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The Shifting of the Corporate Income Tax in the Short Run

by

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PREFACE

This study was prepared for the Royal Commission on Taxation, between August 1963, and June 1964, while I was on leave of absence from the London School of Economics. It is a particular pleasure to acknowledge the help I have received from many people while preparing this study. Among these, I should particularly like to acknowledge debt to the following: Professor T. A. Wilson of Harvard, whose numerous suggestions were instrumental in developing measures of the degree of short-run shifting; Professor Y. Kotowitz whose suggestions, at an early stage of the research, contributed in giving the study its present orientation; Professor G. Rosenbluth who provided data and invaluable help in the preparation of Appendix C; Mr. Claude Langlois whose help with the calculations and data processing went far beyond the call of duty. The discussions I had with various members of the research staff of the Royal Commission on Taxation have also been stimulating. Finally, the Bank of Canada has made some of its facilities available to me. I am grateful to everyone, but I alone am responsible for the final form in which the results appear.

During the course of the revision of the study, I have benefited from the comments of Professor M. H. Peston of Queen Mary College and Dr. Ian Byatt of the London School of Economics.

R. J. Lévesque
London, 1965

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"If you throw enough taxation mud at the businessman a good deal of it will stick". (D. H. Robertson) 1/

CHAPTER 1—INTRODUCTION

Despite its obvious importance, the economic effects of the corporate income tax remain largely unmeasured. Its aggregate dynamic characteristics and theoretical impact have been examined by Lewis, 2/ Goode 3/ and Dosser; 4/ its effects on market organization and resource allocation have been investigated by Harberger, 5/ and by Lintner and Butters; 6/ finally, its interaction with other costs of the corporation have been studied by Eisner 7/ and Hall. 8/

The history of this tax is marked by controversies. This is understandable as inferences about the economic effects of the tax depend very largely on knowledge of the incidence of the tax between various groups in the economy. If, for instance, investors bear the ultimate burden, the tax may limit investment. If, on the other hand, consumers ultimately pay the tax, Canadian products may be at a disadvantage on foreign markets. Sound economic policy thus requires good evidence on the incidence of the tax. The ambitious aim of this study is precisely to provide evidence on this much debated question of incidence.

At the theoretical level one could hope to add very little to the already voluminous literature on the subject of incidence. The best one can do at this level is perhaps to survey this literature. The only option left open is to undertake an empirical analysis of Canadian data in the hope of elucidating the subject with some quantitative knowledge which is certain to be imperfect.

Even though we do not intend to get involved in a semantic discussion of the term "incidence", 9/ it seems logical at the outset to define the

problem and to divide it into a number of distinct and specific questions. The problem here consists of measuring empirically whether and to what extent the corporate income tax is shifted either forward to consumers or back to suppliers. To the extent that it is not shifted, the burden falls on the corporation itself or the shareholders and reduces the net return they realize on their investment.

The problem can be divided into two distinct questions: first, who pays the tax (a) in the short run, and (b) in the long run? Secondly, if the tax is shifted, how is it shifted? "Pays", in this context, means whose income is ultimately reduced because of the payment of the tax rather than who actually pays it in the first instance. Since the tax is levied nominally on the corporation (the shareholders) and is meant to affect income accruing to capital, any part of the tax that is paid by others is considered to be shifted. In this context, a tax is fully shifted if a change in the relative statutory tax burden of different groups of taxpayers leads to changes in their behaviour such that the after-tax distribution of income is unchanged. A tax is not shifted at all if the after-tax distribution of income fully reflects the increased statutory tax burden—in this case, the before-tax distribution of income will be unchanged. A tax is <u>partially</u> shifted if the after-tax distribution of income lies between the above limits.

The concept of shifting must be distinguished from avoidance by which means the total tax liability is reduced by a certain amount due to readjustments either in the form of the enterprise (e.g., disincorporation) or in the structure of the capital of the corporation (e.g., substitution of debt for equity capital). "Avoidance better describes these processes because the burden is not shifted to other taxpayers (except through very indirect

repercussions) but is avoided altogether. A casual glance at the empirical evidence suggests that such avoidance was not quantitatively important.

Even if it could be determined whose income was reduced by the tax there would still be some difficulties in assessing the actual burden of the corporate tax. Indeed, it is not clear whether we are looking at absolute or relative income of various economic groups. It is possible that the tax will reduce the total income of all groups yet not change the distribution (relative share) at all; in this case, it is not quite clear whether we consider that it is shifted or not. Such would be the case if the tax affects investment in any significant manner, and hence the rate of economic growth. The national income would be reduced in future years; however, the distribution of this national income may not be affected. This leads one to distinguish two types of shifting.

Long-run shifting. Upon the imposition of the tax the situation may develop in two ways. The first is a reduction of the net rate of return on capital in the corporate sector. This may or may not result in a reduced rate of capital formation in that sector. If it does, the initial decline in the net rate of return will be at least partly recouped and the burden of the tax will be spread to other receivers of property income; namely bond holders and owners of unincorporated enterprises. The burden may similarly be spread to other factors. This has been referred to traditionally as "long-run shifting".

Short-run shifting. The second possible development is that the imposition of the tax leads to changes in price and/or wage policy, such as to increase profits before tax, thereby holding the net rate of return unchanged. If such adjustments are successful, (which involves some form of market

imperfections) the detrimental effects on capital formation which may result under shifting of the first type do not arise. Since these adjustments may come about promptly, they have been referred to traditionally as "short-run shifting".

Assuming no short-run shifting, the extent to which long-run shifting will occur depends upon (i) the elasticity of total capital supply (with respect to a change in the rate of return) which, as will be seen, has been found to be low; (ii) the responses of corporations and asset holders to the imposition of the tax; (iii) the degree to which capital and entrepreneurs can move between the corporate and unincorporated sectors of the economy; (iv) the elasticity of substitution between capital and labour. Whether the before-tax distribution of income is altered by the change in the rate of capital formation (i.e., long-run shifting) depends heavily on the latter factor. If the elasticity is less than one, part of the tax may be shifted in the long run; if the elasticity is unity, the tax can hardly be shifted in the long run. The evidence examined on this issue suggests that the elasticity of substitution is less than unity (although in many sectors the estimated elasticity is close to unity). 10/ There are hence indications that the corporate tax can only be shifted in the long run through its effects upon investment to a limited extent. If it is shifted, it must be through its impact upon firms' pricing policies. We shall therefore concentrate on the evidence bearing on this issue.

As pointed out earlier, the second question arising here is "if the tax is shifted, how is it shifted?" This question is concerned with the mechanism through which shifting takes place. It should not only throw some light on the short-run aspect of the problem of incidence, but it should also dictate

to a large extent the method of investigation to be adopted in the major part of the study. This question is very important as the effects of the corporate tax on the allocation of resources, the distribution of income, the rate of growth, the formation of capital in the economy, the market structure and organization and our international trade position (i.e., the balance of international payments) may well depend on the form in which shifting occurs. In effect, this question is bridging the gap between the general economic effects of the tax and the narrower question of shifting.

After an exposé of the theoretical background of the problem (Chapter 2), a brief survey of the existing empirical evidence will be attempted and an appraisal of the most important studies will be given (Chapter 3). Then, empirical evidence based on Canadian data will be presented. The evidence will be derived from regression analysis of cross-section data on a sample of some 30 manufacturing industries (Chapter 4). Estimates of the degree of shifting will be derived from both time-series and cross-section analysis (Chapter 5). Finally, an attempt will be made to assess the impact of the corporate tax on Canada's international competitive position (Chapter 6).

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10/ B.S. Minhas, An International Comparison of Factor Costs and Factor Use, Amsterdam: North-Holland Publishing Co., 1963, pp. 17-26. The elasticity of substitution was estimated for a cross-section of 19 countries and 24 industries. The hypotheses of unity and zero elasticity of substitution were tested and rejected. Our inference is based on this result.

CHAPTER 2—THEORETICAL CONSIDERATIONS

As mentioned earlier, one cannot hope to make substantial original additions to the already voluminous theoretical literature on the incidence of the tax. Theoretical evidence, however, is conflicting, inconclusive and insufficient for our purposes. The aim of this chapter is to examine the most important arguments and to trace the source of the conflicts in the conclusions to which they lead.

2.1. The Traditional (marginalistic) View

In the traditional view, the corporate profits tax does not alter the marginal cost at the most profitable output in the short run, and therefore does not change the relative inputs of labour and capital or the marginal contributions of these factors to production and revenue. In other words, the general argument is that, if a company maximizes profits before tax, it will by the same token maximize after-tax profits, so that a tax on profits will not affect the maximum position; therefore, the optimum price and quantity produced will remain unchanged. Thus, the tax cannot be shifted and lies solely on the stockholders. The two extreme cases of competition and monopoly will be considered separately. The case of oligopoly will receive a deeper treatment when the "modernistic view" will be examined.

It would be impossible, so the argument runs, for firms subject to strong competition to raise their prices in response to a tax change, since these corporations that do not make profits pay no tax. Competing unincorporated enterprises will not raise prices either, because they are not subject to corporate tax. (The same is true in the case of corporations competing in the international market; foreign competition, unaffected by

the tax, is not likely to allow price increases, unless parallel movements in tax rates are observed in all trading countries simultaneously.) The "traditional view" is summarized in the following passage by E. G. Keith:

> In a competitive market, the firm that raises its prices above those of other firms will lose its customers. Consequently even though a successful firm may want to pass on a tax imposed on its net profits, it cannot safely do so unless less successful firms are prepared to take the same action. But since the less successful firms will have smaller tax liabilities, and since the least successful ones may well have no income tax to pay, uniform action on the part of all firms is very unlikely to occur.
>
> Only if the tax falls on some elements of short-run cost, is it likely to affect the supply of a product produced under competitive conditions. Virtually all short-run costs are, however, allowed as deductions in computing statutory net income under the Internal Revenue Code. Consequently, supply will not as a rule be affected by a tax on net income, and prices will not rise. 1/

The whole argument is based on the contention that in a competitive market, the price of a commodity is determined by the marginal or least profitable firms producing that commodity. The best way of summarizing and illustrating this point is to quote Professor Seligman:

> Despite the widely held belief to the contrary, even a proportional income tax cannot be shifted. In order to prove this, however, it is necessary to discuss somewhat more fully the conditions which fix prices.
>
> . . . . . .
>
> What is the bearing of this analysis upon the problem of taxation? It resolves itself into the question of how the marginal producer, the producer at the margin is affected. A tax on a commodity per unit affects the cost of the marginal producer as well as of every other producers and therefore tends to be added to the price, because whatever increases marginal cost must ultimately increase price. But a tax on income is a tax on net profits; and net profits are not cost, but surplus over cost. A tax on profits cannot reach the man who makes no profits. But the man at the margin who makes no profits, or who makes only the minimum profits which correspond to wages of management or recompense for the risk, pays no tax because he makes no profits or pays only a negligible tax upon these minimum profits. If the man at the margin who at any particular time fixes the price for the entire supply of commodities

> that is sold in the market pays no tax, how can the income tax be added to the price? The tax on profits is paid only by the man who makes profits, that is by the intra-marginal producer, not by the marginal producer. But the tax paid by the intra-marginal producer cannot affect the price which is fixed by the marginal producer who pays no tax. 2/

The argument which relates to the no-profits firm appears to be defective because it is based on a number of mistaken or ambiguous ideas which will be examined in the following section. The marginal firm of economic theory is not, as the argument alleges, a no-profits firm. The marginal firm is indeed a firm which is just undecided as to whether or not it should continue in its present line of production. The profits of the firm at the moment or in the short run, however, are by no means decisive in determining whether or not a firm is at the margin. The marginal firm may, in the short run, be earning no profits, but it may also be a firm which is earning large profits, or perhaps even large negative profits. The latter case may occur, for instance, when a firm is newly established and expecting to suffer losses for some time as part of the process of building up a business concern. In this case, the firm would look forward to a period in the future at which it expects to recoup its losses out of profits, once it has become fully established. The short-run profit position of the firm is insufficient to determine whether or not the firm is marginal. This is a point which the upholders of the above argument seem to have overlooked. It is in terms of expectation or long-run profits that the theory should be discussed.

2.2. Criticism of the Traditional View

The traditional or orthodox discussions which often lead to the conclusion that the corporate tax cannot be shifted forward via higher prices very often fail to define clearly the concept of profits on which they are

laid and also the length of the period with which they are concerned. The confusion and conflicts in their conclusion very often result from these two lacunae. Let us first deal with the concept of profits. Profits, in a general sense, are the sum of two components: "normal profits" which are part of the normal supply price of all commodities, that is, an element of long-run marginal cost even in competitive industries; and "pure profits" which are over and above the normal profits, and have no logical place in the theory of purely competitive equilibrium. Bearing this in mind, it should be evident that even in competitive industries shifting may occur since "normal profit" is an element of long-run marginal cost. That portion of the tax which bears upon normal profits will be shifted—at least after a period of time (in a growing industry the period will be quite short, since new capital must be attracted). It should also be evident that any estimate of the earnings of capital based on accounting data will contain "normal" and "pure profits" in varying degrees and they will largely be inseparable from each other.

The second point of criticism which is not independent from the first one is the question of the period considered in the analysis. The problem may practically be resolved in the following incisive passage:

> By what warrant do we take the position that the short-run marginal costs are unaffected by the corporate income tax? If by short run we are referring to a period long enough for output, but not plant, to vary, then surely the marginal cost curve can be affected by the corporate income tax....
>
> The difference between the short-run and the long-run effects of the corporate tax under pure competition or pure monopoly, then, are merely questions of degree and not of kind 3/

A rigorous exposition of the "traditional view" will be found in Appendix A for the case where the tax is part of the producers cost of

production. It is shown that shifting possibilities look different when the tax is part of a firm's marginal costs than when it rests only on net profits. A net profits tax will have no effect on the price-output policies of the firm since the tax has no effect on the intersection of the marginal revenue and the marginal cost curves, at least in the short run. On the other hand, the concept of profit defined in the tax law or for accounting purposes is at variance with the concept of normal profits used by economists. In practice the tax hits the former kind of profits (i.e., the sum of normal and pure profits) and hence leaves room for output and price adjustments.

Before turning to the "modernistic view" I would like to examine, at least in a conjectural manner, the possibility of backward shifting. Some critics maintain that corporate enterprises regard the tax as an excise on output and that the direct impact of the tax, therefore, is to raise the output price corresponding to previous money payments to labour and capital at existing output or to reduce the receipts available for distribution to both labour and capital at any given market price of output. This type of direct shifting would place a substantial portion of the tax burden on labour income, and this transfer of burden would substantially mitigate any reduction in profits available to shareholders. Backward shifting through wage cut is virtually impossible in most industries. However, backward shifting through the slowing down of the rate of increase of wages is a definite possibility. There is some evidence that trade union wage demands are related to the level of profits; it is not possible to determine whether before-tax or after-tax profits is the relevant variable, since the empirical evidence is insufficient and since a reasonable theoretical case can be made for each of the alternatives. 4/ If wage demands (and the subsequent contracts achieved) depend in part upon after-tax profits, then some backward

shifting may occur, particularly in unionized industries.

Apart from the criticisms already addressed to the tenants of the orthodox view, a number of more fundamental criticisms have been made of the assumptions underlying the whole marginalistic price theory. These criticisms have led to a more "modernistic view" of the theory of the firm to which we now turn.

2.3. The "Modernistic View"

There are many claims in the recent literature that the so-called orthodox doctrine is at variance with business practices. The profit-maximizing behaviour of the entrepreneurs has been challenged by other assumptions of the nature of sales revenue maximization subject to a minimum profit constraint. Firms would aim at a target rate of return on investment, and the absolute amount of their net profits would then cease to be the ultimate objective. In addition, prices may often be set with reference to rules of thumb, such as target rate of return on full cost pricing. The use of such simple decision rules indicates that these firms do not always succeed in maximizing joint profits, and therefore that a price increase dictated by the decision rule may not appear in retrospect to be unwise. This appears to be the situation in oligopolistic industries. The main constraint on prices in many oligopolistic markets will be the threat of entry by new firms, which is probably a function of the after-tax rate of return that entrants expect to get. Under such conditions, established firms will set prices to maintain after-tax rates of return just below the level at which entry takes place. (In these situations, it is possible that the shifting of the tax will be asymmetrical—that is, tax increases are shifted through higher prices, but tax reductions are not shifted because of the uncertainty

of rivals' reactions to the price cut.) Finally, as has already been mentioned, firms in oligopoly markets may pursue goals other than simple profit maximization, but may seek to maintain profits at a satisfactory level—that is, they maximize some other goal or set of goals subject to a minimum profit constraint. Such firms will shift the tax in order to maintain profits at the required level. The process by which the tax will be shifted via changes in output and price is demonstrated in Section 2.5 and Appendix B.

A practical situation where the above type of reasoning applies is the case in which U.S. corporations operating subsidiaries in protected Canadian markets (which are almost invariably oligopolistic markets) may attempt to maintain after-tax earnings in the subsidiary at a level comparable to rates of return in the United States. This will be particularly important where the main threat of new entry is from other United States firms.

All this exercise should be sufficient to prove that one can draw whatever conclusion one likes from theoretical arguments. All depends on the set of assumptions adopted at the outset. Hence, unless we can base our argument on empirical facts, any conclusion on the incidence of the corporate income tax is bound to fail.

2.4 The Arguments for Short-Run Shifting

Almost all the theories which support the short-run shifting of the corporate income tax by unregulated firms have been based on arguments about the internal decision making of the firm. In order to justify shifting, these theories have had to assert two propositions: (a) that firms do not maximize profits in the short run and (b) that the imposition of the corporate

income tax lessens the relative influence of the factors which prevent short-run maximization. These propositions have been put forward according to four major types of argument: (1) goals other than profits, (2) conflicts between long-run and short-run profit maximization, (3) ineffective price leadership in an oligopoly, and (4) average cost pricing and other rules of thumb. The first of these arguments will be examined in order to bring out how it implies a positive relationship between the monopoly power of the firms in an industry and the degree to which they may be expected to shift the tax and not at all to consider their inherent validity. 5/

Goals Other Than Profits

The hypothesis that shifting cannot exist was based on the assumption that profit maximization was the sole goal of corporations. Many economists, however, have pointed out other possible goals. Those may include a "satisfactory profit rate", "normal dividends", a "just price", the desire for high value of sales, output, assets, market share, or rate of growth, and others. When pursued as ends, these goals can easily conflict with profit maximization. A satisfactory profit rate, normal dividends, or a just price would permit profit maximization only if they could not be met except when profit reached its maximum. On the other hand, neither sales, output, nor assets are maximized, even for positive levels of profits, when profits are maximized. Moreover, the output lost from maximizing profits may restrict market share.

The conflict between profits and other independent goals may be conceptualized as being resolved in a process analogous to consumer choice. The firm may be thought of as facing an opportunity set composed of the

attainable values of each variable desired as an end in itself. The firm would choose among these alternatives according to its preferences as represented by a set of indifference curves. Imposition of the corporate income tax would alter the opportunity set by changing the attainable values of after-tax profits. In the general case this would have both an income and a substitution effect on the behaviour of the firm. The income effect would follow from the fall in the after-tax profits. Provided that no goal was inferior, the firm would wish to obtain each goal to a lesser extent than had been achieved before the tax was imposed. Therefore, through the income effect, firms would reduce the degree to which non-profit goals were obtained and would thereby raise after-tax profits to a level above what they had been immediately after the tax was imposed but below what they have been before the tax was levied. The substitution effect would follow from the reduction in the opportunity cost of non-profit goals in terms of after-tax profits. Each firm would wish to substitute some of the now relatively cheaper non-profit goal for after-tax profits. Depending on whether the income or substitution effect dominated, shifting would be positive or negative.

Resolution of the conflict among goals would unambiguously lead to positive shifting in the special but important case where the firm seeks one goal alone (or maximizes a utility function based on more than one goal) subject to the constraint of a specified after-tax profit rate. One version of this case is given by Baumol and is extensively treated in Section 2.5. and Appendix B. If the profit constraint could not be met, the firm would approach it as closely as possible by maximizing profits. Under these conditions, the imposition of a corporate income tax would have only an income effect, since the technical rate of substitution between goals would

not affect decisions. The profit constraint of firms formerly in equilibrium would no longer be met, so they would respond by raising prices until they had either fully shifted the tax or maximized their profits. Only those firms which had previously maximized their profits at no greater a level than their profit constraints would be unable to shift any of the tax.

The conflict between profits and other independent goals is less likely to be important for a firm as its industry is more competitive. Some non-profit goals which an oligopolist might want would not be meaningful as objective for a competitive firm. A larger market share, for instance, would not matter to a firm whose share would always be insignificant. Similarly, a just price would have no value to a firm which could not noticeably influence the market.

2.5. An Application of Baumol's Oligopolistic Model

In his article, 6/ Baumol challenges the traditional profit-maximization assumption and the theories based on it, in the following terms:

> On grounds which I shall only hint at here, I believe that the typical large corporation in the U.S. seeks to maximize not its profits but its total revenue which the businessman calls his sales. That is, once his profits exceed some vaguely defined minimum level, he is prepared to sacrifice further increases in profits if he can thereby obtain larger revenues. This is suggested by his readiness to use sales as a criterion of the state of his enterprise (e.g., familiar statements such as "Business is good—Sales are increasing"). More important, it is confirmed by a number of cases where businessmen have rejected opportunities (pointed out to them by consultants) to increase their profits at the expense of sales. If they accepted the consultant's analysis of the facts of the situation, as appears to have been the case, this is the acid test. For them the additional profits (and they were not just short run profits) were not worth the loss in sales.
>
> My hypothesis, then, is that oligopolists typically seek to maximize their sales subject to a minimum profit constraint.... (p. 187)

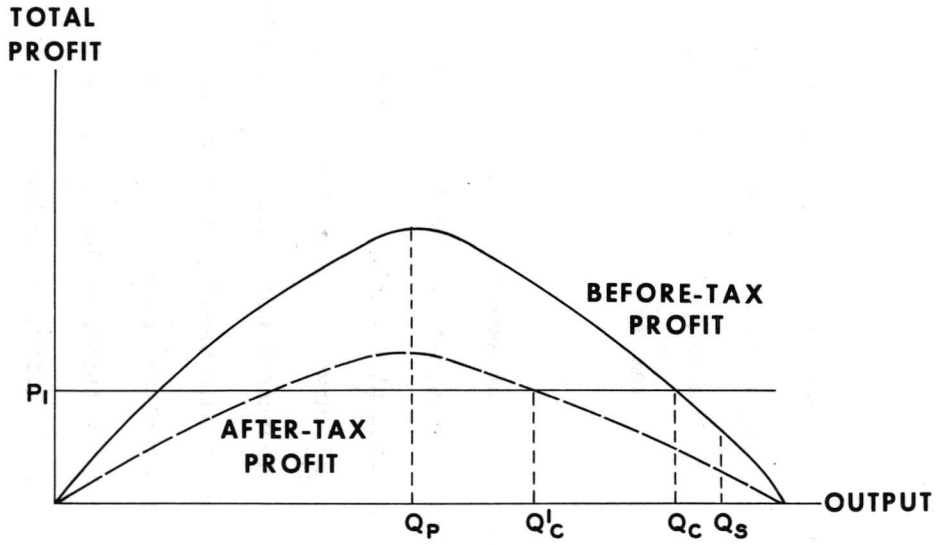
Elsewhere, the author adds:

> Students consistently find one of the most surprising conclusions of the theory of the firm to be the assertion that overhead costs do not matter ... no change in the level of its overhead costs should lead the profit maximizing firm to change either its prices or its outputs. This piece of received doctrine is certainly at variance with business practice, where an increase in fixed cost is usually the occasion for serious consideration of a price increase. (pp. 194-95)

The sales maximization hypothesis has other implications, one of which is pointed out by Baumol and is the main object of this section. To the author it means that "prefixed lump sum" (poll) taxes must lose their convenience for discussion of income redistribution. For even these taxes, like other overheads, can and will be shifted, and their imposition will affect incentives and the allocation of resources. They will be shifted because, when they are levied on him, the oligopolist will raise his prices and reduce his selling costs to a point where his profit constraint is once again satisfied. The explanation of the shiftability of this apparently unshiftable tax is simple—the profit non-maximizer has a reserve of unclaimed profits to fall back on when he is driven to do so by what he considers to be an unsupportable increase in his costs, though he can do so only at the sacrifice of sales which mean so much to him. "Since no one seems to deny that businessmen do in fact often raise prices when their overheads increase this point must be accepted even by someone who questions the sales maximization hypothesis". 7/ The application of corporate income tax to this model leads to very striking results indeed: output reduction, price increase and partial shifting to the consumer.

The major underlying assumption as we already know is the maximization of sales revenue subject to a minimum profit constraint. Figure I, drawn from the article, illustrates the operation of the model. It gives the equilibrium output (Q_c), sales revenue, and profits of the oligopolistic firm.

FIGURE 2



Q_P = profit maximizing output
Q_S = Sales - revenue maximising output in absence of our profit constraint
P_I = minimum acceptable profit level
Q_C = Equilibrium output in absence of tax
Q'_C = Equilibrium output after tax
$Q'_C < Q_C$

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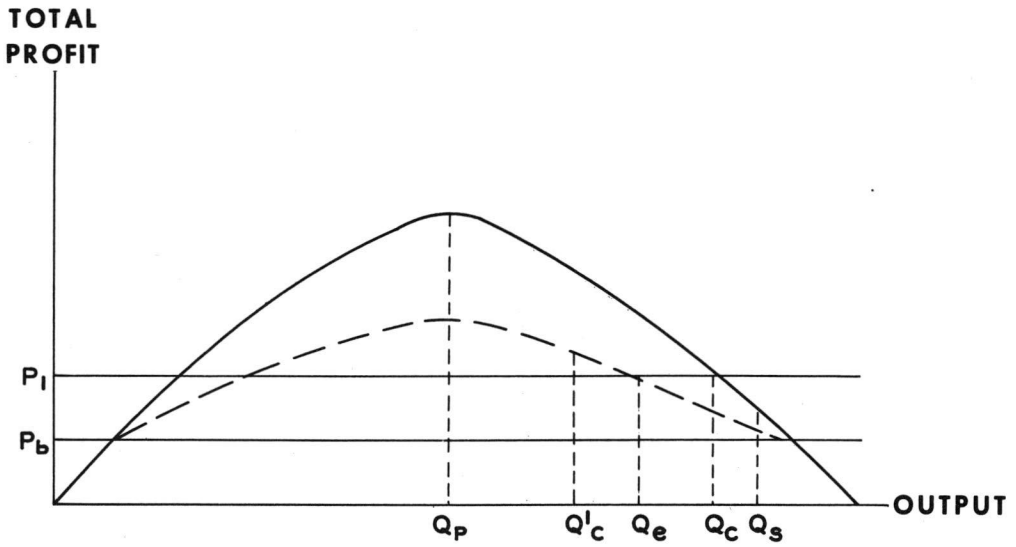
FIGURE 3



P_b = interest return on borrowed capital

$P_l - P_b$ = minimum acceptable return on equity capital when the firm finances to a significant extent by means of borrowed capital

as well as equity capital. Let us assume the same minimum acceptable profit level (P_1) (and the same uniform 50 per cent rate of tax). This is not an unduly unreasonable assumption. Normal return on risk-bearing equity is higher than normal return on borrowed capital. For this reason a shift from equity to borrowed capital tends to reduce the minimum acceptable profit level. At the same time such a shift by reducing the equity basis of the firm, increases the risk taken by each remaining dollar of equity capital and hence raises the normal return on the reduced level of equity capital.

Since interest payments are a deductible item under corporate income tax, the broken line in Figure 3, above, represents net profits (after tax, but including return on borrowed capital) for this firm. Profits before and after tax coincide at profit levels equal to or smaller than R_b. In this case Q_e is the new equilibrium output (as shown in this figure $Q_e > Q'_c$). This means that in the case of debt financing, the imposition of the corporate income tax results in a smaller reduction of output and sales revenue, a smaller increase in price and profit before tax, and a smaller tax revenue than under pure equity financing. Furthermore, tax revenue is not only smaller because of the elimination of interest payments from the tax base but also as a result of the smaller tax-induced reduction in output.

In conclusion, since debt financing under the previous assumptions reduces the sales-contracting effect of the corporate income tax relative to equity financing, the elimination of interest payments from the tax base results in a bias in favour of bond financing rather than equity financing. And the observed change in the debt/equity ratio may well be a <u>verification</u> of this.

The general equilibrium implication of the analysis is that under these assumptions the after-tax profit is not affected by the tax, but the price rises and the output is reduced. However, an examination of the elasticities of output (measured by business gross product) and of the distribution shares with respect to corporate income tax, taken at different points of time, would give misleading results since the change in output in response to a change in the tax rate, for instance, will be smaller than one would normally expect because of the change in the structure of capital over time. The expected reduction in output resulting from an increase in the tax will be smaller because the entrepreneur relies more heavily upon borrowed capital. In other words, his reaction will involve adjustment of his capital structure as well as output. This question is treated in Section 3.2 following.

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6/ William J. Baumol, "On the Theory of Oligopoly", Economica, August 1958, pp. 187-198. [Emphasis added] See also Baumol's Business Behavior, Value and Growth, Macmillan, New York, 1959, p. 73.

7/ William J. Baumol, Ibid., pp. 77-78.

