1080)	-.0530 (.0178)		.7331	1.598

TABLE 3a--Continued

SIC	Industry	a_0 ( )	a_1 ( )	a_2 ( )	a_3 ( )	a_4 ( )	R^2	D.W.$_a$
23	Apparel & Allied Products	-.1678	1.4851 (.2978)	.1095 (.1048)	-.0263 (.0117)	.0011 (.0011)	.9111	1.924
		-.0976	1.3309 (.2566)	.1686 (.0873)	-.0299 (.0111)		.8154	1.618
24	Lumber & Wood Products	-.2216	-1.0701 (.4041)	-.0110 (.1004)	-.0332 (.0111)	.0037 (.0006)	.9276	1.851
		-.2826	1.1072 (.4622)	.4675 (.1395)	-.0495 (.0221)		.6726	1.572
27	Printing	-.0425	.7914 (.3531)	.1841 (.0566)	-.0195 (.0071)	-.0002 (.0004)	.6550	1.766
		-.0710	.8329 (.3337)	.1927 (.0525)	-.0192 (.0068)		.6475	1.638
32	Stone, Clay, Glass Products	-.0572	.7835 (.3549)	.3597 (.0904)	-.0225 (.0130)	-.0014 (.0011)	.7418	1.302
		-.1425	.7936 (.3622)	.2959 (.0760)	-.0222 (.0132)		.7086	1.203

TABLE 3a--Continued

SIC	Industry	a_0 ( )	a_1 ( )	a_2 ( )	a_3 ( )	a_4 ( )	R^2	D.W.$_a$
33	Primary Metals	-.2220	.3577 (.3203)	.2445 (.1841)	-.0201 (.0103)	.0011 (.0011)	.8694	1.721
		-.2592	.5361 (.2613)	.4150 (.0530)	-.0219 (.0101)		.8591	1.945

( ) Standard Error of Coefficient

a Durbin-Watson Statistic

TABLE 3b

REGRESSION RESULTS FOR NON-SHIFTING INDUSTRIES

SIC	Industry	a_0 ( )	a_1 ( )	a_2 ( )	a_3 ( )	a_4 ( )	R^2	D.W.$_a$
25	Furniture & Fixture	-.3025	1.1561 (.7655)	.4104 (.1349)	-.0412 (.0158)	.0003 (.0012)	.6379	1.173
		-.2852	1.0509 (.5952)	.4288 (.1051)	-.0408 (.0152)		.6363	1.185
26	Paper & Allied Products	.0276	-.3004 (.3994)	.4006 (.0747)	-.0058 (.0143)	.0022 (.0008)	.8071	1.686
		-.2180	.3472 (.4042)	.4039 (.0924)	-.0160 (.0171)		.6796	1.222
28	Chemicals & Allied	1.1582	-5.7984 (7.2359)	1.5930 (1.2160)	-.0406 (.2134)	-.0197 (.0109)	.3514	1.984
		-.3192	-8.9258 (7.6091)	1.2279 (1.2987)	.0124 (.2289)		.1756	1.831

TABLE 3b--Continued

SIC	Industry	a_0 ( )	a_1 ( )	a_2 ( )	a_3 ( )	a_4 ( )	R^2	D.W.$_a$
29	Petroleum Products	-.1035	-.2037 (.5658)	.1476 (.0547)	-.0076 (.0087)	.0007 (.0004)	.7614	1.990
		-.1037	.5776 (.4575)	.2188 (.0463)	-.0134 (.0091)		.6810	1.740
30	Rubber Products	-.0692	-.6088 (.3906)	.2304 (.0690)	.0195 (.0151)	.0001 (.0004)	.6483	1.400
		-.0567	-.6088 (.3774)	.2325 (.0664)	.0194 (.0146)		.6443	1.351
31	Leather Products	-.1622	.2621 (.4391)	.1417 (.1078)	-.0271 (.0105)	.0013 (.0008)	.7058	1.780
		-.1419	.6529 (.3954)	.2625 (.0849)	-.0329 (.0106)		.6378	1.997
35	Machinery (excl. electrical)	.0219	.1611 (.4954)	.3909 (.1276)	.0041 (.0179)	-.0007 (.0006)	.6205	1.315
		.0219	.0576 (.4875)	.3082 (.1009)	-.0022 (.0179)		.5854	0.944

TABLE 3b--Continued

SIC	Industry	a_0 ( )	a_1 ( )	a_2 ( )	a_3 ( )	a_4 ( )	R^2	D.W.$_a$
36	Electrical Machinery	-.0301	.1252 (.5161)	.3360 (.1482)	.0116 (.0274)	-.0012 (.0004)	.6394	2.230
		-.1263	.2063 (.6363)	.3099 (.1835)	.0052 (.0339)		.3989	1.147
37	Transportation Equipment	-.3060	.7517 (.4764)	.5568 (.2213)	-.0459 (.0296)	-.0004 (.0007)	.4021	2.067
		-.2982	.6016 (.3972)	.5090 (.2018)	-.0465 (.0289)		.3837	1.742

( ) Standard Error of Coefficient

a Durbin-Watson Statistic

model specification and the method of measuring the degree of shifting, one could infer that shifting was negligible in these industries.

