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SHIFTING OF THE CORPORATION INCOME TAX: THE CANADIAN EXPERIENCE

by

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PREFACE

The question of who bears the burden of a tax is not settled by the legislature when it writes into law the source at which that tax is to be collected. The legislation will typically reflect a consensus of who should bear the burden, but it is in the dynamic setting of economic activity that the actual distribution of the tax burden takes place.

The distribution of the tax burden is not a matter which can be settled satisfactorily or convincingly on a priori grounds. Theory can tell us what variables are relevant, and where one should look, but only by looking -- by empirical investigation -- can one expect to confirm that the theory which one has developed or accepted has real world relevance. It is in the spirit of testing the hypothesis, derived from neoclassical economic theory, that the corporations bear the short-run burden of the tax placed on them by the legislatures, that the present study is conducted.

In the course of working on one's doctoral dissertation many debts are incurred. I am particularly happy to recognize the enormous debt of gratitude which I owe to Professor Marian Krzyzaniak for his very considerable patience in discussing matters ranging from the grand design to the smallest detail, for his most generous provision of time, and for regular encouragement. We found many points on which to disagree -- intellectual encounter is rarely stimulating otherwise -- and remained friends during the continued criticisms of each others work.
Dr. John Conlisk and Dr. Charles McLure were always available on short notice to discuss points as they arose. They were both responsible for raising many important issues; their comments have inevitably made an impression on the final product.
Introduction

The following study is an attempt to determine empirically the extent to which corporations are able to avoid (or "shift"), in the short run, the burden imposed on them by the corporation income tax. In order to bypass some of the various problems associated with the existence of depreciation and depletion allowances the study is restricted to those corporations whose primary business is manufacturing.

Importance of the Question

Tax incidence is usefully and traditionally defined as the distribution of tax-induced changes in absolute income. In the study of tax incidence one is concerned with matters of equity and efficiency. In terms of equity one wishes to know whether the tax burden in fact falls on the taxed group -- as the legislature presumably intended -- or whether the legislative intent is somehow circumvented. The answer to this question, as it turns out, is also the answer to the question of shifting itself. Efficiency is related to incidence in that the total burden of the tax may be greater than is apparent; thus one may wish to determine the extent to which the differential tax on profits (since corporate and noncorporate profits are not taxed

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Equity may be defined in various ways. The view espoused in the text is that the existing tax legislation itself defines equity in the sense of reflecting a community consensus of where the ultimate tax burden should lie. Shifting of the tax burden, therefore, implies that the tax is not equitable in that the intended burden on the taxed group is in whole or part avoided. However, it is recognized that taxes are usually imposed for the purpose of raising revenue and that equity considerations need not be granted due attention.
at the same rate induces a deadweight loss to the whole economy (variously called "excess tax burden" or "waste").

Finally, one may be concerned with matters outside the realm of incidence — viz. the tax effect on particular variables, such as the capital stock, or the aggregate savings ratio.

The ensuing study is directed primarily at the short-run distribution of the tax burden imposed on corporations. However, the short-run distribution of tax burdens provides information on some incentive aspects of the tax question, which are particularly important if one believes profitability or the rate of net of tax to be a significant factor in determining investment and hence the growth of an economy. If the short-run burden is shifted, one can say that the burden of taxes in the economy is not the same in the intended manner. On the other hand, complete short-run shifting of the tax itself implies no reduction in the incentive to invest.

Outline of the Study:

While the major concern of the study is the shifting of the corporation income tax in Canada, tax shifting in the United States economy is considered closely for two reasons. First, extensive empirical investigation of the influence of the corporate income tax in the United States has been published, and an analysis is found suitable as a starting point in the study for the Canadian

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Canada maintains very close political and economic ties with the United States it is of great interest to know how similar the reaction to the tax is in the two countries. Substantial differences in reactions would have its impact in the economic relations between these two countries, each of which is the largest single trading partner of the other.

Chapter I reviews the theoretical literature concerned with profits taxation and in so doing discusses the importance of the measure of tax shifting in its relation to measures of tax incidence generally; special attention is paid to the operationality of the various theoretical constructs. Measures of the tax effect on the rate of return to capital and on the before-tax share of value added are presented and considered. It appears that while virtually all concepts concerned with tax incidence -- or even tax shifting in other than the short run -- may be inoperational, the measure of the tax effect on the rate of return has the brightest prospects in terms of providing useful information in empirical studies.

In Chapter II the reduced-form, single equation model to be used in the empirical work is developed and discussed, and econometric problems are considered.

Chapter III is devoted to a replication and extension of the Krzyzaniak-Musgrave empirical study of tax shifting in the United States economy. The time-coverage of their study is extended to include the latest data available, and an alternative set of data

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\textsuperscript{3} Ibid.
on manufacturing corporations is also tested using the model described in Chapter II. Finally the predictive capacity of the reduced form is utilized to forecast the rate of return for those years following the original study for which the actual figures are available for comparison. It is found that the preferred model of the original study performs well in many respects: 1) using either set of data the inclusion of subsequently available data leaves the estimated coefficients of the included variables (and the tax variable and hence the measure of shifting in particular) virtually unaltered while increasing their significance; 2) the model accurately predicts the subsequent years.

Since the results reported in Chapter III provide added confidence for the empirical method employed in the Krzyzaniak-Musgrave pioneering study, as well as for their measure of tax shifting, basically the same approach is tested in the Canadian economy (Chapter V). At the outset, however, it must be recognized that an approach developed for one economy is not necessarily suited to the study of another. Besides being of a vastly different magnitude the Canadian economy is generally considered "open" (in that foreign trade typically amounts to between 20 and 30 percent of gross national product) whereas the U.S. economy is substantially "closed" (external trade being less than 5 percent of GNP). In the text, however, it is argued that the empirical estimation procedure employed is quite able to accommodate the open economy case, although the possibilities of misspecification in the model may be greater. In addition one might plausibly argue that the openness of the Canadian economy is largely
illusory if both the general level of economic activity and the tax rates and tax shifting have closely similar patterns in Canada and the United States. Under this view the relevant external sector would be the external trade with others than the U.S., which would account for 10 to 15 percent of G.N.P.

The empirical test of tax shifting in Canada follows a discussion of various peculiarities of the Canadian system of corporation taxation, which appears in Chapter IV. In particular the dividend tax credit (which, since 1949 has allowed recipients of dividend earnings to deduct from income taxable under the personal income tax act specified percentage of such earnings) may be viewed as an effective reduction in the rate at which corporation income is taxed; the empirical consequences with respect to tax shifting are considered in Chapter V.

Chapter VI focuses on tax shifting in an open economy. It is pointed out that while the traditional neoclassical analysis leads to the conclusion that a tax on profits is not shifted whether the economy is open or closed, that conclusion has been called into question. If substantial short-run forward shifting of the corporation income tax is an accurate description of reality the corporation income tax will have an impact on the external trade of a country not anticipated by the theory. Neither would the impact be anticipated by some of the international institutions (for example, GATT) which make special allowances for various "cost" taxes imposed on goods traded internationally, but none for profits taxes.
The empirical work preceding Chapter VI gives no indication whether the short-run tax shifting is forward, backward, or some combination of the two or whether the tax is "transformed" (e.g., by tax-induced greater efficiency in production). However, if the tax is shifted forward a higher corporation income tax will induce a rise in absolute domestic prices, thereby making exports less marketable and imports more attractive. On the plausible hypothesis that the tax is shifted forward empirical work is undertaken in Chapter VI to test whether the corporation income tax is a statistically significant factor in international trade. It is found to be significant -- a conclusion most readily compatible with the hypothesis of short-run forward shifting of the tax.

Finally, in Chapter VII the various major conclusions of the study are stated and the empirical results of the United States and Canadian studies are compared. A few of the more striking policy implications are noted -- policy recommendations which appear most unorthodox to those accustomed to thinking in terms of the tax burden resting where the tax is placed.
Chapter I

Tax Shifting and Tax Incidence: the Present State of Theory

This chapter considers in some detail the neoclassical and non-neoclassical theoretical positions with respect to the shifting and incidence of the corporation profits tax in both partial and general equilibrium analysis.

Perhaps the prime issue running through all the discussion in both the theoretical and the empirical literature is the matter of which variable is basic in measuring that particular impact of the tax designated tax shifting. Recurrent suggestions are that the impact of the corporation income tax on one of two variables be considered -- the impact on either (1) the share of profits in value added, or (2) the rate of return to corporate capital. It is shown that the measure of the short-run tax effect on the rate of return tells the incidence of the tax on the taxed group while the measure on the share base does not. The measure of the former tax effect, therefore, is called a measure of tax shifting whereas the latter measure is simply one of many tax effects of interest for their own sake.

Neoclassical Partial Equilibrium, Short-Run Models

The traditional neoclassical analysis, based on the assumption of profit maximization in a context of perfect competition, monopolistic competition, or monopoly, leads unequivocally to the conclusion that a tax on the profits of the firm cannot be shifted in
the short run. Rather it will be borne in its entirety by the tax party. This conclusion follows directly from the assumption that the firm, operating in one of these markets, is maximizing its short-run profits prior to the tax which, when instituted, falls on profits. The tax will not induce the firm away from this maximizing position since the tax, implicitly assumed to fall on short-run (economic) profit, does not enter as an element of cost.  \(^1\)

This conclusion, however, is crucially dependent on the three stated assumptions that short-run profit is maximized, that the tax falls on economic profits, and that the market structure is one of perfect competition, monopolistic competition, or monopoly. Relaxing any one of these assumptions immediately invalidates the conclusion, although it is difficult in theory to determine how substantial the shifting might be in any one of a number of special cases. Furthermore, the taxed firms may be -- and indeed possibly are -- oligopolistic. If so neoclassical theory has nothing to say. That is, outside of the extreme cases no conclusions have been reached: in the intermediate positions between monopolistic competition and pure monopoly the possibility of tax shifting is not excluded.

Quite in addition to the uncertainty with respect to the anticipated reaction to a tax change once the crucial assumptions are relaxed is the very significant fact that the traditional neoclassical analysis is static and partial.  \(^2\) Since the corporate income tax is,

\(^1\) See Krzyzaniak and Musgrave; op. cit., p. 1.

in fact, not imposed on the profits of a single small corporation in an economy, but rather on the profits of all corporations, it is essential to consider in theoretical as well as empirical work the effect of a tax in a general equilibrium setting.

Notation, Definitions, and Measures of Tax Effects

This section is a digression to provide the notation and measures of tax effects which clarify the ensuing discussion of the general equilibrium relationship between tax shifting and incidence.

The following notation is used:

Symbols:

The Main Variables:

π Gross profits,
K Capital stock,
Q Aggregate output,
x Tax rate, levied on profits.

Subscripts:

The first subscript indicates the tax rate:

x any positive rate of profits taxation, constrained as \(0 < x < 1\);
o the absence of a tax on profits.

The second subscript indicates time:

t time variable during adjustment to the tax,
T equilibrium time; the economy has completely adjusted to a tax at the rate "o" or "x".
Define:

\[ Y = \frac{\pi}{K} \] the rate of return to capital;

\[ F = \frac{\pi}{Q} \] the gross share of profits in value added;

\[ S \] a measure of the impact of the tax in which the first subscript indicates the base on which such impact is measured and the second indicates the time period of the measure;

\[ B \] burden of the tax on the taxed group. The first subscript indicates the tax, and the second the time period.

Using the above concepts the following measures of tax effects may be derived:

\[ S_{\pi, t} = \frac{(\pi_{x,t} - \pi_{o,t})}{x_{\pi,x,t}} \]

\[ S_{Y, t} = \frac{(Y_{x,t} - Y_{o,t})}{x_{Y,x,t}} \]

\[ S_{F, t} = \frac{(F_{x,t} - F_{o,t})}{x_{F,x,t}} \]

The economic content and appeal of these measures may be indicated as follows. In a static economy in either short-run or long-run adjustment to the tax a non-zero measure of the impact of the tax implies that the level of profits in the absence of the tax is not reduced by the full amount of the tax. In a growing economy a similar measure in either the short-run or at some point short of
full long-run equilibrium is similarly interpreted. Analogously, in either a static or a growing economy, in either short-run or long-run equilibrium, the tax effect may be defined on either the rate or return base \( S_{Y,t} = 1 \) implies that the rate of return net of the tax is the same as the rate of return in the absence of the tax) or on the gross share base \( S_{F,t} = 0 \) implies that the share of the taxed factor, net of the tax, in total output is reduced by the full amount of the tax).

Each of the above measures has the desirable property of assuming the values of zero and one to indicate that the tax has no impact or a full impact, respectively, on whichever base the measure is taken, as well as values intermediate and beyond. However, for any one of the measures to be operational it must be possible to infer one of the values in that measure -- the equilibrium zero-tax position of the parameter on which the measure is taken.


It is interesting that these measures differ from those originally proposed by Musgrave, when he argued that a useful concept of tax shifting would result "by measuring the difference between the actual (tax-induced) change in distribution (i.e., the effective incidence) and the incidence of legislative intent." Musgrave goes on to note that "shifting thus defined is an index of frustration, (measuring) the failure of tax policy to achieve its distributional objective," Richard A. Musgrave, *The Theory of Public Finance*, (McGraw-Hill, 1959), p. 231. The measure proposed in the text (which compares the equilibrium tax-induced outcome to the inferred equilibrium zero-tax position rather than to the intended with-tax position and is closely related to the measure of the tax burden on the tax group), however, has found greater use in empirical studies: e.g., Krzyzaniak and Musgrave, *Shifting of the Corporation Income Tax*, op. cit., and Robert W. Kilpatrick, "The Short-Run Forward Shifting of the Corporation Tax," *Yale Economic Essays*, Vol. V, Fall 1965, pp. 355-420.
With the notation and measures in mind it is now possible to return to a brief review of the major issues in the relationship between tax shifting and incidence and, in this connection, to show why the measure of the impact of the tax on the short-run rate of return is designated "tax shifting".

Neoclassical General Equilibrium Analysis

In his *Principles of Public Finance* Dalton stated clearly the traditional view of theorists in public finance — viz. that the ultimate concern of tax analysts must be with the global tax burden, defined as the sum of the direct and indirect tax burdens, as well as the distribution of tax burdens amongst individuals and groups. The direct tax burden, in turn, is defined as the tax revenue accruing to the Treasury and the indirect tax burden as the tax-induced reduction in total community output. How does a measure of tax shifting fit in here?