CHAPTER 3—SURVEY OF PAST EMPIRICAL EVIDENCE

3.1. Introductory Remarks

This chapter is designed to present a summary and appraisal of the results of the most relevant studies bearing on the problem of the incidence of the corporate tax. While the literature on the subject is voluminous, the quality of the empirical evidence is rather poor. Gilbert Burck depicts the complexity of the problem and the confusion prevailing despite the numerous attempts to solve it.

> The tax is so hidden that legions of Ph.D.'s, after thirty years of producing exquisitely wiredrawn ratiocination, cannot agree who pays it or how or when. Is the tax passed on in the form of higher prices or lower wages or both, or is it really a tax on equity capital? The problem is almost metaphysical in its gluey complexities, and examining the learned speculations of the academicians, the untutored layman finds himself recalling Macaulay's comments on the medieval schoolmen who 'showed so much acuteness and force of mind arguing on their wretched data, that one is perpetually at a loss to comprehend how such minds came by such data'. 1/

The conclusion reached by economists range from the orthodox view of Adelman, Goode, and others, who think that shareholders pay the entire tax—that is to say, that the tax is not shifted at all—to the opposite position of Boulding who believes in a one hundred per cent shifting of corporation tax to consumers or to factors of production. 2/ The recent trend in academic analysis runs towards the notion that the tax is passed on at a degree exceeding one hundred per cent. This position is held, inter alia, by Mr. Krzyzaniak and R. A. Musgrave in a pioneering study recently published. 3/ This study uses samples of industry and company records to show that manufacturing industries, as a group, shift the tax enough over the short term to prevent decline in the net rate of return, and that those adjustments are maintained subsequently.

The conflicting conclusions found in the theoretical literature considering the incidence of the corporate income tax also characterize those studies which have attempted to answer the question empirically. In the latter studies, the prime source of conflict would seem to lie in the indicators chosen to demonstrate shifting or non-shifting, some indicators consistently demonstrating a high degree of shifting, while the use of others leads to the conclusion that virtually the entire tax is borne by corporations. The contrast between the results obtained from the observation of time series of the net rate of return on capital with those yielded by the gross profit share of value added in the corporate sector, both over periods during which the rate of corporate tax had changed significantly, is of particular interest.

Despite wide variations in conclusions the most recent studies have a number of elements in common: (a) most studies are of the short-run analysis type, (b) they assume effective competition, (c) they assume the existence of alternative investment which is not subject to the corporate income tax (very few of them, however, bother to estimate the degree of substitutability between both forms of investment). Many of these studies (particularly those based on rate of return as an indicator of shifting) suggest that the amount of shifting depends on such factors as: (a) the degree of competition, (b) the rate of turnover (i.e., the ratio of sales to capital assets), (c) the profit margin (i.e., the ratio of profits to sales), and (d) the elasticity of supply of capital with respect to the change in rate of return or the change in tax rate. More important than the degree of competition, in my view, are the pricing policies which may vary between industries or even between firms within an industry. It is

equally important to point out that the rate of turnover and the profit margin are not necessarily two independent factors.

The first three factors enumerated above will receive extensive treatment and will be the object of statistical tests aimed at determining their relative contribution to the producers' ability to shift the tax in a further part of the study. The fourth factor, it seems, cannot be discarded as unimportant without justification. The few studies of the elasticity of supply of capital found it to be amazingly low and therefore unimportant. Jorgensen 4/ has estimated that investment will change very little, given a change in profits. This fact is illustrated by the figures in Table 3-1 following.

A proposition put forward by Mackintosh 5/ is that lower taxation of corporate profits will raise business investment directly by only a small fraction (estimated at between 10 and 30 per cent, the best estimate being 13 per cent) of the forgone tax yield, whereas considerably more of the tax saving will be used, particularly by large corporations, to repay outstanding indebtedness, to acquire financial assets, or to pay dividends. If this is so, the indirect effects of tax changes on investment, exerted through financial markets, may be even more important than the direct effects. As no reliable estimate of the elasticity of supply of capital may be derived from Canadian data, and as the evidence suggests it to be very low, to the point of being a negligible factor, we shall ignore it in the forthcoming analysis.

3.2 Results of Empirical Studies

Let us now turn to the results of empirical investigations mainly carried out in the United States. For the purpose of this survey the studies have been

Table 3-1 - Long-Term Responses and Elasticities of Investment with Respect to Changes in Interest Rates and Tax Structure Variables in United States Manufacturing

Variable	Response a/	Elasticity a/
Rate of Interest	-14.24	-.291
Tax Rate on Business Income	-.375	-.510
Proportion of true depreciation chargeable against taxes	.187	.392

Note:

a/ Evaluated at the mean of the period analyzed.

Source: Dale W. Jorgenson, "Capital Theory and Investment Behavior", American Economic Review, May 1963, Table 3, p. 258.

divided into two broad categories depending on the approach adopted by the various authors. First, the studies focusing on the rate of return on capital will be examined. Secondly, the studies drawing evidence on the examination of the relative factor shares will be dealt with.

(a) Rate of Return Approach

The most recent opinions regarding the incidence of the corporate income tax rest in part on studies of empirical data concerning corporate rates of return on net worth or total investment, before or after tax, over the last 40 years. During this period, tax rates—both statutory and effective—drastically increased. The question asked in these investigations is whether increases in tax rates have been accompanied by corresponding reductions in rates of return after tax as would be expected if the tax is not shifted.

Comparisons of corporate rates of return on net worth before and after changes in tax rates for selected periods are given in Table 3-2. The conclusion that may be inferred from the material assembled in this table is that the rates of return after payments of taxes have not, for corporate manufacturing as a whole, been impaired by the approximate quadrupling of tax rates recorded over the last 40 years.

One of the earliest empirical studies was that of Lerner and Hendriksen, who undertook to determine the effect of the changes in the corporate tax rate which occurred between 1927 and 1952 on the rate of return on investment. Concerning short-run adjustment to the tax they found evidence of substantial changes in the after-tax rate of return on investment consequent upon rate changes, and concluded, therefore, that tax changes were not passed on in

Table 3-2 - Summary of the Results of Five Empirical Studies.
Corporate Rates of Return for Selected Periods
(in Percentage) on Various Bases

	1920's	1927-29	1936-39	1940	1946-51	1952-55	1955-57
TAX RATES							
1. Statutory tax rate (average %) a/		11.0-13.5	15-19				52.0
2. Effective tax rate (manufacturing)	13.3			29.1	40.7	56.2	
RATES OF RETURN							
3. Zellner's after tax b/							
(i) all corporations	5.8					6.0	
(ii) all manufacturing corporations	8.0					7.9	
4. Clendenin's data c/							
(i) large manufacturing	12.2			10.3		13.1	
(ii) all manufacturing	8.1			8.4		8.5	
5. Lerner & Hendriksen d/							
Manufacturing after tax (on total investment)		10.6			11.3		
6. Krzyzaniak and Musgrave e/							
(i) all manufacturing (total capital base)		7.6	6.3				8.5
(ii) all manufacturing (equity base)		8.0	6.3				9.4
(iii) all manufacturing adjusted for price changes			6.5				6.3
(iv) same as (iii) inventory valuation profit included		7.8	6.7				7.3

Source:

a/ Paul G. Darling, "Income Taxation and Dividend Income", Tax Revision Compendium, Washington: U.S. Government Printing Office, 1959, Vol. 3, pp. 1573-1590, especially p. 1582.

b/ Arnold Zellner, "The Corporate Income Tax in the Long Run: A Comment", Journal of Political Economy, October 1958, pp. 444-448. (Zellner's data with rates of return adjusted using replacement cost rather than historical cost as the basis for costing consumption of inventories and other physical assets for valuing net worth.)

c/ J.C. Clendenin, "Effect of Corporate Income Tax on Corporate Earnings", Taxes, Vol. XXXIV, June 1956, p. 396. (Data not adjusted to account for changing price levels and accelerated depreciation.)

d/ Lerner and Hendriksen, "Federal Taxes on Corporate Income and the Rate of Return on Investment in Manufacturing, 1927 to 1952", National Tax Journal, Vol. IX, No. 3, September 1956, pp. 193-202. (Data read off a graph, p. 200, and therefore subject to a small error. The data are not adjusted for change in prices.)

e/ Krzyzaniak & Musgrave, op. cit., p. 17.

full in the short run. On the other hand, with respect to the entire period examined, a trend line fitted to the after-tax rate of return on investment was found to be relatively flat, suggesting that the tax was shifted through higher before-tax profit rates.

These findings with respect to the after-tax rate of return over the longer period were substantially confirmed by data compiled by Clendenin and by Zellner. More recently, Krzyzaniak and Musgrave using similar techniques of analysis in a preliminary part of their study have derived results much in line with those of earlier students of this problem.

Plausible Avenues of Shifting. If the after-tax rates of return are left unimpaired by a fourfold increase in the tax rate, the assumption that all other factors affecting the earning ability of the firms remained constant over the period cannot be true. In other words, the usual long-run ceteris paribus assumption cannot hold. To escape the burden of the tax, the corporations must have succeeded in raising their pre-tax rates of return. To achieve this, only a limited number of ways exist of which the following seem to be the most plausible:

(i) to maintain their rates of return in the face of rising tax rates, corporations switched from equity to debt financing (this process was defined as "avoidance");

(ii) the tax was shifted forward to consumers through higher prices and/or backward by lowering prices to suppliers of inputs;

(iii) the gains resulting from technical innovations which increased the productivity of both capital and labour were not passed along entirely to customers or factors of production, but were used to offset the higher

tax liability of the corporations. (This may be a case of tax shifting if it can be shown that consumers, factors, etc., would have benefited from these gains in the absence of high tax rates.)

(iv) investment in prestige. The tax may have some effects upon cost minimization and profit maximization. Firms may become less vigilant against inefficient practices, since the marginal reward for achieving efficiency is reduced by taxation. If the firm has multiple goals which include profits and other objectives, placing a penalty on profits may lead to their emphasizing the other objectives—e.g., the cost (in terms of forgone profits) of acquiring a prestige office building in Montreal is reduced when the corporate tax is raised.

Let us focus on the first item outlined above, since the extent of shifting via price (and wage) changes will be examined at length later and since the remaining two propositions appear to be exceedingly hard to test. There are two ways of determining whether a greater relative use of debt financing was responsible to any substantial degree, for the maintenance of rates of return in the face of higher tax rates. The first is to see what happens to rates of return on total investment (long-term debt plus equity capital) rather than on equity capital alone. This is precisely what Lerner and Hendriksen did, and their result is given in Table 3-2 above. Post-war rates of return after taxes are found to be greater than during the late 1920's: 11.3 as compared to 10.6 per cent. Their conclusion is that in the long run "...the level of taxation has had no discernable effect on the rate of return on investment." This suggests that, irrespective of the ratio of debt to equity, the profitability of these corporations (manufacturing as a whole) was not depressed during a

period characterized by drastic increases in tax rates. Therefore, to maintain these rates of return, there was no need for a shift toward heavier reliance on debt financing.

A second way of looking at this problem is to examine the change in the debt/equity ratio over this period. This has also been done by the two authors who used a wider base—the ratio of all debt to all debt plus net worth—for all non-financial corporations. They found that the ratio increased only by one percentage point, from 37.8 to 38.8 per cent, over the period from 1928 to 1950 in spite of sharply higher tax rates in the second half of the period. There are a number of reasons why the transfer from equity to debt was shown to be a negligible factor. First, the corporations are continually balancing off the additional debt with new equity funds obtained through earning retentions. A second factor explaining the ralatively low increase in debt financing among manufacturing firms is the very large rise in annual depreciation charge-offs, relative to net earnings, that has taken place during the last years of the period. (This can be checked by using the ratio of amortization of non-current assets to net earnings after tax. In the United States manufacturing corporations, this ratio went from 41 per cent in 1929 to 61 per cent in 1957.) A greater cash inflow from amortizations, relative to cash inflow from earnings, is likely to induce heavier bond financing because this expanded amortization cash inflow provides a better coverage for fixed interest payments. During a low earning year, cash from amortizations can always be made available in an emergency to meet these payments.

Another extensive study carried out for the Commission on Money and Credit in the United States 6/ reaches the conclusion that the corporation tax has

had but little influence on the choice between debt and equity financing. In Canada, the picture looks somewhat different in that a more important transfer from equity to debt financing appears to have taken place over the relatively short period between 1946 and 1960, and even between 1948 and 1952. This fact is well illustrated by the figures in Table 3-3. A greater reliance on borrowed funds rather than stock financing may well be the result of a greater liberalization of the depreciation policy in Canada during those years. It may also be explained by the fact that this ratio was lower to begin with in Canada than in the U.S. The debt/equity ratio rose by 18.2 percentage points (from 33.6 to 51.8) between 1945-47 and 1960-62. The ratio of equity to total capital shows a much greater stability, rising by 1.2 percentage point, from 14.9 to 16.1 per cent, over the same period. A large proportion of the change in the debt/equity ratio took place between 1951 and 1954. The difference in the behaviour of the two series probably originates in the liberalization of depreciation policies in 1949 and 1950. In effect, following the adoption of accelerated depreciation, corporations have accumulated reserves and surpluses which are included in the net worth and consequently in the total capital figures, but not in the equity capital figures. As a result of this accounting operation, the net worth and total capital series rose and paralleled the long-term indebtedness series which explains the constancy in the ratio of these two magnitudes.

One cannot infer from a change in the debt/equity ratio that the tax is shifted from share owners to other groups, but it nonetheless gives some indication of the investment policy of a corporation. A shift from equity to debt financing may be considered as an alternative to either absorption or shifting of the tax through partial elimination of the tax liability.

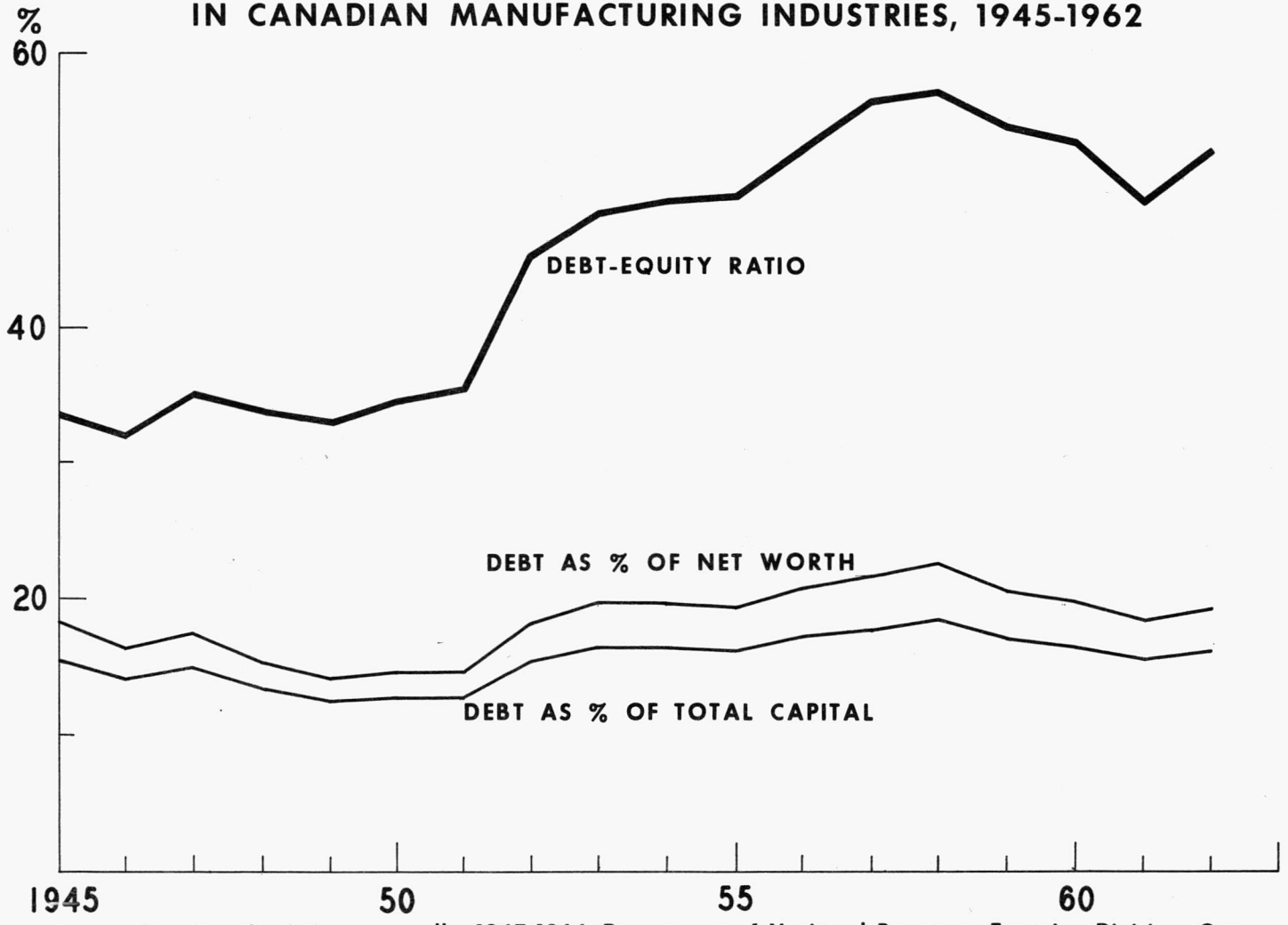
Table 3-3 - Ratio of Debt to Equity Financing in Canadian Manufacturing Industries, 1945-1962

Year	Long-term Indebtedness ($ millions)	Equity Capital ($ millions)	Net Worth ($ millions)	Debt/equity Ratio %	Debt as % of Net Worth %	Debt as % of Total Capital %
1945	643.4	1914.4	3489.7	33.6	18.4	15.6
1946	627.9	1961.1	3819.9	32.0	16.4	14.1
1947	750.5	2135.4	4265.1	35.1	17.6	15.0
1948	743.6	2190.4	4821.8	33.9	15.4	13.4
1949	740.1	2244.5	5241.3	33.0	14.1	12.4
1950	833.5	2407.5	5670.0	34.6	14.7	12.8
1951	921.0	2587.4	6282.8	35.6	14.7	12.8
1952	1195.4	2706.1	6624.1	44.2	18.1	15.3
1953	1437.2	2970.2	7346.5	48.4	19.6	16.4
1954	1549.8	3141.1	7915.0	49.3	19.6	16.4
1955	1662.8	3352.4	8634.5	49.6	19.3	16.2
1956	1990.0	3758.8	9602.5	52.9	20.7	17.2
1957	2215.0	3930.7	10294.8	56.4	21.5	17.7
1958	2465.9	4316.6	10948.0	57.1	22.5	18.4
1959	2387.3	4375.3	11693.7	54.6	20.4	17.0
1960	2432.6	4553.1	12302.7	53.4	19.8	16.5
1961	2492.6	5054.3	13492.3	49.3	18.5	15.6
1962	2629.0	4976.0	13625.1	52.8	19.3	16.2

Source: Taxation Statistics, Annually, 1947-1964, Department of National Revenue, Taxation Division, Ottawa.

Chart 3-1

RATIO OF DEBT TO EQUITY, NET WORTH AND TOTAL CAPITAL IN CANADIAN MANUFACTURING INDUSTRIES, 1945-1962



Source: Taxation Statistics, annually, 1947-1964, Department of National Revenue, Taxation Division, Ottawa.

Before turning to the factor share approach let us consider briefly two of the other possibilities mentioned above: (a) shifting the tax by increasing the consumer price and cutting employees' wages; (b) using the gains from technical progress to offset a heavier burden of taxation. These two possibilities are best discussed together.

As mentioned earlier, if the after-tax rates of return on investment were maintained in spite of heavier taxes, the ratio of profits before tax to investment must have increased. This means that either one or both of two things must have happened: either the profit margin π/s and/or the turnover ratio s/k must have increased since the rate of return may be thought of as the direct product of these two factors.

$$\pi/k = \pi/s \cdot s/k$$

Lener and Hendriksen 7/ found that over the period 1937 to 1952, the long-run trend of these ratios for manufacturing corporations was as follows: the profit margin was about constant over the period whereas the turnover rate went up by approximately 60 per cent. The fact that the profit margin follows a somewhat level trend over time reflects the pricing policy in the marketing of output and the purchasing of inputs. Comparing the profit margin figure at both ends of the period does not necessarily suggest that increased taxes were met by raising prices relative to costs in order to squeeze an extra profit margin from each dollar's worth of sales. A better explanation is suggested by the strong rise in the turnover ratio. As a result of technological progress and, possibly, reduction of excess capacity each dollar's worth of invested capital becomes a more efficient producer of output. Increases in the resulting quantities produced and sold from each unit of investment have generated larger profits before taxes. It is out of the gains from this increased

productivity that higher taxes appear to have been paid. As a result, the shifting of the tax burden was not so much a process of raising prices to consumers (and/or lowering prices to suppliers) as it was a process of failing to pass along to those two groups all the fruits of the increased productivity. 8/ This is a long-run aggregate trend, the picture for one particular industry or for one or two years may have been quite different.

Unfortunately, these conclusions can be no better than the studies upon which they are based, and these are uniformly deficient in that they fail to isolate the effects of changes in corporate tax rates from the effects of various other factors that impinge on the corporate sector. Since tax rate changes usually occur during periods of fundamental change in the economic system, this failure is of considerable significance. In consequence, while these studies do yield useful preliminary insights, they are unable to determine the incidence of the corporate income tax. What is required for this purpose are more comprehensive econometric studies which attempt explicitly to isolate the tax effects from the effects of other elements of budget policy and the various exogenous influences on the corporation. To date, two such studies have been undertaken. The first by Krzyzaniak and Musgrave is based on rates of return on capital, while the second hinges on relative income shares and will be reviewed under this heading.

Krzyzaniak and Musgrave have applied time series data to fit a function where the rate of return is the dependent variable, and where tax factors are among the predetermined variables. The regression coefficients of the variables are derived, and then used to estimate the difference between the observed rate of return and that which would have prevailed without

the tax. From this difference a measure of the degree of shifting is then derived. The model is designed to record the effects of the tax rate changes in the years in which the changes occur. Lagged effects may have somewhat influenced the results, but substantially, these reflect short-run types of adjustments in prices, costs, and output, rather than long-run adjustments reflecting changes in capital stock.

Utilizing this approach, and estimating various versions of two different models, the authors obtained the rather surprising result of shifting well in excess of 100 per cent. While the inability to isolate the tax effects from the influences of changes in public expenditures highly correlated with the tax rate changes may cause the shifting indicators to overstate the true degree of shifting, a result in excess of 100 per cent is not necessarily wrong. However, the models used have other dubious aspects. In particular, the use of the effective tax rate, an endogenous variable of the system, as an instrumental variable for the standardized tax liability probably tends to ensure highly significant estimates with small standard errors. The government expenditure variable and the tax variable are not only correlated, but they are also highly collinear as discarding the public expenditure variable increases the significance of all other coefficients in the model, especially that of the tax variable. This indicates that the tax coefficient is exaggerated by a public expenditure effect which cannot be separated. Consequently, the tax coefficient is not only a measure of tax incidence but it is contaminated by influences of budget incidence. Further shortcomings of the technique of analysis used by the two authors will be pointed out later, when the results of the forthcoming cross-section analysis will be presented.

(b) Factor Share Approach

The original exponent of the income share analysis was Adelman who argued that if an increase in the corporate tax rate were shifted profits before tax would rise. "The relevant statistic for testing this hypothesis is corporate profits before taxes as a fraction of all income originating in corporate enterprise." 9/ Examining this fraction for the 1920's and the period 1946-55, he found no significant differences; he therefore concluded that there has been no shifting of the corporate income tax either to consumers or to employees.

The formal reconciliation of the seemingly contradictory conclusions yielded by the different indicators is not difficult. As Musgrave has shown, (see reference 13 following) where profits, income and capital are represented by P, Y and K respectively, the following relationship will hold:

$$P/Y = (P/K)\ (K/Y).$$

The constancy of the profit share (P/Y) is thus quite consistent with a rising rate of return before tax (P/K) if there has been a sufficient compensating reduction in the capital/output ratio, a ratio which Lerner and Hendriksen have shown has fallen appreciably during the period in which the corporate tax rates were increasing.

Krzyzaniak and Musgrave Study. The two authors attach some importance to the factor share as an indicator of tax incidence on the ground that it is related to the distributional effect of the tax. Following this approach, it is possible to relate the total capital earnings (investment income) or the corporation profits to the total value added or to the domestic product. The purpose of considering shifting in those terms is to find the resulting change in the distribution of income after a change in tax rate.

The extreme hypotheses to be examined may be summarized as follows. In net terms, there is full shifting when the share of after-tax profits in value added remains unchanged after a change in the corporate tax; there is no shifting when the share of profits net of tax in value added is reduced by the change in tax rates (by the full amount of the tax liability). In gross terms, shifting would be indicated by a situation where the share of profits gross of tax in total value added rises by the tax share of the value added; the absorption case would be found when the profit share gross of tax remains constant. 10/

The two authors have found that the gross share of corporation profits, as a percentage of corporate value added rose from 19.2 to 22.6 per cent (an increase of 17.7 per cent) during the period from 1922-29 to 1948-57. Full shifting would have required an increase to 27.0 per cent. While a rough calculation in those terms suggests 44 per cent shifting, the result featured in Adelman's study shows approximately no shifting for a comparable period. The latter result, however, was derived differently: the corporate profit before tax includes interest income. The result of lower shifting, when the interest paid is included, is in line with the hypothesis discussed earlier that the tax raise may induce substitution of debt for equity capital. Here the ceteris paribus assumption does not hold. The interest share declined and this may be attributed largely to a reduction in interest rates. It may be recalled that other studies 11/ have found the switch from equity to debt financing to be only a minor phenomenon which may be explained largely by non-tax factors. Though the last indicator (using investment income instead of corporate profits) may be conceptually better, it is claimed that the evidence derived when using before-tax corporate profits is "preferable because we know that certain additional ceteris paribus assumptions implicit in indicator 10 do not hold". 12/

So far the "gross" side of the picture has been examined, the "net" side, although more difficult to approach, is also of interest. Corporate profits after tax as a percentage of value added in the corporate sector are estimated at 16.0 per cent for 1922-29 and 12.7 per cent for 1948-57. The authors' heroic estimate indicates that this implies 42 per cent shifting. This is not significantly different from the 44 per cent derived in gross share terms.

The relative stability or constancy of the gross profit share over a period during which tax rates rose suggests that the tax has been shifted to a limited extent only. How is this to be reconciled with the results quoted previously which indicate that the rate of return on capital increased sufficiently to suggest very extensive shifting? The answer to this is of a somewhat semantic nature, and we have to go back to the distinction between various definitions of full shifting. One approach considers the tax to be shifted if the net rate of return after tax is maintained. Another considers the tax shifted if net profits as a share of income or value added remain unchanged after a change in the effective tax rate. Total shifting in the first sense, and only partial shifting (if any at all) in the second sense are not mutually exclusive since the initial rate of return may be restored, in the long run, but applied to a smaller capital stock, i.e., there would be "long-run shifting". Musgrave attempted to show that, the tax factor aside, there is nothing incompatible with the finding that the profit share remained constant, while the gross rate of return increased. 13/

Hall's Study. A major piece of empirical evidence based on factor shares is the Study by Challis A. Hall, Jr. 14/ Professor Hall's approach involves

the application of some of the techniques developed by Solow in his investigation of the relationship between technical change and the aggregate production function. 15/ The starting point of the analysis is Solow's conclusion that during the period in question, technical change was neutral, in the sense that at any capital/labour ratio it raised the marginal physical productivities of labour and capital in the same proportion. The method used involves fitting a production relationship (corrected for technical progress) between output and inputs of labour and capital to annual data for the manufacturing sector in the United States, over the period 1919-1959. Since, it is alleged, the derived production relationship depends upon the short-run impact of corporation taxes, three alternative and mutually exclusive assumptions of the tax consequences have been made leading to three different production relationships. (The actual shifting assumptions are that there is "zero shifting" of the tax, that there is "full wage shift", that is, complete backward shifting in the form of lower wages, and finally, that there is "full sales-tax shift", that is, complete forward shifting via higher prices for the output of the corporate sector.) From each of these, the output that would have been produced with the labour and capital actually employed has been estimated. Estimates of profits and wages that would have been received with the employed labour and capital if these inputs received the value of their marginal products were also derived. Estimated values of output and profits are then compared with their actual values to determine which production relationship provides the best estimates. The particular assumption about corporate profits taxation leading to the best estimates of output and profits is suggested as the most valid hypothesis of tax impact.

Hall reaches the conclusion that, if technical progress was in fact neutral over the period considered, the traditional "no-shift" hypothesis gives more consistent results than either of the other shifting hypotheses. The "full sales-tax shift" model did yield somewhat better results than the "full wage shift" model. The author also concludes that a short-run shifting hypothesis is consistent with non-neutral technical progress only if technical change reduced the productivity of capital relative to that of labour during the last half of the period examined. In Hall's own words the quantitative results may be summarized as follows:

> This relationship was fitted by least squares to the logarithms of the variables for all years in the 1919-59 period. The basic linear regressions between logarithms of output per man-hour and capital per man-hour indicate the variance in deflated hourly output is 97.33 per cent accounted for with the no-shift assumption, 94.55 per cent with the sales shift, and 93.60 per cent with the wage shift, for the capital variant including inventory. Approximately the same figures for explained variance are provided with the capital variant excluding inventory, ... 16/

The results obtained and the inferences drawn from them call for serious qualifications. To start with the most obvious points, the differences among the estimating error of the three models are very small and the question of significance between these differences, although not stressed in the study, appears to be quite relevant. Indeed, the closeness of fit obtained with the no-shift assumption does not appear so very much better than that obtained with the full sales-tax shift assumption. The margin seems much too slim to yield more than a tentative suggestion. Given this precarious state of affairs, technical progress does not have to be very far out of line of perfect neutrality to throw these results in the air and turn all conclusions topsy-turvy. The confidence margin implicit in Solow's neutrality test has to be pretty narrow to eliminate

this risk. Moreover, the data cover a very long and varied period, raising serious doubts with respect to homogeneity, and the question whether it would not have been justifiable to exclude the depression and war periods. Finally, there is no a priori reason for believing that the coefficient of determination must necessarily decline continuously as the assumed degree of shifting is increased.