Table 3b presents the nine industries that display no significant degree of shifting of the corporation income tax.

Regression results for the eight industries possessing shifting coefficients significantly greater than zero are presented in Table 3a. Of the eight industries indicating some degree of shifting, one displayed a shift coefficient significantly greater than one.

Two industries out of the seventeen have negative shift coefficients. Even though they are statistically insignificant, the negative sign is questionable. The magnitude of the standard errors of these coefficients and the relatively low coefficient of determination for one industry imply that certain statistical problems exist rather than unusual business behavior. Collinearity among the explanatory variables could cause the negative sign and larger standard errors. However, the results of collinearity are difficult to assess because the estimate of any single coefficient is affected by the cumulative influence of all the other explanatory variables.[1]

The low coefficient of determination generated by

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[1]Donald E. Farrar and Robert R. Glauber, "Multicollinearity in Regression Analysis: The Problem Revisited," The Review of Economics and Statistics, XLIX (February, 1967), pp. 92-107.

the Chemical and Allied Products industry indicates the possibility that a very important explanatory variable is not included in the regression equation. This specification error is likely to occur when one regression equation is used to estimate the coefficients for all the industries. The unique relationships of each industry are overlooked by the generalized function.

When regression equation (1) of this chapter is used, sixteen out of the seventeen capacity utilization coefficients are positive. Thirteen of the sixteen are significantly different from zero at $P \leqslant .05$. The one negative estimate is not statistically significant. Therefore, it appears correct to infer from these results that the degree of economic pressure which increases the utilization of industrial capacity tends to increase the before-tax rate of return on capital.

Most of the seventeen industries experienced increased rates of return during the Korean War, 1951-1953. In ten of the seventeen industries there are positive simple correlations between the before-tax rate of return and the dummy variable. However, fourteen of the seventeen industries have negative regression coefficients of the dummy variable; eight of the negative coefficients are statistically significant, and none of the positive coefficients are significantly different from zero at $P \leqslant .05$. The negative sign could very likely be caused by some degree of collinearity among the explanatory variables.

In each of the eight industries the coefficient of determination (which indicates the percentage of rate of return variation explained by the independent variables in the regression) is .60 or higher. In the one industry which displayed the propensity to shift more than 100 percent of the tax, the R^2 was .94.

Although the measure of shifting is numerically above zero, and in four cases above one, the inferences drawn from these results must be tempered by the statistical significance of the coefficients. Recalling that the shift coefficient is likely to be biased downward, about all that can be said is that the tax was shifted more than 100 percent in one industry (Tobacco Manufactures), and that it may have been shifted more than 100 percent in three others.

When these results are compared with the recent study by Robert J. Gordon,[2] there are some similarities. Gordon found some indication of forward shifting by seven of the ten selected industries.[3]

The conclusions reached by Krzyzaniak and Musgrave[4] that over the periods 1935-42 and 1948-59, 134 percent of the corporate income tax was shifted are not supported by

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[2]Gordon, op. cit.

[3]Since the period encompassed by Gordon's study differs from the years covered by this analysis, and because he used a different data adjustment process, it is impossible to make any rigorous industry comparisons of the shifting inferences.

[4]Krzyzaniak and Musgrave, op. cit.

this study. Since nine out of the seventeen industries showed no significant degree of shifting, it is questionable whether the extent of shifting accomplished by the other eight could have been sufficient enough to increase the average to 134 percent.[5]

Whether there are any distinguishing characteristics that differentiate the nine industries that displayed no significant shifting from the eight that showed a significant propensity to shift is a logical question deserving some attention.

The most frequent argument given in support of long-run shifting is that market power is a determining factor, and the degree of shifting is directly related to the possession of such power. If this is true, then there should be a direct relation between shifting and the degree of industrial concentration, assuming that concentration is an acceptable measure of market power.

Robert W. Kilpatrick[6] attempted to establish this relation by using the percentage of industry shipments by the four largest firms as the measure of concentration along with other independent variables to explain the variation in profits. His conclusion was that there was a direct relationship, and that concentration was a strong influence.

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[5]Unfortunately, they considered this as short-run shifting, where, in fact, it should have been called long-run, inasmuch as the capital stock was increasing over the period of their analysis.

[6]Kilpatrick, op. cit.