In terms of tax shifting, Dalton employs the first-mentioned measure of tax effect, viz.

\[ S_{\pi,t} = \frac{\left( \pi_{x,T} - \pi_{0,T} \right)}{x_{\pi_{x,t}}} , \]

which uses absolute profit figures. Moving from this expression he

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might readily consider the tax burden on the taxed group which
plausibly turns out to be:

\[ B_{x,t} = (1 - \frac{s}{\pi,t}) \pi x_{t} \]

That is, the tax burden on the taxed group equals its tax payment to
the Treasury multiplied by the fraction of its intended burden which it
is able to avoid. This tax burden includes the portion of the indirect
tax burden falling on the taxed group. Similarly, as Krzyzaniak has
shown, one may delineate various relationships between the above tax
burden and the tax burden on the remaining population, both in the
case of a general and of a differential tax on profits.

In line with the recent work of Krzyzaniak the term tax shifting
is used to describe one specific impact of the tax. In particu-
lar, when tax incidence is defined in the traditional manner as the
distribution of the tax-induced change in absolute real income, com-

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5 Marian Krzyzaniak, "The Long-Run Burden of a General Tax on
Profits in a Neoclassical World," mimeographed.

6 Ibid.

7 Marian Krzyzaniak, "The Burden of a Differential Tax on Profits

8 Marian Krzyzaniak, "The Long-Run Burden of a General Tax on
Profits in a Neoclassical World," mimeographed; and Marian Krzyzaniak,
"The Burden of a Differential Tax on Profits in a Neoclassical World,"
mimeographed.
plete shifting of the tax implies that the incidence of the tax is entirely on the untaxed group; that is, the taxed group bears none of the burden of the tax. Zero shifting of the tax, on the other hand, means that the income of the taxed group is reduced by the full amount of the tax. This usage happily coincides with one's intuitive link between the concepts of tax shifting and incidence. 9

The measure of the tax effect on the profits variable corresponds precisely to the above definition of complete tax shifting. Krzyzaniak shows that the same measure of shifting holds in the long run only in the case of a measure on the profits variable. In using short-run measures, however, the tax effect on the rate of return is equivalent to the tax effect on the absolute profits variable since capital is constant. In the ensuing work, therefore, the term shifting is used only when it is one and the same thing to say: 1) that the tax is

9In this Daltonian world it must be stressed what shifting does and does not mean. In particular, 1) Complete shifting of the tax indicates only that the taxed factor is equally well off either net of the tax or in the absence of the tax. Nothing is said of the long-run tax-induced decline which may result in aggregate output (the indirect tax burden which includes the excess tax burden) -- none of which need accrue to the taxed factor. 2) On the other hand, a measure of zero tax shifting indicates only that the taxed factor is made worse off by the full amount of the tax. Once again the long-run indirect tax burden may make the global tax burden much greater than the revenue which accrues to the Treasury. On the neoclassical assumptions, for example (which, as stated, imply that in the short run profits are reduced by the full amount of the tax) it has been shown that this indirect tax burden is very large indeed. On this last point see A. C. Harberger, "Efficiency Effects of Taxes on Income from Capital," in Marian Krzyzaniak (Editor), Effects of Corporation Income Tax, op. cit., pp. 107-17; and Marian Krzyzaniak, "The Long-Run Burden of a General Tax on Profits in a Neoclassical World," and "The Burden of a Differential Tax on Profits in a Neoclassical World," op. cit.
completely shifted; 2) that the burden of the tax is not borne by the taxed group; 3) that the incidence of the tax is not on the taxed group.

We may now turn more specifically to the work of Professors Harberger and Krzyzaniak.

Harberger Contribution

In two important articles A. C. Harberger has considered in some detail the case of a differential tax on income from capital. In his model capital is fixed in total supply, but can be reallocated between two sectors each of which has output distinct from the other, and only one of which has a tax on its profits. His model, therefore, is static, but dealing with a theoretical case of great practical interest since the corporation income tax is imposed uniquely on the earnings of capital invested in the corporate form of business.

The assumed mobility of capital assures that eventually the relative increase of capital in the unincorporated sector will, in equilibrium, equalize the rates of return (net of tax) in the two sectors. And in his general model of the incidence of the corporation tax Harberger shows that although the neoclassical assumptions imply that in the short run the direct tax burden falls entirely on the taxed factor in the taxed sector, at the completion of the long-run adjustments the proportion of the total direct tax burden borne by each factor depends variously on the relative capital-labour ratios

in the two sectors, the price elasticity of demand for the product of the taxed sector, and the elasticities of factor substitution in the output of each sector. On the basis of a single formula\footnote{11} he is able to draw ten "general conclusions". In particular we may note the following restatement of his most general conclusions: 1) The "long-run"\footnote{12} direct tax burden is in all cases spread beyond capital in the taxed sector and in all but one special case\footnote{13} spread beyond the taxed factor in both sectors taken together. Thus labour will, in general, in the long, bear a portion of the tax burden placed initially on capital. The precise proportion in which capital and labour bear the differential tax burden depends in turn on the extent to which the various elasticities differ, and on the initial capital-labour ratios in the sectors. In particular: 2) Granted initially identical capital-labour ratios in each sector, capital (in the aggregate) will bear precisely, more than, or less than the full burden of the tax as the elasticity of substitution in the taxed sector is equal to, greater than, or less than the elasticity of substitution in the untaxed sector.

In his earlier article Harberger considered only the "long-run" distribution of the direct tax burden (defined above as the receipts of the Treasury). His later article considers specifically the

\footnote{11}{A. C. Harberger, "The Incidence of the Corporation Income Tax," \textit{op. cit.}, p. 227.}

\footnote{12}{Since Harberger assumes capital constant in total supply his use of the term "long run" is unique.}

\footnote{13}{Namely, assuming that the elasticity of substitution in demand between the goods of the two sectors and the elasticity of substitution between factors in production in the two sectors are all equal and non-zero.}
indirect tax burden (which he calls "Waste") resulting from the differential tax which induces capital to move in order to equalize the rates of return, net of the tax, in the two sectors. By Harberger's estimate, the indirect tax burden for the United States is approximately $2 billion, or 0.33 percent of gross national output.\textsuperscript{14}

Krzyzaniak Contribution

Krzyzaniak takes up a general case of adjustments to a tax in the context of a neoclassical growth model.\textsuperscript{15} In so doing, he allows capital formation, and thereby makes the adjustments "long run" in the sense in which the term is more commonly used: the Harberger adjustment falls out as a special case of the short run.\textsuperscript{16}

Krzyzaniak finds that Harberger's major conclusion (viz., that in a neoclassical world with a differential tax on profits the movement of capital eventually leads to an equilibrium situation in which the tax

\textsuperscript{14} A. C. Harberger, "Efficiency Effect of Taxes on Income from Capital," \textit{op. cit.}, p. 116. The figure quoted is the average estimated value.

\textsuperscript{15} Marian Krzyzaniak, "Effects of Profits Taxes: Deduced from Neoclassical Growth Models," \textit{op. cit.;} his later mimeographed papers, \textit{op. cit.}, deal more specifically with incidence, whereas the article is concerned primarily with what are here called tax effects.

\textsuperscript{16} The Krzyzaniak contribution is, however, more specific in one respect -- viz. the assumption of constant and identical elasticities of substitution in factor use in both sectors and in the demand for the sectoral products. This assumption was found necessary for reasons of mathematical tractibility (see \textit{ibid.}, p. 58); Krzyzaniak does not think the assumption crucial (\textit{ibid.}). The more common neoclassical assumptions, however, are crucial: perfect competition in the markets for factors and products; factor pricing according to marginal physical product; instantaneous movement of factors to equalize factor prices; linear homogeneous production functions; neutral technical progress; and investment determined by the availability of funds.
burden is spread well beyond the taxed group) is also true in a grow-
neoclassical economy with either a differential or a general tax on
profits. In particular, the short-run rate of return in the taxed
sector is reduced by the full amount of the tax (implying a zero
measure of the tax effect) but recovers to some extent in attaining
its long-run equilibrium value. The extent of recovery depends on
the tax rate itself, the tax effect on the average saving rate in
the economy, and on the share of capital in the taxed sector.

Also, in the short-run the tax reduces the share of output avail-
able to the taxed factor by the full amount of the tax, again imply-
ing a zero measure of the tax effect, the measure this time being on
the share. In the long run, however, there is in general a non-zero
measure of the tax effect on the share, once again in the sense of
recovery from the initial impact of the tax. The extent of recovery
is found to be inversely related to the elasticity of substitution
parameter.\(^\text{17}\)

The essential mechanism inducing these two results centres on the
reduced aggregate propensity to save (because the tax falls exclusively
on profits, out of which the propensity to save is assumed higher) and
therefore to invest (since available funds are invested in a neoclassi-
cal model). The reduced capital formation thus raises the long-run
rate of return to capital, partially restoring it to its pre-tax
position while simultaneously lowering the capital-output ratio and
thereby yielding a negative measure of the impact of the tax on the
capital share.

\(^{17}\)Krzyzaniak, *ibid.*, p. 47.
In terms of tax incidence analysis the major conclusion of Krzyzaniak's work is that theoretical and especially empirical studies of short-run tax effects should concentrate attention on either the profits variable or the rate of return (which, in the short run, is tantamount to working with profits since capital is constant) if any statement is to be made concerning the incidence of the tax. In long-run studies, however, one may go from a measure of tax effect to a statement of tax incidence only by using the measure of the tax effect on an absolute (e.g., profits) variable. He therefore calls that particular measure of the tax effect tax shifting.

Empirical Considerations

In the foregoing measures of tax effects are presented and discussed. However, one of these measures -- the one based on the tax-induced change in absolute profits -- has not been used at all in empirical studies. Empiricists have instead always used the ratios of variables. The fundamental reason is that the absolute variables themselves, in both theoretical and empirical work, can be used most readily in the setting of a static economy: when the profits and tax variables themselves grow it is difficult to use them directly in long-run analysis.

However, in exclusively empirical work, which inevitably uses observations not in long-run equilibrium, it would be possible to work directly with the absolute variables but not without first removing from the points of observation the influence attributable only
to growth. Only in this way is there any prospect of isolating the strictly tax influence. However, removing the influence of growth is very difficult, and might well be regarded as the primary reason that empirically-oriented economists have worked directly with the ratios of growing economic variables. In so doing, the empiricists have support from the neoclassical growth models which in short-run and long-run equilibrium have constant ratios of the various important variables. Furthermore, in using such ratios, as Kryzaniak has noted, one may plausibly assume not only that the influence of growth is removed but also that the assumption of homogeneity is meaningful -- i.e., that important factors other than those taken into account have not resulted in a shift in a secular constant -- and that the observed values are in (short-run, medium-run, or long-run) equilibrium.

Using ratios of variables one can still make inferences from measures of short-run shifting based on such ratios to the interesting concept of the short-run tax burden on the taxed group. In principle, the remaining tax burdens can also be found. In practice, however, one is precluded by statistical intractibilities from inferring much at all from the long-run measure of shifting; the various relationships therefore become tautologies. This is so because the long-run measure of shifting must take into account more tax-induced changes than is operational.

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18 Kryzaniak, "The Long-Run Burden ...," op. cit., p. 11.
19 See, for example, J. R. Hicks, Capital and Growth (Oxford: Oxford University Press, 1965), esp. pp. 20-21, where the importance of the (usually implicit) assumption that observed values are equilibrium values is stressed.
20 Kryzaniak, "The Long-Run Burden ...," op. cit.
Chapter II

Empirical Approach

The fundamental empirical problem in the present study is to isolate the influence of a tax variable on the rate of return to capital in manufacturing corporations. In this chapter two alternative ways in which one might hope to solve this problem are considered. The first involves the estimation of an entire system of equations; the second involves the estimation of a single equation. On several grounds, of which the limited sample size is the most important, it is argued that the latter approach is preferred.

1) Estimation and Reduction of a Complete System of Equations

One way in which the influence of a tax variable on the rate of return might be isolated is by first specifying a system of structural equations in which the rate of return is one of the jointly dependent variables and a tax variable is amongst the predetermined variables in the system. Using econometric techniques consistent estimates of the coefficients of the variables in the system may be obtained, thereby assuring at least a minimal desirable statistical property. Furthermore, if the estimation technique employed is sufficiently robust the estimates will not be seriously impaired by possible misspecification in the equations.

Using the estimates thus obtained, the system could then be solved for each jointly dependent variable as a function of the predetermined variables in the system -- which is to say that the reduced-form
solution to the system would be obtained. In this form the rate of return variable would appear as one of the jointly dependent variables and the influence of the tax variable on it would be isolated. In particular, if the tax variable did not appear in this reduced-form equation its influence on the rate of return is negligible, or at least not statistically significant, which is what neoclassical theory predicts.

However, the estimation of the coefficients in even a medium-sized structural system of equations is a very considerable undertaking, the advantages of which are quite uncertain in the present context. In particular, the dangers of misspecification remain great; and with but a small number of annual observations the very limited size of the structural system of equations which could be estimated would almost certainly involve serious misspecification. If so, the reduced form of the estimated structural system would not be satisfactory. And, as noted, it is the reduced-form solution which is of special interest.

In view of the above comments, therefore, it is judged impossible to seek the reduced-form of a system of equations in the present context. However, the possibility exists of going directly to the estimation of a reduced-form equation, for which the dangers of misspecification are probably less than in the alternative.

2) Estimation of a Reduced-form Equation

If the intermediate process of estimating a structural system is to be by-passed, and analytic and econometric efforts are to be devoted to the estimation of one unconstrained reduced-form equation it is of
especial importance that the nature of the equation be clearly understood. For this reason we turn briefly to two special topics, viz., a) behavioural implications and reduced-form estimation; and b) the inclusion of variables in the reduced-form equation.

a) Reduced-form Estimation and Behavioural Implications

Although one typically ties behavioural equations to structural estimation, in the ensuing study it is desirable to make some connection between the reduced-form of a system of equations and the behavioural implications of the (exogenous) tax variable in particular. It is here argued that in considering different possible tax variables, should any one alone appear in one of the structural equations in an implied system of equations then it alone will reappear in the reduced form: the reduction of a system of equations leaves the variables themselves, altering only their coefficients.¹ In this way one may grant to Krzyzaniak and Musgrave (hereafter "K-M") the behavioural importance which they attach to the tax variables tested in their reduced-form equation, although they failed to recognize that such a problem exists.²

b) Reduced-form Estimation and the Inclusion of Variables

In the present study it is of primary concern to isolate the influence of the tax variable on the rate of return. The dependent variable will, therefore, be the rate of return and some tax variable

¹It is, of course, possible that more than one tax variable would appear in the structural system in which case more than one may appear in the reduced-form equation of interest. That hypothesis is tested below.
²See, for example, K-M, op. cit., pp. 26-27, and p. 49.
will be amongst the predetermined variables included. However, in order to isolate the influence of the tax variable other variables need to be included in the equation. Furthermore, some means must be found by which one can be fairly confident that the other variables remaining in the final equation have, in fact, separated out the bulk of the non-tax influences. But how can this be done -- particularly in the normal econometric case involving a small number of observations but a large number of factors thought to be of some importance?