There are further criticisms which must be levied against the Hall approach. In the first place, while some excellent pioneering investigations into the nature of technical change have been undertaken, much remains to be done before it will be possible to assert confidently that technical progress has in fact been neutral. In consequence, the dependence of the study upon the possibility of deflating for technical progress must render its conclusions somewhat suspect. In addition, this approach suffers from the further deficiency that the underlying work by Solow assumes competitive markets, while the shifting hypotheses tested involve forward and backward shifting of a sort that could occur only in imperfect markets.

In conclusion, the fact that the three mutually exclusive hypotheses tested give a quasi-equally good fit suggests that the approach is somewhat crude. In other words, the fact that the high explanatory value of the model is barely reduced by the mix of assumption tested strongly suggests that the approach is insensitive to the phenomena under investigation. Moreover, there is no reason to believe that an intermediate hypothesis of, say, 50 per cent shifting (forward and/or backward) would not yield a better fit than any one of the extreme hypotheses considered by Professor Hall.

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3/ M. Krzyzaniak and R.A. Musgrave, The Shifting of the Corporate Income Tax - An Empirical Study of its Short-Run Effect upon the Rate of Return, Baltimore: The Johns Hopkins Press, 1963.

4/ D.W. Jorgensen, "Capital Theory and Investment Behavior", American Economic Association, Papers and Proceedings, May 1963, pp. 247-259.

5/ A.S. Mackintosh, The Development of Firms - An Empirical Study with Special Reference to the Economic Effects of Taxation, Cambridge: Cambridge University Press, 1963, especially pp. 125-128, and Appendix II, pp. 296-298.

6/ Merton H. Miller, "The Corporation Income Tax and Corporate Financial Policies", in Stabilization Policies, The Commission on Money and Credit, Englewood Cliffs, N.J.: Prentice-Hall Inc., 1963, pp. 381-470.

7/ Lerner and Hendriksen, op. cit., pp. 199-201.

8/ According to Paul Darling, a part of the rise in the turnover ratio s/k may, however, be accounted for by increases in the price level which would affect s immediately but k only with a lag since net worth is conventionally measured on the basis of historical cost of fixed assets less depreciation. Cf. Paul G. Darling, op. cit., pp. 1579-1590.

9/ M.A. Adelman, "The Corporate Income Tax in the Long Run", Journal of Policital Economy, Vol. LXV, April 1957, p. 152.

10/ Algebraic expressions for these hypotheses and further evidence may be found in Krzyzaniak and Musgrave, op. cit., pp. 9-16.

11/ Namely, the one by Lerner and Hendriksen and the one by Miller.

12/ Krzyzaniak and Musgrave, op. cit., p. 16. The "indicator 10" in the quotation is defined as "corporate profits before tax plus interest paid by corporations to non-corporate sector as percentage of corporate value added". This figure shows a slight decrease from 1922-29 to 1948-57, and indicates approximately zero shifting for the period.

13/ Richard A. Musgrave, "Effects of Tax Policy on Private Capital Formation", in Fiscal and Debt Management Policies. Study papers prepared for the Commission on Money and Credit, pp. 45-142, especially pp. 108-120. His demonstration may be summarized as follows:

$$\frac{P}{Y} = \frac{P}{K} \cdot \frac{K}{Y}$$

where: P= Profits
Y= Income
K= Capital
P/K= Rate of return
K/Y= Capital-output ratio
P/Y= Profit share

(P/Y), the profit share remains constant with a rising rate of return (P/K), if the capital-output ratio (K/Y) shows a corresponding decline. This relationship, implied in the Cobb-Douglas type of production function, seems to be compatible with the behaviour of the economy over recent decades. Bringing the tax factor into the picture, the constancy of the gross profit share was noted to occur despite the sharp increase in tax rates. Assuming the profit share would have remained constant in the absence of the corporation tax, Musgrave examines the implication of this constancy in view of changing corporation tax rates under two different hypotheses.

He first, supposed that the rising rate of return (P/K) was the result of short-run shifting via price increase. Since the increase in P is added to Y, there also follows a reduction in (K/Y). For (P/Y) to have remained constant, the percentage fall in (K/Y) must have equalled the percentage rise in (P/K). However, it is easy to see that the percentage decline for (K/Y) due to shifting must have been much less than the rise in (P/K). This follows since P is only a small part of of Y. Since (P/Y) remained constant, the increase in (P/K) caused by shifting must have been accompanied by a fall in (K/Y) due to other causes. This last fall, in turn, must have raised (P/K) so that only part of the increase in (P/K) can be attributed to shifting.

He, next, supposes that the rising rate of return (P/K) was the result of "long-run shifting" via reduced investment. Given a Cobb-Douglas type of production function, the tax-induced reduction of capital formation or (K/Y) will leave (P/Y) unaffected, and hence raise (P/K). In other words, the evidence of rising (P/K) and constant (P/Y) is wholly compatible with the hypothesis of complete shifting of the rate of return type. At the same time, (K/Y) may have been reduced as well due to other forces, such as technical progress, and only a small part of the rise in (P/Y) may have been due to tax. Given other types of production functions, the door is open to a variety of alternative interpretations.

14/ Challis A. Hall, Jr., "Direct Shifting of the Corporation Income Tax in Manufacturing", American Economic Review, Vol. LIV, May 1964, pp. 258-271.

15/ R.M. Solow, "Technical Change and the Aggregate Production Function", Review of Economics and Statistics, Vol. XXXIX, August 1957, pp. 312-320.

16/ Hall, op. cit., p. 265.

CHAPTER 4—EMPIRICAL EVIDENCE ON SHORT-RUN SHIFTING: A CROSS-SECTION ANALYSIS

4.1. Introductory Remarks

As hitherto mentioned, any study of long-run shifting is bound by very severe limitations because of the ceteris paribus assumptions inherent in that type of analysis with respect to investment, capital structure, technical progress, and the like. For this reason, I propose to concentrate on short-run shifting only. (Long-run evidence has been looked at briefly in the previous chapter.) A study of this type calls for a different approach to the problem. Time series analysis has to be discarded in favour of cross-sectional analysis for direct comparisons between various industries, or groups of industries, which are thought to have differential ability to shift the tax.

Such an option suggests that statistical tests ought to be applied for the alleged ability to shift of industries or classes of industries differing in their characteristics but subject to similar tax treatment at a given point in time. The industries may be classified according to their capital intensity (ranging from capital—to labour-intensive): capital structure, given their capital intensity (measured by debt/equity relationship); by market conditions (measured by the level of concentration); and others.

Such empirical tests will be applied following two approaches based on two different indicators. The first will relate the change in rates of return, before and after a change in tax rates, to the various characteristics enumerated above. It is indeed logical to think that industries having a greater ability to shift the tax will have a greater success in maintaining their net rate of return in the short run (or in raising their pre-tax

return). The second test bears on the mechanism of shifting as well as on the ability to shift. It relates the relative change in the price of various products to the characteristics of the industries producing them. An increase in price is the main avenue by which a corporation may succeed in recouping the additional tax burden or part of it, in the short run, thus passing the tax on to the consumers. If this hypothesis is to be retained, larger price increases should be observed for products sold by capital-intensive industries, but not on markets where the competition tends to be restricted.

Although the tax treatment of various industries does not differ sufficiently to justify its inclusion as a variable in our cross section, it is possible to gain vantage points by applying our method at more than one point of time and for periods of various lengths. Such tests were performed with both indicators—changes in rates of return and relative price changes—by taking year-to-year differences over five years and differences between various non-consecutive years over the same period. These will be our dependent variables. To follow this procedure throughout, the values of some of the explanatory variables have to be averaged over the period under consideration. This period extends from 1948 to 1952 and, as will be discussed in detail later, the statutory tax rate rose by over 70 per cent, jumping from 30 to 52 per cent. It should be understood that the major assumption underlying the procedure outlined above is that, despite the identical tax treatment affecting all the industries and all the firms within each industry, some differences between various groups of firms (industries) will be observed. It is also implied that these differences are due to tax factors only (i.e., to the different ways in which each industry reacts to the tax). All the other factors are assumed

to affect the various industries in a random fashion; if omitted factors are correlated with included factors, however, biased results will be obtained. The complete absence of a systematic pattern according to which factors, other than those included in the models, may affect, say, the rate of return in various industries is far from certain, although its assumption is rather crucial.

4.2. The Hypotheses

The study of short-run incidence revolves mainly around the difference in the ability of various industries to pass on the corporate tax. The major hypothesis is, therefore, that a higher proportion of the tax will be passed on by industries operating under oligopolistic market conditions as opposed to highly competitive industries and, consequently, a larger increase in gross rates of return should be observed in favour of the former industries as a result of higher tax rates. This hypothesis also applies with regard to capital intensity and capital structure, although the nature of the relationship may be different and remains to be determined. As alluded to earlier, the technique used for measuring the degree of competition characterizing the market in which each group operates, is the concentration ratio as derived in Appendix C. The rational for the choice of this measure will be found in a further section of this chapter.

In testing the hypothesis stated above, it has seemed pertinent to test also for the association of year-to-year changes in profit rates with other potential determinants, and of such determinants with concentration. Thus, some tests were made for the association of changes in gross rates of return with industry concentration, relative importance of capital assets in various industries (represented in the models by some measure of capital

intensity), and also with capital structure (measured by a debt/equity ratio).

The second and no less important set of hypotheses centres on the mechanism of shifting and is related to the question, "if the tax is shifted, how is it shifted?" The contention is that if short-run forward shifting occurs it has to be through higher prices of products. The second hypothesis may then be stated: if some industries have a smaller amount to shift per dollar of output relative to others (i.e., greater ability to shift), they require a relatively smaller change in the price of their product in order to maintain their pre-tax rate of return. Our second task will then consist of relating the relative change in price of various goods to the characteristics that render some more apt to pass on the tax than are others. The (nature of the) relationship is not as straightforward in this case as it was in the previous one. Indeed the industries which allegedly have the greater ability to shift are precisely those which need the smallest hike in prices to maintain their rate of return. As a result small relative changes in price would be associated with a greater ability to shift.

4.3. The Models

(a) Symbols and Notations

i subscript indicating the industry (i.=. 1, ..., 31),

t subscript indicating time,

t = 0 for the initial year,

t = 1 for the final year.

π gross profits (current year profits before tax and gross of depreciation).

K net worth (capital stock plus surplus less deficit).

P wholesale price (index number).

C concentration ratio (number of employees accounted for by the three leading firms in 1948, in percentage, see Appendix C).

D debt or borrowed capital (long-term indebtedness including funded and mortgage debt).

K' fixed capital assets (land, building and equipment).

S gross sales or revenue.

V value added.

E labour earnings.

V^1 investment income as a ratio of value added, defined as $\frac{V-E}{V}$.

Y equity share of value added (value added less labour earnings and bond interest paid). (V-E-I)

$\frac{\pi}{K}$ gross rate of return on net worth.

$\Delta(\frac{\pi_i}{K_i})$ change in rate of return = $(\frac{\pi_1}{K_1} - \frac{\pi_o}{K_o})$.

$\frac{K'}{S}$ ratio of fixed capital assets to sales (capital-output ratio).

$I/_O$ investment income resulting from one dollar's worth of final output; drawn from the input-output table for 1949.

$\frac{D}{K}$ debt/equity ratio.

$\frac{K}{D+K}$ equity as a proportion of total capital invested.

$V'. \frac{K}{D+K}$ capital intensity variable adjusted for differences in the capital structure.

$\frac{\pi}{S}$ profit margin (ratio of taxable income to sales).

$\frac{S}{Y}$ ratio of sales to taxable income, (i.e., ratio of sales to the equity share of value added).

$\frac{S}{K'}$ turnover ratio (ratio of sales to fixed assets).

$\frac{\Delta S}{S_o}$ relative change in sales = $\frac{S_1 - S_o}{S_o}$.

$\frac{\Delta P}{P_o}$ relative change in prices = $\frac{P_1 - P_o}{P_o}$.

$\Delta\frac{D}{K}$ change in debt/equity ratio.

$\Delta\frac{K'}{S}$ change in capital-output ratio (in the rate of utilization of capital).

Ui error term.

(b) The Rate of Return Indicator

Let us turn now to the test of the first set of hypotheses stated above and examine the association of the industries' rates of return with the industries' concentration, capital intensity, capital structure, and others in our sample of 31 manufacturing industries.

Regression equations. Our aim is to devise a function for predicting changes in gross rates of return on net worth which result from changes in tax rates in industries subject to similar tax treatment but differing in their production and market structure. Equation (1.1) below, is typical of the kind of relationship we are trying to investigate, using the ordinary least squares technique.

$$(1.1) \qquad \Delta\left(\frac{\pi_i}{K_i}\right) = B_o + B_1 C + B_2 V' + B_3 \left(\frac{K}{D+K}\right) + U_i$$

The equation thus formulated implies that the size of the change in rates of return observed in various industries depends upon: (1) the concentration ratio characterizing each industry considered; (2) the capital intensity (here measured as the share of value added accruing to capital); and (3) the proportion of total capital which is equity capital. This last variable (or its complement, equity capital as a proportion of total capital) appears to be the logical correction factor to introduce, since the income accruing to borrowed capital, as any other fixed payment of the nature of a rent, is considered as a cost of production and, as such, is deductible from corporation income for tax purposes. A variant of this equation may be written:

$$(1.2) \qquad \Delta\left(\frac{\pi_i}{K_i}\right) = B_o + B_1 C + B_2 \left(\frac{K'}{S}\right) + B_3 \left(\frac{K}{D+K}\right) + U_i$$

In this equation, the capital intensity variable is measured differently. The capital share of value added is replaced by a capital-output ratio defined as the ratio of fixed capital to sales. The model was also fitted to the data with the capital structure correction factor introduced in a multiplicative, rather than in an additive, manner.

$$(1.3) \qquad \Delta\left(\frac{\pi_i}{K_i}\right) = B_o + B_1 C + B_2 \left(V' \cdot \frac{K}{D+K}\right) + U_i$$

The variable so introduced is a capital intensity measure adjusted for the proportion of equity in total capital characterizing each industry. The statistical results obtained by fitting the three versions of this model are not significantly different. The variable (correction factor) representing the proportion of total investment taking the form of equity is not significant. The two other variables, however, appear to be significant for most of the years under consideration, as the statistical

results of Table 4-4 indicate. In view of this, attempts were made with limited success to improve the specification of the model. It must be pointed out that whenever the change in rates of return occurring between the non-consecutive years was considered, as is the case here, the value of the independent variables on the right hand side of the equations were averaged over the years under consideration. This remark does not apply for the values of the concentration ratio which are available for 1948 only. These values were assumed constant over the few years considered. This is not a severe restriction since the level of concentration characterizing each industry shows a high degree of constancy over time. Both profitable and non-profitable firms of the manufacturing industries included in the sample were considered. Before turning to the price indicator, it seems desirable to outline the various attempts made in order to improve the rate of return equations.

As pointed out earlier, in reviewing the theoretical literature of the incidence of the corporate income tax, I encountered some claims that the relative ability to shift the tax depends, in part at least, on: (a) the capital structure of the corporation; (b) the speed with which assets are turned over into sales, (i.e., the nature of the industry with respect to the normal speed of turnover of assets); and (c) the profit margin or its reciprocal, the ratio of sales to taxable income (i.e., the greater the proportion of taxable income per dollar of sale, the greater the tax liability for every dollar of product sold). 1/ This assertion was subjected to a test similar to the one already applied to the allegation that ability to shift originated in other industrial characteristics. The method, as indicated in Equation (1.4), consists in regressing the changes in gross rates of return on three explanatory variables representing

respectively, the capital structure, the turnover rate and the profit margin or, more precisely, its reciprocal, the ratio of sales to taxable income. The algebraic formulation of the functional relationship will throw some light on this relationship.

$$(1.4) \qquad \Delta\left(\frac{\pi_i}{K_i}\right) = B_o + B_1 \left(\frac{S}{Y}\right) + B_2 \left(\frac{S}{K'}\right) + B_3 \left(\frac{K}{D+K}\right) + U_i$$

In this equation, (Y) the value added in each industry less labour earnings and bond interest paid represents the taxable operating income. This represents the first attempt to improve the model aimed at explaining the relative ability to shift of various industries. As the statistical results of Table 4-4 show, it was unsuccessful. (The failure probably originates in a misspecification of the model arising from the exclusion of the concentration ratio which was found significant earlier and has no systematic connection with the other explanatory variables in the model.)

A second and more successful attempt to improve the situation consisted in: (1) removing the capital structure variable from the original model, and (2) introducing a new variable accounting for the change in capital intensity taking place during the period considered. The amended version of the model is expressed in the following equation.

$$(1.5) \qquad \Delta\left(\frac{\pi_i}{K_i}\right) = B_o + B_1 C + B_2 \left(\frac{K'}{S}\right) + B_3 \left(\Delta \frac{K'}{S}\right) + U_i$$

The new variable $\Delta\left(\frac{K'}{S}\right)$ is very highly significant (without much sign of collinearity with the capital intensity itself $\frac{K'}{S}$) and the overall results seem much more encouraging.

A third and final attempt to improve the predictions given by the rate of return model was more successful. The major amendment consisted

in introducing in the model a variable accounting for the change in sales observed in the various industries. 2/ Since we deal with gross rates of return rather than gross profits, the sales figure (i.e., the change in sales) had to be standardized to keep the same dimensional units on both sides of the regression equation. This was done by taking the relative change in sales rather than the absolute change, thus giving the following equation:

$$(1.6) \quad \Delta\left(\frac{\pi_i}{K_i}\right) = B_o + B_1 C + B_2 \left(\frac{K'}{S}\right) + B_3 \left(\frac{\pi}{S}\right) + B_4 \left(\frac{\Delta S}{S_o}\right) + U_i$$

Although far from perfect, the results obtained after this transformation was made are more satisfactory, as can be seen in Table 4-4.

(c) The Price Indicator

The test of the second set of hypotheses is related to the mechanism of short-run shifting and the results obtained, although far from conclusive, tend to support the results derived from the approach described above. Because of the similarity between the price models and the rate of return models, there is no need for an extensive treatment of each variable and for the rationale for each inclusion. The price equations should throw sufficient light on the matter to make the logic clear.

Regression equations. The general and most comprehensive equation for the price approach reads as follows:

$$(2.1) \quad \frac{\Delta P}{P_o} = B_o + B_1 \left(I/_O\right) + B_2 \left(\frac{D}{K}\right) + B_3 \left(\Delta\frac{D}{K}\right) + B_4 C + U_i$$

Thus formulated, Equation (2.1) implies that the size of the relative change in the price of the product in various manufacturing industries depends upon:

(1) The intensity with which the capital is used in the production of each unit of output in various industries. This is measured by the share of capital in final output ($^{I}/_{O}$). The reason for the choice of this particular measure will be given in the forthcoming section (4.4.). It seems logical to think that a firm which relies more heavily on capital for the production of a unit of output should raise the price of that unit relatively more, in order to recoup the additional tax burden arising from a change in the corporate tax rate, than would a firm relying relatively more heavily on factors of production other than capital.

(2) The structure of the capital invested. The larger the proportion of borrowed capital, given the capital intensity, the smaller the change in tax liability resulting from a change in tax rate and therefore the smaller the rise in price necessary to recoup it in the short run. The variable indicative of the capital structure is $(\frac{D}{K})$, the debt/equity ratio.

(3) The change in the structure of capital $\Delta(\frac{D}{K})$. As mentioned earlier, the businessman facing an increase in the tax rate has at least two possible courses of action open to him in the short run. He may raise the price of his product, thus shifting the tax to the consumer, or he may avoid the tax by eliminating the tax liability itself. The latter may be achieved in the short run by changing the capital structure (i.e., by substituting debt for equity capital). A shift from equity to debt financing as (measured) indicated by an increase in the debt/equity ratio was recorded between 1948 and 1952 in manufacturing as a whole (see Table 3-3), and it seems reasonable to think that such a shift varies in magnitude with different industries. Although possible in the short run, this reaction cannot operate as promptly as a change in price. Consequently, the

regression coefficient of the variable representing the change in capital structure is expected to be more significant for non-consecutive years (i.e., when longer periods are considered). It is also expected to vary in a direction opposite to that of the change in price (i.e., the regression coefficient should be negative).

(4) The degree of competition. Finally, it was thought that the degree of competition (measured by the concentration ratio) characterizing the market in which each industry sells its output may have some bearing on the producer's ability to raise the price of their product in the short run.

Many simpler versions of this model were fitted to the data without much effect on the correlation coefficient or on the overall significance of the model as measured by an overall F ratio. In all cases, the simplifications consisted of taking one or more variables out of the model. Finally, the allegation encountered in the literature, and mentioned in the previous section, was also tested using the relative change in price as an indicator of shifting ability.

$$(2.2)\quad \frac{\Delta P}{P_o} = B_o + B_1 \left(\frac{S}{\pi}\right) + B_2 \left(\frac{S}{K'}\right) + B_3 \left(\frac{K}{D+K}\right) + U_i$$

Equation (2.2) relates the size of the relative change in price observed in various industries to: (1) the reciprocal of the profit margin, the ratio of sales to taxable income $\frac{S}{\pi}$; (2) the turnover rate $\frac{S}{K'}$; and (3) the capital structure variable $\frac{K}{D+K}$, the proportion of equity to total capital.

The presence of collinearity between the first two variables has to be expected and will be commented upon in the interpretation of the results. The results obtained by fitting the price models to the data are summarized in Table 4-5. As will be seen there, these results never show a very strong

correlation (at best 57 per cent of the variation in the relative change in price is explained by the variability of the chosen predetermined variables of Equation (2.2)). The consolation is that some of these variables have significant regression coefficient and the overall models are also significant.

4.4. Key Variables and Data

(a) Dependent

As already pointed out in the statement of the two sets of hypotheses and the presentation of the corresponding regression models, the dependent variables will be the change in gross rate of return in various industries in the first case, and the relative change in price in the treatment of the second approach. Although this probably became clear when these two variables were tied up with the rest of the picture in the regression equations, some additional explanations seem relevant at this stage.

The rate of return $\frac{\pi_i}{K_i}$ used here has been defined as the ratio of taxable profits, gross of capital cost allowances, to net worth. The rationale for the inclusion of book depreciation in the profit figure is given (see reference 2, p. 104). Briefly, we want to eliminate the downward bias affecting the profit figure which was brought about by the introduction in 1949 of accelerated depreciation (i.e., adoption of the diminishing balance method instead of the straight-line method used until then). In order to eliminate the bias, we include the capital cost allowance in the profit figure. The rate of return thus calculated is overestimated but its rate of change should not be seriously affected by a consistent inclusion of the capital cost allowance in the numerator of

the ratio. The data involved in the calculation of this ratio are drawn from the Department of National Revenue's annual publication, Taxation Statistics.

For relative change in prices, price index numbers were used. We had to rely upon a "Wholesale Price Index" for some components which in most cases are comprehensive enough to support the assumption that the prices of the components give a fair picture of the selling prices of the industries in which they are produced. Whenever the product component was not comprehensive enough (i.e., did not represent a sufficient proportion of the products of the industry) to support this assumption, a weighted average of the price of as many components as available was taken to represent the prices in that industry. The weight taken for that calculation is the relative weight that each component had in the industry in the year used as a base for the construction of the index. The data are drawn from the Dominion Bureau of Statistics publication, Price and Price Indexes 1949-1952. The industry breakdown and coverage is not always identical to the one found in Taxation Statistics and the lack of availability of price data forces the loss of a few observations.

(b) Explanatory

As pointed out earlier, one of the main measures according to which the industries in our samples were classified is the concentration ratio (C). This measure is often used as an approximation for the degree of competition of the market in which each industry operates. It has been used, inter alia, by Minhas 3/ and by Stigler 4/ in a recent book. Stigler's primary concern is to examine the traditional theory of the effect of competition upon rates of return in different industries. For this purpose he examines

differences in rates of return between concentrated and unconcentrated industries.

In Stigler's own words, this word (unconcentrated) is not an euphemism for 'competitive' because it takes account (and then, none too well) of only one requisite of competitions—the presence of numerous independent firms (none dominant in size) in the industry.

> Economic theorists have long emphasized the differences in rates of return—and other aspects of business enterprise such as price behavior—between competitive and monopolistic industries. Some of these hypotheses will now be examined. But first, how are we to classify industries as competitive or monopolistic?
>
> The definition of unconcentrated industries has already been given. Concentrated industries are simply those in which the four leading firms produce 60 per cent or more of the value added, and for which the market is national. Industries falling in neither of these categories are labeled ambiguous. It should be noticed that some of the unclassified (ambiguous) industries, operating in smaller than national markets, may be effectively more concentrated than those we so designate. Readers who are acquainted with either the highly controversial literature on concentration ratios or the even more controversial literature on antitrust policy hardly need be told that a concentrated industry need not be monopolistic. High elasticity of demand for the industry's products, or ease of entry by new firms, or the extent of independent rivalry among firms may make the concentrated industry (in this definition) differ in, at most, trifling respects from a fully competitive industry. 5/

This passage gives an indication of the reasons underlying the choice of this variable and also of its weaknesses in perfectly reflecting the level of competition. These ratios were computed for 1948 and they are assumed to have a sufficient degree of constancy to be applicable throughout the period under consideration. As defined earlier, the short-run forward shifting of a corporation income tax is the process whereby corporations react to that tax by raising the prices of their products and thereby restore at least partly their former after-tax profits. The existence of

shifting would require that industries have not been maximizing their short-run profits previously and that the tax increase provides an incentive for industries to approach short-run profit maximization more closely. Since these conditions depend upon monopoly power, the shifting hypothesis implies that shifting will be greater for industries with more monoply strength. Therefore, if shifting occurs, then during a period when the corporate income tax rises the percentage increase in corporate profit rates should be positively related to industry monopoly power, or to its proxy, the level of concentration. As may be seen in Table 4-4, concentration was highly significant for all combinations of years which were used to calculate profit rate changes.

The second predetermined variable included in both models is a measure of capital intensity—the capital share of value added or final output—for each industry: (V') or (I/O). The first expression used in the rate of return models holds for investment income as a proportion of value added. It is easily derived from data published in the Dominion Bureau of Statistics' General Review of the Manufacturing Industry of Canada. The second expression used in the price models represents the investment income resulting from ten dollars' worth of final output in each industry. It is drawn from the input-output table for 1949. (Dominion Bureau of Statistics, Supplement to Inter-Industry Flow of Goods and Services Canada, 1949.)

The relative importance of capital assets in the production of a commodity may be regarded as an indication of the relative disadvantage to the industry producing that commodity, when the tax is raised. The more capital intensive the industry, the greater the amount of tax to be shifted per unit of output. This follows from the fact that the corporate income

tax is meant to hit the income accruing to capital. Whoever must suffer the bite ultimately, the tax always hits the supplier of capital (share-holder) first. The degree to which the tax bite is shifted to other groups afterwards is precisely what we are trying to assess. The argument then runs as follows: if industry A uses relatively more capital and less labour in the production of one unit of output than industry B, then a relatively greater proportion of the receipt originating in the sale of a unit of commodity A goes to capital and a smaller proportion goes to labour than in industry B. If the corporation tax rate is raised (autonomously), this in turn means that the price of a unit of commodity A should show a greater increase than the price of a unit of commodity B if the tax is being shifted to the same extent in both industries. For the mechanism to be described entirely, it must be added that (changes in technology notwithstanding) the only other way by which the capital can maintain its relative share of the corporation income, over a somewhat longer range, is by increasing wages at a slower rate in industry A than in industry B. It takes a longer time for the latter mechanism to be set in action because of the way in which labour contracts are negotiated. Although a producer may raise the price of his product on the day following a budget speech which announces a change in the tax rate, he must wait until the prevailing labour contract expires before he can cut into labour's share of the corporation income.

To sum up, the above line of reasoning implies that the capital intensive industries are at a disadvantage. If two industries are identical in all their characteristics, save in the degree of capital intensity, the more capital-intensive industry will have a larger increase in its tax burden originating in a change in tax rate than the labour-intensive industry.

This suggests that if the tax is to be passed on in the same proportion by the two industries, a greater increase in price and/or cut in the relative share of labour will be observed in the more capital-intensive industry.