TABLE 4

SHIFTING MEASURES AND CONCENTRATION RATIOS

SIC	Industry	Shifting	Concentration*		
			1954	1958	1963
20	Food & Kindred Products	.9037	.453	.438	.446
21	Tobacco Manufactures	1.3247	.918	.934	.955
22	Textile-Mill Products	1.6066	.369	.405	.458
23	Apparel & Allied Products	1.3309	.201	.206	.238
24	Lumber & Wood Products	1.1072	.165	.166	.203
27	Printing	.8329	.255	.254	.271
32	Stone, Clay, & Glass	.7936	.578	.492	.485
33	Primary Metals	.5361	.648	.613	.651

Source: U.S., Congress, Senate, Subcommittee on Antitrust and Monopoly of the Committee on the Judiciary, Concentration Ratios in Manufacturing Industry, 1963, 89th Cong., 2d Sess., 1966, Part I, Table 2.

*Concentration percentages are based upon sales of the 8 largest firms in the industry.

The connection between concentration and shifting was tested in the present study in two ways. First, the dependency of shifting upon concentration was established by calculating a Kendall Rank Correlation coefficient[7] between the shifting measures for the eight shifting

[7]Maurice G. Kendall, The Advanced Theory of Statistics, Vol. I (New York: Hafner Publishing Company, 1952), Chapter 16. Also see Frederick C. Mills, Statistical Methods (New York: Henry Holt and Company, 1955), pp. 311-18.

industries (based upon numerical values) and concentration for each of the years 1954, 1958, and 1963. Table 4 gives the statistics used in computing the rank correlation coefficients.

The Kendall Rank Correlation coefficients for both 1954 and 1958 were -.286; for 1963, it was -.214. All three coefficients are not significantly different from zero at $P < 0.05$.[8] Thus, due to the insignificance of the rank correlation coefficients, the null hypothesis of no direct connection between shifting and concentration must be accepted.

The second method of analysis was to compare the median concentration percentage of the two groups for each of the years 1954, 1958, and 1963. For the eight industries which showed shifting, the medians were 41% in 1954, 42.5% in 1958, and 45.5% in 1963. The nine no-shift industries had medians of 58% in 1954, 55% in 1958, and 46% in 1963. Here again the industries with the lower overall concentration shifted the tax more than the industries with higher ratios.

The findings of this part of the study disagree with those of Kilpatrick and Gordon; both of them established some positive relationship between shifting and concentration. Krzyzaniak and Musgrave made no inferences about

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[8] C.R.C. Handbook of Tables for Probability and Statistics ed., W. H. Beyer (Cleveland: Chemical Rubber Company, 1966), Table X.10.

concentration; they attempted to show the correlation between shifting and firm size. Their results showed that for the thirty firms selected as either price-leaders or followers shifting was less than for the manufacturing sector as a whole.

When the above concentration statistics are related to the percentage change in corporation total assets between 1947-1957 (1947 priced) for each industry, an additional distinguishing characteristic comes to light. For the group of eight industries which shifted the tax, the percentage change in total assets was generally less than for the group of nine industries which did not shift the tax. Of the "shifting" industries, only Primary Metals, and Stone, Clay, and Glass displayed substantial increases in assets -- thus these industries (shifting industries) were apparently able to maintain their after-tax rates of return during a time of rising income taxes by limiting their capital stock growth rates. See Table 5.

The shifting group experienced a relatively stable degree of concentration (median of 41% in 1954 and a median of 45.5% in 1963). At the same time, the other group experienced a decrease in concentration from a median of 58% to one of 46%. Thus the group of industries which experienced a slight growth in concentration and increased their assets by a smaller percentage was able to shift the burden of the corporation income tax. The group of industries which absorbed the tax was characterized by a decrease in

concentration and by a more rapid increase in total assets.

TABLE 5

INDUSTRY PERCENTAGE CHANGE IN TOTAL ASSETS

SIC	Industry	Percentage Change in Corporation Total Assets (excluding other invest.)
20	Food & Kindred Products	.028*
21	Tobacco Manufactures	.064*
22	Textile-Mill Products	-.054*
23	Apparel & Allied Products	-.049*
24	Lumber & Wood Products	.263*
25	Furniture & Fixtures	.246
26	Paper & Allied Products	.303
27	Printing	.186*
28	Chemicals & Allied Products	.422
29	Petroleum Products	.571
30	Rubber Products	.326
31	Leather Products	-.166
32	Stone, Clay, & Glass	.701*
33	Primary Metals	.489*
35	Machinery, excl. electrical	.518
36	Electrical Machinery	.604
37	Transportation Equipment	.887

Source: Asset data from George J. Stigler, Capital and Rates of Return in Manufacturing Industries, (New York: National Bureau of Economic Research, 1963) selected industries of Table A.