It is in these circumstances that one has a good possibility of valuable empirical work using the reduced-form equation directly. In the unconstrained reduced-form equation the variables included are not of importance in themselves, but rather in their ability to represent a spectrum of variables and thereby remove, in this case, the non-tax influences on the rate of return while isolating the influence of the tax. The variables are chosen by alternatively selecting variables for inclusion in the equation or removing them on the statistical grounds of insignificance or collinearity with the other predetermined variables; it is then claimed that the final selection of included variables effectively isolates the influence of the tax. However,

3 Slitor would appear not to be quite convinced of the above rationalization of the included variables, although his description of the nature of the specific variables chosen in the K-M study may be attributed to the various classes of variables significant in explaining profits. His more general point of possible inadequate or incorrect specification is, however, well taken ("Corporate Tax Incidence: Economic Adjustments to Differentials under a Two-Tier Tax System," by Richard E. Slitor in Marian Krzyzaniak (Editor) Effects of Corporation Income Tax, op. cit., pp. 155-61). Goode, too, is most concerned with the particular variables included, objecting to the inclusion of lagged endogenous variables, and suggesting the inclusion of contemporary endogenous variables which would of course, violate the reduced form (Richard Goode, "Rates of Return, Income Shares, and Corporation Tax Incidence," ibid., pp. 214-16).
if it is found that the further inclusion of any admissible predetermined variable, itself statistically significant in the equation, substantially changes the coefficient of the tax variable and through it the estimated measure of shifting, the influence previously attributed to the tax variable is unjustified. 4

The approach outlined above is the one which, in fact, has been adopted in the econometric work to follow. By way of comparison with other econometric work, it is compatible with the ideas of Ta-Chung Liu who offers support for going immediately to the reduced form when he argues that the genuine, albeit circumvented, problem of structural estimation is that of underidentification of the equations. Thus, he concludes, "the least squares reduced forms are likely to be better forecasting equations than the reduced forms obtained by solving the (improperly) overidentified structural relationships." 5 It is, of course, crucial to the present study to be able to predict the influence of the tax (or a change in the tax) on the profitability (i.e., the rate of return) of a corporation. Franklin Fisher lends inadvertent support to the present position when he notes that "it may indeed be that many or all a priori restrictions used (in estimating structural models) are not 'good enough' approximations (in the sense

4 In their later comments, K-M substantially agree with this view in saying "... we grant that the value of our results would be greatly reduced if the tax coefficient were shown to be quite sensitive to admissible changes in specification of the estimating equation," Krzyzaniak and Musgrave, in Krzyzaniak (Editor), op. cit., p. 252.

that they lead to inconsistencies too large to be tolerated)."\(^6\) The \textit{a priori} restrictions which would have to be made in order to estimate the small structural system possible with the limited number of observations would in all likelihood be of this sort.

The method used here, however, differs from Liu's in that he suggests including even jointly dependent variables in the forecasting equation since that "will improve the efficiency of the equation."\(^7\) Fisher's point, however, is that in "applying restrictions in the estimation of the reduced form one trades consistency for efficiency"\(^8\) leaves the matter open to question.

The Krzyzaniak-Musgrave Reduced-form Model

The Krzyzaniak-Musgrave single-equation reduced-form model of the rate of return appears as a very natural outcome of the sort of reasoning and estimation procedure described above. In particular, their estimated model is

\[ Y = f(\Delta c_{-1}, v_{-1}, j, l) \]

where the variables are defined:

\(^7\)Liu, \textit{op. cit.}, p. 861.
\(^8\) \textit{op. cit.}, p. 149.
$Y$ the before-tax rate of return to capital;

$\Delta C_{t-1}$ the change in the ratio of consumption to gross national product;

$V_{t-1}$ the inventory-to-sales ratio in manufacturing;

$J$ a personal tax variable, defined as government revenue at all levels, excluding the corporation income tax revenues and transfer payments, and standardized by G.N.P.; and

$L$ the tax variable which may also be the statutory tax rate ($Z$).

**Tax Variables**

To derive a measure of shifting based on the rate of return one must specify the form of the tax variable. Any number of formulations is possible. Thus far the published empirical works have employed two forms: a) the rate of taxation on capital ($T/K_{t-1}$, defined "L"); and b) the rate of taxation on profits, defined to be either the effective rate of taxation ($T/P$, or "Z") or the statutory tax rate ("Z"). In the K-M study these two variables, when introduced into a model, yield Model A and Model B, respectively; their notation is continued here. The profits tax rate may seem the more natural of the two variables since it is in terms of this tax rate that the legislature established the corporation income tax. One may also anticipate that businessmen would react to the tax to the extent that it reduced profits -- i.e., that they would be influenced in their behaviour by the same profits tax rate variable. However, the alternative, Model A, tax variable which one might view as a "negative rate of return" variable could equally be

---

important in a behavioural sense. One might argue, for instance, that the businessman (in a dynamic setting) is concerned with his rate of return (and hence whatever detracts from it) rather than simply his absolute level of profits. It seems, then, that the matter is essentially empirical. The inclusion of both tax variables may even be appropriate since not all manufacturing corporations may react in a similar manner to the tax -- a substantial portion may react in a manner consistent with each hypothesis.

Model A and the Instrumental Variable Approach

In Model B, which uses the (exogenous) tax rate as the tax variable, ordinary least squares estimation of the equation is clearly justified. However, to the extent that one can claim behavioural implications for the formulation of a reduced-form equation one would also wish to test the behavioural implication that the impact of the tax on corporation income is viewed as a tax on the rate of return, in the sense that the tax represents a negative rate of return. That is, one would like to be able to test Model A.

The plausibility of Model A is generally recognized. In particular, in a growing economy firms would be acting irrationally if their sole concern with the tax in other than the quite short run were its

\[10\] It is valid to question whether the tax rate itself is properly deemed exogenous: legislators may be induced to change the rate precisely because of the prevailing economic conditions. This, however, is unlikely to be found empirically accurate and for present purposes the statutory tax rate is regarded as exogenous.
impact on profits alone. Clearly one could invest in sufficient amounts to maintain the absolute level of profits in the face of any tax rate less than 100 percent, but the rate of return would approach zero as investment increased.

If, however, the Model A tax variable (i.e., "L") is included the equation may not be consistently estimated using ordinary least squares. Krzyzaniak and Musgrave recognized this problem, arguing that "in this case the tax variable is not independent and the system is not fully reduced." They used the instrumental variable approach in order to obtain consistent estimates of the coefficients. Subsequently, however, they explicitly recognized that the L tax variable may also be viewed as a non-linear rather than a dependent variable and, therefore, that one may justify the use of the instrumental variable approach as a means to estimate its non-linear influence.

Using the above notation, this may be seen as follows:

1) \[ Y = a_0 + a_1 \Delta C_{-1} + a_2J + a_3V_{-1} + a_4L \]

\[ L \frac{T}{P} \frac{P}{K_{-1}} = Z*Y \]

2) \[ Y = a_0 \frac{1}{1-a} Z^* + a_1 \frac{\Delta C_{-1}}{1-a} Z^* + a_2 \frac{J}{1-a} Z^* + a_3 \frac{V_{-1}}{1-a} Z^* \]

---

11 Krzyzaniak-Musgrave, op. cit., p. 34.


13 In Krzyzaniak (Editor), Effects of Corporation Income Tax, op. cit., pp. 248-49.
Equation (2) is a simple transformation of equation (1); however, it is non-linear. Furthermore, in this form one cannot estimate separately the coefficient $a_4$ which, as it happens, is the coefficient of primary interest. However, one may obtain consistent estimates of the coefficients in this assumed non-linear reaction to the tax by using the instrumental variable approach to estimate the equation in form (1). Viewed in this way, the K-M Model A is relieved of much otherwise serious criticism, in that one may now argue that the estimated coefficients are those of a fully reduced equation and that the tax effect has, therefore, been isolated. This claim could not be made if any of the included variables were deemed dependent.

The Instrument

There remains the matter of selecting the instrument to be used in the estimation of the above equation. It happens that the instrument in this particular case is rather obvious -- viz., the tax rate -- which in itself lessens the objection of "the arbitrary nature of the variables chosen as instrumental."\textsuperscript{14} Furthermore, the tax rate is rather highly correlated with the tax liability on capital. And, if the statutory tax rate is used as the instrument the "great difficulty of checking on the assumption that each instrumental variable is independent of each and all the errors of observation"\textsuperscript{15} is beside the point.

\textsuperscript{15} J. Johnston, \textit{ibid.}
On statistical grounds, therefore, it would seem that the statutory marginal tax rate is the preferred instrumental variable; it is used in most of the empirical work to follow. In point of fact, however, it made little difference in the K-M study whether the instrument was the statutory or effective tax rate, although the effective tax rate is not an exogenous variable.

Finally, in considering the model to be used attention must be paid to the rate of return variable itself.

Equity vs. Total Rate of Return

The imposition of a tax tends to induce adjustments on the part of the taxed group such that the impact of the tax is minimized. In the case of immediate interest -- the tax on corporation income -- one can readily formulate a lengthy list of ways to lessen the impact of the tax by considering the nature of the tax base, viz., taxable income, and the fact that, by law, certain expenditures are deemed tax deductible while others are not. One particularly conspicuous, and frequently mentioned, non-neutrality in the existing tax system is the inclusion as a tax allowable expense the costs of debt financing (i.e., interest payments) and the exclusion of the costs of equity financing (i.e., dividend payments).16 As the tax on corporation income increased

from the low levels of pre-World War II to the subsequent high levels any substantial changeover from equity to debt financing would be statistically discernible. It is, therefore, unfortunate that in the empirical work on the Canadian economy the lack of data has made it impossible to distinguish systematically between these two forms of capital. Nevertheless, in order to make clear the distinction between the two concepts we shall define them and briefly consider the empirical findings in the American economy.

The rate of return to equity capital is defined as the ratio of taxable income to the book value of stocks (common plus preferred) plus surplus (or less deficit). The rate of return to total capital is analogously defined as the ratio of taxable income plus interest payments to equity capital plus interest-bearing debt. In order to obtain a measure of shifting not biased by the means of financing, the K-M study worked with both ratios, but emphasized the latter. On the equity capital base, their estimated measure of shifting was 123 percent,\textsuperscript{17} while on the total capital base (their standard model) the measure was 134 percent.\textsuperscript{18} The relationship between these estimates is consistent with a tax-induced movement to greater debt finance. The two measures, however, are of the same order of magnitude, which lends support to the view that the means of financing is determined largely by non-tax factors.\textsuperscript{19} It is, therefore, assumed that the influence of any relative increase in debt financing in Canada has had a similarly small impact on the measure of tax shifting.

\textsuperscript{17}See K-M, \textit{op. cit.}, p. 55, line 3.

\textsuperscript{18}K-M, \textit{op. cit.}, p. 45, line 3.

In addition, for reasons of comparability, all the empirical work reported in the remainder of this study, including the replication of the American case, is in terms of the equity capital base.

Summary of Conclusions

In this chapter it is argued that in order to isolate the influence of the corporation income tax on the rate of return to capital it is necessary to estimate a reduced-form equation. Only in the reduced form is the explicit dependence of the dependent variable (the rate of return) on the predetermined variables (including the tax) made clear. It is further argued that the best feasible way in which to attempt to isolate this influence is to approach the problem directly by the estimation of the coefficients in a reduced-form equation. In such an equation the dependent variable would obviously be the rate of return and a tax variable would be amongst the predetermined variables in the system.

The alternative is the specification and estimation of an entire system of structural equations which describe a much broader set of behavioural and technological relationships in the economy, but which would also contain the same rate of return and tax variables. Once estimated the structural system of equations may be solved for the "constrained" reduced form, and the impact of the tax variable on the rate of return again made apparent. However, the direct estimation of a single reduced-form equation is preferred primarily because the limited sample size would permit the estimation of only a quite small system of equations, thereby making the dangers of misspecification
very great.

Since direct estimation of a single unconstrained reduced-form equation is to be undertaken specific important problems are considered -- viz., the role of behavioural assumptions and the inclusion of variables in the equation. It is argued that the behavioural assumption associated with structural estimation is maintained in the reduced form, and that there is a reasonably satisfactory basis on which variables may be selected for inclusion in the reduced-form equation. In this connection the K-M preferred model is discussed, and possible tax variables considered.

One problem arises when, on a priori grounds, it is desired to include as the tax variable the "negative rate of return" concept (the ratio of the tax payment to capital): its inclusion precludes the use of ordinary least squares in obtaining consistent estimates. The problem is resolved by introducing the instrumental variable approach.

Finally, the rate of return variable itself is considered. It is noted that while the difference between the return to equity capital and total capital may in part be tax induced, Canadian data availability necessitates the adoption of the former base in the empirical work. It is likely, however, that the particular choice of base does not make a substantial difference to the measure of shifting eventually obtained.
Chapter III

Experiments with the Krzyzaniak-Musgrave Estimating Model for the U. S. Economy

In this chapter major portions of the K-M study are reworked in order to incorporate corrections and revisions in their input data, and to re-estimate their equation using an alternative body of data available on manufacturing corporations. Their preferred equation is also used to predict the rate of return in U. S. manufacturing corporations for the years following their time coverage. In the course of this chapter the various major criticisms which have been raised in connection with their study are considered.

I Replication of Portions of the K-M Study

In this section the K-M model used to estimate the short-run shifting of the corporation profits tax on manufacturing corporations operating in the U. S. is replicated; the replication is limited in coverage to the equity capital base, and extended in time coverage, utilizing data made available since the publication of their study.

Data Corrections

In re-working the K-M study minor corrections in the input data were found necessary. The data used in the present study is recorded in the Appendix.
Symbols and Definitions

The basic K-M model is stated above, at which point the variables used are also defined. In addition the following symbols and definitions are used in the empirical results reported in Tables 1 and 3:

\( G_f \) \hspace{1cm} \text{Federal government expenditures on goods and services, standardized by gross national product.}

\( I_f \) \hspace{1cm} \text{the ratio of federal corporation income taxes paid by manufacturing corporations to equity capital, the series on a fiscal basis.}

\( I_n \) \hspace{1cm} \text{the ratio of federal corporation income taxes paid by manufacturing corporations to equity capital, the series on a calendar-year basis.}

\( Z \) \hspace{1cm} \text{the statutory marginal federal government tax rate on corporation income.}

\( Z^* \) \hspace{1cm} \text{the effective tax rate on corporation income.}

The Krzyzaniak-Musgrave Standard Model: Replication

In table 1, line 1 and 2, the estimated coefficients of the K-M standard model (equity capital base) are compared with the estimates incorporating corrections in the input data. The estimated coefficients remain of the same general order of magnitude, while the overall measure of goodness of fit rises and the t-score for the consumption term more than doubles. The estimated measure of shifting is one of overshifting, which may be accepted at the 95 percent level of confidence; 100 percent shifting may be accepted at the 99 percent level of confidence.
Using the revised model (equation 2) it is found that the addition of the three years of data which have become available since the publication of their study makes very little difference to the coefficients of the reduced-form equation; the results are reported in lines 3 through 5.