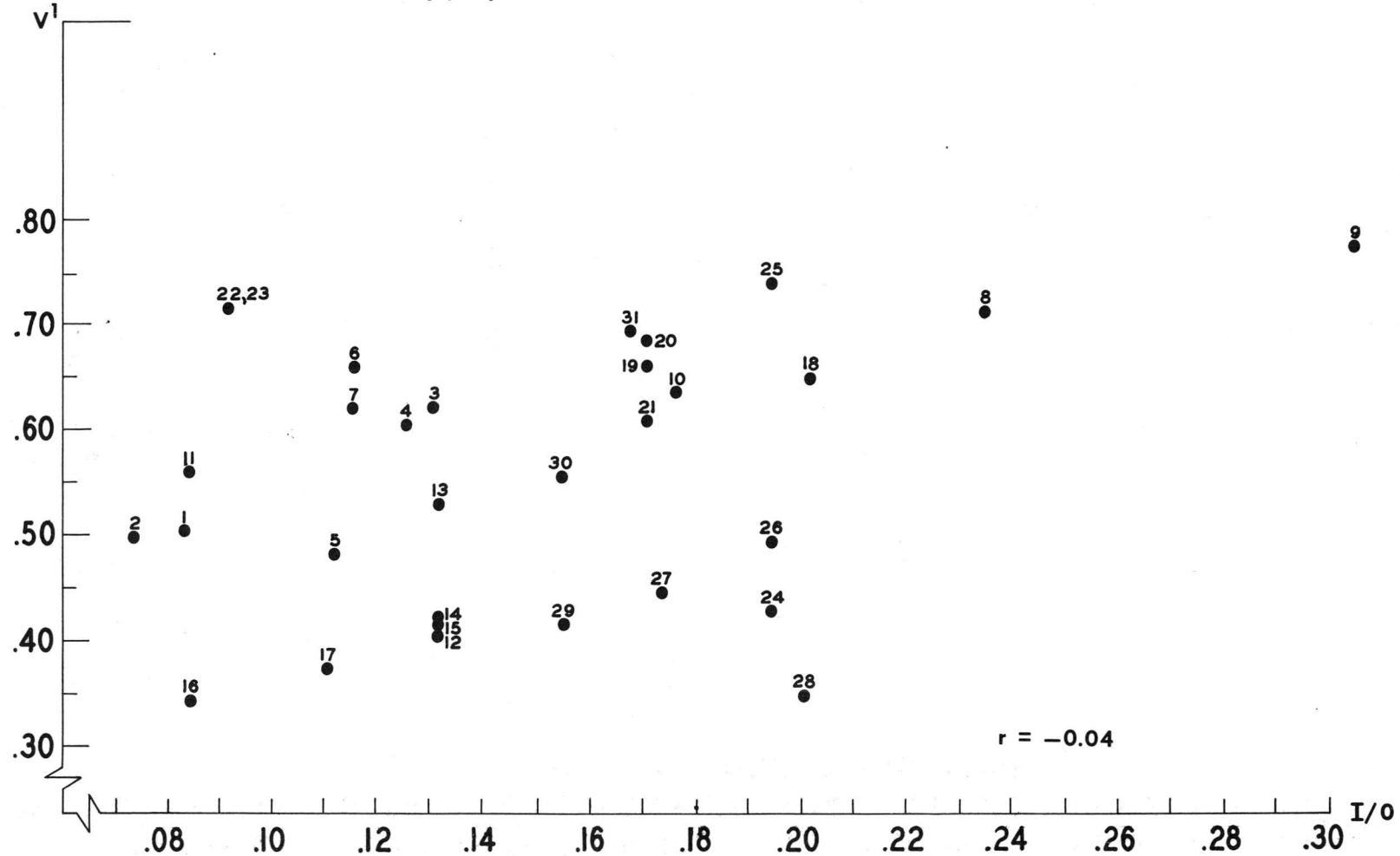
There is more than one way of measuring capital intensity. Three of the possible measures have been retained here and the rationale for their respective use will now be discussed. Although the measuring device used does not affect the height of a man, it appears that the choice of one device, rather than another, to measure the capital intensity is not an indifferent matter. One would expect two measures of capital intensity to give very close and/or very closely related results, but the facts seem to contradict this expectation. The share of capital in value added (V'), the ratio of fixed assets to sales ($\frac{K'}{S}$), and the investment income originating in one dollar's worth of final output ($^{I}/_{O}$) (three measures of capital intensity) give results so far apart, and show such a lack of relationship that it seems necessary to make a choice each time this variable has to be included in our regression equations. A glance at the following scatter diagrams should be sufficient to indicate the absence of relationship between any two measures of capital intensity. The co-ordinates of the points in the diagrams are generated by pairs of measures of capital intensity characterizing the industries included in the sample. The simple correlation between any two measures is given on the diagrams. The explanation for the disturbingly low correlation between any two measures of capital intensity is manifold. First, the three measures encompass some conceptual differences. For instance, primary input (the sum of which is equal to the value of final product) is equal to the "value added" by the industry, but this concept of value added incorporated in the ($^{I}/_{O}$) measure is a more refined concept than the one used in the (V') measure. The latter

is obtained by subtracting only the cost of materials, fuel, and electricity used from the gross value of products. Primary input (incorporated in the former), on the other hand, is equal to the gross value of production less the cost of materials, fuel and electricity used and less the cost of such operating expenses as office supplies, repair and maintenance, purchased transportation services, advertising, communication, insurance, rent, professional and other services. Primary input is therefore an unduplicated measure of value added for the whole economy. Similarly, the capital share or investment income incorporated in these two measures is conceptually different. The investment income incorporated in the (V') measure is equal to this unrefined value added concept less the labour earnings without any further adjustments for inventory valuation and depreciation. The investment income incorporated in the $(^{I}/_{O})$ measure is the sum of corporation profits and other financial items (such as interest on bonds), including capital consumption allowances and miscellaneous valuation adjustments. In the second place, the $(\frac{K'}{S})$ measure is conceptionally different from the other two measures in that it measures more the degree of utilization of capital than the capital share of value added.

Apart from these conceptual differences, the three measures of capital intensity with which we are concerned here encompass other differences originating in differences in the methods of estimation. To give only one example, the components of investment income (i.e., corporation profits, interest and rental income, capital consumption allowances and miscellaneous valuation adjustments) incorporated in the $(^{I}/_{O})$ measure are on an establishment rather than on an enterprise basis. In adjusting corporation profits large adjustments were needed to data in taxation statistics. The principal adjustments were (i) for not fully tabulated companies and for calendar

Chart 4-1

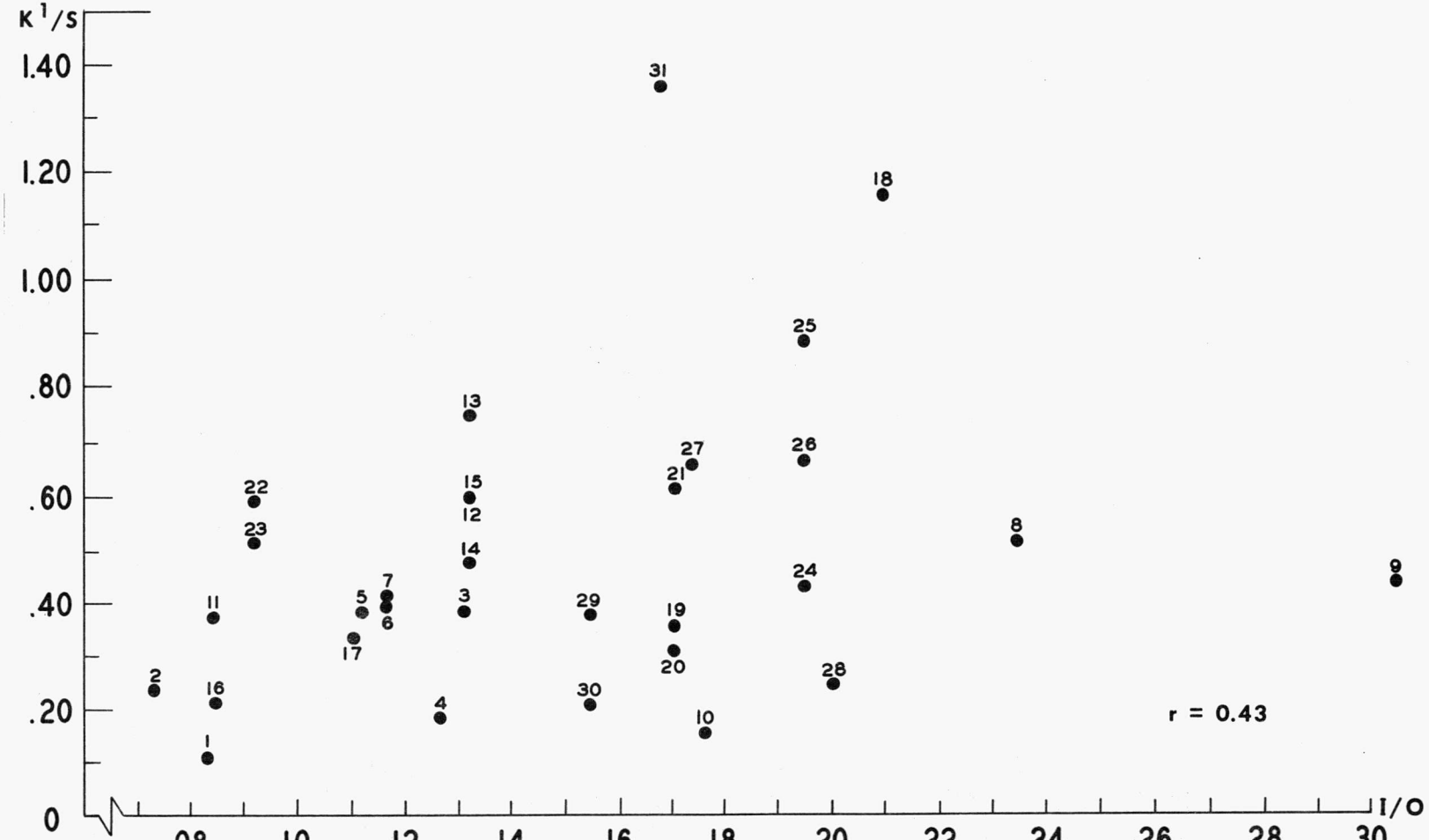
CAPITAL SHARE IN VALUE ADDED (V^1) VERSUS INVESTMENT INCOME RESULTING FROM ONE DOLLAR'S WORTH OF FINAL OUTPUT (I/O) IN 31 MANUFACTURING INDUSTRIES



Source: Appendix on Basic Data.

Chart 4-2

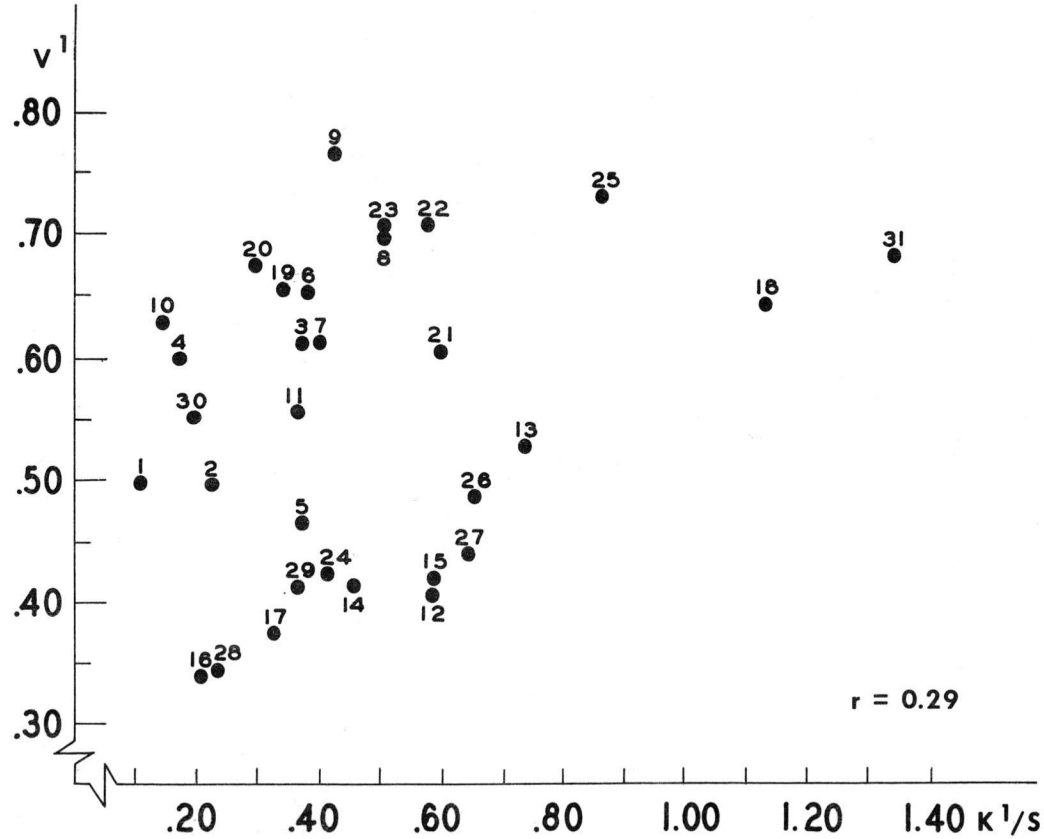
RATIO OF FIXED ASSETS TO SALES (K^1/S) VERSUS INVESTMENT INCOME RESULTING FROM ONE DOLLAR'S WORTH OF FINAL OUTPUT (I/O) IN 31 MANUFACTURING INDUSTRIES



Source : Appendix on Basic Data.

Chart 4-3

CAPITAL SHARE IN VALUE ADDED (V^1) VERSUS RATIO OF FIXED ASSETS TO SALES (K^1/S) IN 31 MANUFACTURING INDUSTRIES



Source: Appendix on Basic Data.

rather than fiscal year, (ii) for differences between the National Revenue and the Standard Industrial Classification codes, and (iii) for conversion from an enterprise basis to an establishment basis. An example should suffice to illustrate the discrepancy between the National Revenue coding and the S.I.C. coding. The National Revenue Code coded asphalt roofing companies under petroleum products while the S.I.C. coded them under paper products. Finally, the (I/O) measure is based on 1949 figures alone and assumed constant over the period 1948-1952 whereas the other measures are averaged over the whole 1948-1952 period.

The conceptual and estimating differences outlined above suggest that one measure may be best suited in the price indicator models while another measure would yield better results when used in the rate of return models. This was in fact the case, the measure used in the price regression models (I/O) is drawn directly from the Canadian input-output table for 1949. 6/ As said earlier, this ratio is defined as the investment income (capital input) resulting from the production of one dollar's worth of final output of an industry. Without entering into the complexities of input-output analysis, the meaning becomes clearer when we trace what happens in one particular industry. The total output of an industry consists of "final" output (i.e., value added) plus "intermediate" output, while its input consists of the intermediate output of domestic industries used by that industry, and of wages, salaries and supplementary labour income, of investment income, and of other components of gross domestic product and, finally, of imports and indirect taxes. The inputs which are not intermediate output of domestic industries are termed "primary inputs". Investment income falls into that category. The computations are based on the assumption that the same inputs are used in the same proportion for all components of an industry's output, whether it is intermediate or final. 7/

Because of the proportionality assumption, this measure of capital intensity has one advantage when used in the price approach in that it includes the eventual effects on the price of final output caused by shifting that might occur in the intermediate stages of the process of production. In other words, the price of a consumer commodity may reflect a tax shift at two levels: (1) from the manufacturer to the wholesaler (as we are working with wholesale prices), and (2) from the supplier of raw materials or semi-finished (intermediate) products (who is also liable to the corporate income tax) to the manufacturer. Therefore, if shifting is taking place at the intermediate level, we want the model to account for it.

The picture is somewhat different when we turn to the rate of return approach. We do not want the tax shift, which may possibly take place at the intermediate stages of the process of production, to be attributed to the suppliers of consumer goods (i.e., to the manufacturer of final product), because that portion of the total shifting does not help them maintain their rate of return at the pre-tax level. This suggests the use of a different measure of capital intensity. One possible way around this problem is to take the ratio of fixed assets (land, building and equipment) to sales $(\frac{K'}{S})$ or alternatively the share of capital in value added in each industry (V'). The advantage of the latter is that the gross value of sales is more responsive to price movements than the value added, and the volatility of the sales figure may alter the picture over a relatively short period of time. The magnitude of the effects of an inter-industry difference as to inventory policy, although probably important, is as yet undetermined. Duesenberry, Eckstein and Fromm 8/ have found that the influence of changes in inventories upon the change in profits is very significant indeed.

A third explanatory variable to enter the regression models is an indicator of the capital structure. As already discussed, the capital intensity, measured by the capital-output ratio, or otherwise, does not reflect the whole picture. The statement "the more capital intensive an industry is, the greater the tax liability per dollar of output" calls for qualification concerning the structure (debt/equity) of that capital. In fact, it is the ratio of equity capital to sales (or the ratio of taxable income to value added) which is the prime determinant of tax liability, and therefore of relative ability to shift the tax. The tax liability may vary in size for a reason independent of the nature of the industry, that is to say, independent of its capital intensity and its rate of turnover. The tax liability depends upon the extent to which the property used in the industry is either leased by the corporation or has been purchased with borrowed money—generally referred to as debt capital—or, on the other hand, has been purchased with money from stock issue or from retained earnings—generally referred to as equity capital. The difference in the tax liability arises from the fact that, in computing its taxable income, the corporation can deduct fixed charges, that is rental, lease and interest payments, while it cannot deduct dividends paid out or any other form of income accruing to equity holders, whether it is distributed or not. The variable accounting for the difference in capital structure among industries, $\frac{K}{D+K}$, may be viewed as a correction factor for the various measures of capital intensity used in the regression models.

To sum up, the larger the ratio of borrowed capital to total capital, the larger will be the ratio of interest payment to operating income and, consequently, the smaller the taxable portion of a dollar of operating income. Hence, two corporations equally capital intensive, but with

different amounts of interest payable, will have different amounts of taxable income and, therefore, different relative ability to pass the tax on. 9/ The difference in capital structure between industries has been accounted for in so far as bond and equity capital are concerned. However, it appears that the relevant demarcation line is not always between debt and equity, but sometimes between debt or preferred stock on the one hand, and common stock on the other hand. If the firms differ with respect to the amount of taxable income to be paid out in preferred dividends, they will be under unequal degrees of pressure to recoup the tax. With regard to the structure of equity capital, the most unfortunate firm from a competitive standpoint would be the corporation which has a large proportion of its taxable income earmarked for preferred dividends, with some of its operating profits going to interest or rentals. It would be forced to pass on at least part of the tax to its consumers or employees if its stockholders are not to suffer a drastic decline in their net rate of return.

Unfortunately, for the period under consideration the capital stock statistics do not provide a breakdown between common and preferred stock so that the desired adjustment is impossible and will be limited to the distinction between equity capital (both preferred and common) on the one hand and debt capital on the other hand.

The relative importance of debt in total capital may be measured by the ratio of debt, or of equity capital, to the sum of equity and debt funds $(\frac{D}{D+K})$ or $(\frac{K}{D+K})$, and this correction may be introduced in the model either as a variable in itself, or in a multiplicative way, as a correction to the capital intensity variable. A common and simpler indicator of the capital structure is the debt/equity ratio $(\frac{D}{K})$. The two measures are very

closely related, and the use of one or the other indicator in the regression model is practically indifferent. The data for the calculation of such ratios were drawn from the Department of National Revenue's annual publication Taxation Statistics.

In addition to the explanatory variables just considered, other variables were introduced in variants of the models considered, some of these variables deserve attention. As already pointed out, the literature on incidence mentions the ratio of sales to taxable operating income (i.e., the reciprocal of the profit margin) as a prime determinant of the relative ability of various industries to shift. A measure of this ratio was introduced in both the rate-of-return and the price models, and was found significant in both cases. A similar test was applied to the claim that ability to shift the corporate tax is a function of the turnover rate, that is to say to the speed with which assets are turned over into sales. No real additional information was derived from the introduction of such a variable in the regression models since the turnover rate is nothing but the reciprocal of the capital-output ratio $(\frac{K'}{S})$ which has already been considered. The data required for the calculation of both ratios were drawn from Taxation Statistics.

Finally, the most important and successful addition on the right-hand side of the rate of return equation is that of a variable representing the relative change in sales in various industries. As indicated earlier, Duesenberry, Eckstein and Fromm found evidence that "the decline in profits depends on the industrial composition of the decline, the decline in sales as opposed to the decline in production..." 10/

Although stronger during periods of decline in profits and sales, this relationship also appears during periods of growing profits and sales. The reaction and relative success in increasing the sales proceeds differ from industry to industry. This suggests that, for a cut in the sales receipt of a given size, the resulting drop in rates of return, if it takes place, is smaller in some industries than in others. Evidence of this is indicated by the following scatter diagram, in Chart 4-4, where the change in rate of return is plotted against the relative change in sales for the period 1949-1950. For this exercise, the industries have been divided in two categories: concentrated and unconcentrated. It appears that the reaction and the success of industries differ depending upon which category these industries fall into. Thus, the two variables, relative change in sales and concentration, are not entirely independent but may be said to interact and a somewhat more sophisticated technique of analysis will be required to disentangle the respective effect of each variable on the change in rate of return. This will be done in the section dealing with the interpretation of the results.

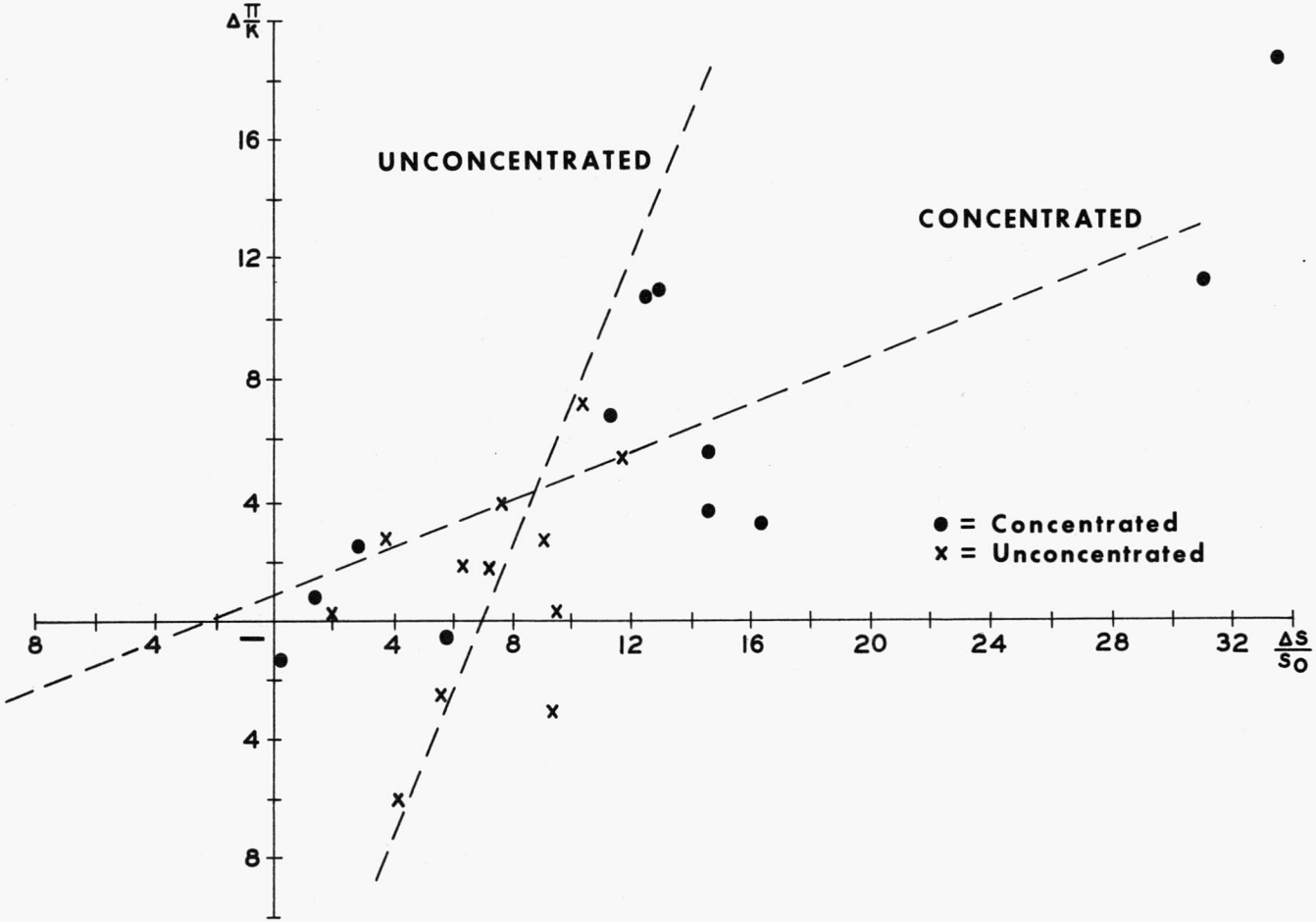
Similar diagrams plotted for other periods reveal the same trend, although not always so clearly. The trend seems to be clearer in periods of decline than in periods of expansion. There is a sign of collinearity between concentration and the change in sales for the period 1948-1952, a period of decline ($r=0.49$), but all signs of collinearity between these variables disappear for the period 1949-1950, a period of expansion (for which the results are recorded in Table 4-4 on page 84).

4.5. Periods and Subperiods

The overall period covered by the analysis runs from 1948-1952, inclusive. Special attention is given to changes occurring between 1949 and 1950,

Chart 4-4

SCATTER DIAGRAM: CHANGE IN RATE OF RETURN BETWEEN 1949 AND 1950 VERSUS RELATIVE CHANGE IN SALES IN (I) CONCENTRATED INDUSTRIES, AND (II) UNCONCENTRATED INDUSTRIES



Source : Table 4-1

Table 4-1 - Change in Rate of Return versus Relative Change in Sales in (a) Concentrated and (b) Unconcentrated Manufacturing Industries, 1949-1950

(a) CONCENTRATED INDUSTRIES ($C \geq 60.0$)

Code No.	$\Delta(\frac{\pi}{K})$	$\frac{\Delta S}{S_o}$	C
80151	.0250	.0281	84.5
80611	.0697	.1129	81.4
80701	.0371	.1469	80.1
80706	.0569	.1474	80.1
80721	.0332	.1637	91.7
80726	.0076	.0132	70.0
80826	-.0439	-.1890	79.2
80831	.1160	.3113	87.5
80901	.1091	.1249	100.0
80126	.1123	.1283	68.3
80201	-.0057	.0582	60.0
80731	.1891	.3464	64.0
80816	-.0132	.0033	63.4

(b) UNCONCENTRATED INDUSTRIES ($C \leq 40.0$)

80106	.0548	.1170	19.2
80116	.0029	.0190	25.7
80121	.0190	.0632	20.9
80211	.0404	.0770	17.2
80216	.0253	.0568	15.7
80301	.0037	.0963	7.4
80606	.0736	.1042	19.7
80111	-.0304	.0941	32.4
80131	.0276	.0951	33.4
80136	-.0605	.0414	30.9
80141	.0185	.0735	39.0
80801	.0267	.0372	40.0

Note: The industries included in the original sample, but for which $40<C<60$ were classified as ambiguous and thus left out for the present chart and calculation.

and also between 1949 and 1952. The rationale behind this choice is threefold. (1) The significant increase in the federal tax rate on income in excess of $10,000—from 30 per cent in 1948 to 52 per cent in 1952. An historical table indicating the year-to-year changes in the tax rates is given below. (2) Because of the Korean War boom, the early 1950's were good business years in which shifting would most likely be observed if it had taken place at all. (3) This period covers a full business cycle with a peak year in 1948, a trough in 1949, a peak in 1951 and a trough again in 1952. This allows comparisons between two years reasonably far apart but characterized by similar business conditions. This is the reason why special attention was paid to changes occurring between 1949 and 1952. Despite the occurrence of noticeable changes in the corporate tax rate in 1945, the early 1950's were chosen because, besides being good business years, they are further away from World War II, and as such are less liable to be marked by abnormal price movements attributable to the relaxation of price controls exerted during the war and the immediate post-war period.

The logical way of dividing the overall five-year period into shorter spans so as to study the short-term effects of changes in tax rates is simply to follow the periods during which the different tax rates are applicable, as indicated in Table 4-2. These rates generally apply for a calendar year, although they are announced in the Budget which, as a rule, is brought down in the spring and made retroactive to the first of the year. In 1950, however, a special session was held and a tax change was announced and made effective on September 1. Hence, ideally the relevant period for consideration of shifting generally is not the calendar year during which the respective tax rates were in force, but the period between

Budget speeches announcing changes in rates. Unless he anticipates the change, a businessman will start raising his prices in order to recoup the tax only when he becomes aware of the change in tax rate. Unfortunately most of the data used are only annual figures published on a calendar year basis.

Table 4-2 summarizes the rates effective during the period under consideration. Throughout 1949 and until August 31, 1950, the statutory rate applicable was 10 per cent on the first $10,000 of income plus 33 per cent on the excess. This was announced in the Budget speech of March 22, 1949. The new rate structure, effective as at September 1, 1950 was 15 per cent on the first $10,000 plus 38 per cent on the excess; it was announced the same day. A further change was announced in the Budget of April 10, 1951; the rate became 15 per cent on the first $10,000 of income and 45.6 per cent on the excess, retroactive to January 1. Finally, in 1952 new rates were introduced—22 per cent on the first $10,000 and 52 per cent on any excess—effective as of January 1, to December 31, 1952, and announced on April 8 of the same year.