*Industries in which shifting occurred.

Finally, there is evidence that the eight shifting industries did not rely totally upon price increases to offset the burden of the income tax, but shifted some of the burden backwards upon wage earners. The Kendall Rank Correlation coefficient between the measure of shifting in the eight industries and the percentage increase of average weekly earnings for production workers between 1947-1963 in each industry (Table 6) is -.643, and significantly different from zero at $P \leq .05$. This implies that the eight industries may have retarded wage advances in order to shift the burden backwards upon the wage earner.

TABLE 6

SHIFTING MEASURES AND PERCENTAGE CHANGE IN AVERAGE WEEKLY EARNINGS

SIC	Industry	Shifting Measure	Percentage Change in Average Weekly Earnings 1947-1963
20	Food & Kindred Products	.9037	102.8
21	Tobacco Manufactures	1.3247	106.1
22	Textile-Mill Products	1.6066	65.9
23	Apparel & Allied Products	1.3309	46.5
24	Lumber & Wood Products	1.1072	78.0
27	Printing	.8329	83.6
32	Stone, Clay, & Glass	.7936	103.6
33	Primary Metals	.5361	124.3

Source: U.S., Department of Labor, Bureau of Labor Statistics, Employment and Earnings Statistics for the United States, 1909-62, 1963, Section I, selected industries.

Conclusion

The inferences drawn from this disaggregated analysis of the corporation income tax incidence support the hypothesis of shifting in eight of the seventeen major industry groups under consideration. The indication that eight out of seventeen industries shift some of the tax, and that one out of the eight shifts more than 100 percent of the tax suggests that the burden is not being completely borne by the stockholders, and that some or all of the tax burden may be passed on to the consumer in higher prices and/or backwards on labor in lower wages.

According to traditional theory, long-run shifting is to be expected on grounds of profit-maximizing behavior in competitive or monopolistic industries. The alternative models proposed by Baumol and Williamson predict an upper limit of 100 percent shifting. As shown in Chapter II, the Baumol behavior model of sales maximization or target-rate-of-return and the Williamson managerial discretion model cannot rigorously predict more than 100 percent shifting of the corporation income tax. Only the Krzyzaniak and Musgrave model, based upon the "signal" theory of business response to a tax increase, can predict more than 100 percent shifting. Therefore, the shift coefficient of the Tobacco Manufactures industry, which is significantly greater than one at $P \leq .05$, can be supported by the Krzyzaniak and Musgrave model.

The previous studies of Krzyzaniak and Musgrave,

Hall, Kilpatrick, and Gordon have added to the controversy of shifting. Each has examined the question differently, but not one theoretically justified his results other than attributing the presence of shifting to market power. When this hypothesis was tested in this thesis, the results indicate that market power, as measured by proportion of industry sales accounted for by the eight largest firms, had no correlation with the amount of tax shifting. Therefore, either concentration is not a good measure of market power, or the commonly accepted explanation is disputable.

Because of the interaction of a large number of variables on the profits of a firm, agreement between theoretical prediction and empirical results does not, in and of itself, substantiate a theory. However, incorrect predictions are sufficient to cast doubt on the usefulness of a theory.

On the basis of the empirical results of this study, it would be difficult to substantiate any convincing argument which discriminates between the "traditional" and the sales-maximizing and/or expense preference models. All three models theoretically predict a maximum of 100 percent shifting in the long-run. The model which can predict more than 100 percent is the one proposed by Krzyzaniak and Musgrave. Therefore, the finding of more than 100 percent shifting in the Tobacco Manufactures industry must rely upon the behavioral assumptions included in the Krzyzaniak and Musgrave model for justification. However, the incidence of one

industry out of seventeen industries does not provide an unquestionable basis for preferring the Krzyzaniak and Musgrave model over the "traditional", sales-maximizing, and/or expense preference models. More substantial evidence is needed before any conclusive selection of the most appropriate model can be made.

An important inference can be drawn from the negative correlation between the measures of shifting and the percentage changes in average weekly earnings of production workers. The indication is that those firms which are most successful in shifting the burden of the corporation income tax also are the most successful in retarding the increase of wages. This possibility of backward shifting has not been found in any of the previous studies of the incidence of the tax. The importance of this implication of backward shifting upon the distribution of income and the incidence of our total tax structure warrants further study in this area.

The results of this study of shifting on the two-digit industry level lend credence to the demand for continued investigation into the complexities of the theory of the firm. It remains for future research to investigate the importance of demand elasticity, technological change, mobility of capital, and numerous behavioral goals upon the question of shifting. As this thesis has demonstrated, study on a more disaggregated basis should be fruitful once the data become available. Only then will we be able with more certainty

to evaluate the double-taxation argument of stockholders; only then will we be able to predict the results of corporation income tax changes; and only then will we be able to rewrite the tax laws so that the impact incidence corresponds to the effective incidence.