In line 6 the instrument is changed. Rather than using the effective tax rate (as K-M did) the statutory (marginal) rate is employed. The estimated coefficients and their t-scores remain virtually unaltered. While it has been argued (above) that K-M should have used the statutory rather than the effective tax rates on the grounds that the former more nearly meets the statistical requirement of being an exogenous variable in the system, the point is apparently of little empirical significance.

In line 7 the K-M standard revised model is again estimated, but this time in first difference form. By estimating the first differences of the equation one would hope both to reduce the amount of serial correlation which may be contaminating the estimates, and to guard against the possibility that the high estimate of tax shifting is the result of both the tax rate and the rate of return moving generally upward. In the first difference estimate the standard errors rise, as one would anticipate, but the point estimates -- in particular, the point estimate of tax shifting -- remain of the same order of magnitude.

Finally, in equations 8 and 9 the federal government expenditures on goods and services is included. With both twenty and twenty-three observations the government variable is found to be both insignificant and collinear, especially with the tax variable and is, therefore,
Table 1.
Tax Shifting in the American Economy
- the Krzyzanik-Musgrave Model A, Equity Base -

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>No. of Observations</th>
<th>Regression Coefficients, [t]-scores</th>
<th>Instrument</th>
<th>$R^2_{1}$</th>
<th>D-W(2) Stat</th>
<th>Shifting Measure, Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Intercept $\Delta C_{-1}$ $V_{-1}$ $J$ $L_F$ $G_F$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>K-M Standard Model through 1959</td>
<td>20</td>
<td>0.423 0.343 -0.094 -1.178 1.233</td>
<td>Z*</td>
<td>.950</td>
<td>2.43</td>
<td>1.233 (0.118)</td>
</tr>
<tr>
<td>2</td>
<td>K-M Standard Model-Revised through 1959</td>
<td>20</td>
<td>0.382 0.722 -0.075 -1.155 1.305</td>
<td>Z*</td>
<td>.958</td>
<td>2.78</td>
<td>1.305 (0.117)</td>
</tr>
<tr>
<td>3</td>
<td>Revised Model through 1960</td>
<td>21</td>
<td>0.383 0.727 -0.075 -1.170 1.308</td>
<td>Z*</td>
<td>.960</td>
<td>2.78</td>
<td>1.308 (0.111)</td>
</tr>
<tr>
<td>4</td>
<td>Revised Model through 1961</td>
<td>22</td>
<td>0.384 0.727 -0.075 -1.170 1.308</td>
<td>Z*</td>
<td>.960</td>
<td>2.79</td>
<td>1.308 (0.107)</td>
</tr>
<tr>
<td>5</td>
<td>Revised Model through 1962</td>
<td>23</td>
<td>0.380 0.727 -0.075 -1.147 1.303</td>
<td>Z*</td>
<td>.960</td>
<td>2.75</td>
<td>1.303 (0.104)</td>
</tr>
<tr>
<td>6</td>
<td>Revised Model through 1962</td>
<td>23</td>
<td>0.371 0.729 -0.071 -1.144 1.331</td>
<td>Z</td>
<td>.962</td>
<td>2.75</td>
<td>1.331 (0.100)</td>
</tr>
<tr>
<td>7</td>
<td>First Differences through 1962</td>
<td>21</td>
<td>0.002 0.819 -0.410 -0.206 1.204</td>
<td>$\Delta Z$</td>
<td>.790</td>
<td>2.39</td>
<td>1.204 (0.243)</td>
</tr>
<tr>
<td>8</td>
<td>Revised Model through 1959</td>
<td>20</td>
<td>0.346 0.586 -0.061 -1.113 1.495 -0.071</td>
<td>Z*</td>
<td>.970</td>
<td>3.11</td>
<td>1.495 (0.191)</td>
</tr>
<tr>
<td>9</td>
<td>Revised Model through 1962</td>
<td>23</td>
<td>0.343 0.585 -0.062 -1.074 1.472 -0.065</td>
<td>Z*</td>
<td>.970</td>
<td>2.97</td>
<td>1.472 (0.170)</td>
</tr>
</tbody>
</table>

(1) R-squared, adjusted for degrees of freedom
(2) The Durbin-Watson statistic
(3) K-M, Table 7-1, line 3.
excluded from the standard model. It is, however, recognized that the impact of the government variable on the rate of return has not been satisfactorily isolated: the tax variable must, therefore, be regarded as encompassing the influence of both. K-M argue plausibly that the insignificance of the government variable indicates that its role is much weaker. Their defence, however, could go beyond a statement of plausibilities only by the addition of points of observation such that the series were no longer collinear. In the Canadian data this problem did not exist (see Chapter V, below).

II Model A: Prediction

One important implication of the reduced-form estimation technique is its potential as a tool of prediction. The accuracy of the rate of return as predicted by the K-M equation is indicated in Table 2, where the actual and predicted rates of return are tabulated, together with the difference separating them as a percent of the actual value.

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1 K-M, op. cit., p. 47.
Table 2

The Actual Rate of Return in Corporate Manufacturing in the U. S., and its Value as Predicted by the K-M Standard Equation

<table>
<thead>
<tr>
<th>No.</th>
<th>Year</th>
<th>Actual Value</th>
<th>Predicted Value</th>
<th>Percent Difference</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>1929</td>
<td>8.8</td>
<td>13.5</td>
<td>53.4</td>
</tr>
<tr>
<td>2</td>
<td>1959</td>
<td>16.1</td>
<td>(1)</td>
<td>(1)</td>
</tr>
<tr>
<td>3</td>
<td>1960</td>
<td>13.7</td>
<td>13.8</td>
<td>0.7</td>
</tr>
<tr>
<td>4</td>
<td>1961</td>
<td>13.3</td>
<td>13.2</td>
<td>0.7</td>
</tr>
<tr>
<td>5</td>
<td>1962</td>
<td>14.4</td>
<td>13.9</td>
<td>3.5</td>
</tr>
</tbody>
</table>

(1) Not predicted since the year 1959 is included in the estimation of the K-M standard equation. The "actual value" is included to allow comparison with the year 1960.

The inability to predict the year 1929 is clear. However, the inability to predict the year preceding the greatest depression of the century may not be a serious indictment, especially when one considers the substantially modified policies espoused by economists and to some extent, adopted by government before and after the depression. In addition, the statistics on which the prediction is based are themselves very suspect since observations on the lagged endogenous variables are from the years preceding the establishment of national accounting in the United States.²

For the three latest years the predictions are quite accurate and,

²Nevertheless the prediction is considerably more accurate than the naive prediction implied by Slitor and by Goode; see below.
furthermore, the predicted value changes in the same direction as the actual value each year. This period, as it happens, provides an important test of the model since it involves a constant tax rate during fluctuations in the level of aggregate economic activity.

Model A: Re-Estimated, Using a Different Manufacturing Corporation Series

The K-M model, as reported above, is developed using a combination of fiscal year data (from the Statistics of Income) and calendar year (or national accounts) data. Since the data incorporated are available entirely on the calendar-year basis it is useful to re-estimate the function incorporating this new body of data. The alternative estimates of manufacturing corporations' profits, taxes, and capital have been obtained from the Federal Trade Commission and Securities and Exchange Commission publication Quarterly Financial Report for Manufacturing Corporations (hereafter the "FTC publication"). Besides providing more recent data (in that the FTC publication is available in the quarter following the period covered, whereas the Statistics of Income is at least two years behind) the FTC data have the potential advantage of being available on a quarterly basis.

For present purposes it is necessary, in order to obtain a sufficient number of annual observations, to include the period 1935-42 even though the FTC data were not published prior to 1947. In order to estimate the relevant series the simple correlation coefficients of the
<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>No. of Observations</th>
<th>Regression Coefficients,{</th>
<th>\text{their t-scores}</th>
<th>Instrument</th>
<th>R^2_{a} \text{(1)}</th>
<th>D-W Stat \text{(2)}</th>
<th>Shifting Measure, ( ) Standard Error</th>
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</thead>
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<tr>
<td></td>
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<td>Intercept</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ΔC_{-1}</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>to 1959</td>
<td>20</td>
<td>0.40</td>
<td>0.72</td>
<td>-0.07</td>
<td>-1.27</td>
<td>1.413</td>
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<td>[3.58]</td>
<td>[3.12]</td>
<td>[5.12]</td>
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</tr>
<tr>
<td>2</td>
<td>to 1964</td>
<td>25</td>
<td>0.39</td>
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<td>-0.07</td>
<td>-1.05</td>
<td>1.34</td>
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<tr>
<td>3</td>
<td>to 1959</td>
<td>20</td>
<td>0.388</td>
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<td>-0.065</td>
<td>-1.277</td>
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<td>[2.94]</td>
<td>[5.20]</td>
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<td>4</td>
<td>to 1964</td>
<td>25</td>
<td>0.361</td>
<td>0.633</td>
<td>-0.066</td>
<td>-1.040</td>
<td>1.390</td>
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<td>[5.26]</td>
<td>[12.89]</td>
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<td>5</td>
<td>post-war only-</td>
<td>17</td>
<td>0.46</td>
<td>0.82</td>
<td>-0.14</td>
<td>-0.72</td>
<td>0.980</td>
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<td>[2.21]</td>
<td>[2.15]</td>
<td>[4.79]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) R-squared, adjusted for degrees of freedom
2) The Durbin-Watson statistic
profits, taxes, and capital series as drawn from the post-1949 series
of Statistics of Income and the FTC were compared. For all three series
the simple correlation coefficient was found to be in excess of 0.90.\textsuperscript{3}
The ratio of the FTC series to the Statistics of Income series was then
calculated for the period 1950-1962, and the 1935-42 figures for the
latter series adjusted accordingly.

Using the data obtained in this manner, the instrumental variable
approach was used to estimate the equations reported in Table 3. In
the first two lines the instrument for the tax variable is the effect-
ive tax rate, while for the next two lines the instrument is the statutory
marginal tax rate. For both instruments the periods 1935-42, 1948-59
and the extension to 1964 are estimated. The results are not sub-
stantially different from those reported by K-M. The estimated measures
of shifting continue to indicate overshifting of the corporation income
tax, even though the inclusion of the years 1960-64 results in a reduc-
tion of the estimated degree of shifting.

The above remarks may also be considered in view of a quotation
from Richard Sliter:\textsuperscript{4} The K-M selection of years and sources of data
on manufacturing corporations "must have governed the results to a
considerable degree since, with the exception of the late fifties, the
periods included were consistently characterized by rising trends of

\textsuperscript{3} The simple correlation coefficients are: for profits, 0.924;
for taxes 0.991; and for capital (stockholders' equity), 0.999.

\textsuperscript{4} Op. cit., p. 163.
profits and tax rates." The relevance of this comment is doubtful in view of the virtually unaltered estimate of tax shifting as a result of increasing the sample size by 25 percent (or, by five observations) and, particularly since the statutory tax rate remained at a level of 52 percent until 1964, when it was reduced to 50 percent. Furthermore, the average annual rate of return was lower during the period 1959-64 than during either 1949-59 or 1954-59.

Finally, as reported in line 5, the FTC data are tested for the period 1948-64 alone. While the measure of shifting dropped, it still remains high at 98 percent. However, with the smaller number of observations the standard errors rise, and the measure of shifting may be accepted only with a lesser degree of confidence.

III The Slitor-Goode Critique

In the course of their detailed critical reviews of the K-M study\(^5\) both Slitor and Goode emphasize the important role of possible misspecification in the K-M model, and imply the existence of a serious identification problem in the study. Slitor is especially clear on these points, arguing that one cannot remove the influence of collinear time trends in the rate of return and the tax rate series by the conventional technique of using first difference since "it seems apparent that the historical relationship (not a matter of single collinear time trends, but several major episodes) dominates the K-M results."\(^6\)

---

To test the hypothesis that tax rates have jumped at the same time as the general level of economic activity and that, in fact, it is the latter which has had the major influence on the rate of return, both Goode and Slitor suggest including in the K-M preferred equation a variable indicative of the general level of economic activity; they both chose the Knowles ratio of actual to potential output which they designate the "pressure variable (Pr)". Goode tested the "ratio of actual manufacturing production to its estimated high-level trend" as well\(^7\) designated the "capacity utilization variable (Q)". They found that the inclusion of Pr did, in fact, substantially influence the estimated measure of shifting, reducing it by about 38 percent of the original estimate;\(^8\) furthermore, this variable is surprisingly collinear with both the rate of return and the L tax variable (0.93 and 0.95, respectively), thereby, they conclude, making it impossible to distinguish their separate influences on the rate of return. The capacity utilization variable (Q) is similarly highly collinear, but Goode does not report estimates of the K-M rate of return equation incorporating both Q and L.

In their rebuttal\(^9\) K-M deal directly with the problem of possible misspecification by arguing against the inclusion of the pressure variable on three grounds: 1) The pressure measured by this variable is, in part, caused by the tax itself and thus a dependent variable.

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\(^7\) For sources, see their bibliographies.
One might add that this is obviously the case if, in fact, the corporations are attempting to shift the tax in the face of an overall short-run inelastic demand curve. 2) The inclusion of the pressure variable lagged one period, on the other hand, is econometrically legitimate, but the coefficient becomes insignificant, and its inclusion fails to influence the tax variable coefficient. They also test a conceptually superior pressure variable -- viz. Klein's percentage-of-utilization-of-capital series -- to find that the inclusion of the variable unlagged reduces somewhat the measure of shifting (for the post war years alone, from 1.205 to 1.056) while the inclusion of the series lagged one period reduced the estimated measure less (from 1.205 to 1.105). 3) If the reduce-form equation is well specified (i.e., if all relevant variables are included) the explicit inclusion of such a pressure variable would be entirely redundant since the included variables would themselves fully account for such pressure. While not claiming completeness for their model, K-M do maintain that the included variables should at least account for a substantial portion of the "pressure" in the economic system.