Since monthly data for prices are available for 1950, 1951 and 1952, it is possible to divide the overall period into four subperiods according to the changes in the rate structure described above and summarized in the table following. For the rate of return models, however, this was not possible and the analysis was carried out on a calendar year basis. In an ordinary time series analysis, special attention would have to be paid to seasonal movements in prices, etc., but here, since the variations are presumably identical for all industries, no seasonal adjustment seems necessary.

Table 4-2 - **Federal** a/ **Corporation Tax Rates, Canada, 1946-1952**

Year of Amendment	Statutory Rate	Effective Rate b/	Taxation Period to which Applicable	Budget Speech Date at which Changes Were Announced	Reference Cycle Peak and Trough
1946	30%	30.0%	Jan. 1, 1947— Dec. 31, 1948		P 10/48
1949	10% on $10,000 plus 33% on excess	33.0%	Jan. 1, 1949— Aug. 31, 1950	March 22, 1949 (retroactive to Jan. 1)	T 9/49
1950	15% on $10,000 plus 38% on excess	34.1%	Sept. 1, 1950 Dec. 31, 1950	Sept. 1, 1950	
1951	15% on $10,000 plus 45.6% on excess	44.2%	Jan. 1, 1951 Dec. 31, 1951	April 10, 1951 (retroactive to Jan. 1)	P 3/51
1952	22% on $10,000 & 52% on excess (with 5% credit for provincial tax)	48.3%	Jan. 1, 1951 Dec. 31, 1952	April 8, 1952 (retroactive to Jan. 1)	T 5/52 P 5/53

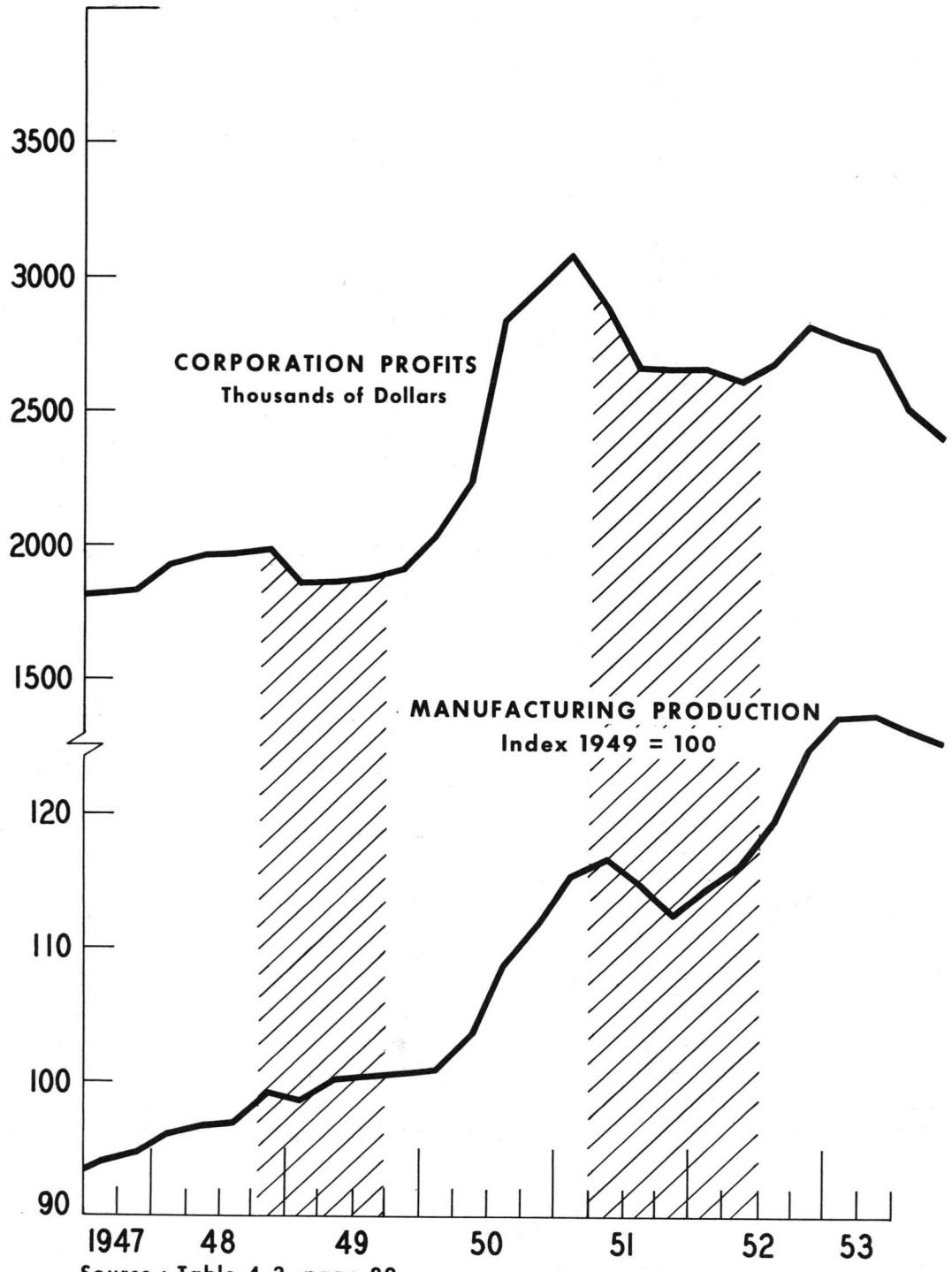
a/ The rates given above are those applied by the Federal Government only, without any adjustment for the rates applied in Quebec and Ontario. These rates were maintained constant at 7 per cent until 1952 and the change taking place in 1952 does not alter the picture given here.

b/ These rates were computed for "total manufacturing", dividing the total tax declared by the profits figure for every taxation year.

Source: CCH Canadian Tax Reports, par. 12-619; section 39(1) of the Income Tax Act.

Chart 4-5

REFERENCE CYCLE



Source : Table 4-3, page 82

Table 4-3 - Data For Reference Cycle

		Corporation Profits 1/ $000	Index of Gross Domestic Product 2/	Manufacturing Production Index 3/
1947		1814		93.2
	I	1784	91.8	91.6
	II	1812	93.6	92.8
	III	1824	94.0	94.0
	IV	1836	95.0	94.7
1948		1964		97.3
	I	1932	94.8	96.0
	II	1964	95.2	96.7
	III	1972	97.1	96.9
	IV	1988	98.7	99.2
1949		1879		100.0
	I	1856	97.7	98.6
	II	1868	100.0	100.1
	III	1880	100.3	100.3
	IV	1912	101.6	100.6
1950		2522		106.2
	I	2040	103.2	100.9
	II	2236	104.2	103.5
	III	2844	107.4	108.6
	IV	2968	110.1	111.9
1951		2825		115.0
	I	3080	114.1	115.4
	II	2896	115.9	116.8
	III	2664	114.4	114.9
	IV	2660	114.0	112.4
1952		2698		118.5
	I	2664	119.3	114.2
	II	2616	122.6	116.1
	III	2688	123.4	119.5
	IV	2824	126.2	124.6
1953		2611		126.4
	I	2780	126.0	127.1
	II	2736	127.0	127.3
	III	2516	127.7	126.1
	IV	2412	126.3	124.2

Notes: 1/ National Accounts, Income and Expenditure, by Quarters, 1947-61, Dominion Bureau of Statistics, No. 13-519, Table 10, pp. 42-43.

2/ Indexes of Real Domestic Product by Industry of Origin, 1935-61 Dominion Bureau of Statistics, No. 61-505, Table 3, p. 73.

3/ Ibid, p. 76.

4.6. Statistical Results

Turning to the estimates and tests of significance, the main results derived from the rate of return equations (1.1 to 1.6) are given in Table 4-4. The results for the price equations (2.1 and 2.2) are shown in Table 4-5. In both tables the first left-hand column refers to the equations dealt with in Section 4.2. (b) and (c). In the second column are the degrees of freedom, a piece of information of crucial importance in the interpretation of the tests of significance based on the t and F statistics. The third column shows the year between which the changes in rate of return (or the relative change in price) were observed for each individual regression recorded. The remaining results given for each equation are the value of the constant term (B_o), the estimated regression coefficients of the independent variables heading each column, in brackets underneath these figures, the values of t for each of these estimates (the regression coefficient divided by its standard error, a value which is used to test the statistical significance of the coefficient), R the coefficient of multiple correlation adjusted for the number of degrees of freedom, and finally, the overall F ratio (an indicator of the significance of the model as a whole) is listed. Those values of t indicating a regression coefficient greater than or less than zero on a one-tailed test are asterisked. One-tailed tests are appropriate, because the maintained hypothesis for each variable specifies whether it is positively or negatively related to the dependent variable $\Delta \left(\frac{\pi_i}{K_i}\right)$. (The existence of shifting will be tested by whether the coefficient of C is significantly greater than zero.) The significant values of F are also asterisked. It should be recalled that the results for each equation are recorded for only one pair of years in order to avoid the otherwise inevitable duplication of roughly similar

Table 4-4 - Statistical Results: Rate of Return Approach

Equ. No.	d.f.	Change in $\frac{\pi}{K}$ Occurring Between	Intercept B_o	INDEPENDENT VARIABLES Regression Coefficients and Values of t in Brackets											R Adjusted	F Ratio
				C	V'	$\frac{K}{D+K}$	$\frac{K'}{S}$	$\frac{K'}{S}\frac{K}{D+K}$	$V'\frac{K}{D+K}$	$\frac{\Delta S}{S_o}$	$\frac{S}{\pi}$	$\frac{\pi}{S}$	$\frac{S}{K'}$	$\Delta(\frac{K'}{S})$		
				(X10)												
1.1	27	1949-1952	-0.1402	0.9994 (2.6432)**	0.2015 (2.4942)**	-0.0834 (-0.7129)									0.54	5.61**
	28	"	-0.1438	0.9270 (2.5679)**	0.1968 (2.4658)*										0.55	8.30**
	29	"	-0.0444	1.1378 (2.9925)**											0.43	8.95**
1.2	28	"	-0.0313	1.2290 (3.1132)**			-0.0364 (-0.8983)								0.42	4.85**
1.3	28	"	-0.1411	1.0847 (3.0798)**					0.2027 (2.4353)*						0.55	8.20**
1.4	27	1951-1952	0.1615			-0.2147 (-1.6867)					-0.0066 (-2.1351)*		0.0152 (2.2907)*		0.39	3.15*
1.5	27	1949-1950	-0.0311	0.6044 (2.7321)**			-0.0737 (-2.7514)**							-0.6761 (-6.5922)**	0.78	17.43**
	28	"	0.0030	0.4729 (1.9704)*										-0.5300 (-5.4362)**	0.72	18.11**
1.6	26	"	-0.0125	0.4609 (1.9682)*			0.0081 (1.4901)			0.3779 (5.9550)**		-0.1942 (-1.6584)			0.78	13.19**
	27	"	-0.0146	0.5281 (2.2480)*						0.4139 (6.3585)**		-0.1414 (-1.2210)			0.77	16.12**
	28	"	-0.0256	0.4347 (1.9401)*						0.3947 (6.1945)**					0.76	23.03**
	27	"	-0.0139	0.4681 (2.0761)*				-0.0353 (-1.0875)		0.4072 (6.3083)**					0.76	15.85**

Notes:

* 5 per cent significance level (one-tailed test critical value t = 1.703 for 27 d.f.)

** 1 per cent significance level (one-tailed test critical value t = 2.473 for 27 d.f.)

Table 4-5 - Statistical Results: Price Approach

95159-7½

Equ. No.	d.f.	Change in P Between Periods	Intercept B_o	INDEPENDENT VARIABLES Regression Coefficients and Values of t in Brackets							R Adjusted	F Ratio
				$\frac{I}{O}$	$\frac{D}{K}$	$\Delta(\frac{D}{K})$	C (X10)	$\frac{K}{D+K}$	$\frac{S}{\pi}$	$\frac{S}{K}$		
2.1	24	4 - 1	-0.1963	0.0840 (3.0017)**	0.1477 (1.0993)	-0.2613 (-1.5123)	0.6604 (1.5543)				0.53	4.09*
	25	"	-0.1844	0.0974 (3.5593)**	0.1371 (0.9942)	-0.2194 (-1.2510)					0.49	4.40*
	25	"	-0.0215	0.1546 (3.4397)**			-0.9363 (-1.4095)	-0.0012 (-0.0550)			0.47	4.00*
	25	"	-0.1690	0.0803 (2.8788)**		-0.0803 (-1.5237)	0.6368 (1.4944)				0.53	5.01**
	26	"	-0.1531	0.0913 (3.3544)**	-0.0281 (-0.7012)						0.47	5.69**
	27	"	-0.1562	0.0894 (3.3324)**							0.49	11.10**
2.2	25	"	-0.1044					0.1363 (0.9807)	-0.0098 (-2.7526)**	0.0286 (1.5334)	0.57	5.84**

Notes:

* 5 per cent significance level (one-tailed test critical value t = 1.708 for 25 d.f.).

** 1 per cent significance level (one-tailed test critical value t = 2.485 for 25 d.f.).

results. In most cases the years 1949 and 1952 were chosen, because they display comparable business conditions as may be seen in Chart 4-5 page 81.

4.7. Interpretation of the Results

(a) General Remarks

It should be obvious from the way the major hypothesis has been stated that the focus of interest in these equations is the result for C. However, the validity of the regression estimates of C depends in part upon the acceptability of the regression equations as wholes. Multiple regression analysis was used instead of simple regression analysis in order to isolate the impact of C upon the dependent variable net of the effects from other variables which influence $\Delta(\frac{\pi_i}{K_i})$. Therefore the estimates of the other independent variables included in the regression equations have to be examined to insure that they are acceptable in their role of explaining the behaviour of $\Delta(\frac{\pi_i}{K_i})$. In addition, the proportion of the variance of the dependent variable explained by the significant independent variables must be viewed in order to judge the likelihood that new variables or differently defined ones may exist which may alter the estimated coefficient of C. In the rate of return models only V' or $\frac{K'}{S}$ (i.e., capital intensity measures and/or $\Delta(\frac{K'}{S})$ or $\frac{\Delta S}{S_o}$, (i.e., measures of relative change in capacity utilization and relative change in sales) should be included with C as independent variables in the final analysis. These are the only significant variables to be analyzed, as will be explained below.

In all models, whether they relate the change in rate of return or the relative change in price to various industrial characteristics, the degree of association as measured by the coefficient of multiple correlation

(R adjusted for the number of degrees of freedom) is never very high. It must be observed, however, that most rate-of-return models tend to give better fits than their price counterparts. The relatively low proportion of the variance of the dependent variables explained by the independent variables may matter considerably, for all the remainder is left to be explained by refinement of the variables already used and by the introduction of new ones. The more that is left unexplained, the more likely is the existence of other causal factors which are correlated with C so that their introduction in the analysis would alter the estimated regression coefficients and significance levels of C. Since R^2 is relatively low, such a possibility is a serious qualification to the results of this analysis. The low values of R^2 cannot be attributed with certainty to any cause but to a large extent are probably due to (i) different inter-industry responses to the same stimuli and (ii) to problems of measurement.

(i) Industries respond differently to the same stimulus when the nature of the response depends upon other conditions besides the stimulus itself and when these other conditions vary among industries. This factor will be emphasized in Chapter 6 with regard to the fact that an industry is export-oriented, import-competing or purely domestic, since the fact that an industry falls into one category rather than another would affect profits differently. The response of rates of return to this factor would also depend on such other phenomenon as changes in the exchange rate. Similar considerations may be raised for many other variables. Casual observation suggests that many of these characteristics vary a great deal among the 31 industries, yet none is accounted for in the regressions. For this reason perhaps a large part of the variance of $\Delta(\frac{\pi_i}{K_i})$ caused by a monopoly power, relative change in sales, etc., was not explained in the regressions by the variables which measure these phenomena.

(ii) Measurement problems arose for several reasons: lack of any data, the use of proxy variables for the desired variables, and the poor quality of the data used. Some of these factors have already been commented upon or will be later on in this chapter.

Beside the coefficient of multiple correlation, the overall significance of the regression models was tested by the use of an F statistic. The calculated value of the F-ratio was compared to a critical value, and a single asterisk indicates significance at the 5 per cent level, while a double asterisk indicates that the model considered is significant at the 1 per cent level. All the cases for which the results are recorded show significance at the 5 per cent level, and most of the rate of return equations give results significant at the 1 per cent level.

Before turning to a detailed examination of each variable included in the regression models, it seems appropriate to identify those aspects of the results which present more relevance to the present analysis. First, the estimated values of the parameters present some interest because the models fitted so far are designed both to yield an estimate of the degree of shifting occurring in each industry and to test the hypothesis that shifting exists and that some industries have a greater ability to shift the tax than others. The second goal of this exercise was to test the hypothesis that the characteristics alleged to give these industries a greater ability to pass the tax on are the relevant ones. Testing these hypotheses, then, amounts to testing the overall significance of the models considered and the significance of each individual variable included in these models. It should be recalled, however, that some variables are more important to the analysis than others. The test for the existence of shifting, for instance,

revolves around the significance of C, the proxy for the monopoly power characterizing each industry. The significance of each estimate is indicated by the t values given in brackets underneath the estimated regression coefficients in Tables 4-4 and 4-5.

Another feature of major interest in the interpretation of the results is the sign of the estimated parameters. For instance, it is important to know if, as hypothesized, the change in rate of return varies directly with the concentration ratio and inversely with the capital intensity. In other words, it is important to ascertain the nature (direction) of the relationship between the dependent variable and any of the industrial characteristics included as explanatory variables in the right-hand side of the regression equations. The direction of the relationship is generally predicted by economic theory. It is hence worth while noting whether the coefficients consistently vary in the same direction over the entire period considered and for any combination of years between which the change in rate of return is considered.

To sum up, the absolute values of the estimates and their individual sign and significance are of interest. It must be added in concluding that the models analyzed are not coloured by multicollinearity. Indeed, a glance at the correlation matrix indicates that none of the independent variables is seriously correlated with any other such variable included in the same regression equation.

(b) Rate of Return Models

Considering, first, the equations in which we attempt to relate the change in gross rate of return to various industrial characteristics (see Table 4-4), the results point toward the following interpretation:

(1) The estimated coefficients of the concentration ratio are consistently positive and always significant, no matter which version of the rate of return model is considered. This result is consistent with the hypothesis that the more concentrated industries would raise their profit rates relative to the profit rates of the less concentrated industries during a period when the corporate income tax rate rose. The high standard of acceptability revealed by the results of Equations 1.1 to 1.3 for the period 1949-1952 easily meets the test propounded for short-run forward-shifting. The coefficients of C and their level of significance do not fluctuate very much among the pairs of years between which large changes in tax rates were enacted, but these magnitudes vary considerably for the pairs of years with constant tax rates. This is obvious from comparison between the results for 1949-1952 and those for 1949-1950, in Table 4-4. The effective corporate tax rate rose by seventeen percentage points during the first period as compared with one percentage point for the latter period. The regression coefficients are much smaller and less significant for the latter period than for the former. This brings about the problem of the relationship between C and $\Delta(\frac{\pi_i}{K_i})$ for reasons other than shifting, particularly for reasons related to the aftermath of World War II. The question can be more definitely examined by multiple regression analysis of the determinants of $\Delta(\frac{\pi_i}{K_i})$ during periods of constant tax rates when shifting would not be taking place. The hypothesis that C and $\Delta(\frac{\pi_i}{K_i})$ were positively related during 1948-1949 (a period of practically constant tax rates) for reasons other than shifting is rejected, since the coefficients of C are never significantly different from zero for this period. 11/

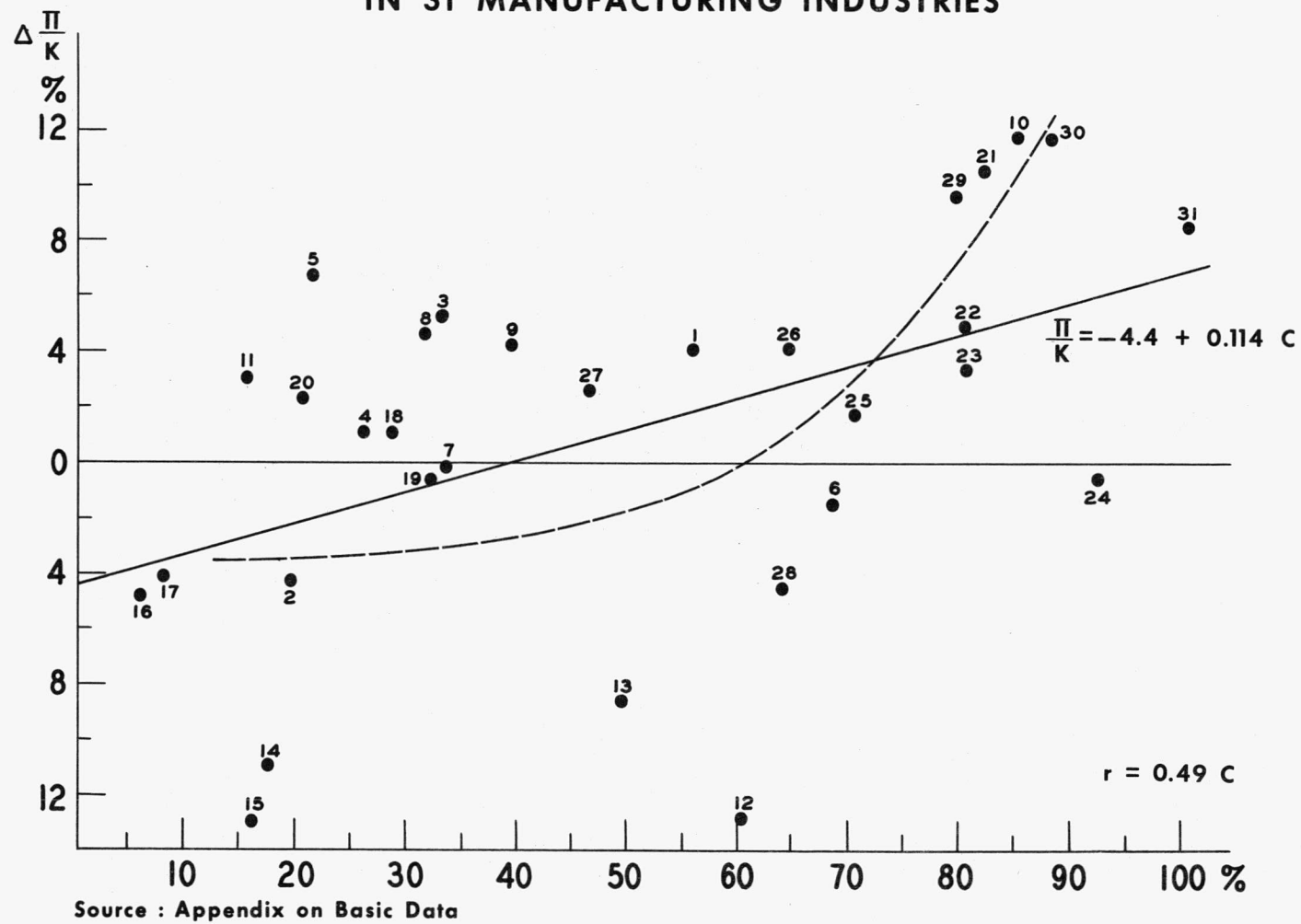
Non-linear functions of C could also have been used. One may test for non-linearity by using, for instance, C^2 instead of C in the regression

equations. A look at the scatter diagram, Chart 4-6, suggests that for the pair of years 1949-1952, transformations of C which make our function convex (from below, such as C^2) would yield better results. This remark applies, of course, whether the change in rate of return is considered in absolute or in relative terms.

(2) The level of capital intensity characterizing each industry's production is also significantly associated with the size and direction of the change in rate of return. The $(\frac{K'}{S})$ measure is inversely related to the change in rates of return. The direction of the relationship means that the more capital-intensive industries, hence the more tax-vulnerable corporations, were not as successful in raising their gross rate of return in order to maintain their after-tax earnings as were the less capital-intensive industries. The conceptual differences between the various measures of capital intensity have already been discussed and it comes out very obvious when submitted to close examination. Indeed, the relationship between (V') and the change in rate of return is of a different nature. The two variables are directly related. A fully satisfying explanation for this is not easy to find, but a satisfactory explanation on logical grounds is possible. In effect, one would expect the two measures $(\frac{K'}{S})$ and (V') to be inversely related in that a large ratio of capital to sales (that is, a low degree of capital or capacity utilization) is likely to be associated with a low ratio of investment income to value added. Hence, if these two quantities are inversely related between themselves, they cannot both be directly or indirectly related to a third variable, in the present case the change in rate of return.

Chart 4-6

SCATTER DIAGRAM : CHANGE IN RATE OF RETURN BETWEEN 1949 AND 1952 VERSUS CONCENTRATION RATIO IN 31 MANUFACTURING INDUSTRIES



Source : Appendix on Basic Data

(3) The capital structure variable, measured by the ratio of equity to total capital, is, as suggested by the maintained hypothesis, inversely related to the change in rate of return, but its coefficient is not significantly different from zero. Used in a multiplicative way as a correction factor to the capital intensity variable, the capital structure variable does not seem to affect the result in any way. The corrected variable has the same coefficient as the uncorrected one (2.4353 as opposed to 2.4658 for 1949-1952) and is equally significant.

(4) Besides the variables already mentioned, a number of variables were introduced, some of which deserve comments. The first one measures the change in capital intensity or, more precisely, the short-run change in the rate of capacity utilization $\Delta(\frac{K'}{S})$ (Equation 1.5). The regression coefficient of this variable is highly significant and, as expected, has a negative sign. The high degree of significance of this variable in the short run (one year) clearly suggests that the variation in capital intensity does not arise because of a change in fixed assets (i.e., in capital formation), a magnitude which is stable in the short run, but because of a change in sales. Therefore, this variable measures the change in the rate of utilization of the existing stock of capital, and the result recorded clearly implies that the industries which succeeded in increasing their sales, given their capital equipment, were more successful than others in raising their gross rate of return. A large reduction in the ratio $(\frac{K'}{S})$, brought about by a substantial increase in sales (i.e., an increase in capacity utilization) between 1949 and 1950 is associated with a proportionately large increase in the gross rate of return. The statistical results suggest that a 10 per cent increase in the rate of capacity utilization would result in a rise in the rate of return of the order

of 6 per cent. It must be pointed out that such an increase in capacity utilization is not necessarily or entirely induced by a change in tax rates; business conditions have to be such that the change is possible. Over the period considered, an increase in capacity utilization was found in many industries to be an avenue extensively used to lighten the burden of an additional tax liability. The most important aspect of this result is that it can be achieved without the need for any shifting of the tax burden to other groups, consumers or employees. Indeed, an increase in capacity utilization is one way of improving the yield on existing capital without raising the price of the product or cutting into the share of other factors of production. This is a typical example of a situation where a firm is not maximizing profits but is induced to come closer to profit maximizing equilibrium when a change in tax rate takes place. It appears that the opportunity cost of making a deeper use of the existing capacity is lower under the new (higher) tax rate than it was beforehand.

The above result and interpretation are confirmed by the results obtained from fitting Equation 1.6 over the same period of time. In this case the change in rate of return is made a function of concentration and of the relative change in sales observed in each industry. The latter variable may be interpreted as measuring the shifts in demand. Since the relative impact of a given absolute change in demand depends upon the size of the previous demand, the shift in demand should be measured as a proportionate change. Since changes in demand cannot themselves be computed, the percentage change in demand must be approximated by another variable which is closely related. The most closely related variable is probably the percentage change in sales. Therefore, this measure was used as an independent variable expected to be positively related to the change in profit rate. This expectation is consistent with the facts as the latter

variable has a highly significant positive coefficient. This indicates that the industries showing a relatively important increase in their sales receipts (disregarding the possibility of fluctuations in capital equipment) are those which were successful in increasing their gross rate of return to net worth in the short run. An analysis of variance on these data, however, permits one to carry the inference one step further. The analysis reveals the presence of interaction between the two variables—concentration and relative change in sales (i.e., change in demand). 12/

The industry sample was divided into three sub-groups according to the level of concentration prevailing: concentrated, semi-concentrated, and unconcentrated industries. It was found that the relative change in sales observed in the semi-concentrated industries resulted in a greater increase in rate of return than in the other two groups. It was also found that the change in sales observed in the unconcentrated industries resulted in a relatively larger rise in rate of return than in the concentrated group.

The test of claims encountered in the theoretical literature on incidence, and summarized in Equation 1.4, does not give very illuminating results. The ratio of sales to operating income $\frac{S}{Y'}$ (the reciprocal of the profit margin) and the turnover ratio $\frac{S}{K'}$ are found to be associated with the change in profit rate in the expected way if one is to judge by the sign and significance of the regression coefficients. However, what seems to be a sound theoretical hypothesis cannot easily be tested empirically because of statistical difficulties arising in the testing process. The two supposedly independent variables, in fact, appear to be collinear and, as a result, the estimates are inefficient and unreliable. Apart from multi-collinearity between independent variables, it is a definite possibility that there is simultaneity between the change in profit rate and the profit margin, in which case the estimates would also be biased.

(c) Price Models

Although less striking, the results obtained from fitting the various price equations are in line with those derived following the rate of return approach. The goodness of fit, in so far as it is reflected in the coefficient of multiple correlation, is not very impressive, as may be seen in Table 4-5. Many of the variables included in Equation 2.1 are not significant and explain only a negligible portion of the variability of the dependent variable.