BIBLIOGRAPHY

BIBLIOGRAPHY

Articles and Periodicals

Adelman, M. A. "The Corporation Income Tax in the Long-Run," Journal of Political Economy, LXV (April, 1957), pp. 151-157.

Beck, Morris. "Ability to Shift the Corporate Income Tax: Seven Industrial Groups," National Tax Journal, III (September, 1950), pp. 248, 253-256.

Brown, Cary. "The Corporate Income Tax in the Short-Run," National Tax Journal, VII (September, 1954), pp. 240-241.

Brown, Murray and de Cani, John S. "Technical Changes in the United States, 1950-1960," Productivity Measurement Review, No. 29 (May, 1962), pp. 26-39.

Brown, Murray and Popkin, Joel. "A Measure of Technological Changes and Returns to Scale," Review of Economics and Statistics, LXIV (November, 1962), p. 402.

Clendenin, John C. "Effects of Corporate Income Taxes on Corporate Earnings," Taxes, XXXIV (June, 1956), p. 396.

Collier, Robert P. "Cost Plus Pricing and Tax Incidence," Proceedings of the Thirty-First Annual Conference of the Western Economic Association, 1956.

Colm, Gerhard. "The Corporation and the Corporate Income Tax in the American Economy," American Economic Review, XLIV (May, 1954), p. 406.

Cooper, W. W. "Theory of the Firm: Some Suggestions for Revision," The American Economic Review, XXXIX, No. 6 (December, 1949), pp. 1204-1222.

Cragg, John G., Harberger, Arnold C., and Miezkowski, Peter. "Empirical Evidence on the Incidence of the Corporation Income Tax," Journal of Political Economy, LXXV (December, 1967), pp. 811-821.

David, P. and van de Klundert, T. "Biased Efficiency Growth and Capital-Labor Substitution in the U.S., 1899-1966," American Economic Review, LV (June, 1965), pp. 357-94.

De Alessi, L. "The Incidence of the Corporate Income Tax: A Stock Price Approach," Public Finance, 20(3-4), 1965, pp. 263-268.

de Leeuw, Frank. "A Revised Index of Manufacturing Capacity," Federal Reserve Bulletin, Vol. 52 (November, 1966), pp. 1605-1615.

Farrar, Donald E. and Glauber, Robert R. "Multicollinearity in Regression Analysis: The Problem Revisited," The Review of Economics and Statistics, XLIX (February, 1967), pp. 92-107.

Ferguson, C. E. "Substitution, Technical Progress, and Returns to Scale," American Economic Review, Papers and Proceedings, LV, (1965), pp. 296-305.

Fuchs, Victor R. "Integration, Concentration, and Profits in Manufacturing Industries," Quarterly Journal of Economics (May, 1961), pp. 278-291.

Goode, Richard. "Some Consideration on the Incidence of the Corporation Income Tax," Journal of Finance, VI (June, 1951), p. 197.

Gordon, Robert J. "The Incidence of the Corporation Income Tax in U.S. Manufacturing, 1925-62," The American Economic Review, LVII, No. 4 (September, 1967), p. 731.

Hall, Challis, Jr. "Direct Shifting of the Corporation Income Tax in Manufacturing," American Economic Review, LIV (May 1964), p. 258.

Hall, R. E. and Jorgenson, D. W. "Tax Policy and Investment Behavior," American Economic Review, LVII (June, 1967), pp. 391-413.

Harberger, Arnold C. "The Incidence of the Corporation Tax," Journal of Political Economy, LXX (June, 1962), pp. 215-240.

Kendrick, J. N. and Sato, Ryuzu. "Factor Prices, Productivity, and Growth," American Economic Review, LIII (December 1963), pp. 974-1003.

Kilpatrick, Robert W. "The Short-Run Forward Shifting of the Corporation Income Tax," Yale Economic Essays, Vol. 5 (Fall 1965), pp. 355-420.

Klein, L. R. and Preston, R. S. "Some New Results in the Measurement of Capacity Utilization," American Economic Review, LVII (March, 1967), pp. 34-58.

Kravis, I. B. "Relative Income Shares in Fact and Theory," American Economic Review, XLIX (December, 1959), p. 917.

Lerner, Eugene M. and Hendriksen. "Federal Taxes on Corporate Income and the Rate of Return on Investment in Manufacturing, 1927 to 1952," National Tax Journal, VIII (September, 1955), pp. 199, 202.

Lintner, John. "Effects of a Shifted Corporate Income Tax on Real Investment," National Tax Journal, VIII (September, 1955), p. 235.

Margolis, J. "The Analysis of the Firm: Rationalism, Conventionalism, and Behaviorism," The Journal of Business, XXXI, No. 3 (July, 1958), pp. 187-199.