Should one fail to be convinced by their rebuttal, thus far exclusively on statistical grounds, K-M discuss what is here distinguished as an identification problem by commenting on the general plausibility test postulated by Goode, who found the predicted rates of return of 7.2 percent for the period 1955-57, assuming the 1936-39 level of taxation, very unlikely. In particular, they argue that if the abovementioned

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10 Ibid., p. 251, Table 32.
11 Ibid., p. 251.
pressure or the capacity utilization variable and not the tax variable is the dominating influence in determining the generally higher rates of return during the high-tax period then that same variable should also provide a more accurate prediction of the rate of return in the 1920's. In testing this hypothesis, K-M find that the capacity-utilization variable predicts a before-tax rate of return of 17.5 percent for the year 1929 when, in fact, the rate of return was 8.1 percent. Although K-M did not predict the same year using their own standard equation, that has been done in this study. The resulting prediction cannot be considered accurate at 13.5 percent but it is considerably closer than the prediction implicitly suggested by Goode.

Conclusions

The original K-M model -- used to measure the degree to which American manufacturing corporation shift the short-run tax burden of the corporation income tax -- stands up very well to a series of tests undertaken here. In particular, the estimated coefficients are not markedly affected either by increasing the sample size (by using data made available since the publication of their study) or by using an alternative set of data on American manufacturing corporations. A not unrelated point is that their original equation also predicts quite accurately the rate of return in U.S. manufacturing corporations for those years following publication of the K-M study.

12 In Table 2 of this chapter.
Chapter IV

The Canadian Economy: Institutions, Data and
a Preliminary View of Tax Shifting

In view of the ability of the K-M model to withstand the replication and extensions reported in the previous chapter it seems worthwhile to consider the application of their basic approach to other economies. In this chapter and the following, therefore, their approach is adapted to the Canadian context.

It is widely recognized that the Canadian economy has close economic ties with the American economy in that (i) a very substantial portion of almost every sector of the Canadian economy is American owned, and (ii) a large and increasing portion of Canada's external trade is with the United States. One might, therefore, anticipate that typically the business reaction to economic influences (for example, the behaviour with respect to the tax on profits) would parallel closely the American counterpart. As we shall see, a broadly similar model yields measures of shifting of the same order of magnitude in Canada as the foregoing indicates was found in the United States.

However, before proceeding to the presentation and discussion of empirical findings for the Canadian economy, it is appropriate to

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consider the system of corporations taxation in Canada with a view
to pointing up institutional peculiarities -- especially those which
might prove amenable to further empirical work.

Profits Taxation in Canada

In Canada both the personal and the corporation income tax were
established by the Income War Tax Act of 1917. In its origins and
throughout its history the corporation income tax in Canada has re-
mained substantially similar to its U. S. counterpart -- and this in
spite of frequent interpretations by the courts defining taxable
income by English precedents.2 The marginal statutory rates, defined
as employed in this study, together with the rates used in the American
study, are depicted in graph 1.

One of the more obvious English influences in the court inter-
pretation of income has been the exclusion of capital gains from taxable
income. It is, however, probable that the economic impact of this
peculiarity has not been great inasmuch as what qualifies as a capital
gain has become increasingly narrowly defined. Unfortunately no way
has been found to undertake a test of the impact of this peculiarity
of Canadian taxation since figures on capital gains are not available
in the aggregate (they are not included in the national income accounts);
nor are the figures regularly or consistently reported in the published
financial statements of corporations.

2On the corporation income tax in Canada see J. Harvey Perry,
"Development of the Canadian Corporation Income Tax," The Canadian
Chartered Accountant, January, 1951; Taxation in Canada
(Sponsored by the Canadian Tax Foundation; University of Toronto Press,
1961), Ch. 3; and John R. Allan, The Income Tax Burden on Canadian
Stockholders, (Queen's University Papers in Taxation and Public Finance,
No. 2, Sponsored by the Canadian Tax Foundation, 1966), Ch. 2.
The greatest institutional difference in the Canadian system of corporation taxation, vis-a-vis the U. S. counterpart, stems from the fact that Canada is divided into a relatively small number of provinces (ten since 1949, nine previously) all of which have directly taxed the corporations based in their particular jurisdictions during some portion of the period under study. Furthermore the two central provinces (Ontario and Quebec) account for a substantial majority of the total manufacturing output and sales in the entire country; \(^3\) these two provinces have levied a significant tax on corporation income, especially since World War II. It is, therefore, essential that the provincial taxation of corporation income be taken into account when one considers any aspect of corporation taxation in Canada.

In Table 4 the statutory tax rates legislated by the federal government and by the two central provinces are reported for the period 1935-1964. Omitting from consideration the war years, the federal government has had a two-tier level of corporation taxation since 1949; not only the rates, but the amount of income to which they apply has changed. The provinces have levied a single, and substantially lower profits tax. With the various complications resulting from the existence of two tax rates at the federal level and unsynchronized rates at the provincial level, there is no completely satisfactory way to combine

\(^3\)In 1959, for example, Ontario and Quebec together accounted for 80.8 percent of the national "census value added by manufacture;" source: M. C. Urquhart (Editor), *Historical Statistics of Canada*, (Cambridge: At the University Press, 1965), p. 464.
the rates into one rate which might be considered the tax rate. It would be possible to work with the "effective tax rate" (defined as the corporation income tax payment to all levels of government divided by corporation profits) but such a variable would have undesirable statistical properties since it is not clearly exogenous. The solution adopted is to use the marginal federal statutory tax rate plus the average of the rates imposed by the provinces of Ontario and Quebec, exclusive of the federal government rebate allowed those provinces, as the statutory tax rate. By way of comparison, one could not easily adopt this expedient in the U. S. economy since manufacturing corporations are much more widely scattered throughout fifty states. One would, therefore, be obliged to use the effective tax rate, or the rate levied by the federal government alone.

The third and final peculiarity of Canadian corporation income taxation to be noted here is the existence of a fairly substantial dividend tax credit which non-corporate recipients of dividend payments from Canadian-based corporations may deduct from their total earnings in arriving at a figure for taxable income. (Corporate dividend recipients are not taxed on dividend receipts from other corporations in Canada). A 10 percent tax credit was introduced in 1949 in a partial attempt to reduce the alleged double taxation of corporation income; in 1953 it was raised to 20 percent at which level it has subsequently remained.4 If one views the corporation in its capacity as an income-earning agent for its stockholders the tax rate is effectively reduced

Table 4
Statutory Profit Tax Rates in Canada

<table>
<thead>
<tr>
<th>Taxation Year</th>
<th>Federal Tax 1)</th>
<th>Provincial Tax 2) less Federal Rebate</th>
<th>Total</th>
<th>Effective Rate of Dividend Tax Credit</th>
<th>Rate net of Effective Dividend Credit</th>
</tr>
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<tr>
<td></td>
<td>Max, Income Taxable at Lower Rate ($ .000) (%) (%)</td>
<td>Lower Rate (%)</td>
<td>Marginal Rate (%)</td>
<td>Ontario (%)</td>
<td>Quebec (%)</td>
</tr>
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<td>I</td>
<td>II</td>
<td>III</td>
<td>IV</td>
<td>V</td>
<td>VI</td>
</tr>
<tr>
<td>1935</td>
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<td>7.0</td>
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<td>49.0</td>
<td>49.0</td>
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<td>1955</td>
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<tr>
<td>1964</td>
<td>35</td>
<td>22.0</td>
<td>50.0</td>
<td>2.0</td>
<td>2.0</td>
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</table>


1. Includes Old Age Security Tax
3. VIII = IV + VII.
4. Assuming one-half of after-tax profits is distributed.
5. This is the rate charged on taxable income greater than indicated in Col. II.
by the existence of the dividend tax credit. In Table 4, column IX, the "effective rate of dividend tax credit" is tabulated. It is defined as the percent by which the tax on corporation profits is reduced, assuming that one-quarter of annual profits is distributed to personal income recipients. Subtracting the effective dividend credit rate from the statutory rate yields the "rate net of effective dividend credit" compiled in column X. In the next chapter the empirical consequences of the dividend tax credit as it relates to tax shifting are considered.

Data and Coverage

In developing a single-equation, reduced-form model by which to measure the short-run shifting of the corporation income tax levied on corporations operating in Canada, points of observation are needed on both the various macro-variables likely to be of significance and on the variables of interest for the particular industrial division under investigation. With respect to the former, the Dominion Bureau of Statistics (D. B. S.) is an excellent source of information since it has published data on most of the relevant macro-series since 1926. Data relating to profits, tax, and capital series for the manufacturing industries in Canada may be obtained from one source in addition to the D. B. S., viz. the Department of National Revenue's publication, Taxation Statistics. In what follows both these sources of information are utilized; it is found that the estimated coefficients in the rate-of-return equations are substantially unaffected by the particular choice of data.
For the major portion of the empirical work, the period included is 1935-39, and 1948-64. It was necessary to remove the war years and the early 1930's on grounds of extraordinary economic conditions; the late 1930's was included primarily with a view to increasing the number of observations, and hence the degrees of freedom. While one may fear non-homogeneity of data which extends over a thirty year period, the series does, in fact, pass the F-test, implying that earlier and later periods come from the same statistical population or universe. Furthermore, the major results reported are also estimated using the post-1947 period alone; the estimated coefficients are substantially unaffected.

The coverage is limited to all corporate manufacturing. In this way there is little problem with changing industrial classifications and many of the other data problems which plague the empiricist. Nevertheless, the approach adopted here can readily be applied to test the importance vis-a-vis tax shifting of various economic factors such as market concentration and industrial structure.

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One might hope to multiply points of observation while working only with the post-World War II period by using quarterly observations. No attempt has yet been made in this direction although it does appear to be the logical next step. The quarterly corporation data, however, is typically not audited; also, some major Canadian series, including capital, are not available quarterly.
Variables and Notation

In isolating the influence of the tax variable on the rate of return, predicting the rate of return in the absence of the tax, and hence estimating the extent to which tax shifting has occurred, the variables listed below were selected. When the data series is thought comparable to that used in the American case discussed above, the same notation is used. Further information on the data is included in the appendix.

Industry Variables:

\( Y \) the rate of return in corporate manufacturing; the ratio of before-tax profits to equity capital lagged one period.

\( Z \) the statutory marginal tax rate on corporate income, defined as the marginal federal statutory rate plus the average of the rates imposed by the provinces of Ontario and Quebec, exclusive of the federal government rebate allowed corporations in those provinces. See Table 4.

\( L \) the tax liability, defined as the actual tax payment made by manufacturing corporations, divided by their equity capital lagged one period (i.e., \( T/K_{-1} \)).

General Variables:

\( \Delta C_{-1} \) the change in consumption standardized by GNP, lagged one period.

\( V_{m-1} \) the inventory-to-shipment ratio in all manufacturing, lagged one period.

\( J \) government revenue, all levels, excluding the corporation income tax revenues, and less transfer payments, standardized by GNP.

\( I \) merchandise exports to all countries, standardized by GNP.

\( G \) federal government expenditures on goods and services, standardized by GNP.

\( P_r \) "pressure variable"; the ratio of actual to potential output as calculated by the Economic Council of Canada.
Naive Measure of Tax-Shifting

Before turning to the results of the econometric study one could attempt to find a rough measure of the amount by which manufacturing corporations have "shifted" the tax on their profits simply by comparing rates of return during periods of relatively low and relatively high profits taxation. The difference may then be attributed to the higher tax, using the *caeteris paribus* assumption.

Comparing the entire earlier period (1935-39) with the later period (1948-64) used in the econometric work to follow one finds the long-run measure of the tax effect on the rate of return of approximately 78 percent. Similar measures taken on American data result in a measure of "shifting" nearer 100 percent. All such calculations, however, make the untenable assumption that all else has remained constant, or at least that all else has somehow cancelled out and the tax factor has, on balance, induced the rather considerable change in the before-tax rate of return. It is precisely for the purpose of isolating the influence of the tax variable in determining the rate of return that more sophisticated empirical tools must be brought into play. We now, therefore, turn to the results of the econometric investigation.

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6The measure is analogous to those developed above, viz. 
\[ S_{\text{naive}} = \frac{1}{Y_{1Z} - Y_{0Z}} \]
where "o" and "l" refer to periods of low and high tax, respectively. The formula is the same as K-M, *op. cit.*, p. 18. Note that it is specifically not a measure of shifting since it provides no information on tax incidence.

Chapter V

Is the Corporation Income Tax Shifted in the Canadian Economy?

Basic Results

In tables 5 and 7 are reported the major results of the present study as they relate to the Canadian economy. The results are separated into those using as the tax variable the rate of taxation on capital (i.e., the L tax variable in Model A) and those using the statutory tax rate (i.e., Z in Model B).

Model A

In the first four lines of Table 5 are reported the results of successive elimination of variables for reasons of insignificance and/or collinearity. In moving from line 1 to line 2, the lagged tax variable is removed. It is so highly collinear with the contemporary value of the tax variable (from Table 6, the simple correlation coefficient is seen to be .985), that its separate influence cannot be estimated accurately. However, in terms of point estimates, it appears that by far the larger portion of the tax-induced change in the rate of return occurs in the first period following the tax change. The government variable is now the only one remaining in the equation which is not nearly significant at the 95 percent confidence level. Its removal, as reported in line 3, perceptibly increases all of the t-scores, while leaving substantially in tact the overall measure of goodness of fit. As compared with the K-M study, it is noteworthy that the government variable is
not partially on grounds of collinearity (which necessitated the statement that its influence could not be separated) but exclusively on grounds of insignificance. That is, the estimated influence of the government variable on the rate of return is not significantly different from zero.

The further removal of the remaining variable having the least significance (in line 4) decreases the overall measures of goodness of fit, and without offsetting advantages. Equation (3), therefore, is considered to be the best fit of the Model A, and as such is singled out as the "standard model".