The estimated coefficient of the capital intensity variable is positive as hypothesized, and always highly significant. Thus, industries using capital-intensive techniques show a greater relative increase in price than the industries relying more heavily on labour for their production. This is in line with the hypothesis put forward at the beginning of the chapter.

In the event of an increase in tax rates, the industries relying more heavily on capital (thus having a greater tax liability per dollar of output) have to increase their price relatively more if they are to maintain their profit margin per unit of output and their rate of return on capital.

None of the other variables included in the price models is significant at the 5 per cent level, except the ratio of sales to taxable operating income (i.e., the reciprocal of the profit margin), but here again, this variable is affected by the weaknesses just outlined.

(d) Limitations Inherent in the Analysis

Before turning to the estimation of the actual degree of short-run shifting, it seems appropriate to evaluate the test for the existence of

shifting. The evidence of this study is unequivocally consistent with short-run shifting. The test for the existence of shifting was whether the change in gross rate of return during a period when the tax rate rose was positively related to industry monopoly power, which was theoretically believed to be positively related to whatever short-run forward shifting might exist. In regression equations concentration was highly significant in meeting this test regardless of the years for measuring profit rates. The reasonable amount of stability in the level of significance of the coefficient of C for all the conditions which were tried provides evidence that the relationship between $\Delta(\frac{\pi_i}{K_i})$ and C did not depend on chance. The profit rates of the more concentrated industries definitely rose relative to the profit rates of the less concentrated industries during the period observed. This result, besides supporting the shifting hypothesis, brings out the diversity of effects of the corporate income tax among different industries. A further test for the association of concentration with the change in profit rates for reasons other than shifting was also conducted (through regression analysis for a period of constant tax rate) and lead to the rejection of such hypothesis.

Serious qualifications are called for in interpreting this evidence. It is unlikely, however, that these qualifications would reverse the conclusions about tax shifting. First, the variables included in the regression equations explain only 20 to 65 per cent of the variance of the dependent variable. A substantial proportion of the variability of $\Delta(\frac{\pi_i}{K_i})$ is left to be explained by other variables or by better measures of the variables used. Although it is quite hard to find out which variable should be introduced, it is possible to foresee the possible effects of their introduction upon the existing results. Some of these variables may be

correlated with C, so their introduction might significantly alter its regression coefficient. The positive correlation observed between C and $\Delta(\frac{\pi_1}{K_1})$ would then be at least partly attributable to the correlation of both these variables with the dependent variable. While this hypothesis cannot be tested, it stands forth as a definite possibility.

The possible independent variables other than concentration and those already included in the models may be classified under three headings: (1) variables which correct for the poor measurement of the basic variables, (2) variables other than concentration which affect shifting, and (3) variables other than shifting strength which affect profit rates.

1. Variables which correct for poor measurement of the basic variables:

(i) Accelerated amortization

Measured profit rates are altered by changes that affect the calculation of profits on net worth. Between 1948 and 1952, as already mentioned, perhaps the most important of such changes was the substitution of diminishing balance depreciation for the straight line method enacted in 1949. The liberalization of capital cost allowances results in a downward bias in the profit figures. The capital cost allowance figure was consistently added to the profit figure in order to eliminate the downward bias, but this is an imperfect correction since it does not take into account the true depreciation of assets.

(ii) Market regionalism

One of the drawbacks of the concentration ratios is that they are based on national employment. In industries where the market is regional (as in the case of bakery products), the concentration ratio understates the average monopoly strength unless the three leading companies together account for the

same proportion of employment in each market. This factor, however, does not appear to be very important. Another weakness of the concentration ratio as a measure of the degree of competition is that it does not give any indication as to the elasticity of demand for the industry's product, neither does it reflect precisely the ease of entry of new firms.

2. Variables other than market power which affect shifting:
Under this heading we might include a variable measuring the proportion of sales by unincorporated firms. A large unincorporated sector in an industry may inhibit shifting if the rise in the corporate income tax is not accompanied by a rise in the personal income tax large enough to require unincorporated firms to raise their profits in the same proportion as corporations in order to maintain after-tax profits. During the period under consideration, the personal income tax did rise, but for almost all unincorporated firms the increase in profit necessary to fully shift the tax was much less than that required for corporations. Exact comparisons, however, cannot be made because the progression in the personal income tax makes impacts very diverse and the data for unincorporated firms by income class are non-existent.

3. Variables other than shifting strength which affect profit rate:

(i) The base period profit rate

This variable could be used as a proxy to reflect initial disequilibrium in each industry, as equilibrium implies that profit rate be the same in all industries.

(ii) Change in cost

Cost of production may change through either shifts in the production function or movement in factor prices. By altering the cost function of the

firm, either development changes the equilibrium price and output and thereby changes the profit rate in the short run. The change in the cost function of a firm may be due either to a change in technology or to a change in factor prices or else to a combination of both factors. No provision was made to take into account the inter-industry differences with respect to technical progress, although it is likely that all manufacturing sectors were not equally affected by technical changes over the period under consideration.

In addition to the variables included in the various regression models and to those enumerated above, a host of other factors could be taken into consideration. The elasticity of demand, changes in the relative importance of accounting deficiencies (such as the failure to recognize price changes and the recording of some profits as wages of owner-managers), managerial ability, difference in attitude toward risk, differences between firms within an industry, the flow of capital in response to profit rate differentials created by shifting, to mention only a few. The latter factor warrants further comments. The flow of capital may respond to profit rate differentials created during the period studied as well as to the initial profit rate differentials. Capital flows responding to profit rate differentials created by short-run shifting would reduce and might even eliminate these differentials, so that the estimate of the degree of short-run shifting would be too low and the test for the existence of shifting could fail. Long-run effects would obscure the nature of short-run effects.

A second set of qualifications is called for with regard to data and measurement problems. The reliability of the results and the relevance of the whole approach is, of course, dependent upon the availability of a

large range of consistent and reliable information on every industry. The problem of obtaining comparable information for every industry is a serious one since, in a cross-section analysis, each industry accounts for one observation. A lack of information of any one of price, profit, concentration, sales, net worth, capital assets, etc., for one industry means the loss of one observation. This is a severe constraint as the initial population is already limited in size. Heroic estimates sometimes have to be made in order to rescue a single observation.

The quality of the available data also raises difficulties. The problem of obtaining the relevant price index numbers has already been mentioned and its tentative solution outlined. Other figures of critical importance for this study also raise problems. The profit figures, for instance, are strongly influenced by the changes in depreciation policy. The introduction of a downward bias in the profit figures attributable to the liberalization in 1949 of capital cost allowances was partly solved by the consistent addition of capital cost allowances to profit figures, but this again is an imperfect correction as it does not take into account the true depreciation of capital assets.

Further problems arise from a data standpoint. Aside from the normal problem of standard classification which seems to differ from one source of data to the next, not to mention changes of classification over time, the available data on corporate finance suffer serious drawbacks. As mentioned earlier, most of the data used are contained in the annual taxation statistics. They comprise all fully tabulated companies, but a company may be included one year and left out the next because it did not file its income tax returns on time for its statistics to be included.

Furthermore, taxation statistics cannot be used as a consistent source of information over a long period of time because the number of companies filing income tax returns increases as new companies come into existence, either from scratch or through incorporation of existing business concerns. Thus, the data provide an indication of the overall growth of corporate enterprises, but they do not necessarily show how the companies which were in existence at the start of the period in 1948 have developed between that time and 1952.

In contrast with data drawn from other sources and compiled on a calendar year basis, the taxation statistics are on a fiscal year basis. All companies with fiscal year ending between the 1st of January and the 31st of December 1950, for instance, have their statistics recorded for the year 1950. Hence a company with a fiscal year ending in January has the bulk of its 1949 operations recorded in the 1950 taxation statistics. This is clear from the following paragraph taken from the 1952 report:

> The period covered is the 1950 taxation year which embraces all company returns for fiscal periods ending between January 1, 1950 and December 31, 1950. Except where a company's fiscal year ends on December 31, 1950, the data pertain partially to the 1949 calendar year and partially to the 1950 calendar year. 13/

Another source of concern is that, until 1952, companies could submit returns on a consolidated basis; hence, the consolidated return submitted by a holding company and the return of each of its subsidiaries could conceivably be entered. This, however, should not affect our data since we are concerned here with manufacturing corporations only.

Finally, one whole aspect of the problem of the incidence of the corporate income tax has not yet received any attention. The position of an industry with respect to international trade may constitute one source

of differences in competitive pressure which is not accounted for by the concentration ratio. For instance, an industry which is export-oriented is more subject to international price competition than an industry operating domestically or an import-competing industry protected by a tariff wall. These inter-industry differences have not been taken into consideration in the regression models, but in an open economy like Canada, these factors are not negligible and they will be the object of Chapter 6.

In view of the fact that short-run shifting is conceived as the entrepreneur's reaction to a change in tax rate, it seems that the industry is a rather large aggregate to consider, when one aims at discussing the behaviour of entrepreneurs. The ideal unit for analytical purposes would be the firm, unless one can assume that every firm within an industry has the same characteristics and reacts in the same way as the others. The latter is a very dubious assumption however, and the only justification for the procedure adopted here is the absence of a reliable core of statistical information at the individual firm level.

REFERENCES

1/ See mainly Carl S. Shoup, "Incidence of the Corporate Income Tax: Capital Structure and Turnover Rates", National Tax Journal, March 1948, pp. 12-17, and Morris Beck, "Ability to Shift the Corporate Income Tax; Seven Industrial Groups", National Tax Journal, September 1950, pp. 248-256.

2/ J.S. Duesenberry, O. Eckstein and G. Fromm: "A Simulation of the United States Economy in Recession", Econometrica, Vol. 28, No. 4, October 1960, pp. 749-809 and especially pp. 781-786. The authors in an attempt to explain the change in gross corporate profits from the previous peak to any given time, used a similar explanatory variable.

They state:

> "... the decline in profits depends on the industrial composition of the decline, the decline in sales as opposed to the decline in production, the movements of wage-price relationships in oligopolistic industries, the degree of utilization of the capital stock at the peak in various industries, the degree of flexibility of existing technology under changes in output, and other factors.
>
> A relationship which accounts for a good deal of the timing of the profit decline within recession is the following, which has also been fitted to pooled data of the recessions of 1949 and 1954 (48:4 to 50:2 and 53:3 to 51:1):

$$(6.4)\quad \Delta\Pi_{g_o} \equiv P_{a_{g_o}} - P_{a_{g_t}} = -.253 + \underset{(.098)}{.230}\,(S_{f_o} - S_{f_t}) + \underset{(.118)}{.558}\,(\Delta Inv_o - \Delta Inv_t) \;;\; R = .902$$

> P_{a_g} is gross corporate profit before depreciation but after the inventory valuation adjustment; S_f is final sales, equal to GNP minus inventory investment; ΔInv is inventory investment. The equation states that the decline in profits from its peak value depends on the decline in final sales and the decline in inventory investment.
>
> Gross corporate profits before depreciation are used because they are the total return on fixed assets; depreciation, after all, is no more than an accounting convention, which continues to rise in recession and puts a downward trend into the figures for profits after depreciation. Final sales rather than GNP are used as the measure of economic activity because profits are earned on sales, not on production.

> Inventory decumulation affects profits at least via two routes. First, when much of final sales is out of inventory, sales in intermediate stages of production fall. The amplified decline in the sales figures for the manufacturing and wholesale sectors in recession bears evidence on this phenomenon. But corporate profits, to a large extent, are earned in these earlier stages of production. Therefore they fall when inventory decumulation supplies an extraordinary share of the goods for final sale.
>
> . . . . . .
>
> The other influence of inventory change in profits is more indirect. Inventory change is an indicator of the state of the market. It is when decumulation is large that business conditions are at their worst. Expectations are poor, and companies strike the worst bargains to get rid of inventory. Thus, profit margins shrink, accentuating the decline in total profits."

If the arguments of the three authors are valid, our own model suffers from at least one weakness—it fails to take into account any change in inventory.

3/ Minhas, op. cit., pp. 82-84.

4/ George J. Stigler, Capital and Rates of Return in Manufacturing Industries, National Bureau of Economic Research, Princeton: Princeton University Press, 1963.

5/ Ibid., pp. 66-67.

6/ Dominion Bureau of Statistics, Supplement to the Inter-Industry Flow of Goods and Services Canada, 1949. (Supplement to Reference Paper No. 72). The values are drawn from Table 3-B, row 49.

7/ On the basis of this proportionality assumption, it is possible to trace the effects of final expenditure on the output of an industry upon the intermediate output of all industries. Table 3A of the Supplement to the Inter-Industry Flow of Goods and Services presents the results of a calculation of the total output of each industry resulting from the production of one dollar's worth of final output by an industry for each of the 42 industry groups shown in Table 1 of the same publication. From this table it can be seen, for example, that the production of one dollar's worth of final output of the electrical apparatus industry resulted in the iron and steel products industry producing an output worth $.032 (Column 23, row 28), and the electrical apparatus industry itself producing an output worth slightly more than $1.00 (Column 32, row 32). From Table 2, it can be seen that to produce one dollar's worth of output, the iron and steel industry used net investment (income) worth $0.12 (Column 28, row 49). This average net investment input coefficient can be applied to the total output figure of $.032 from Table 3A to obtain an investment

income content estimate of $0.004 (0.03178 x 0.1244) for this portion of output resulting from one dollar's worth of final output of the electrical apparatus industry. Similarly, the investment income content of the output of all other industries resulting from the production of a dollar's worth of final output of this industry can be calculated; the total average investment income content of one dollar's worth of final output of the electrical apparatus industry was $.158 (Column 32, row 44 of Table 3B). This value and the analogous ones for other industries were used. In the present study, they were multiplied by 10 for manipulation purposes. The only effect of the latter operation is that we consider inputs resulting from ten dollars' worth of input instead of in terms of one dollar's worth. The relative position of any industry is not altered by such an operation.

For the benefit of the reader whose knowledge of input-output analysis is limited, it may be noted that the above explanation may be skipped, provided that the reader remembers that the price increase necessary to recoup a given tax loss depends on the ratio of profits (investment income) to sales for any given industry, or on the average ratio of investment income to final value, if we want to take into account the entire process of shifting. This fact is clearly pointed out by Carl Shoup in the article cited earlier.

8/ Duesenberry, Eckstein, and Fromm, op. cit., pp. 781-786.

9/ The relevance of a capital structure variable in a model aimed at explaining the difference in the ability of various industries to shift is argued by Shoup, op. cit., pp. 12-17 and Beck, op. cit., pp. 248-256.

10/ See reference 2, p. 104.

11/ 1948-1949 is a period of constant effective tax rate even though the table recording these rates shows a very slight rise in the tax rate, because in 1948 there was still an excess profits tax which was not incorporated in the calculation of the effective tax rate. Moreover, the calculation of the gross effective tax rate shows an identical figure (25 per cent) for both 1948 and 1949. The following regression results clearly show that the coefficient of C is never significantly different from zero for the period 1948-1949. The evidence indicates that the profit rates of the more concentrated industries did not rise relative to the profit rates of the less concentrated industries over a period of constant tax rate. This suggests that the equations used for testing the existence of shifting do not seriously overestimate the extent to which the positive association between C and $\Delta(\frac{\Pi}{K})$ was caused by shifting.

Equ.	d.f.	CONSTANT B_o	C	$\frac{\Delta S}{S_o}$	$\frac{K'}{S}$	$\frac{\pi}{S}$	R	F
1.6	29	-0.0414	0.0518 (1.5644)				0.12	2.45
	28	-0.0489	0.0261 (0.8456)	0.2745 (2.9003)*			0.46	5.74
	27	-0.0493	0.0260 (0.8202)	0.2744 (2.8372)*	0.0010 (0.0220)		0.43	3.69
	28	-0.0662	0.0377 (1.1224)			0.2636 (1.5327)	0.24	2.46
	27	-0.0659	0.0181 (0.5769)	0.2539 (2.6538)*		0.1860 (1.1725)	0.47	4.34
	26	-0.0670	0.0287 (0.9016)	0.2730 (2.8700)*	-0.0096 (-1.3781)	0.2541 (1.5523)	0.50	3.84

12/ This point may be illustrated by the following results and should become clearer if one cares to look at the scatter diagram (Chart 4-4), p. 76.

Concentrated: $\Delta(\frac{\pi_i}{K_i}) = 0.0025 + 0.32\ (\frac{\Delta S}{S_o})$; R = 0.79
(4.261)

Semi-concentrated: $\Delta(\frac{\pi_i}{K_i}) = 0.0052 + 0.65\ (\frac{\Delta S}{S_o})$; R = 0.78
(4.69)

Unconcentrated: $\Delta(\frac{\pi_i}{K_i}) = 0.0129 + 0.42\ (\frac{\Delta S}{S_o})$; R = 0.59
(2.70)

Assuming a linear relationship between the change in rate of return $\Delta(\frac{\pi}{K})$ and the relative change in sales $\frac{\Delta S}{S_o}$, the value of the regression coefficient of the latter variable indicates the size of the effect of the relative change in sales upon the rate of return in the three industrial groups. The values under the regression coefficients are the values of t.

13/ Department of National Revenue, Taxation Statistics, Ottawa, 1952, p. 24.

CHAPTER 5—ESTIMATED DEGREES OF SHIFTING

5.1. General Remarks

A study of short-run shifting involving only empirical tests of the existence of shifting and of the relative ability to shift would be incomplete without an attempt to measure the degree of short-run shifting. In view of the difficulties involved in developing a clear-cut and somehow comprehensive and definite answer to this question, a number of piecemeal measures of various types were applied to the data. Even then, satisfactory evidence turned out to be quite hard to come by. The attempts aimed at estimating the degree of shifting fall under two broad approaches. The first one is based on cross-sectional data and looks at rates of return in various industrial groups. The second one is based on the observation of aggregate time series pertaining to the rates of return and relative shares in national income. The period covered extends from 1948 to 1952 for cross-sectional data, and from 1947 to 1962, for time series.

5.2. Empirical Evidence from Cross-Sectional Data Analyzed for the Period 1948-1952

(a) Absolute Terms

The implications of the arguments in support of short-run shifting were stated originally in terms of two variables: the change in industry gross profit rate $\Delta(\frac{\pi_i}{K_i})$ induced by a change in tax rate and a measure industry monopoly power (C). From observations of each of these variables for a sample of manufacturing industries, a cross-section regression equation has been estimated with the form:

$$\Delta(\frac{\pi_i}{K_i}) = \frac{\pi_1}{K_1} - \frac{\pi_o}{K_o} = B_o + B_1 C$$

The shifting hypothesis predicts that $B_o = 0$ and $B_1 > 0$. The shifting hypothesis predicts that $B_o = 0$, because when $C = 0$ an industry cannot shift the tax at all and therefore $\frac{\pi_1}{K_1} = \frac{\pi_o}{K_o}$. Consequently,

$$\Delta\left(\frac{\pi_i}{K_i}\right) = B_o + B_1 (0) = B_o = 0$$

The shifting hypothesis predicts that $B_1 > 0$, because an increase in C raises the degree of shifting; the rise in shifting increases the value of $\frac{\pi_1}{K_1}$ and $\Delta\left(\frac{\pi}{K}\right)$; and the effect of the increase in C on $\Delta\left(\frac{\pi}{K}\right)$ is measured by B_1. Thus the existence of different degrees of shifting can be tested by whether B_1 is significantly greater than zero. If only industries with positive concentration can shift the tax and if the true relationship between C (or a transformation of C) and shifting is linear, then all the shifting which occurs will show up in the value of B_1. This test was therefore the primary test for the existence of shifting.

However, these assumptions may not hold. First, industries with zero concentration and zero actual monopoly power may be able to shift at least some of the tax, in which case B_o would be positive. Secondly, measured concentration may break down as a valid representation of monopoly power for industries with very low concentration. If C underestimated the monopoly power of industries with very low concentration B_o would be greater than zero. If C overestimated the monopoly power of industries with very low concentration, B_o would be less than zero. Therefore testing whether B_o was significantly different from zero would give valuable information about the existence of shifting.

Unfortunately, this latter test cannot be made. In a multiple regression equation B_o is the expected value of the dependent variable when all independent variables, not just C is zero. The expected value of $\Delta(\frac{\pi}{K})$ when C is zero depends upon the value of all the other independent variables as well. No particular set of values of the independent variables other than C is uniquely fit to test shifting power by being used to calculate the expected value of $\Delta(\frac{\pi}{K})$ when C is zero, and the answer would vary for each different set. Therefore the value of B_o has no implication for the existence of shifting. Even more important, B_o is determined by variables outside the model.

If the existence of short-run shifting is established, the degree of shifting would be estimated. The definition of the degree of shifting and the derivation of its measurement from the regression result may be explained first for a single industry and then for the manufacturing sector as a whole. It is in the latter measure that we are mainly interested and we shall limit the investigation to the aggregate estimate.

The analysis of the industrial data used in the cross-section models leads to the following observations regarding the degree and mechanism of shifting. Between 1948 and 1952, very substantial increases in sales receipts were observed in most manufacturing industries. The relative increase in sales over that period ranged from 16 to above 100 per cent in industries included in the sample. The analysis reveals that this upward movement is not due only to the increase in the scale or size of the operations (i.e., to an increase in capacity). Up to 80 per cent of this change originated in increases in the price of the product (i.e., forward-shifting of the tax), and in better utilization of the existing capacity.

A substantial proportion of the aforementioned change resulted directly in higher rates of return before tax in many industries. In other words, only a fraction of this increase in sales receipts was due to an expansion of the stock of capital and real output; the remaining fraction was due to increases in prices and capacity utilization and was coupled with higher rates of return on a possibly larger stock of capital.

A glance at the estimated regression coefficients reveals that, in the early 1950's a postulated increase in the value of sales of the order of 10 per cent was accompanied by an increase in the gross rate of return of the order of 4 per cent. (See Table 4-4, Equation 1.6.) As indicated earlier, (see Reference 12 and Chart 4.4) a more refined calculation indicates that a postulated increase in the value of sales of the order of 10 per cent results in an increase in gross rate of return of the order of 4 per cent in concentrated industries while the same increase in sales brings about an increase in rate of return of the order of 5.5 per cent in unconcentrated industries. As already suggested, such an increase in the rate of return is not entirely due to tax shifting via higher prices; part of it is attributable to tax avoidance, through heavier bond financing, and part of it originates in a more efficient use of the existing stock of capital. It is hard to evaluate what proportion of this rise in gross rate of return is due to the shifting of the tax, and what proportion is attributable to the other factors enumerated above (or as yet unidentified). If the degree of shifting is defined as the ratio of the change in rate of return, due to shifting, to the change in tax liability caused by a change in tax rate, it is possible to use the results of the cross-section regressions to measure the extent to which the tax has been shifted. Thus defined the degree of shifting may be calculated from the following formula:

$$S = \frac{\frac{\pi_1}{K_1} - \frac{\pi_o}{K_o}}{z_1\left(\frac{\pi_1}{K_1}\right) - z_o\left(\frac{\pi_o}{K_o}\right)}$$

As the change in rate of return attributable to shifting of the tax has been estimated by a regression equation of the following form:

$$\frac{\pi_1}{K_1} - \frac{\pi_o}{K_o} = B_o + B_1 C$$

$B_1 C$ may be substituted in the numerator of the above formula to arrive at the estimated degree of shifting for the period 1949-1952. Besides the point estimate, 90 per cent and 95 per cent interval estimates of the degree of shifting were also calculated and the results are assembled in the following table.

Table 5-1 - Estimated Degree of Shifting: Absolute Terms

		Degree of Shifting (%)
Point estimate B_1		97
90% interval	$B_1 + 1.699\ S$	153
	$B_1 - 1.699\ S$	42
95% interval	$B_1 + 2.045\ S$	164
	$B_1 - 2.045\ S$	31

Note: The symbol "S" stands for the standard error for B_1. The range $B_1 \pm 1.699\ S$ and $B_1 \pm 2.045\ S$ specify, respectively, the 90 per cent and 95 per cent confidence intervals.

(b) Relative Terms

The degree of shifting may also be defined as the ratio of the amount of the initial burden of the tax which is shifted to the initial burden of the tax. In terms of profit rates the initial burden is approximately the reduction in the after-tax rate of return caused by the change in tax rate, that is, $(1-z_o)p_o - (1-z_1)p_o$, where z_o and z_1 are the effective tax rates before and after the tax change, respectively, and p_o and p_1 are the rates of return before and after the tax change. The amount of the initial burden shifted, or the gain from shifting, is the rise in the after-tax rate of return caused by the shifting process, that is $(1-t_1)p_1 - (1-t_1)p_o$. The degree of shifting may therefore be written:

$$\frac{(1-z_1)p_1 - (1-z_o)p_o}{(1-z_o)p_o - (1-z_1)p_o}$$

or after simple algebraic transformations:

$$\frac{\dfrac{p_1 - p_o}{p_o}}{\dfrac{(1-z_o) - (1-z_1)}{(1-z_1)}} = \frac{\dfrac{p_1}{p_o} - 1}{\dfrac{1-z_o}{1-z_1} - 1}$$

The latter expression may be interpreted as the ratio of the percentage increase in rate of return caused by shifting to the percentage increase in rate of return necessary for full shifting. Thus defined, the degree of shifting cannot be calculated directly from the regression equation used to test the existence of shifting, because this equation is expressed in terms of absolute change in rate of return and what is needed here is an expression involving the relative change. In order to estimate the degree of short-run shifting, between 1949 and 1952, a regression equation

of the following form was fitted to the data:

$$\frac{p_1}{p_o} = B_o + B_1 C$$

This equation yielded the following result:

$$\frac{p_1}{p_o} = \underset{(0.111)}{0.779} + \underset{(0.199)}{0.550}\, C \quad ; \quad (R^2 = .21)$$

where the values in brackets are the standard errors of estimate.

Expressed in these terms, the shifting hypothesis predicts that $B_o = 1$ and $B_1 > 0$. For the reasons given earlier, the shifting hypothesis predicts that $B_o = 1$, because when $C = 0$ an industry cannot shift the tax at all and therefore $p_1 = p_o$. The shifting hypothesis predicts that $B_1 > 0$, because an increase in C raises the degree of shifting; the rise in shifting increases the value of p_1 and p_1/p_o; and the effect of the increases in C on p_1/p_o is measured by B_1. Tests of hypothesis on these two magnitudes reveal that B_1 is significantly greater than zero at the 1 per cent level and B_o is not significantly different from one at the 5 per cent level. The 99 per cent confidence limits for B_o for 29 degrees of freedom yields the following confidence interval for B_o: $B_o = 0.779 \pm 2.756\ (0.111) = 0.779 \pm 0.306$. The 95 per cent confidence interval for B_o is: $B_o = 0.779 \pm 2.045\ (0.111) = 0.779 \pm 0.227$. It should be noted that both intervals do include the value one. If on the basis of this statistical evidence, we accept that B_o is equal to one, the following formula may be used to calculate the degree of shifting:

$$\frac{\frac{p_1}{p_o} - 1}{\frac{1 - z_o}{1 - z_1} - 1} = \frac{B_o + B_1 C - 1}{\frac{1 - z_o}{1 - z_1} - 1}$$

Assuming $B_o = 1$ we then obtain:

$$\frac{B_1 C}{\frac{1-z_o}{1-z_1} - 1}$$

Thus calculated, the degree of shifting for the period 1949-52 is 80 per cent, when the effective tax rate is used in the calculation. This is the point estimate, the table below also gives the 90 per cent and the 95 per cent interval estimate.

Table 5-2 - Estimated Degree of Shifting: Relative Terms

		Degree of Shifting (%)
Point estimate B_1		78
90% interval	$B_1 + 1.699\ S$	128
	$B_1 - 1.699\ S$	30
95% interval	$B_1 + 2.045\ S$	144
	$B_1 - 2.045\ S$	21

Note: The symbol "S" stands for the standard error for B_1.
The range $B_1 \pm 1.699\ S$ and $B_1 \pm 2.045\ S$ specify, respectively, the 90 per cent and the 95 per cent confidence intervals.

The estimators of the degree of shifting developed and applied above imply that the constant term (B_o) of the regression equations be zero in the absolute terms formula and unity in the relative terms formula. Although the hypothesis $B_o = o$ in the first case and $B_o = 1$ in the second case cannot

be rejected statistically, it appears that the above conditions are not exactly fulfilled. This consistently entails an upward bias in the estimated degree of shifting, as the measures used are very sensitive to a departure from these conditions. A correction for this factor would bring the point estimates recorded in Tables 5-1 and 5-2 down to 77 per cent and 68 per cent respectively.

5.3 Empirical Evidence from Aggregate Time-Series Data Analyzed for the Period 1947-1962

(a) Rate of Return

In this section, evidence will be drawn from aggregate time-series for short periods. The first measure applied bears on the gross rate of return of the industries before and after the occurrence of a change in the tax rate. The formula used follows from the Krzyzaniak-Musgrave definition of the condition for 100 per cent shifting.