Miller, Merton H. and Shelton, John P. "Effects of a Shifted Corporate Income Tax on Capital Structure," National Tax Journal, VIII (September, 1955), p. 256.

Moroney, John R. "The Share of Corporate Income, 1922-61," The Quarterly Review of Economics and Business, IV (Winter, 1964), p. 72.

_____. "Technological Progress, Factor Proportions, and the Share of Capital in American Manufacturing, 1942-1957," Western Economic Journal (forthcoming 1968).

Nerlove, Marc and Wallis, Kenneth. "Use of the Durbin-Watson Statistic in Inappropriate Situations," Econometrica, Vol. 34 (January, 1966), p. 235.

Ratchford, B. V. and Han, P. B. "The Burden of the Corporation Income Tax," National Tax Journal, X, No. 4 (December, 1957), pp. 310-324.

Shoup, Carl S. "Some Considerations of the Incidence of the Corporation Income Tax," Journal of Finance, VI (June, 1951), p. 187.

Slitor, Richard E. "Corporate Tax Incidence: Economic Adjustments to Differentials Under Two-Tier Tax Structure," Effects of Corporation Income Tax, ed. Marian Krzyzaniak (Detroit: Wayne State University Press, 1966), pp. 136-208.

_____. "Corporate Tax Incidence," Public Finance, XVIII (Nos. 3 and 4), 1963.

Solow, Robert M. "The Constancy of Relative Shares," American Economic Review, XLVIII (September, 1958), p. 618.

_____. "Technical Change and the Aggregate Production Function," Review of Economics and Statistics, XXXIX (August, 1957), pp. 312-320.

Weston, J. Fred. "Incidence and Effects of the Corporate Income Tax," National Tax Journal, II (December, 1949), pp. 307, 309, 312, 315.

Zellner, Arnold. "The Corporate Income Tax in the Long-Run: Comment," Journal of Political Economy, (October, 1958), pp. 444-446.

_____. "Rejoiner," Journal of Political Economy, LXVI (October, 1958), p. 448.

Books

Baumol, William J. Business Behavior Value and Growth. New York: The Macmillan Company, 1959.

Beyer, W. H., ed. C.R.C. Handbook of Tables for Probability and Statistics. Cleveland, Ohio: Chemical Rubber Company, 1966.

Brennan, Michael J. Preface to Econometrics, 2nd ed. Cincinnati: South-Western Publishing Co., 1968.

Chamberlin, Edward H. The Theory of Monopolistic Competition, 8th ed. Cambridge, Massachusetts: Harvard University Press, 1962.

Cohen, Kalman J. and Cyert, Richard M. Theory of the Firm. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1965.

Colm, Gerhard. Essays in Public Finance and Fiscal Policy. New York: Oxford Press, 1955.

Cyert, Richard M. and March, James G. A Behavioral Theory of the Firm. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1963.

Dirlam, Joel B. and Alfred E. Kahn. Fair Competition: The Law and Economics of Antitrust Policy. Ithaca, New York: Cornell University Press, 1954.

Federal Excess Profits Tax. New York: Prentice-Hall, Inc., 1954.

Fitzpatrick, Albert A. Pricing Methods of Industry. Boulder, Colorado: Pruett Press, Inc., 1964.

Friedman, Milton. Essays on Positive Economics. Chicago: The University of Chicago Press, 1966.

Goldberger, A. S. Econometric Theory. New York: John Wiley & Sons, Inc., 1964.

Goode, Richard. The Corporation Income Tax. New York: John Wiley & Sons, Inc., 1951.

Henderson, James H. and Quandt, Richard E. Microeconomic Theory. New York: McGraw-Hill Book Company, 1958.

Hickman, Bert G. Investment Demand and U.S. Economic Growth. Washington: The Brookings Institute, 1965.

Johnston, J. Econometric Methods. New York: McGraw-Hill Book Company, 1963.

Kaplan, A. D. H., Dirlam, Joel B. and Lanzillotti, Robert F. Pricing in Big Business. Washington: The Brookings Institute, 1958.

Kendall, Maurice G. The Advanced Theory of Statistics, Vol. I. New York: Hafner Publishing Company, 1952.

Klein, Laurence R. A Textbook of Econometrics. Evanston, Illinois: Row, Peterson and Co., 1953.

Krzyzaniak, Marian and Musgrave, Richard A. The Shifting of the Corporation Income Tax. Baltimore: The Johns Hopkins Press, 1963.

Krzyzaniak, Marian, ed. Effects of Corporation Income Tax. Detroit: Wayne State University Press, 1966.

Lanzillotti, Robert F. Pricing, Production, and Marketing Policies of Small Manufacturers. Pullman, Washington: Washington State University Press, 1964.