As was the case in the K-M study, the point estimate is one of short-run overshifting of the corporation profits tax, although the hypothesis of 100 percent shifting of the tax may be accepted at the 95 percent level of confidence, the confidence interval running from 96.5 to 140.1 percent shifting.¹

The standard model is considered further in lines 5 to 9. To assure that the results thus far mentioned have not captured primarily similar long-run trends in the rate of return and tax variables, the model is estimated in the first difference form (line5). The estimated measure of shifting remains of the same general order of magnitude, although its standard error rises markedly, and the overall measure of goodness of fit declines. Still using all years in the estimation, an approxi-

¹ Compare with equation 2, Table 1 above, where the null hypothesis of 100 percent shifting was rejected at the 95 percent confidence level in favour of a measure greater than 100 percent, with its lower confidence limit at 102 percent shifting.
<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>n(1)</th>
<th>( \Delta c_{-1} )</th>
<th>( V_{m-1} )</th>
<th>( J )</th>
<th>( X )</th>
<th>( G )</th>
<th>( L )</th>
<th>( L_{-1} )</th>
<th>( P_{x} )</th>
<th>Instrument or Technique</th>
<th>( R_{a}^{2} )</th>
<th>D-W Stat</th>
<th>Shifting Measure, Standard Error</th>
</tr>
</thead>
<tbody>
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<td>1</td>
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<td>[2.22]</td>
<td>[4.05]</td>
<td>[2.22]</td>
<td>[1.20]</td>
<td>[3.05]</td>
<td>[1.42]</td>
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<td>.939</td>
<td>2.16</td>
<td>1.395</td>
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<tr>
<td>2</td>
<td>All Years</td>
<td>22</td>
<td>0.36</td>
<td>0.34</td>
<td>-0.94</td>
<td>-1.19</td>
<td>0.87</td>
<td>-0.15</td>
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<td>Z</td>
<td>.945</td>
<td>2.01</td>
<td>1.276</td>
</tr>
<tr>
<td>3</td>
<td>All Years (standard model)</td>
<td>22</td>
<td>0.37</td>
<td>0.35</td>
<td>-1.05</td>
<td>-1.28</td>
<td>1.01</td>
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<td>1.183</td>
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<td>All Years</td>
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<td>[6.09]</td>
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<td>5</td>
<td>All Years, first differences</td>
<td>20</td>
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<td>-0.75</td>
<td>-0.83</td>
<td>0.79</td>
<td></td>
<td>1.079</td>
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<td>( \Delta Z )</td>
<td>.671</td>
<td>2.45</td>
<td>1.079</td>
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<tr>
<td>6</td>
<td>All Years</td>
<td>22</td>
<td>0.30</td>
<td>0.11</td>
<td>-0.67</td>
<td>-1.35</td>
<td>1.05</td>
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<td>1.215</td>
<td></td>
<td>Klein(4)</td>
<td>--</td>
<td>--</td>
<td>1.215</td>
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<tr>
<td>7</td>
<td>All Years</td>
<td>22</td>
<td>0.35</td>
<td>0.34</td>
<td>-0.96</td>
<td>-1.25</td>
<td>0.97</td>
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<td>.945</td>
<td>n.c.</td>
<td>1.242</td>
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<tr>
<td>8</td>
<td>Post-War Years</td>
<td>17</td>
<td>0.31</td>
<td>0.21</td>
<td>-0.99</td>
<td>-1.24</td>
<td>1.41</td>
<td></td>
<td>0.960</td>
<td></td>
<td>Z</td>
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<td>2.60</td>
<td>0.9601</td>
</tr>
<tr>
<td>9</td>
<td>Post-War Years</td>
<td>16</td>
<td>0.28</td>
<td>0.28</td>
<td>-1.39</td>
<td>-1.00</td>
<td>1.82</td>
<td></td>
<td>1.101</td>
<td></td>
<td>Z</td>
<td>.964</td>
<td>3.11</td>
<td>1.1005</td>
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<tr>
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<td>Taxation Statistics</td>
<td></td>
<td></td>
<td>[1.96]</td>
<td>[3.06]</td>
<td>[6.05]</td>
<td>[5.10]</td>
<td></td>
<td>[12.87]</td>
<td></td>
<td>OLS</td>
<td>.957</td>
<td>2.55</td>
<td>1.158</td>
</tr>
<tr>
<td>11</td>
<td>All Years, allowing the dividend tax</td>
<td>22</td>
<td>0.37</td>
<td>0.34</td>
<td>-1.04</td>
<td>-1.27</td>
<td>0.99</td>
<td></td>
<td>1.198</td>
<td></td>
<td>( Z_{c} )</td>
<td>.972</td>
<td>2.07</td>
<td>1.198</td>
</tr>
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</table>

(1) Number of observations
(2) R-squared, adjusted for degrees of freedom
(3) The Durbin-Watson statistic
(4) The calculations start with the estimates reported in line 3 of Table 7. The Klein approximation, \( L=\hat{Y}=\frac{Z}{Y}+\frac{Y}{Y-Z} \) (where \( Y \) is the rate of return, \( Z \) is the tax rate, and \( Z^* \) the effective tax rate), is then used to link the two concepts of the tax variable. The approximation may be solved in terms of \( Z^* \) and substituted back into the Table 5 equations which may then be resolved in the form \( Y=f(L) \).
mation procedure developed by Klein\textsuperscript{2} is used to estimate the variable coefficients, including a point estimate of the measure of shifting. Once again, as reported in line 6, the estimated coefficients are substantially unaltered. For purposes of comparison the least squares estimate of the standard model is recorded in line 7. The coefficients differ little from the standard model. To test the hypothesis that the tax behaviour of corporations differed as between the earlier (1935-39) and later (1948-64) periods of observation, the post-war period alone is tested (line 8). While the shorter period results in larger standard errors, the estimated coefficients differ little from those in the standard model.

In line 9 the standard model is fit to post-war data obtained from Taxation Statistics. Once again the estimated coefficients differ little from the standard model.

In anticipation of an objection to the Canadian study similar to the major objection of Slitor and Goode in commenting on the K-M study, the standard equation has been re-estimated for the period 1948-64 to include the series on actual-to-potential output in the Canadian economy.\textsuperscript{3} Unlike the American study, it is found that the "pressure" variable used in the Canadian case is not collinear with either L or the rate of return. Using ordinary least squares estimation, the addition of this pressure variable in the preferred equation yields coefficients for that variable not

\textsuperscript{2}L. R. Klein, A Textbook of Econometrics (Row, Peterson & Co., 1953), pp. 120-21.

\textsuperscript{3}The series of actual-to-potential output was reported in B. J. Drabble, Potential Output, 1946 to 1970 (Economic Council of Canada, Staff Study No. 2), p. 65. For the years 1948-63 the simple correlation coefficient of the rate of return (Y) and the pressure variable (Pr) is 0.57, which appears suspiciously low; with the tax variable (L) the simple correlation coefficient is 0.55.
significantly different from zero while leaving the L coefficient virtually unaltered. This evidence, in combination with the K-M comments on the Slitor-Goode critique (summarized above in Chapter III) strongly supports the view that the tax influence has been substantially isolated from non-tax influences, including, for example, pressure variables on the rate of return.

It appears, therefore, that in Canada the hypothesis of 100 percent short-run shifting of the corporation income tax may be accepted. Furthermore, it may be accepted with greater confidence than the measure of over-shifting reported in the U. S. study in which collinearity in the data precluded any claim that effect of government expenditures was isolated. Also, in the Canadian case the Durbin-Watson statistic gives no indication of serial correlation; while using the U. S. data, there is doubt.\(^4\)

The Dividend Tax Credit

In the final line of Table 5 allowance is made for the tax credit on dividend income by reducing the tax burden on manufacturing corporations by the amount of the tax credit accruing to personal recipients of dividend income. This particular test is rationalized by the (perhaps unlikely) view that a corporation is primarily an income-earning agent for its shareholders and, as such, feels that its tax burden is effectively reduced by the dividend tax credit. Compared to the standard model, the measure of shifting rises (as it must, in view of the reduced tax burden) but by very little.

\(^4\) However, in view of the comments on the Durbin-Watson statistic contained in the appendix, the indication may be of little consequence.
Serial Correlation

The calculated residuals in the estimated equations reported in this study were tested for serial correlation using the test suggested by Durbin and Watson.\(^5\) It is typically found that the so-called Durbin-Watson statistic is near the value of two, allowing one to accept with certainty the hypothesis of no serial correlation. Further comments on the use of this statistic is included in the appendix.

Table 6
Simple Correlation Matrix - All Years
(Corporate Manufacturing)

<table>
<thead>
<tr>
<th>Variables</th>
<th>(V_{-1})</th>
<th>(J)</th>
<th>(X)</th>
<th>(G)</th>
<th>(Z)</th>
<th>(Z_{-1})</th>
<th>(L)</th>
<th>(L_{-1})</th>
<th>(Y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\Delta C_{-1})</td>
<td>-0.49</td>
<td>0.29</td>
<td>-0.28</td>
<td>0.29</td>
<td>0.45</td>
<td>0.42</td>
<td>0.29</td>
<td>0.18</td>
<td>0.27</td>
</tr>
<tr>
<td>(V_{-1})</td>
<td>-0.77</td>
<td>0.46</td>
<td>-0.53</td>
<td>-0.79</td>
<td>-0.80</td>
<td>-0.42</td>
<td>-0.39</td>
<td>-0.18</td>
<td></td>
</tr>
<tr>
<td>(J)</td>
<td>-0.33</td>
<td>0.50</td>
<td>0.74</td>
<td>0.77</td>
<td>0.22</td>
<td>0.24</td>
<td>-0.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(X)</td>
<td>-0.51</td>
<td>-0.43</td>
<td>-0.44</td>
<td>0.06</td>
<td>0.01</td>
<td>-0.35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(G)</td>
<td>0.86</td>
<td>0.88</td>
<td>0.65</td>
<td>0.73</td>
<td>0.27</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Z)</td>
<td>0.98</td>
<td>0.72</td>
<td>0.73</td>
<td>0.36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Z_{-1})</td>
<td>0.67</td>
<td>0.72</td>
<td>0.29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(L)</td>
<td>0.91</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(L_{-1})</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.74</td>
</tr>
</tbody>
</table>

Model B

Using the Model B formulation, as reported in Table 7, a similar process of variable elimination leads to line 4 as the equation singled out as having the best explanatory power. But the estimated measure of shifting is very high at 239 percent, and has a wide confidence interval. In fact, the lower bound of the 99 percent confidence interval extends approximately to the upper bound of the preferred estimate using Model A (i.e., to a measure of approximately 140 percent shifting).

In lines 5 and 6 support is provided for the finding of line 4. That is, the postwar years alone and all years in first difference form yield a very high measure of profits tax shifting. Statistical significance, however, is lower in terms of both R-squared and t-score for the tax variable. The Model A approach is, therefore, preferred.

The Klein approximation is used to estimate from line 3 the standard model of the alternative (nonlinear) tax variable considered in Model A; the result is reported above as line 6 in Table 5. It is found that the point estimate of the measure of shifting thus obtained is very close to that of the standard model, thereby lending further support to the Model A approach.

Rising Prices and the Measure of Tax Shifting

While the profits and tax series are stated in current dollars, the capital series is stated essentially in a conglomeration of original cost dollars. It is, therefore, possible that if one were to make proper
<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>(1)</th>
<th>Regression Coefficients, [ ] their t-scores</th>
<th>G</th>
<th>Z</th>
<th>Z-1</th>
<th>$R_a^2$ (2)</th>
<th>(3) D-W Stat</th>
<th>Shifting Measure, ( ) Standard Error</th>
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<tr>
<td></td>
<td></td>
<td>n</td>
<td>Intercept</td>
<td>$\Delta C_{-1}$</td>
<td>$\Delta V_{m-1}$</td>
<td>$\Delta J_0$</td>
<td>$\Delta X$</td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>All Years</td>
<td>22</td>
<td>0.43</td>
<td>0.20</td>
<td>-1.29</td>
<td>-2.66</td>
<td>2.05</td>
<td>-0.07</td>
<td>0.438</td>
</tr>
<tr>
<td>2</td>
<td>All Years</td>
<td>22</td>
<td>0.43</td>
<td>0.20</td>
<td>-1.27</td>
<td>-2.69</td>
<td>2.04</td>
<td>-0.12</td>
<td>0.423</td>
</tr>
<tr>
<td>3</td>
<td>All Years</td>
<td>22</td>
<td>0.43</td>
<td>0.21</td>
<td>-1.33</td>
<td>-2.67</td>
<td>2.08</td>
<td>0.398</td>
<td>.840</td>
</tr>
<tr>
<td>4</td>
<td>All Years</td>
<td>22</td>
<td>0.46</td>
<td>-1.44</td>
<td>-2.72</td>
<td>2.07</td>
<td>0.405</td>
<td>.845</td>
<td>1.96</td>
</tr>
<tr>
<td>5</td>
<td>All Years</td>
<td>20</td>
<td>-0.01</td>
<td>0.45</td>
<td>-1.30</td>
<td>-0.71</td>
<td>0.95</td>
<td>0.481</td>
<td>.383</td>
</tr>
<tr>
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<td>- first differences</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Post-war Years</td>
<td>17</td>
<td>0.26</td>
<td>-1.19</td>
<td>-2.31</td>
<td>2.55</td>
<td>0.380</td>
<td>.872</td>
<td>2.60</td>
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</tbody>
</table>

(1) Number of Observations  
(2) R-squared adjusted for degrees of freedom.  
(3) The Durbin-Watson statistic, not adjusted for the discontinuity.
allowance for the inflation factor the measure of shifting would be markedly altered. No attempt has been made to make such allowance in working with the Canadian data; it is, therefore, instructive to summarize the K-M work on this aspect, and to report their results.

K-M contend that allowance for the inflation factor is not a priori to be preferred to the case of no allowance. If rising replacement costs induce the businessman to raise prices in order to recover his depreciation (now greater than the historical cost measure) then allowance should be made for inflation in order to avoid overstating the influence of the tax change on the rate of return. On the other hand, if businessmen do not raise prices to account for such a change in circumstances, allowing for the price changes would result in underestimating the reaction to the tax alone. The appropriate form for the estimating equation is, therefore, itself an empirical question.

In undertaking their statistical investigation to determine whether allowance for changing prices is preferred, K-M derived a reflator index for their capital series, and applied it to re-estimate the standard equation. On this basis the estimated measure of shifting declined from 134 percent to 101 percent (in K-M, Table 6-1, line 3, compared with Table 7-1, line 7). Since the statistical fit is not substantially less satisfactory than that of the standard model, K-M accept the results corrected for inflation as establishing a lower bound on the shifting measure while the uncorrected case establishes an upper bound.

No strong statement on the implications of the K-M inflation adjustment vis-a-vis tax shifting in Canada is justified. It is, however,
assumed that adequate allowance for price inflation in Canada would result in a percentage decline in the estimated measure of shifting no greater than that in the U. S. On this assumption the point estimate of shifting for Canadian manufacturing would be reduced to 89 percent of the direct tax burden.