If we define:

z_o = effective tax rate before the change in rate;

z_1 = effective tax rate after the change in rate;

$\pi_{g,o}$ = gross profits (before tax) in the base year (that is, before the change in tax rate is enacted);

$\pi_{g,1}$ = gross profit after the tax rate change has been enacted;

π' = profit in absence of tax;

then the conditions for 100 per cent shifting in gross terms between the two years may be expressed:

$$(1-z)\pi_g = \pi'$$

or

$$\pi_g - z\pi_g = \pi'$$

hence $\pi g - \pi' = z\pi g$

Since we are concerned with a change in tax rate, we must compare the 100 per cent shifting equilibrium at the new tax rate (z_1) with that at the initial tax rate (z_o).

thus (1) $\pi_{g,1} - \pi' = \pi_{g,1} z_1$

and (2) $\pi_{g,o} - \pi' = \pi_{g,o} z_o$

Subtracting (2) from (1) we obtain:

$$\pi_{g,1} - \pi_{g,o} = \pi_{g,1} z_1 - \pi_{g,o} z_o$$

as the condition for 100 per cent shifting of the incremental tax rate. The above formula for 100 per cent shifting suggests that the degree of shifting can be defined as:

$$S = \frac{\pi_{g,1} - \pi_{g,o}}{z_1 \pi_{g,1} - z_o \pi_{g,o}}$$

This is nothing but the change in gross profits as a fraction or a percentage of the increase in tax liability. This formula involves the absolute level of profits and is quite inadequate because of the one-sided nature of the main underlying assumption. For instance, the formula assumes that the increase in price meant to recoup the new tax liability does not induce any change in sales or output. This is contradicted by the facts, even in the short run. Moreover, the absolute level of profit is seriously affected by non-tax factors such as increases in capital stock and capacity utilization. The simplest and most efficient way of correcting the absolute figure for these changes is to standardize it with the proper capital figure and thus work with rates of return rather than absolute profits. The formula involving gross rates of return then reads:

$$S = \frac{\frac{\pi_{g,1}}{K_1} - \frac{\pi_{g,0}}{K_0}}{z_1\left(\frac{\pi_{g,1}}{K_1}\right) - z_0\left(\frac{\pi_{g,0}}{K_0}\right)}$$

Effective rates of taxation, rather than statutory rates, were used to estimate the degree of shifting in total manufacturing for periods of various lengths. The rate of return was calculated both on equity and on total capital; in each case, both profits net of capital cost allowances and gross of capital cost allowances were considered. The application of the formula to these magnitudes leads to the following results.

Table 5-3 - Rates of Return and Effective Tax Rates in Total Manufacturing, Canada, 1945-1962

Year	Rates of Return: Equity Base $\frac{\pi_g}{K}$ % (1)	Equity Base $\frac{\pi_g+CCA}{K}$ % (2)	Total Capital Base $\frac{\pi_g+I}{K+D}$ % (3)	Total Capital Base $\frac{\pi_g+CCA}{K+D}$ % (4)	Effective Tax Rate: z Gross % (5)	z Net % (6)
1945	17.76	21.64	15.54	18.27	14.8	18.0
1946	18.88	22.60	16.68	19.41	15.2	18.2
1947	22.68	27.05	19.70	23.00	24.1	28.8
1948	22.17	26.94	19.60	23.34	25.0	30.4
1949	19.11	24.86	17.06	21.78	25.4	33.0
1950	23.13	29.06	20.55	25.33	27.1	34.1
1951	24.70	31.01	21.96	27.04	35.2	44.2
1952	20.66	27.21	18.04	23.05	38.0	50.1
1953	18.79	26.07	16.28	21.80	34.0	47.2
1954	14.36	22.05	12.65	18.44	31.1	44.8
1955	17.05	24.59	14.91	20.62	30.8	44.5
1956	16.52	24.10	14.24	19.96	30.3	44.2
1957	13.78	21.43	11.98	17.63	26.5	41.2
1958	11.94	19.28	10.43	15.73	25.0	40.4
1959	13.47	20.71	11.88	15.20	27.6	42.4
1960	11.83	18.96	10.52	15.83	26.7	42.8
1961	10.74	17.41	9.67	14.69	26.3	42.7
1962	12.32	19.50	10.95	16.34	25.9	41.0

Note: The meaning of the symbols is as follows:
- π_g: before-tax profits
- K: net worth (that is, equity capital plus surplus less deficit)
- CCA: capital cost allowances
- I: interest payments
- D: long-term indebtedness
- z gross: ratio of tax paid to profits gross of CCA
- z net: ratio of tax paid to profits net of CCA

Source: Taxation Statistics, annually 1947-1964.

Table 5-4 - Estimated Degree of Shifting in Total Manufacturing for Selected Years

All Profit Figures before Taxes	Degree of Shifting in Percentage 1948 to 1951	1949 to 1952	1950 to 1951
	%	%	%
Equity Base			
1. Profit net of CCA on net worth	60.4	42.3	51.5
2. Profit gross of CCA on net worth	73.2	48.7	51.0
Total Capital Base			
3. Profit net of CCA on total capital	63.2	26.0	51.9
4. Profit gross of CCA on total capital	76.6	32.3	51.4

Source: Table 5-3.

(b) Factor Shares

The second set of measures based on aggregate time-series bears on the relative share of capital in the national income. Following the procedure adopted in the previous section, let us derive the formula used.

If we define:

z_o = effective tax rate before the change in rate;

z_1 = effective tax rate after the change in rate;

π_0 = property income before taxes prior to the change in tax rate;

π_1 = property income before taxes after the change in tax rate;

GDP = gross domestic product at factor cost.

The condition for 100 per cent shifting between the two periods may be expressed:

$$\frac{\pi_1/GDP_1}{\pi_0/GDP_0} = \frac{1-z_0}{1-z_1}$$

If this equality holds, after-tax relative shares (and, in the short run, rates of return) will be maintained fully. If on the other hand the following equality holds, there is no shifting taking place:

$$\frac{\pi_1/GDP_1}{\pi_0/GDP_0} = 1$$

(That is, the after-tax share is reduced by the full amount of the tax.)

We, therefore, define S' as our measure of shifting.

$$S' = \left(\frac{\pi_1/GDP_1}{\pi_0/GDP_0}\right) - 1 \quad \div \quad \left(\frac{1-z_0}{1-z} - \right)$$

Strictly speaking, this formula was not applied, since the effective tax rate on corporate profits was applied rather than the effective corporate tax rate on all property income. Table 5-5 presents data on effective tax rates, profits and gross domestic product in all Canadian corporations for selected years. The effectice tax rate on gross profits (that is, profits gross of capital cost allowances) is analyzed since a large part of the change in capital consumption has been due to changes in allowable rates of depreciation. The estimated degrees of shifting in all corporations and in total manufacturing are given in Table 5-6.

Table 5-5 - Corporation Profits, Capital Cost Allowances, Taxes, and Effective Tax Rates, All Corporations, Canada, 1947-1963
(All money figures in millions of Canadian dollars)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
					Effective Tax Rate on		
Year	Corporation Profits	Corporation C.C.A.	Gross Profits	Corporation Taxes	Gross Profits %	Net Profits %	GDP at Factor Cost ($ millions)
1947	1,814	582	2,396	702	29.3	38.7	11,857
1948	1,964	702	2,666	687	25.8	35.0	13,699
1949	1,879	797	2,676	718	26.8	38.2	14,885
Total	5,657	2,081	7,738	2,107	27.2	37.2	40,441
1951	2,825	1,037	3,862	1,416	36.7	50.1	19,126
1952	2,698	1,189	3,887	1,384	35.6	51.3	21,344
1953	2,611	1,354	3,965	1,220	31.0	46.7	22,206
Total	8,134	3,580	11,714	4,020	34.3	49.4	62,676
1954	2,290	1,521	3,811	1,082	28.4	47.2	22,213
1955	2,965	1,733	4,698	1,272	27.1	42.9	24,326
1956	3,345	1,976	5,321	1,413	26.6	42.3	27,189
1957	3,056	2,242	5,298	1,337	25.2	43.8	28,455
Total	11,656	7,472	19,128	5,104	26.7	43.8	102,183
1958	3,075	2,091	5,166	1,315	25.5	42.8	29,354
1959	3,504	2,303	5,807	1,581	27.2	45.1	31,175
1960	3,338	2,426	5,764	1,544	26.8	46.3	32,336
1961	3,400	2,508	5,908	1,600	27.1	47.1	33,351
1962	3,640	2,702	6,342	1,700	26.8	46.7	36,123
1963	3,920	2,827	6,747	1,810	26.8	46.2	38,440
Total 58-62	16,957	12,030	28,987	7,740	26.7	45.6	162,339
Total 58-63	20,877	14,857	35,734	9,540	26.7	45.7	200,779

Source: National Accounts, Income and Expenditures 1926-1956, and annually 1955-1963, Table 50.

Table 5-6 - Estimated Degree of Shifting in (a) All Corporations, and (b) Total Manufacturing, for Selected Years

Period	Basis	Degree of Shifting in All Corporations %	Degree of Shifting in Manufacturing %
1947-49 to 1951-53	gross	69.4	70.0
	net	26.1	—
1951-53 to 1954-57	gross	-8.7	53.8
	net	40.0	—
1951-53 to 1958-62	gross	-5.7	58.4
	net	45.7	—

Source: Table 5-5.

During the postwar period corporate tax rates were raised and lowered. Three distinct episodes may be detected: the pre-Korean War period, when effective tax rates on gross profits varied between 25 to 29 per cent (24 to 29 per cent in manufacturing); the Korean War period (excluding 1950, the year during which the tax increases were enacted) when effective tax rates varied between 31 and 37 per cent (34 and 38 per cent in manufacturing); and the post-Korean War period, with rates varying between 25 and 28 per cent (25 and 31 per cent in manufacturing).

It seems logical to analyze the impact of tax changes on relative shares over these periods. Average rates for the pre-Korean, Korean, and for two sub-periods of the post-Korean period were analyzed, rather than the annual rates themselves, in order to mitigate the effect of the business cycle and lags in the reactions of firms to tax changes. It should be pointed out that effective tax rates on personal income and effective indirect tax rates did not show nearly as much variability over these periods, but rather displayed greatly rising trends. Consequently, it is reasonable to assume that the extent of the shifting observed was not coloured by changes in those other

tax rates. Unfortunately, corporate tax rates in the United States closely paralleled tax rates in Canada, so that the estimated degree of shifting reveals the extent of shifting in Canada when Canada and United States rates move together, rather than the extent to which an independent Canadian tax change will be shifted.

A final point to consider is whether the four periods selected differ significantly in terms of average performance. The first three periods each included years of pronounced boom coupled with years of mild recession. However, the pre-Korean and Korean War periods had lower unemployment, a higher ratio of actual to potential GNP, and more inflationary pressures, than did the third period. Therefore, a decline in the property share after the Korean War may be expected as a result of the reduced pressure of aggregate demend. The fourth period (1958-62) was one of marked weakness in aggregate demand, as a glance at the unemployment rates would reveal. Consequently, an even larger decline in the relative share of property income may be expected.

The extent of shifting was measured between the high tax period (1951-53) and each of the other periods for (a) the private non-farm economy as a whole, on both a net and a gross basis, and (b) the manufacturing sector, on a gross basis only. The latter calculation provides a rough check on whether the more aggregative results are affected by inter-industry shifts.

The results are recorded in Table 5-6. The gross aggregate measure confirms earlier results, indicating that the tax increases were extensively shifted, but that the tax decreases were not shifted at all. The net increases show a somewhat different pattern: tax increases were shifted by approximately 25 per cent, subsequent decreases by approximately

40 per cent. Since the capital stock was growing relative to output over this period, the differences between the two measures reflect the fact that the increase in capital cost allowances was partly due to real increase in depreciation costs, and partly due to changes in rates allowable for tax purposes.

The gross revenue for manufacturing shows extensive shifting (70 per cent) of the tax increase and more moderate shifting (between 50 and 60 per cent) of tax decreases. Once again, the fact that the increase in C.C.A. reflects real increases in depreciation costs probably explains the asymmetry. These results are admittedly crude, since they are highly aggregative and rest on the assumption that tax changes were the only important factors leading to changes in relative shares over these periods. The results are even less reliable in the case of manufacturing, because the data are drawn from two different and hardly reconcilable sources. Profit and tax figures are based on taxation statistics and relate to corporations alone, whereas the gross domestic product figures originating in the manufacturing industries are on a national account basis, and include all manufacturers, whether they are incorporated or not. Different coverage with respect to time (that is, calendar versus fiscal year) and firms (that is, all firms versus incorporated firms) together with inter-industry shifts, may have contributed to a serious distortion of the picture.

If we assume that the revealed asymmetries are wholly explained by the factors mentioned, an average of the tax increase and tax decrease shifting is the best measure of the extent of shifting. Averaging the 1947-49 to 1951-53 and the 1951-53 to 1954-57 comparisons we obtain the following estimates of average shifting:

Gross Private Non-Farm	30 per cent
Net Private Non-Farm	33 per cent
Gross Manufacturing only	60 per cent

While the manufacturing estimate is somewhat less reliable than the aggregative measures, it is not surprising that more shifting occurs in that sector, since giant oligopolistic firms are relatively important in manufacturing. These results suggest that the corporate tax is mostly shifted when Canadian and United States tax rates move roughly together. The extent of the shifting (for both tax increases and decreases) is of the order of one third for the private non-farm earnings as a whole, and somewhat higher for the manufacturing sector.

5.4. Evaluation of the Estimated Degree of Shifting

In this section, estimates of the degree of shifting of the corporate tax have been attempted. Instead of relying on a single comprehensive estimate, many piecemeal measures have been applied. The advantage of this procedure is that it allows the results to be cross-checked by comparing one estimate with a battery of other estimates, derived from different approaches. None of these measures is perfect and entirely reliable in itself. However, a number of partial measures which may be checked against each other appear much more reliable than a unique and more comprehensive measure such as that developed by Krzyzaniak and Musgrave. A single measure generated by a model which can never be perfectly specified, even though it takes into account factors other than the tax factors is not very satisfactory especially when, as is the case in the two authors' model, there is collinearity between two crucial and supposedly independent variables. Another weakness of their approach is

that it implicitly assumes that tax increases and tax decreases are shifted symmetrically, while, in effect, the evidence suggests asymmetry in the shifting of tax increases and tax decreases. One way of getting around this problem would be to find two relations, one for the period of rising tax rate and one for the period of declining tax rate, by dividing the overall period into two shorter spans or by simply using dummy variables. The alleged advantage of the single-estimate approach is that it permits the tax effects to be isolated from the others, if there is no multicollinearity. If there is multicollinearity, then the method defeats its own purpose in that the tax effects are never really isolated. Moreover, the estimates obtained are inefficient and often unreliable because the significance tests are meaningless due to the underestimation of the sampling variances involved in these tests.

In the study by Krzyzaniak and Musgrave, apart from the fact that the samples are small (never more than 20 observations), the tax effects are never disentangled from the effects of the other factors because the tax variables are highly correlated with other explanatory variables and, consequently, the estimated degree of shifting is more than likely biased upward. Estimating procedures based on the simplifying assumption that the rate of return is influenced by no factor other than taxes do not seem far-fetched when compared with a method in which extraneous influences are recognized, but not successfully isolated. It is largely for this reason that the piecemeal approach has been adopted here.

In this section, empirical evidence has been derived from (1) cross-sectional data analyzed for the period 1948-1952, in absolute and relative terms (revealing 97 per cent and 78 per cent shifting respectively);

(2) aggregate time-series data analyzed for the period 1947-1962, through rates of return and factor shares approaches. The rate of return approach yields an estimated degree of shifting of the order of 70 per cent in gross terms for long and short periods of time, and a somewhat lower figure for the net term estimate. The factor shares approach also yields an estimated 70 per cent shifting of the tax increases in gross terms for all Canadian corporations and for the manufacturing sector alone. The evidence points toward a lower degree of shifting when the estimate is derived from net profit figures. There is also evidence that the tax decreases were shifted to a lesser extent than the tax increases.

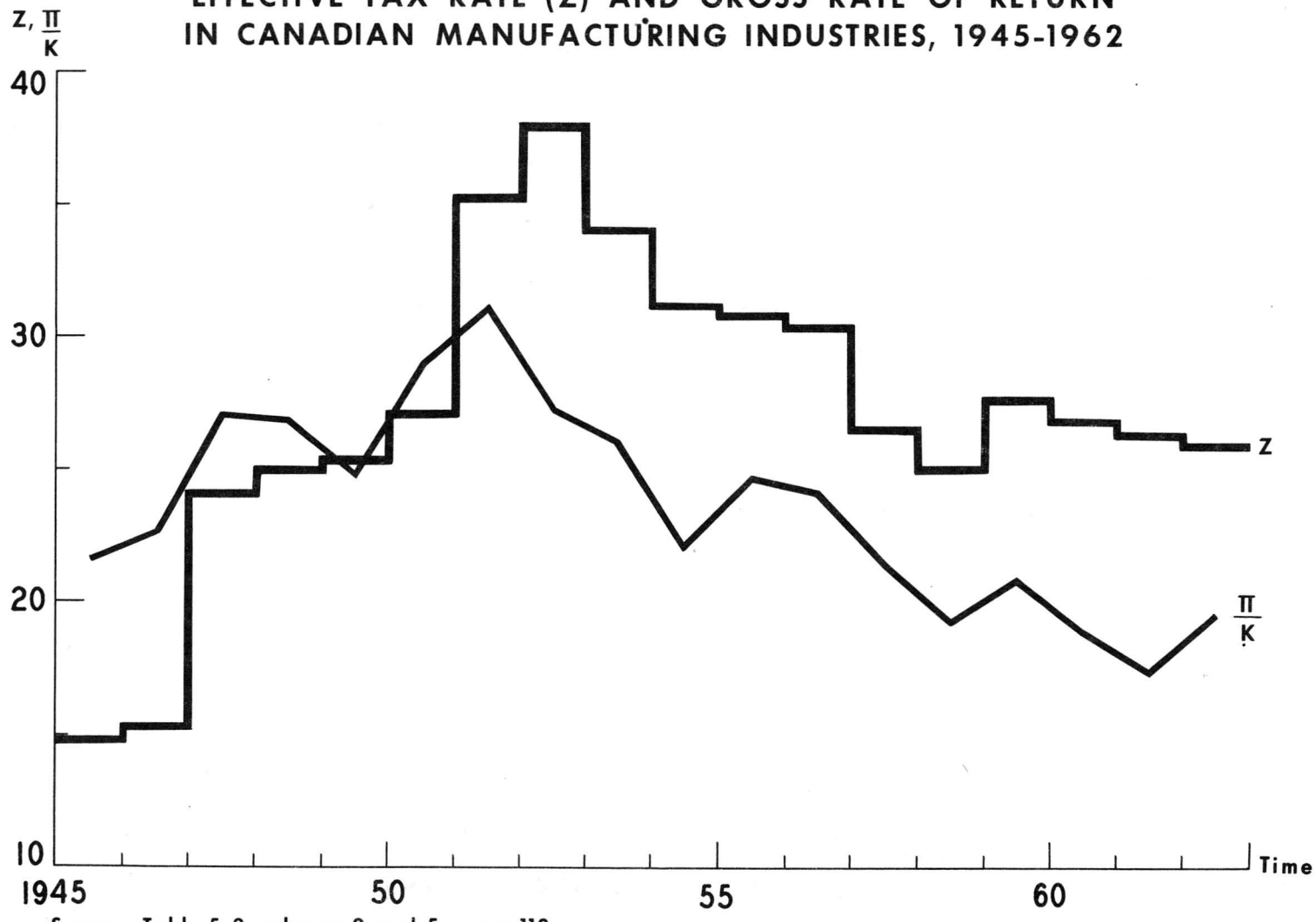
The results just summarized show too high a degree of coherence and convergence to be merely coincidental and they allow a number of conclusions to be drawn. First, the results obtained are consistent with the hypotheses that (a) there is extensive shifting in the manufacturing sector, and (b) the most successful industries are precisely those which were thought of as having a greater ability to shift, because of their level of concentration, capital structure, and the like. Secondly, there is asymmetry between the degree of shifting of tax increases and of tax decreases. This revealed asymmetry calls for a manifold explanation: (a) the two measures reflect the fact that the increase in capital cost allowances was partly due to increases in depreciation costs, and partly due to changes in rates allowable for tax purposes; (b) it reveals the inter-industry differential lags in the shifting process; indeed, some industries may still try to recoup the additional tax liability when the effective tax rate is being reduced, while other industries have already succeeded in passing on the additional tax burden brought about by an increased tax rate; (c) while the incentive to shift an increased tax burden is strong, the incentive to pass on the

fruits of a reduced burden is much less so.

The evidence of asymmetries in the shifting process may cast very serious doubts on the validity of the approach adopted by Krzyzaniak and Musgrave as suggested by the following scatter diagram, Chart 5-1. The period with which the two authors are concerned is also marked by a period of tax increase followed by a period of tax decrease. It appears in the scatter diagram that asymmetry did in fact occur, and that a unique linear relationship between the rate of return and the tax factor cannot be defined as the two authors implicitly assumed it could. The diagram strongly suggests that there exist two distinct relationships characterizing the overall period under examination, one characterizing the years during which the tax rate was being moved upward and the other characterizing the period of downward-moving tax rates.

Chart 5-1

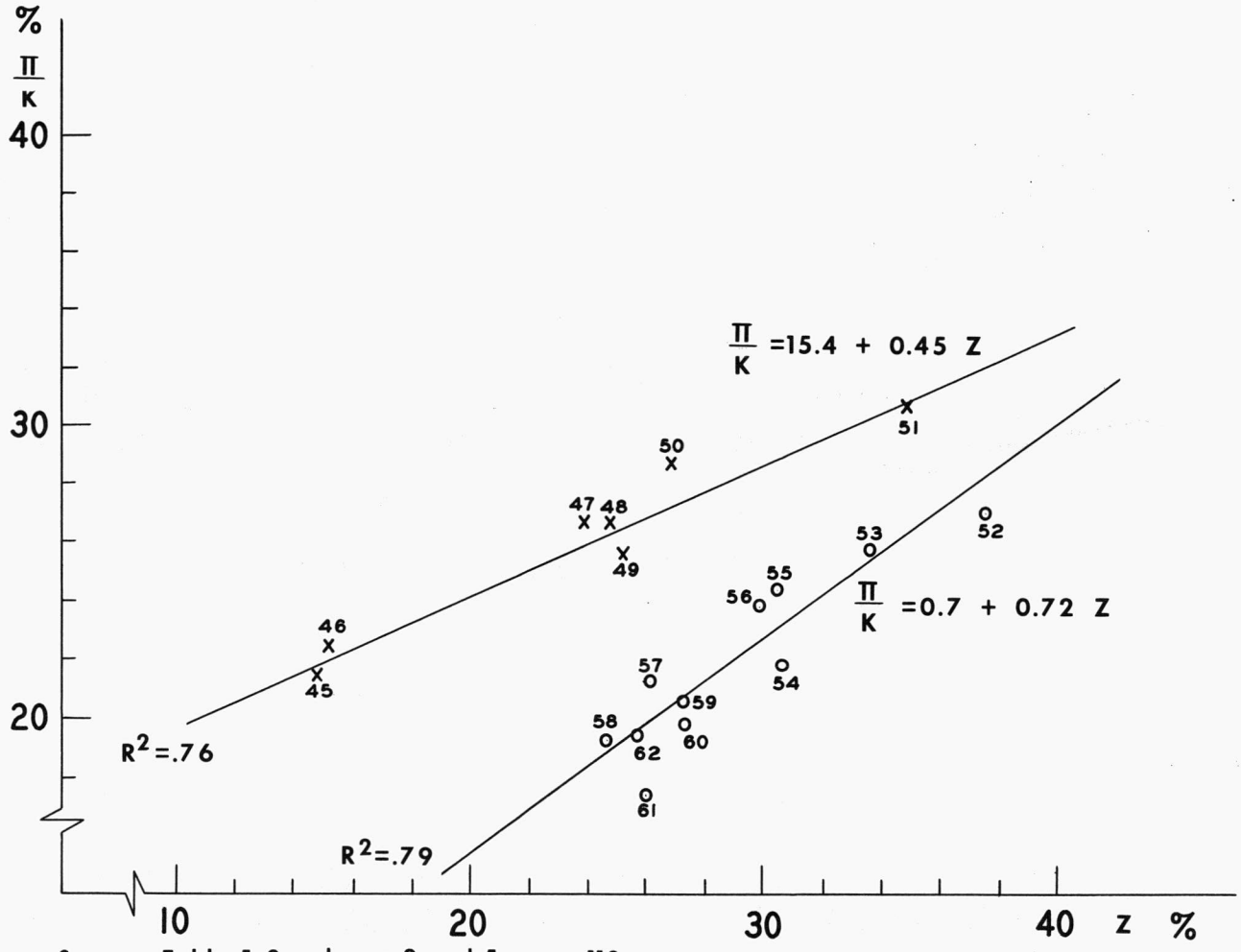
EFFECTIVE TAX RATE (Z) AND GROSS RATE OF RETURN IN CANADIAN MANUFACTURING INDUSTRIES, 1945-1962



Source : Table 5-3, columns 2 and 5, page 118

Chart 5-2

RATE OF RETURN VERSUS EFFECTIVE TAX RATE FOR THE PERIODS 1945-51 AND 1952-62



Source : Table 5-3, columns 2 and 5, page 118

CHAPTER 6—INCIDENCE OF THE CORPORATE INCOME TAX AND INTERNATIONAL TRADE

6.1. Introductory Remarks

Many problems falling under this heading have received careful examination in the literature during the last few years. For instance, the arguments which relate to exports and the balance-of-payments effects of the substitution of a value-added tax for the profits tax have been assessed by the Richardson Committee. 1/ The suitability of certain taxes in securing various objectives of tax policy such as employment, capital formation, work effort, the efficiency of resource allocation and the desired levels of exports, imports, and capital flows have been the object of a recent conference on the role of direct and indirect taxes in the federal revenue system in the United States. 2/ The comparative bearing of certain "direct" and "indirect" taxes on these economic objectives, with emphasis primarily on the differential effects of the corporate profits and value-added taxes upon international trade was extensively treated by Musgrave and Richman during the conference. 3/ None of these issues constitutes the specific object of the present chapter, but some of them have some bearing on the analysis of the following pages. The issue with which we are concerned here is the impact of the corporate income tax on the international competitive position of an economy which is open to international trade such as the Canadian economy. Since Canada was experimenting a flexible exchange rate in the 1950's, a major problem will be to disentangle the effects of the changes in the exchange rate from those of changes in the corporate tax rate over the same period.

The consensus of public opinion is that as a result of heavy taxation

Canadian business tends to be uncompetitive. Before examining the facts underlying this contention it seems logical to establish the meaning of the opinion itself and the underlying assumptions. First, the public opinion assumes that the corporate income tax is an element of costs and, therefore, of prices. This view has been examined in Chapter 2 and in Appendix A. Secondly, it postulates no connection between the level of business taxes and the degree to which government services reduce the costs to business. If, for instance, one thinks of the public transportation services, this postulate does not seem too realistic, and may become a very weak assumption indeed. Finally, it overlooks tariffs and other trade agreements, thus treating all Canadian business sectors in the same way.

There is a lack of evidence that the Canadian taxation system has changed in a direction that would account for a deterioration of Canada's competitive position in international trade. As will be seen below, the burden of business taxation is roughly equal in Canada and in the United States, but somewhat heavier in both countries than in Europe. The effect of this difference, although hard to assess, does not seem to be significant. However, since the Canadian economy devotes a very large proportion of its resources to the production of export-oriented goods and draws a considerable proportion of her total supply of goods and services from foreign countries, it is important to consider what are the facts of the case. The statement that Canadian business faces a heavier effective burden of tax must be subject to closer examination. The argument is based on the claim that Canada's major competitors on the international markets rely largely on sales taxes which are rebated on their exports.

If we consider the six countries of the European Common Market, the United Kingdom, Japan and the United States (that is, Canada's major trade partners and competitors), we find that six of the countries (France, West Germany, the United Kingdom, Luxemburg, the Netherlands and the United States) have statutory tax rates on undistributed profits very much in line with those in Canada (see Table 6-1, Column 1). If we make adjustments for certain other taxes which fall on corporate profits, such as net wealth, capital taxes, local surcharges, state corporation tax (in the United States) and provincial corporation tax (in Canada), and if we make further adjustments to the statutory rates with respect to accelerated depreciation, investment allowances, and other forms of deductions and profits exemptions we arrive at an approximation of the effective tax rate. The general picture is not changed, Canada's position being largely the same as when the statutory rates were considered. On the whole, the foreign effective rates on retained earnings do not differ substantially from the Canadian rates.

For distributed earnings, the Canadian position (as shown in Columns 2 and 4) is less favourable However, only in the case of Italy, the United Kingdom, and Japan is the difference large enough to become a source of concern. In addition to the corporation taxes all the countries considered, except the United States and the United Kingdom, impose national sales, value-added or turnover taxes. These taxes varying greatly in their rates and domain of application are generally rebated on export with compensating sales taxes imposed on imports.