Malinvaud, E. Statistical Methods of Econometrics. Chicago: Rand McNally and Company, 1966.

Marshall, Alfred. Principles of Economics, 8th ed. London: Macmillan and Company, Ltd., 1961.

Mills, Frederick C. Statistical Methods. New York: Henry Holt and Company, 1955.

Musgrave, Richard A. The Theory of Public Finance. New York: McGraw-Hill Book Company, 1959.

Stigler, George J. Capital and Rates of Return in Manufacturing Industries. New York: National Bureau of Economic Research, 1963.

Williamson, Oliver E. The Economics of Discretionary Behavior: Managerial Objectives in the Theory of the Firm. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1964.

Public Documents

U.S. Congress, Joint Economic Committee. "The Potential Economic Growth of the United States." Paper submitted by James W. Knowles, 86th Cong., 2d Sess., 1960.

U.S. Congress, Senate, Subcommittee on Antitrust and Monopoly of the Committee on the Judiciary. Concentration Ratios in Manufacturing Industry, 1963. Part I, Table 2. 89th Cong., 2d Sess., 1966.

U.S. Department of Commerce, Bureau of the Census. Census of Manufactures, Vol. II, selected years.

U.S. Department of Commerce, Bureau of the Census. Annual Survey of Manufactures, selected years.

U.S. Department of Labor, Bureau of Labor Statistics. Employment and Earnings Statistics for the United States, 1909-62, 1963, Section I.

U.S. Executive Office of the President, Bureau of the Budget. Standard Industrial Classification Manual, Vol. I, Part 1 and 2, 1945.

U.S. Executive Office of the President, Bureau of the Budget. Standard Industrial Classification Manual, 1957.

U.S. Treasury Department, Bureau of Internal Revenue. Statistics of Income, selected years.

APPENDICES

APPENDIX A

ADJUSTMENT PROCEDURE FOR INCOME DATA

The analysis of the shifting of the corporation income tax was based upon the annual statistics for the years 1947-1963. The financial information for each industry was obtained from the Statistics of Income.[1] The Internal Revenue Service, in the compilation of their statistics, used the Standard Industrial Classification as a basis for industrial identification. Unfortunately, the Standard Industrial Classification changed twice during the test period; once in 1948 and again in 1958.[2]

The Standard Industrial Classification revisions aim at a clearer categorization of products and industries. Over time, certain products change in importance and/or substance, and by reclassifying them into different subgroups, major industries are more distinctly differentiated. Most

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[1]U.S. Treasury Department, Bureau of Internal Revenue, Statistics of Income, selected years.

[2]Executive Office of the President, Bureau of the Budget, Standard Industrial Classification Manual, Vol. I, Part 1 and 2, 1945. Executive Office of the President, Bureau of the Budget, Standard Industrial Classification Manual, 1957. Although the Codes were published in 1945 and 1957, the Internal Revenue Service did not change their classifications in accordance with the revisions until 1948 and 1958.

of the reclassifications concern either entire subgroups, designated by three or four digits, or single products within these subgroups. The consequence of the Code changes is that the composition of the two-digit industries varied over the seventeen years, 1947-1963.

The problem of adjustment would not have existed if complete financial data on all subgroups had been available. The absence of appropriate disaggregated data necessitated changing the reported income statistics to reflect the reclassification.

In the Statistics of Income of 1948 and 1958, reconciliations are presented on a value-added-by-manufacture basis for each transitional year, 1948 and 1958. The adjustments for the intervening years are dependent upon these calculations. The adjustment method and the requisite assumptions will be discussed below.

The calculated adjustments of the income statistics relied upon the data from the yearly Annual Survey of Manufacturers and the appropriate Census of Manufactures.[3] However, for the years following 1953, value-added-by-manufacture was reported on an "adjusted" basis instead of "unadjusted", as it had been for the previous years.

> Adjusted value added by manufacture represents value of products shipped (including resales of

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[3]U.S. Department of Commerce, Bureau of the Census, Census of Manufactures, Vol. II, Statistics of Industries, 1947, 1954, 1958, and 1963. U.S. Department of Commerce, Bureau of the Census, Annual Survey of Manufacturers, selected years.

> finished products produced by other manufacturing establishments) less cost of products, materials, supplies, fuel, electric energy and contract work plus the net change in finished products and work-in-process inventories between the beginning and the end of the year. The inventory figures were not adjusted for price changes. Unadjusted value added by manufacture represents value of the products shipped (excluding resales) during the year less the cost of materials, supplies, fuel, electric energy and contract work.[4]

In order to adjust the value added by manufacture for the years prior to 1954, each unadjusted value added by manufacture (by 2-digit industry) was multiplied by the average of the annual ratios of adjusted to unadjusted value added by manufacture presented for each year, 1954-1957. It is assumed that the relationship between adjusted value added and unadjusted value and unadjusted value added remained the same throughout the seventeen years; the constant ratio being the calculated four-year average.