Conclusions

If one finds acceptable the econometric approach used in this study the evidence is most impressive that the corporation income tax in both Canada and the United States is approximately completely shifted in the short run. The implication of this finding is that the short-run burden of the corporation tax on manufacturing corporations in both countries is not borne, even in part, by these corporations. More detailed comparisons of the Canadian and American studies are made in Chapter VII; at this point, however, it is noted that because of the data peculiarities the econometric work is, in some important respects, more satisfying in the Canadian case.
Chapter VI

Tax Shifting in an Open Economy

The theoretical literature concerned with the influence of domestic taxation in international trade is of quite recent origin; and of the existing literature only a small proportion deals with the question of the probable influence of the shifting of the corporation profits tax on the external trade of a country. The publication most specifically dealing with this topic is by Musgrave,¹ whose approach is taxonomic. The cases which he considers, however, all implicitly assume that the degree of shifting is determined by domestic factors, and that the prices of the goods exported is identical to the price of those traded domestically and, therefore, similarly incorporate the price effects of tax shifting. Such an approach is appropriate in considering a nearly closed economy, but it need not be satisfactory when discussing tax shifting in an open economy. In the latter case the extent to which tax shifting occurs may itself be influenced by the possibility of tax shifting through price adjustments in international trade. Thus the case of tax shifting in an open economy requires explicit attention to the conceptual framework in which shifting of the tax might occur. Even though firms may otherwise have considerable market control domestically, and therefore be able to shift a tax burden in the short run, they may be price takers in an open economy. Conceptually, then, opening an economy to inter-

national trade multiplies alternative sources of supply for a wide variety of domestically consumed goods and thereby reducers, probably leaving the final outcome with respect to tax shifting rather nearer that anticipated for the perfectly competitive case. In addition, firms able to do so may discriminate internationally thereby leaving entirely open to investigation the question of shifting. Discriminatory shifting implies an average degree of shifting depending on the weights of profit margins domestically and in international trade.

These various theoretical problems, however important they may be, do not invalidate the above use of the basic K-M reduced-form model in the context of an open economy in obtaining an empirical estimate of tax shifting. In particular the reduced-form equation is equally well suited for an open economy, in which case, if properly specified, it will take into account the influences of the open economy on the domestic rate of return of corporations; the preferred equation in the Canadian work, for example, includes exports as one of the predetermined variables.\(^2\) Criticisms of the Krzyzaniak-Musgrave approach applied to the study of tax shifting in an open economy, therefore, do not differ in kind from the criticisms of the use of the unconstrained reduced form generally.

\(^2\) The empirical work in this study follows the time-honoured assumption in describing imports as endogenous (since they are explained primarily by domestic factors) and exports as exogenous (since they are explained primarily by external factors). A more extensive empirical study of the influence of taxation -- and especially tax shifting -- in international trade would certainly wish to relax the latter assumption.
Musgrave makes the point that if in fact the corporation profits tax is shifted forward in foreign trade in the short run there will be an impact on international trade broadly similar to the impact of other taxes. However, under the rules of GATT a country is permitted to rebate to the producers of exported goods any "cost taxes" incurred in production, and to impose an offsetting import tariff on comparable goods; no such allowances are permitted in the case of a profits tax. This asymmetry is presumably in part based on traditional economic theory which (as was pointed out earlier) maintains that a profits tax is not an element of cost and will, therefore, not enter the price of a good -- at least not in the short run.

Some Empirical Evidence

The ensuing empirical work is limited to a simple test of the significance of the corporation income tax in international trade. The hypothesis on which the work is based is straight-forward: any short-run impact of the tax rate might have on international trade will be via a change in absolute prices. The case of zero tax shifting implies no short-run change in prices and, therefore, the anticipation is that the estimated coefficients for the tax variable would not be significantly different from zero. Thus, in a properly specified import equation a significant tax variable coefficient lends support to the hypothesis of non-zero tax shifting in that it allows one to reject

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the hypothesis of zero tax shifting.

In attempting to test this hypothesis the author looked to the published accounts of the large econometric models of the Canadian economy. The two major ones have been developed by T. M. Brown,4 and by R. R. Rhomberg.5 In each case the imports of goods and services is regarded as one of the dependent variables in a system of equations. A number of variables are then selected and tested as explanatory in the reported equation. As it happens, the estimated import equations known to the author have invariably been estimated by the technique of ordinary least squares, even though the system as a whole is estimated by a method taking into account the simultaneous nature of the system, and the import equation itself contains variables jointly dependent with imports. However, the choice of estimating technique is most fortunate for the purposes at hand, since it is therefore possible to remove from the system this single equation of special interest and to re-estimate it while altering the particular selection of variables. Such a procedure is adopted in the work reported below. The original equation on which the work is based is that of T. M. Brown,6 chosen largely because he uses annual points of observation and because the included variables readily obtainable (with exceptions, noted below). We shall first


6 op. cit., p. 65.
consider his equation, re-estimate it using the best data available, and then proceed to include the tax variables.

Brown's reported equation is:

\[ F = 0.65 + 0.12 (\text{GNP}_{na} + F) + 0.58 \Delta \text{H}_{na} + 0.55 \text{GI}_m \\
+ 0.68 C_{hda} - 0.34 P_l - 0.22 A_{fl} + 0.31 \frac{\Delta KS}{P_{fl}} + u_6 \]

where,

\( F \) imports of goods and services, defined to include payments of interest and dividends to foreign owners of domestic capital.

\( \text{GNP}_{na} \) gross national product generated by the non-agricultural private sector (a dependent variable in the system).

\( \text{H}_{na} \) total inventory of firms, non-agricultural.

\( \text{GI}_m \) gross investment by firms and non-government institutions (the private sector) in machinery and equipment.

\( C_{hda} \) consumer purchases of new household durable goods and automobiles (dependent variable in the system).

\( P_l \) price level of imported goods adjusted for the import duties and taxes.

\( A_{fl} \) shift variable to allow demand for import equation to adjust to import controls of 1948-1950. 1948 and 1949 are set equal to 1.0; and 1950 equal to 0.5. Otherwise the variable equals zero.

\( \Delta KS \) net inflow of capital for direct investment (K) and for portfolio (S).

\( P_{fl} \) price level of F.
His included period covers the years 1926-41, 1946-56, and uses 1935-39 constant dollar series for flows and stocks of goods and services, but current dollar series for financial variables. Since it is not clear from the published report what price deflators would be used it was decided to use all current dollar series in the ensuing work. In addition the specifically price variables included in Brown's equation were also excluded below, both because it is not clear what data are used and, more importantly, because it is through some impact on the prices of internationally traded goods that the corporation tax could have any short-run impact on trade.

In the empirical work reported below the years included, viz. 1935-39, 1947-64, correspond closely to those used in the empirical work of earlier chapters. The estimated equation closest to the one from the model mentioned above is reported in line 1, Table 8. By way of comparison, it appears that the two equations are relatively close when one considers the different periods included, the fact that one uses partly constant dollar series while the other uses entirely current dollars, and the fact that the included variables are not identical.

In moving from line 1 to line 2 attention was paid to the existence of multicollinearity in the variables. From Table 9 it is evident that the variables GI_m, C_d, and (GNP^{na} + F) are highly intercorrelated. As a first step, therefore, it was necessary to remove all but one of them, the one remaining to represent the impact of all three. While one might prefer to leave (GNP^{na} + F) on the grounds that it is most highly significant, it was decided to leave GI_m instead since it alone of the
<table>
<thead>
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<th>No.</th>
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<th>Intercept $a_0$</th>
<th>$\text{GNP}^{\text{na}+\text{F}}$</th>
<th>$h^{\text{na}}$</th>
<th>$G_{\text{m}}$</th>
<th>$C_d$</th>
<th>$\Delta KS$</th>
<th>$z_{u_s}$</th>
<th>$z_c$</th>
<th>$z_{u_s}/z_c$</th>
<th>$z_c-z_{u_s}$</th>
<th>DW(2)</th>
<th>$R^2$ (3)</th>
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<td>22</td>
<td>295 [5.85]</td>
<td>0.16 [11.09]</td>
<td>0.50 [7.28]</td>
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<td>0.15 [0.60]</td>
<td>0.08 [0.74]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.84</td>
<td>.999</td>
</tr>
<tr>
<td>2</td>
<td>23</td>
<td>272 [0.52]</td>
<td>0.01 [0.05]</td>
<td>2.99 [10.07]</td>
<td>-0.31 [0.75]</td>
<td>-5308 [3.06]</td>
<td>7322 [2.30]</td>
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<td>.981</td>
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<tr>
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<td>2.85 [12.67]</td>
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<td>0.09 [0.36]</td>
<td>3.08 [33.69]</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>1.46</td>
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(1) Number of observations.
(2) Durbin-Watson statistic, not adjusted for discontinuity.
(3) $R^2$-squared adjusted for degrees of freedom.
three is exogenous in the specification of Brown's model. The remaining variables taken from Brown's equation are left; and the tax variables (the tax rate imposed in the U. S., $Z_{us}^*$, and in Canada, $Z_c^*$, as reported above) are introduced. The $\Delta H^{na}$ and $\Delta KS$ variables are not found to be significant in the relationship. However, the tax variables and the composite (i.e., $GI_m$) variable are all highly significant, bearing the anticipated sign.

Table 9
Simple Correlation Coefficient Matrix

<table>
<thead>
<tr>
<th>Variables</th>
<th>$\Delta H^{na}$</th>
<th>GI$_m$</th>
<th>C$_d$</th>
<th>$\Delta KS$</th>
<th>$Z_{us}$</th>
<th>$Z_c$</th>
<th>$Z_{us}/Z_c$</th>
<th>$Z_c-Z_{us}$</th>
<th>F</th>
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<td>GNP$^{na} + F$</td>
<td>.254</td>
<td>.981</td>
<td>.996</td>
<td>.859</td>
<td>.718</td>
<td>.872</td>
<td></td>
<td></td>
<td>.997</td>
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<tr>
<td>$\Delta H^{na}$</td>
<td>.322</td>
<td>.247</td>
<td>.370</td>
<td>.343</td>
<td>.374</td>
<td></td>
<td></td>
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<td>.316</td>
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<tr>
<td>GI$_m$</td>
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<td>.985</td>
<td></td>
<td>.897</td>
<td>.785</td>
<td>.905</td>
<td>.243</td>
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<td>.988</td>
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<tr>
<td>C$_d$</td>
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<td></td>
<td></td>
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<td>.742</td>
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<td>.822</td>
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<td></td>
<td></td>
<td></td>
<td>.939</td>
<td>.738</td>
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<tr>
<td>$Z_c$</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>.886</td>
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<tr>
<td>$Z_{us}/Z_c$</td>
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<td>.158</td>
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<td>$Z_c-Z_{us}$</td>
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<td></td>
<td></td>
<td></td>
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<td>-.089</td>
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In line 3 variable $\Delta KS$ is deleted on the grounds of insignificance. The resulting fit is not substantially altered. Introducing the tax variables in a different form eliminates any possible problem associated with collinearity of the two tax variables taken separately, and does not
alter the conclusions. The various tax variables tested in lines 3, 4, and 5 all bear the anticipated sign, and all are significant. The fact that the coefficients are all significantly different from zero allows one to reject the hypothesis that zero tax shifting occurred.

In lines 6, 7, and 8 the formulation of the three previous lines is re-run, this time deleting the insignificant variable — viz. the change in business inventories. As a result all the variables remaining gain increased significance, and the extent to which the results are contaminated by serial correlation (as measured by the Durbin-Watson statistic) declines slightly.

Measures of Shifting

By making three additional assumptions it is possible to derive a measure of tax shifting in the international economy, quite analogous to the measure presented above. Assume: (1) that the aggregate output function is Cobb-Douglas. It follows that the gross capital share (i.e., before-tax profits) in aggregate output is a constant. Symbolically, \( \frac{\pi}{Q} = a \). (2) that the marginal and average propensities to import are identical (\( \equiv m \)) and constant (thus \( M = MQ, m = M/Q \)). (3) that profits are a constant function of imports, i.e., \( \pi = bM \). Using these assumptions,

\[
\frac{\pi}{Q} = a \\
\frac{\pi}{M} = b, \text{ and} \\
\frac{M}{Q} = m.
\]

thus \( b = \frac{\pi}{M} = \frac{\pi}{Q} \cdot \frac{Q}{M} = \frac{a}{m} \).
Now the measure of shifting may be derived.

Let \( M_z = f_1 \) (-----, tax, --)

\[ M_0 = f_2 \) (-----, 0, --)

define, respectively, the imports equation estimated in the case of a tax at the rate "z", and the inferred level of imports in the absence of a tax. Subtracting yields \( M_z - M_0 = c \text{.} \text{tax} \) where "c" is the estimated coefficient of the tax variable. As defined above, the measure of shifting is:

\[ S = \frac{\pi_z - \pi_0}{Z \pi_z} \]

By substitution

\[ S = \frac{bM_z - bM_0}{Z bM_z} = \frac{M_z - M_0}{Z M_z} = \frac{c \text{.} Z}{Z M_z} \]

which may be approximated

\[ S = c/ \bar{M}_z \]

This measure of shifting has its most natural interpretation in the case of the differential tax variable \((Z_c - Z_{us})\) and was, therefore used in this case. On this basis the estimated measure of the shifting of the differential tax is 73 percent.
It must be emphasized that such a measure of tax shifting cannot command very great confidence alone in view of both the questionable assumptions on which it is based and possible misspecification in the equation. It is nevertheless interesting to note that this measure of shifting taken on the differential tax in the import equation is lower than the previous measure which reflects primarily domestic factors and, therefore, concurs with the presumption that exposure to international trade permits less shifting of the corporation profits tax. In addition the persistently lower point estimate of tax shifting using Canadian data is compatible with the claim that the Canadian economy is more open to the influences of international trade than is the American.

However, the important point is that the various tax variables tested all have estimated coefficients significantly different from zero -- a finding which lends support to the conclusions reached in earlier chapters since one may again reject the hypothesis of zero tax shifting.
Chapter VII

Conclusions

In Chapters III and V were recorded the results of fairly extensive efforts to isolate the influence of the corporation income tax on the rate of return of manufacturing corporations in Canada and in the United States. From that influence is derived a measure of tax shifting indicating the extent to which manufacturing corporations in the two countries have avoided the short-run direct burden of the tax on their profits. The means by which they do this are thus far not established.

Since the econometric approach adopted in the two cases is so similar, and the major conclusions so close, it is valuable to compare the two cases in some detail.

Comparison of Findings: Canada and the U. S. A.

The major conclusion is that the direct short-run burden of the corporation income tax on the profits of manufacturing corporations is, in both countries, shifted completely and, in the American case, that possibly overshifting of the burden has occurred. To elucidate these results further, three points are noted:

(1) In the K-M study the (federal) government expenditures variable was found to be collinear with the tax rate, such that the influence of such expenditures was not successfully distinguished from the influence of the tax on the rate of return. But since the
coefficient of the collinear government variable was insignificant K-M concluded that its impact, while undetermined, was nevertheless much less substantial than that of the tax. In the Canadian study, on the other hand, the government variable (again federal government expenditures on goods and services) was found not to be collinear and, furthermore, to have a coefficient in the standard model not significantly different from zero. One can, therefore, conclude that, in Canada at least, the influence of the tax on the relevant rate of return was successfully separated from the government expenditures variable. By reflection, one suspects that the influence of the government variable in the U. S. was small (as K-M suggested); furthermore, it is quite possible that were its influence successfully separated the confidence interval on the estimated measure of shifting would include 100 percent shifting, though the point estimate of the measure would not itself be much reduced.

(2) The inclusion of the ratio of actual to potential output in the K-M standard equation (which K-M maintain to be unwarranted on several grounds, summarized in Chapter IV above) and the resulting fickleness of the estimated measure of shifting claimed by Slitor and by Goode might still be found convincing by other critics. In anticipation of further such criticism a similar pressure variable was introduced into the preferred reduced-form equation for the Canadian study even though the variable itself is endogenous. It was found that the pressure variable is not collinear with the tax or rate of return variables, and
that its addition to the preferred equation does not significantly alter
the measure of shifting, nor the confidence associated with that measure.
Neither is the coefficient for the pressure variable significant.¹

(3) The tax rate considered in the K-M study is that rate imposed
by the federal government. In the Canadian study, on the other hand,
the major tax influence associated with the corporation income tax im-
posed by the provincial governments is included by adding to the federal
rate the average of the rates imposed by Ontario and Quebec. A similar
inclusion of state taxation of corporation income in the U. S. study,
if feasible, could yield an estimated measure of shifting consistent
with the hypothesis of 100 percent shifting of the tax rather than over-
shifting. As indicated above the 95 percent confidence interval comes
very close to including 100 percent shifting. It is, however, rather
more difficult to test this hypothesis in the American case in view of
the greater dispersion of industry and the larger number of taxing bodies.

The Open Economy

The corporation profits tax, if shifted, will be an explanatory
factor in the direction and extent of international trade -- at least
in the (presumably likely) event that the tax is shifted "forward" and

¹ See, however, the footnote 3 on page 55.
therefore reflected in absolute prices. 2 In Chapter VI, therefore, various tax variables were tested for significance in an import equation estimated by least squares and drawn in modified form from a system of equations for the Canadian economy which were estimated by T. M. Brown. After removing variables for reasons of collinearity or insignificance it was found that the addition of any one of the three different tax variables considered resulted in a substantial increase in the explanatory power of the equation and, furthermore, that all of the various tax variables so tested had significant coefficients of the anticipated sign.

Policy Implications

The assumption that the corporation income tax is not substantially shifted at least in the short run has enjoyed such widespread support amongst economists that very little analysis has been based on the assumption that the corporation income tax is completely shifted in the short run. 3 If the latter assumption is more nearly accurate...

2 The case would benefit from recognizing that the level of the flexible exchange rate which Canada had during a substantial portion of the period in question would itself be influenced by the tax rate. In particular the tax, if shifted forward via higher prices, would induce a compensating decline in the exchange rate (using the ratio Canadian-to-foreign currency); alternatively, should the short-run burden of the tax be borne by the corporations the domestic rate of return after tax would be reduced, and international capital flows would again tend to reduce the exchange rate. Nevertheless the existence of the flexible exchange rate is disregarded, primarily on the assumption that the potential influence of tax factors in determining its level is very small.

3 Krzyzaniak and Musgrave, The Shifting of the Corporation Income Tax, op. cit., Ch. 8, provides a brief statement of policy implications on the assumption that the profits tax is fully shifted.
than the former and the degree of shifting is maintained, the following implications may be noted:

1. Full tax shifting leaves the claim of double taxation without foundation: the stockholders' dividend income is apparently not reduced by the existence of the corporation income tax. Thus the dividend tax credit introduced in Canada in 1949, and a modified version in the U. S. in 1954, do not serve to alleviate a tax burden greater than that intended by the legislature; rather they serve to provide an unintended reduction in tax burdens on the taxed group.

In one of few analyses paying explicit attention to the impact of tax shifting, J. R. Allan concludes that "if ... some substantial part of the tax is shifted by corporations...few stockholders will bear an adverse differential tax burden on their net corporate earnings; on the contrary, for many this component of income will actually be taxed more lightly than income from other sources."\(^4\)

2. The persistent proposals to integrate the personal and corporation income taxes, of which the dividend tax credit is a product, are predicated on the neoclassical conclusion that the corporation tax is not shifted in the short run. While part of the problem of such integration evaporates if the tax is shifted, there remains the problem of integrating retained earnings into the tax structure since they appear to be entirely free of any short-run tax burden.

3. Harberger "waste" (the tax-induced loss to total output) is one measure of the "long"-run impact of a differential tax, but based on the assumption that the corporation tax is not shifted in the short run. If the tax is completely shifted in the short run the Harberger-type waste would not occur. But there would be a different form of waste resulting from the tax-induced change in relative prices.

4. Short-run shifting of the corporation income tax implies that the intended distribution of tax burdens indicated by the tax legislation is circumvented; however, the ability to avoid the burden of the corporation income tax opens the prospect that the burden of most other taxes could similarly be avoided. It may, therefore, be best in terms of equity to view the corporation simply as a tax collector and attend to the desired distribution of tax burdens by the use of the personal income tax. But perhaps the personal income tax is shifted -- at least by those segments of the population able to exert some monopolistic influence. If so the value-added tax may be a desirable alternative, and one which could be collected at the corporate level.
Appendix

Data and Data Sources

Canadian Industry Data

The industry data are obtained from two primary sources, the Dominion Bureau of Statistics (hereafter D. B. S.) -- various publications -- and Taxation Statistics, published by the Department of National Revenue. The former is entirely on a national accounts, calendar year basis, whereas the latter is on a taxation year, and typically company fiscal year basis. By using both sources, therefore, conceptually distinct data are tested in the same functional relationship.

From Taxation Statistics the following data were obtained for "fully tabulated manufacturing corporations" for the taxation years 1947-63:

1) income taxable by the federal government
2) tax payment to the federal government
3) equity capital base, defined as stock (common and preferred) plus surplus, less deficit.

Using these three basic series, the following transformations were made:

4) \( \pi/K_{-1,ts} (= Y_{ts}) \), the rate of return.
5) \( T/K_{-1,ts} (= L_{ts}) \), the tax liability on capital.

It is impossible, using published data, to reconstruct the Canadian counterpart to the total capital series of K-M since data on funded and other interest-bearing debt is not available for the entire
period. Furthermore, the interest-payment series is not available, making the interest-inclusive calculation of the rate of return to total capital impossible. However, judging from the rather small difference found in the estimated measure of shifting in the American economy by K & M, this case is probably not different from the one reported.

From the D. B. S. the following series were obtained:

   Sources: National Accounts, Income and Expenditure (hereafter, N. A.); Bank of Canada, Statistical Summary.

7) Capital. Estimated mid-year net stock of fixed capital in all manufacturing, current dollars.
   The 1961-64 values are crudely estimated.

   1947-1949: estimated

Other Canadian Data

From various D. B. S. publications and a few others, the following series were obtained:

9) Government revenue, excluding corporation tax receipts, and less transfers.
   Source: N. A., various issues.

10) Personal consumption expenditure, current dollars.
    Source: N. A., various issues.

    Source: N. A., various issues.
12) Inventories. The book value of manufacturing inventories, year end.
         ii) 1961-64, owned inventory in all manufacturing, adjusted to correspond to the remainder of the series by a correcting factor equal to the ratio of the two series for the years 1958-59, from Statistical Review.

13) Shipments. Shipments in all manufacturing industries, annual totals.
   This series is entitled "Value of Shipments of own Manufacture," but prior to 1952 the basis of collection was "Gross Value of Product."
         ii) 1963-64, in D. B. S., Industry Division, Inventories, Shipments and Orders in Manufacturing Industries. This series is completely comparable with source (i).

14) Exports. Total merchandise exports to all countries, current dollars.
   Source: N. A., various issues.

15) Federal Government expenditure on goods and services.
   Source: N. A., various issues.

To obtain a series on equity capital in corporate manufacturing extending into the 1930's, the two above mentioned series were compared and found to be very highly correlated. It was then decided to base the backward extension on the series from Taxation Statistics. To do this the year 1944 (as the earliest year in which both series are available) is taken as the basis for adjustment, and the D. B. S. capital stock series for the 1930's is multiplied by a constant factor, viz. the ratio capital stock (Taxation Statistics) to capital stock (D. B. S.) the resulting series is then called

16) Equity capital.
Using the equity capital series thus obtained, and the various other series mentioned, the following transformations are made:

17) \( \pi/K_{-1} \) The rate of return, defined as before-tax profits divided by equity capital.

18) L Tax liability on capital, defined as \( T/K_{-1} \).

19) \( \Delta C_{-1} \) The change in the consumption-to-GNP ratio, lagged one period.

20) \( V_{m-1} \) Ratio of Inventory to Shipments in all manufacturing, lagged one period.

21) X Merchandise exports, standardized by division by GNP.

22) J Personal tax variable; \( (9)/(11) \), a proxy for the personal tax rate.

U. S. Data

The data used in Chapter III is, in the main, taken from the same sources used in the K-M study.\(^1\) The major sources for the basic series of data on U. S. manufacturing corporations are listed in the notes to Table 12.

---

\(^1\) For sources see K-M, *op. cit.*, Appendix A, pp. 67-75.
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<thead>
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<th>Year</th>
<th>Dominion Bureau of Statistics</th>
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<td>Profits</td>
<td>Taxes</td>
<td>Capital (all mfg.)</td>
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Table 11
Variables Used, All Manufacturing, Canada

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Table 12

Basic Series of Data for U. S. Manufacturing Corporations in Billions of Current Dollars

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3. Income Tax payment to Federal Government

4. Equity Capital (or Net Worth) at the end of the preceding period.


6. "Total Stockholders Equity."
Table 13
Variables Used, All Manufacturing, U.S.A.¹

| Year | Manufacturing Corporation Variables | | | Other Variables |
|------|-----------------------------------|----------|--------|--------|--------|
|      | Statistics of Income | Federal Trade Commission | | | ΔC<sub>-1</sub> | V<sub>-1</sub> | J | C<sub>f</sub> | Z |
|      | Y | L | Y | L | | | | | |
| 1935 | 0.048 | 0.009 | 0.058 | 0.010 | -0.032 | 2.460 | 0.120 | 0.052 | 0.138 |
| 1936 | 0.096 | 0.016 | 0.117 | 0.017 | -0.025 | 2.110 | 0.106 | 0.079 | 0.150 |
| 1937 | 0.095 | 0.017 | 0.116 | 0.019 | -0.023 | 2.000 | 0.134 | 0.071 | 0.150 |
| 1938 | 0.039 | 0.009 | 0.047 | 0.010 | -0.013 | 2.200 | 0.137 | 0.085 | 0.190 |
| 1939 | 0.086 | 0.015 | 0.105 | 0.017 | 0.023 | 2.460 | 0.127 | 0.076 | 0.190 |
| 1940 | 0.125 | 0.036 | 0.152 | 0.041 | -0.019 | 2.110 | 0.128 | 0.085 | 0.240 |
| 1941 | 0.233 | 0.111 | 0.283 | 0.123 | -0.022 | 2.060 | 0.120 | 0.210 | 0.610 |
| 1942 | 0.280 | 0.160 | 0.340 | 0.188 | -0.038 | 1.780 | 0.119 | 0.586 | 0.800 |
| 1943 | 0.234 | 0.088 | 0.266 | 0.095 | 0.015 | 1.580 | 0.142 | 0.095 | 0.380 |
| 1949 | 0.168 | 0.065 | 0.194 | 0.070 | -0.014 | 1.570 | 0.133 | 0.114 | 0.380 |
| 1950 | 0.265 | 0.119 | 0.270 | 0.121 | 0.017 | 1.750 | 0.149 | 0.096 | 0.420 |
| 1951 | 0.254 | 0.145 | 0.273 | 0.155 | -0.019 | 1.480 | 0.159 | 0.183 | 0.678 |
| 1952 | 0.219 | 0.108 | 1.218 | 0.116 | -0.042 | 1.660 | 0.170 | 0.239 | 0.700 |
| 1953 | 0.194 | 0.110 | 0.223 | 0.119 | -0.001 | 1.780 | 0.169 | 0.248 | 0.700 |
| 1954 | 0.160 | 0.083 | 0.182 | 0.084 | 0.002 | 1.760 | 0.160 | 0.200 | 0.520 |
| 1955 | 0.216 | 0.108 | 0.232 | 0.109 | 0.021 | 1.810 | 0.166 | 0.173 | 0.520 |
| 1956 | 0.187 | 0.093 | 0.221 | 0.101 | -0.002 | 1.620 | 0.169 | 0.171 | 0.520 |
| 1957 | 0.163 | 0.083 | 0.195 | 0.088 | 0.005 | 1.730 | 0.172 | 0.176 | 0.520 |
| 1958 | 0.126 | 0.064 | 0.151 | 0.067 | 0.006 | 1.800 | 0.164 | 0.185 | 0.520 |
| 1959 | 0.161 | 0.080 | 0.185 | 0.083 | 0.012 | 1.840 | 0.166 | 0.173 | 0.520 |
| 1960 | 0.137 | 0.070 | 0.164 | 0.074 | -0.003 | 1.700 | 0.176 | 0.165 | 0.520 |
| 1961 | 0.133 | 0.067 | 0.156 | 0.069 | 0.002 | 1.760 | 0.178 | 0.171 | 0.520 |
| 1962 | 0.144 | 0.072 | 0.173 | 0.077 | 0.000 | 1.740 | 0.179 | 0.179 | 0.520 |
| 1963 | n.a. | n.a. | 0.182 | 0.080 | -0.010 | 1.700 | 0.184 | 0.172 | 0.520 |
| 1964 | n.a. | n.a. | 0.194 | 0.080 | 0.002 | 1.690 | 0.173 | 0.164 | 0.500 |

¹For data sources see above, Chapter III, and Krzyzaniak and Musgrave, op. cit., Appendix A.
On the Use of the Durbin-Watson Statistic

It is recognized that the statistic employed in this study and in K-M to provide a measure of serial correlation of the error terms is in fact inappropriate. This is so because the inclusion of lagged endogenous variables biases the value of the statistic towards two, the value which would otherwise permit one to accept the hypothesis of no serial correlation. In the absence of a superior test, the Durbin-Watson statistic is nevertheless employed to provide at least a rough measure of serial correlation.\(^2\)

Since the time period is disjoint, the Durbin-Watson statistic may not be appropriately used without modification. The calculated residual for the sixth observation was, therefore, removed in both the numerator and denominator.\(^3\)

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2 Nerlove and Wallis, however, state that "... it is doubtful that the (Durbin-Watson) statistic should ... be used either to test for serial correlation in the residuals or to provide any indication of the extent of such correlation when the estimated equation contains lagged values of any endogenous variables." Nerlove, Marc, and Kenneth F. Wallis, "Use of the Durbin-Watson Statistic in Inappropriate Situations," in *Econometrica*, Vol. 34, No. 1 (Jan., 1966), pp. 235-38.