The calculated average ratios are presented in Table A1.

Value-added-by-manufacture was used as the adjustment base for two reasons. The first is that value-added-by-manufacture data are more readily available for the relevant industries. Value of shipments are available for fewer industries on the 4-digit level. Secondly, by using value-added-by-manufacture, the actual processing and the utilization of productive facilities becomes the basis of

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[4]U.S. Department of Commerce, Bureau of the Census, Annual Survey of Manufacturers, 1955, 1956, and 1957, Footnote to Table 1.

adjustment rather than the sales value of the product (which would have been the case if value-of-shipment were used).

TABLE A1

ADJUSTMENT RATIOS

Industry Two-digit S.I.C.	Average Ratio
20	1.02860
21	1.00721
22	1.00145
23	1.02021
24	1.02086
25	1.02232
26	1.01375
27	1.02332
28	1.02536
29	1.01187
30	1.12027
31	1.00949
32	1.02995
33	1.03070
35	1.05432
36	1.03535
37	1.00812

In correcting the data from the Statistics of Income for changes in the Standard Industrial Classification, two important assumptions are made. The first is that the same relationship that existed between the value-added-by-manufacture of 4-digit industries and its inclusive 2-digit, major industry prevailed between the various accounts of the Statistics of Income. The second assumption is that this relationship remained the same for each intervening year.

The basis for the adjustments of the accounts for

all years prior to 1958 is the reconciliation given in the 1958 Statistics of Income. This is possible because the adjustment of the 1947 accounts is provided by the reconciliation presented in the 1948 Statistics of Income. The 1958 reconciliation (based upon 1958 data) shows each 4-digit classification under the new code and lists the 4-digit industries and amount of value-added-by-manufacture under the old code which make up the new classification. Also, it itemizes how each old 4-digit classification was distributed to the new code. In making the adjustments, I was concerned only with those transfers which occurred between major, two-digit industries.

Example

In the case of the Food and Kindred Products Industry (20) under the new code of 1958, $380,623,000 of value-added-by-manufacture was included in this major industry which was previously attributed to industry subgroups, under the 1948 classification, of the Chemical and Allied Products Industry (28). In addition, $50,020,000 of value-added-by-manufacture, which was classified under All Other Industries in the code of 1948, was included in the total value-added-by-manufacture for Food and Kindred Products under the Code of 1958. These two amounts were added to the total of the other 4-digit industries in (20) which did not change major classification under the new Code of 1958.

Thus, of the $17,532,558,000 of the value-added-by-

manufacture of Industry 20 under the Code of 1958, $380,623,000 came from subgroups classified under Industry 28 according to the Code of 1948, or .03013 of the total value-added-by-manufacture of Industry 28 under the Code of 1948. In addition, $50,020,000 came from all other industries of the 1948 Code. The latter amounted to .00035 of the total value-added-by-manufacture by all industries under the 1948 Code. Partially offsetting this addition was the $62,986,000 of value-added-by-manufacturing, which was included in Industry 20 of the Code of 1948, but was transferred to all other industries under the new Code of 1958. This subtraction amounted to .00366 of the total value-added-by-manufacture of Industry 20 according to the 1948 Code.

The adjustments were calculated by following these steps for each year 1948 through 1957.

1. Take the total value-added-by-manufacture for Industry 20 under the old Code of 1948.
2. Add .03013 of total value-added-by-manufacture of Industry 28 under the old Code of 1948.
3. Add .00035 of total value-added-by-manufacture of all industries under the old Code of 1948.
4. Subtract .00366 of total value-added-by-manufacture of Industry 20 under the

old Code of 1948.

5. Calculate a ratio between the total value-added-by-manufacture adjusted for the transfers and the unadjusted total for Industry 20.

6. Multiply all accounts for Industry 20 in the Statistics of Income by this ratio. A separate ratio must be calculated for each year that requires adjustment.

APPENDIX B

INDUSTRY CLASSIFICATION USED BY FRANK DE LEEUW*

Advanced Processing

Chemicals and Allied Products

Food and Kindred Products

Tobacco Manufactures

Apparel and Allied Products

Furniture and Fixtures

Printing

Leather Products

Machinery, both electrical and others

Transportation equipment

Primary Processing

Textile-Mill Products

Lumber and Wood Products

Paper and Allied Products

Petroleum Products

Rubber and Plastics

Stone, Clay, and Glass Products

Primary Metals

*Frank de Leeuw, "A Revised Index of Manufacturing Capacity," Federal Reserve Bulletin, November 1966, pp. 1610.