The validity of the contention under examination will also depend heavily upon assumptions as to the degree of shifting and incidence of

Table 6-1 - Comparative Profit Taxes in Selected Countries and Canada in 1963

Country	Profit Taxes Statutory Rates National Level a/		Estimated Effective Total Tax Rates on Profits, All Levels b/		Sales, Value-Added and Turnover Taxes	
	Undistributed	Distributed	Undistributed	Distributed		
	(1)	(2)	(3)	(4)	(5)	Type of Tax
Belgium	.30	.30	.33	.31	.06	Turnover
France	.50	.50	.46	.46	.25	Value-added
West Germany	.56	.32	.67	.44	.04	Turnover
Italy	.36	.15 c/	.40	.10 c/	.03	Turnover
Luxemburg	.45	.45	.34	.34	.02	Turnover
Netherlands	.45	.35	.42	.33	.05	Turnover
United Kingdom	.54	.24 d/	.45	.20 d/	e/	
Japan	.38	.28 f/	—	—	.20-.40	Manufacturer's Sales
United States	.52	.52	.48	.48	0	
Canada	.50	.50	.45 g/	.45 g/	.11	Manufacturer's Sales

Notes: a/ For Germany, the Gewerbesteuer is included. Where more than one tax exists, deductibility of one from the other's base is allowed for.

b/ These effective rates are estimated for a representative manufacturing firm and allow for respective depreciation treatment. The figures include lower level profits taxes and surcharges as well as net wealth and capital taxes. For the United States, state corporation taxes are included but property taxes are excluded.

c/ Excludes the Ricchezza mobile tax, which is paid by corporations but not again imposed on individual recipients of dividends.

d/ Excludes the income tax (standard rate), which is paid by corporations but not again imposed on individual recipients of dividends.

e/ Selective purchase tax at varying rate.

f/ Rates applicable to profits in excess of 2 million yen.

g/ Varies by provinces, rate applies to Ontario.

Source: Musgrave and Richman, op. cit., Table 4, pp. 128-29.

the taxes under examination. If there are no important international differences with regard to the extent of shifting of business taxes, it appears that the Canadian corporations are not seriously handicapped as compared with their foreign competitors.

6.2. The Differential Principle

Since the validity of the opinion stated in the previous section depends so heavily upon the assumptions as to the shifting of the taxes, I would like to emphasize the so-called "differential principle" and to apply it to the corporate income tax. Assuming unrestricted competition on world markets and abstracting from transportation costs, the differential principle states simply that taxes on business income cannot be shifted beyond the limits imposed by prices of foreign competitors. This may be illustrated as follows: assuming that the world price of an internationally traded commodity stands at $10, with foreign production costs standing at $6, taxes at $2, and after-tax profits also at $2, the normal return just sufficient to warrant risk of investment stands at one third of the costs (that is, 33 1/3 per cent calculated by dividing profits after taxes by costs). If a corporation operating in a domestic economy in open competition with foreign countries is subject to identical production costs of $6, but a higher income tax of $3 rather than $2 (a rate of 75 per cent instead of 50 per cent of gross income), then the domestic producer would be subject to a differential tax load of $1. To sell at a price of $10 would entail below normal profits for him of $1 per unit instead of the normal profits of $2. The limit to price shifting is set at $10, the price of foreign competitors. The measure of absorption for the domestic economy would be equated to its differential tax disadvantage. This does

not mean that all domestic producers would not be subject to different degrees of foreign competition. Furthermore, the elasticity of demand for different commodities has a different bearing on the determination of the price of each specific commodity. However, absorption in total for the domestic economy would be equivalent to the excess tax load imposed on it. The excess tax load may be defined as the difference in the ratios of tax to production costs in various countries. (Here, for example, it would be 3/6 - 2/6 = 1/6). Needless to say, this principle if it is consistent with facts has some considerable implications on the international aspects of the incidence of the corporate income tax. In the case of an open economy such as the Canadian one, the degree of absorption is likely to be high in so far as the excess tax load is high. The implications of the differential principle will be tested empirically in the forthcoming analysis.

6.3. The Situation from 1948 to 1952

A brief look at the following table suggests that Canadian producers were submitted, from 1948 to 1952, to four sets of changes or, as statisticians would say, they were submitted to four different "treatments". Indeed, the Canadian experience in the 1950's with a flexible exchange rate and simultaneous changes in the corporate tax rates suggests that we have been presented with a rare opportunity to study the relative effects of these two factors and their interaction upon the performance of various groups of producers in the economy. The magnitude of the changes in both the exchange rate and the corporate tax rate, occurring as they did within a relatively short period of time, allows us to use very powerful statistical techniques generally reserved for the searchers who are

Table 6-2 - Effective Tax Rate and Exchange Rate (average spot noon rate in U.S. cents), 1948-1952

Year	Effective Tax Rate z net %	Effective Tax Rate z gross %	Exchange Rate r $ Can. in $ U.S.	Δz Gross in Percentage Points	Δr in cents	Treatment No.
1948	30.4	25.0	100.0			
				+0.4	-2.66	(1)
1949	33.0	25.4	97.34			
				+1.7	-5.32	(2)
1950	34.1	27.1	92.02			
				+8.1	+2.98	
1951	44.2	35.2	95.00			
				+2.8	+7.15	(3)
1952	50.1	38.0	102.15			
1948-1952	—	—	—	+13.0	+2.15	(4)

Source: Table 5-3 and Bank of Canada, Statistical Summary, various issues, also United States Board of Governors of the Federal Reserve System, Federal Reserve Bulletin, various issues.

presented with the possibility of conducting controlled experiments. In fact, these simultaneous changes observed during a short period of time do put us in a situation which resembles that of a controlled experiment.

The four treatments to which Canadian businesses were submitted during that period may be summarized as follows:

1. between 1948 and 1949, change in the exchange rate alone;

2. between 1949 and 1950, change in the tax rate and the exchange rate in opposite directions;

3. between 1951 and 1952, tax rate and exchange rate move in the same direction (that is, movement upward in both rates which is detrimental to Canadian producers, particularly those involved in international trade);

4. between 1948 and 1952, change in the tax rate only (this is not strictly true since there was a net appreciation of the Canadian dollar in terms of its United States counterpart during that period; however, if we neglect the change of the order of 2 per cent and if we assume that reactions to changes in the exchange rate are less than symmetrical, then we may consider the period as one characterized only by a change in the tax rate).

6.4. Effects of the Movements in the Exchange Rate

Before turning to the analysis, it seems worth while digressing briefly on the alleged effects of the successive decrease and increase in the external value of the Canadian dollar recorded between 1948 and 1952.

Reduction in the External Value of the Canadian Dollar Between 1948 and 1950

The magnitude of the change in the exchange rate occurring as it did within a relatively short period of time (see Table 6-2 above), could be expected to have significant effects on Canada's international trade and therefore on domestic production and employment opportunities. Considerable improvement has in fact been noticeable in both of these areas and, although numerous other factors have played a part, it appears that the movement of the exchange rate has been an important influence on the course of the Canadian economy during the early fifties. That the improvement in the competitive position of the Canadian producers vis-à-vis foreign supplies in both domestic and world markets should lead to increased domestic production—and possibly to increased profitability via greater utilization of existing capacity—implies that it induces changes in the local currency prices of internationally traded goods of Canadian and foreign origin. A change in the exchange rate which was accompanied by no alteration in the local currency prices at which foreign produced goods were offered in the Canadian market, or at which Canadian exports were sold in markets abroad, would merely result in a transfer of income from export industries in foreign countries, which sell to Canada, to Canadian export industries; it would not by itself (that is, omitting the effects of the income transfer) affect production in the countries concerned.

The short-run effect of the depreciation of the Canadian dollar may be summarized as follows. It changes the relationship between the prices of internationally traded goods—goods exported and imported and goods produced domestically which are close competitors of imports—and the price of domestic goods which do not enter into international trade. If

this is so, the increase in the price of internationally traded goods would expand the production of exports and import-competing goods, curtail expenditures on imports, and leave the purely domestic sector unaffected. The predicted effects of the change in the exchange rate on the profitability of the export-oriented, import-competing and purely domestic industries should be borne in mind in the interpretation of the results derived from the forthcoming analysis.

Increase in the External Value of the Canadian Dollar Between 1950 and 1952

If a depreciation of the Canadian dollar is expected to favour the Canadian exporters and the producers of import-competing commodities, relative to the domestic producers, it seems logical to think that an appreciation of the external value of the Canadian dollar will have the opposite effect. However, it seems unlikely that the opposite state of affairs will ensue, that is, that the prices of goods imported into the Canadian market will rise pari passu with an increase in the exchange rate and that the selling price of Canadian exports will be reduced commensurately. The asymmetry in the effects of an appreciation and depreciation of the external value of the Canadian dollar is similar to the asymmetry observed earlier in the degree of shifting of an increase and a decrease of the corporate tax rate.

6.5. The Case for Further Analysis

One of the assumptions underlying the analysis of Chapter 5 is that there were no factors or important changes, other than changes in tax rates, during the period covered by the analysis. More precisely, it was assumed that the reactions of the manufacturing industries included in the sample

were simply reactions to the recorded changes in tax rates. It must now be obvious that during the period 1948-1952 there were other important changes taking place, besides the changes in tax rates, namely, changes in the exchange rate, to which the manufacturers were likely to react. In other words, the changes in tax rates were not the only impulse to which the various producers were reacting, but there were other significant changes taking place simultaneously which were likely to affect their behaviour. One of the aims of the forthcoming analysis is precisely to assess the impact of this other factor (that is, the changes in the exchange rate) on the profitability of the manufacturing industries already considered and to study the interaction between the two factors (change in tax rates and changes in the exchange rate), an objective for which regression analysis is not designed. Indeed, whenever there is interaction between two supposedly independent factors the estimates derived from regression analysis would be inefficient and unreliable. In such a case, the analysis of variance becomes a more appropriate and powerful technique of analysis as certain models pertaining to this type of analysis are precisely designed to study the importance of the interaction between two factors which have to be assumed independent when regression analysis is used.

A further assumption underlying any least squares regression model is that each sample or observation is drawn from a homogeneous or homoscedastic population. It is very likely that this assumption was not satisfied in the models of Chapter 4, since we can easily detect three subpopulations from which our observations were drawn: (1) export-oriented industries, (2) import-competing industries, and (3) domestic industries, that is, industries not significantly involved in international trade.

For the purpose of the forthcoming analysis, the manufacturing industries have been divided according to the above classification and three samples of identical size have been drawn at random as implicitly required by the statistical technique contemplated. The industries have been divided according to the following criteria: (1) an industry exporting more than 25 per cent of domestic output in 1949 was classified as export-oriented; (2) an industry in which competitive imports are in excess of 25 per cent of domestic output in 1949 was classified as import-competing; (3) finally, an industry exporting or importing less than 10 per cent of domestic output was classified as a domestic industry. The random samples from these three subpopulations are given in Table 6-3.

A second objective of the present exercise is precisely to assess the consequences on the results of the analysis of Chapter 4 of a departure from the assumption of homoscedasticity. Significant consequences of a departure from the homoscedasticity assumption will be found to exist if, for instance, the change in rate of return (the dependent variable) in the first two groups of industries is found to be significantly different from the change in rate of return of the industries falling in the third category.

The focus of interest of the analysis of Chapter 4 was the estimated coefficient of C, the concentration ratio used as a measure of monopoly power. It was also observed that the degree of association between the change in rate of return on the one hand, and various industrial characteristics on the other hand, a magnitude measured by the coefficient of multiple correlation (R) adjusted for the number of degrees of freedom, was never very high. The relatively low proportion of the variance of the dependent variable explained by the independent variables may matter

Table 6-3 - Industry Samples

Code	Industry	% of Domestic Product Exports	% of Domestic Product Competitive Imports	C
	(1) Export-oriented Industries			
80816	Agricultural Implements	53.4	96.2	63.4
80401	Paper products	57.6	2.2	27.8
80116	Grain mill products	24.6	0.2	25.7
80156	Fish processing	28.1	3.2	14.9
	(2) Import-competing Industries			
80731	Non-metallic mineral prod.	8.3	27.0	64.0
80201	Textile products	2.9	32.9	59.8
80801	Primary iron and steel	12.3	33.3	46.0
80211	Woollen and worsted textile	2.1	84.6	17.2
	(3) Domestic Industries			
80151	Tobacco products	5.1	0.6	84.5
80111	Fruit and vegetable preps.	4.8	6.5	34.2
80136	Carbonated beverages	—	0.1	30.9
80121	Bakery products	0.1	0.5	20.9

Source: Appendix C and D, and R. J. Wonnacott, Canadian-American Dependence - An Interindustry Analysis of Production and Prices, Amsterdam, North-Holland Publishing Co., 1961, pp. 117-120.

considerably, for all the remainder is left to be explained by refinements of the variables already used and by the introduction of new ones. The more that is left unexplained, the more likely is the existence of other causal factors which are correlated with C so that their introduction in the analysis would alter the estimated regression coefficients and significance levels of C. Since R^2 is relatively low, such a possibility is a serious qualification to the results of the analysis. In the discussion of the results, the low values of R^2 could not be attributed with certainty to any cause, but it was thought that they were due to a large extent to (i) problems of measurement, and (ii) different inter-industry response to the same stimuli. Very little can be done about the first factor, but it is an objective of the present analysis to measure the importance of the second factor.

Again one of the assumptions underlying the procedure outlined earlier is that despite the identical tax treatment affecting all industries, some differences among various industries would be observed. It is also implied that these differences are attributable to the characteristics included in the regression models. All other factors are assumed to affect the various industries in a random fashion. The complete absence of a systematic pattern according to which factors, other than those included in the models, may affect the rate of return in various industries is far from certain, although its assumption is rather crucial. In the forthcoming analysis, we are precisely concerned with the problem of identifying one of these factors and to trace its effects on the results already obtained.

Industries respond differently to the same stimulus when the nature of the response depends upon other conditions, besides the stimulus itself,

and when these other conditions vary among industries. The degree of monopoly strength is one such source of difference in inter-industry response. However, the level of concentration does not adequately reflect the monopoly strength of the industries selling a large proportion of their product abroad or of industries selling products at home but in competition with foreign producers. Hence, the nature of the response of a given industry to a change in tax rate will depend upon whether this industry is export-oriented, import-competing or purely domestic. It will also depend upon such factors as the extent of tariff protection, and others. Casual observation suggests that many of these characteristics vary a great deal among the 31 manufacturing industries, yet none is accounted for by the variables included in the regression models. For this reason perhaps a large part of the variance of $\Delta(\frac{\pi}{K})$ caused by differences in monopoly power, relative change in sales (change in demand), etc., was not explained in the regressions by the variables which measure these phenomena.

To sum up, it must be borne in mind that there are two points at issue here. First, there are factors other than tax factors which were present during the period under consideration, but which were assumed to be negligible in the sense that all reactions taking place were assumed to be the result of changes in tax rates. The change in the exchange rate is one of these. Secondly, there are inter-industry differences or characteristics which are not accounted for or which are only imperfectly measured by the variables included in the regression models. These characteristics are likely to cause differences in the reactions of various industries to the change in tax rates. The proportion of an industry's output exported is one such characteristic. More precisely,

an industry is likely to respond differently to a change in tax rate depending upon whether it falls into the export-oriented, import-competing, or domestic category.

Finally, the interest of the forthcoming analysis does not reside entirely in the fact that it allows one to assess and improve the reliability of the previous results, it also sheds light on the contention that "as a result of a heavy taxation Canadian business tends to be uncompetitive on international markets".

6.6. The Choice of an Experimental Design

In the present context, it is desirable to investigate two (or even more) factors in the same experiment. More specifically, we want to study the manner in which four different combinations of changes in tax rate and exchange rate affect gross rates of return, at the same time we are comparing three different types (or groups) of industries. Tax and exchange rates combination and industrial classification according to the nature and extent of involvement in international trade are both called factors in the statistical jargon. There are four different "levels", or classifications, for exchange and tax rates changes and three different levels for industrial classes. The term factorial is used to identify this type of experiment in which two or more independent variables are considered simultaneously.

There are many reasons why we want to use that type of analysis. First, it enables us to study the interaction of the factors. Some tax and exchange rate treatment may increase the rate of return in some industries, but decrease it in others. This type of effect can be

investigated only if both factors are combined in the same experiment. Secondly, a saving of time and effort results. All observations may be used to investigate the effects of each of the factors. The experiment being considered now could be conducted as two simple one-factor experiments. If this were done, then some of the observations would only yield information about tax and exchange rate treatments, and others only information about industrial types. Consequently, more experimental units would be needed to achieve the same degree of accuracy as that obtained by a two-factor experiment. Hence one two-factor experiment is more economical than two one-factor experiments. Thirdly, the conclusions reached have broader application. This is due to the fact that the behaviour of each factor is studied with varying combinations of other factors. Thus, the results are more useful than those obtained by holding all other factors constant (that is, by making a severe and sometimes heroic ceteris paribus assumption).

6.7. Notation for Two-factor Completely Randomized and Randomized Blocks Experiments

Denote the factors by A and B. Let the levels of A be numbered 1, 2, ... a and the levels of B be 1, 2, ...,b. Assume that we have n observations for each treatment combination. Then the data can be arranged as in Table 6-4. The symbols used are defined as follows:

$$\text{Total of Cell ij} = T_{ij.} = \sum_{k=1}^{n} X_{ijk},$$

$$\text{Mean of Cell ij} = \bar{X}_{ij.} = \frac{T_{ij.}}{n},$$

$$\text{Total of the } i^{\text{th}} \text{ row} = T_{i..} = \sum_{j=1}^{b} \sum_{k=1}^{n} X_{ijk} = \sum_{j=1}^{b} T_{ij.},$$

Mean of the i^{th} row $= \bar{X}_{i..} = \frac{T_{i..}}{nb}$,

Total of the j^{th} column $= T_{.j.} = \sum_{i=1}^{a} \sum_{k=1}^{n} X_{ijk} = \sum_{i=1}^{a} T_{ij.}$,

Mean of the j^{th} column $= \bar{X}_{.j.} = \frac{T_{.j.}}{na}$,

Overall Total $= T... = \sum_i \sum_j \sum_k X_{ijk} = \sum_i \sum_j T_{ij.} = \sum_i T_{i..} = \sum_j T_{.j.}$,

Overall Mean $= \bar{X}... = \frac{T...}{abn}$.

The table could be regarded as data from a completely randomized experiment. If, on the other hand, we look upon the first observation in each cell as being in block 1, the second observation in each cell as being in block 2, ..., and the n^{th} observation in each cell as being in block n, then the table represents data from a randomized block experiment. For reasons given below, randomized blocks will be used here. The grouping into blocks will be based on the level of concentration characterizing the industries falling in each industrial type (that is, export-oriented, import-competing and purely domestic industries).

Since the level of concentration was found to have a significant effect on the rates of return in the regression analysis of Chapter 4, the relevant analytical design here appears to be not the fully randomized experiment, but the randomized block experiment. The latter design allows the formation of blocks according to the level of concentration of the industries falling in each industrial group. The objective of the grouping of the observations in fairly homogeneous groups according to concentration is to eliminate one source of variation in which we are not interested. The procedure adopted here consists in grouping the industries according

Table 6-4 - Arrangement of Data for a Two-Factor Experiment.

A \ B	1	2	. . .	b	Totals	Means
1	x_{111} ⋮ x_{11n}	x_{121} ⋮ x_{12n}	. . .	x_{1b1} ⋮ x_{1bn}	$T_{1..}$	$\bar{X}_{1..}$
2	x_{211} ⋮ x_{21n}	x_{221} ⋮ x_{22n}	. . .	x_{2b1} ⋮ x_{2bn}	$T_{2..}$	$\bar{X}_{2..}$
⋮	⋮	⋮	. . .	⋮	⋮	⋮
a	x_{a11} ⋮ x_{a1n}	x_{a21} ⋮ x_{a2n}	. . .	x_{ab1} ⋮ x_{abn}	$T_{a..}$	$\bar{X}_{a..}$
Totals	$T_{.1.}$	$T_{.2.}$		$T_{.b.}$	$T_{...}$	
Means	$\bar{x}_{.1.}$	$\bar{x}_{.2.}$		$\bar{x}_{.b.}$		$\bar{X}_{...}$

to their level of concentration and then conduct the tests based upon these groups. After eliminating one source of variation, we may expect the scores (observations) to be less variable. Intuitively, at least, it seems that more accurate conclusions should result by way of reducing the probability of type II error. This is indeed the case despite the fact that degrees of freedom are lost.

The main difference between the two designs is found in the method by which experimental units are assigned to treatments. In the completely randomized design, units are assigned at random with no restrictions except possibly that each treatment receives the same number of experimental units. With randomized blocks, units are also assigned randomly to treatments, but not until they have first been placed into fairly homogeneous groups. The main purpose of the blocking is to eliminate a variable in which there is no interest so that more accurate conclusions may be drawn. In other words, having eliminated one source of variation, it is more likely that significant differences among treatments will be detected. If the experimental units are relatively homogeneous with respect to the variable used to form the blocks, then a randomized block design sacrifices degrees of freedom with no compensating return. On the other hand, if the units vary greatly with respect to this variable (as it is the case here), but can be grouped into fairly homogeneous blocks, then the use of blocks is rewarding.

The assumptions for randomized blocks may be expressed as follows:

(a) A random sample of size one is drawn from each of abn populations.

(b) All abn populations are normal.

(c) The variance of each of the abn populations is the same.

(d) Blocks and treatment effects are additive.

Table 6-5 - Cell, Row, Column, and Overall Means

A \ B		(1) $-\Delta r$	(2) $-\Delta r$ & $+\Delta z$	(3) $+\Delta r$ & $+\Delta z$	(4) $+\Delta z$	$\bar{X}_{i..}$
(1) EXPORT-ORIENTED	$\bar{X}_{1j.}$	-3.68	+2.26	-6.36	-3.59	-2.84
(2) IMPORT-COMPETING	$\bar{X}_{2j.}$	-0.05	+1.20	-8.76	-6.53	-4.71
(3) DOMESTIC	$\bar{X}_{3j.}$	+2.19	-1.17	+5.31	+9.22	+5.18
	$\bar{X}_{.j.}$	-0.51	+0.865	-3.27	-0.303	
						-0.83 $\bar{X}_{...}$

Let u_{ijk} be the mean of the population from which X_{ijk} is drawn.

If we let

$$u_{i..} = \frac{\sum_{j=1}^{b}\sum_{k=1}^{n} u_{ijk}}{bn} =$$ Average of the population means for the i^{th} level of factor A

$$u_{.j.} = \frac{\sum_{i=1}^{a}\sum_{k=1}^{n} u_{ijk}}{an} =$$ Average of the population means for the j^{th} level of factor B

$$u_{..k} = \frac{\sum_{i=1}^{a}\sum_{j=1}^{b} u_{ijk}}{ab} =$$ Average of the population means for the k^{th} block

$$u_{ij.} = \frac{\sum_{k=1}^{n} u_{ijk}}{n} =$$ Average of the population means for cell or treatment combination ij.

$$u_{...} = u = \frac{\sum_{i}\sum_{j}\sum_{k} u_{ijk}}{abn} =$$ Average of all the abn population means,

then we may write the following identities:

$$(1)\quad X_{ijk} = u_{ijk} + (X_{ijk} - u_{ijk}) = u_{ijk} + e_{ijk}$$

and

$$(2)\quad u_{ijk} = u + (u_{i..} - u) + (u_{.j.} - u) + (u_{..k} - u)$$
$$+ (u_{ij.} - u_{i..} - u_{.j.} + u) + (u_{ijk} - u_{..k} - u_{ij.} + u)$$
$$= u + \alpha_i + B_j + P_k + (\alpha B)_{ij} + (u_{ijk} - u_{..k} - u_{ij.} + u).$$

If we assume that block and treatment effects are additive then

$$(u_{ijk} - u_{..k} - u_{ij.} + u) = 0$$

combining (1) and (2) we may write the assumptions

$$X_{ijk} = u + \alpha_i + B_j + P_k + (\alpha B)_{ij} + e_{ijk} ; \quad \begin{matrix} i=1,\ldots,a \\ j=1,\ldots,b \\ k=1,\ldots,n \end{matrix}$$

e_{ijk} are independently $N(0,\sigma^2)$

$$\sum_i \alpha_i = \sum_j B_j = \sum_k P_k = \sum_i (\alpha B)_{ij} = \sum_j (\alpha B)_{ij} = 0$$

The hypotheses:

If $H'_o : \alpha_i = 0$ is true, then there is no difference between the means of the various levels of A (that is, industrial classes).

If $H''_o : B_j = 0$ is true, then there is no difference in the various levels of B (that is, tax and exchange rates treatments).

If $H'''_o : (\alpha B)_{ij} = 0$ is true, the effects due to factors A and B are additive, that is, factor A and B do not interact.

Since the block effect (P_k) does not present much interest, it is not worth testing for it specifically. However, there exists a quantitative measure by which the relative efficiency of complete randomization and randomized blocks can be compared. This quantity was estimated and randomized blocks were found to be significantly more efficient than completely randomized experiment. Bearing in mind that factor A refers to the classification of industries according to the nature and extent of their participation to international trade and that factor B refers to the various tax-exchange rate situations, the results of Table 6-6 may be interpreted as follows.

(i) The differences in means attributable to factor A (that is, row means)

Table 6-6 - Analysis of Variance Results

Source of Variation	S.S.	d.f.	M.S.	F-Ratio
Blocks	381.55	3		
Treatments	1,215.85			
A	537.68	2	268.84	$\frac{MS_A}{MS_E} = 9.33$ **
B	106.74	3	35.58	$\frac{MS_B}{MS_E} = 1.24$
AB	571.42	6	95.24	$\frac{MS_{AB}}{MS_E} = 3.31$ **
Error	950.53	33	28.80	
Total	2,547.92	47		

Notes:

S.S. = sum of squares

d.f. = degree of freedom

M.S. = mean square

** indicates significance at the 1 per cent level.

are significant. This indicates that a change in tax rate and/or exchange rate does not affect all the industries in the same way. Indeed, a significant value of F means that export-oriented, import-competing, and domestic industries do not react in the same way to a change in tax and/or exchange rate.

(ii) The difference in means attributable to factor B (that is column means) are not significant. This indicates that whether a change in tax rate is accompanied by an increase or a decrease in the exchange rate does not make any difference. It also means that whether the change in tax rate is accompanied by a change in the exchange rate or not is also indifferent.

(iii) The differences in means due to the interaction between factor A and factor B (that is, cell means) are significant. This indicates that some tax-exchange rate combinations have been detrimental to certain classes of industries and relatively favourable to other groups, if one is to judge by their impact on the rate of return of the industries falling in each category.

The tests conducted so far only allow to detect that all population means are not equal. To find out the exact origin of these differences it is necessary to conduct further tests involving linear combinations of the population means.

Tests Involving Contrasts or Linear Combinations of the Population Means

So far we have been concerned with testing the hypothesis of equal means (equal treatment effects). We may be interested in formulating

other hypotheses, particularly if we are reasonably certain that all means are not equal. For example, we may hypothesize:

$$H_o : \frac{u_{1..} + u_{2..}}{2} = u_{3..}$$

$$H_1 : \frac{u_{1..} + u_{2..}}{2} \neq u_{3..}$$

if we feel that it makes no difference whether industries are involved in international trade or not. If we are inclined to believe that it makes no difference whether industries are export-oriented or import-competing, then it is reasonable to test:

$$H'_o : u_{1..} = u_{2..}$$

$$H'_1 : u_{1..} \neq u_{2..}$$

If, in addition, we think that a change in tax rate will produce the same result on export-oriented and domestic industries on the one hand, and on import-competing and domestic industries on the other hand then it is reasonable to test:

$$H''_o : u_{1..} = u_{3..}$$

$$H''_1 : u_{1..} \neq u_{3..}$$

and

$$H'''_o : u_{2..} = u_{3..}$$

$$H'''_1 : u_{2..} \neq u_{3..}$$

Statisticians have shown that when several hypotheses are tested, each with a specified significance level, the probability of rejecting one or more of them is a difficult number to obtain. In other words, we do not know the significance level of the experiment as a whole even though all hypotheses are formulated before the experiment is conducted. Usually the null hypothesis is tested in analysis of variance type experiments with no special concern being given to other hypotheses. If the null hypothesis is rejected, then it is reasonable to look for contrasts which are responsible. It is desirable to have a procedure (a) that permits selection of the contrasts after the data are available, and (b) with which a known level of significance is associated. One such procedure has been devised by Tukey 4/ and will be used here.

As we are only interested in contrasts among the A means, these contrasts will be of the form $L = \sum_{i=1}^{a} c_i u_{i..}$ and are estimated by $\hat{L} = \sum_{i=1}^{a} c_i \bar{x}_{i..}$. Tukey has shown that the probability is $1-\alpha$ that

$$\hat{L} - T\sqrt{MS_E} \leq L \leq \hat{L} + T\sqrt{MS_E}$$

holds simultaneously for every possible contrast that may be constructed. Here

$$T = \frac{1}{\sqrt{bn}} q_{1-\alpha;\ a,\ (n-1)(ab-1)}$$

where $q_{1-\alpha;\ a,\ (n-1)(ab-1)}$ is the point exceeded 100α percent of the time in the distribution of the studentized range.

(If $y_1, \ldots, y_n$ are independently $N(u, \sigma^2)$ and s^2 is an unbiased estimate

of σ^2 based upon v degrees of freedom, then

$$q_{n,v} = \frac{\text{largest y - smallest y}}{s}$$

is called the studentized range.)

The analysis of variance of Table 6-6 indicates that the A (row) means are not all equal. For the purpose of the present analysis, the question of knowing exactly which means are different is relevant. As just pointed out the answer to this question is provided by conducting tests involving linear combinations of the population means. The results of such tests are recorded in Table 6-7 and they point toward the following conclusions.

(i) Whether industries are involved in international trade or not makes some difference when the fiscal and monetary authorities are contemplating changes in tax and/or exchange rates.

(ii) Import-competing and export-oriented industries are not differently affected by a change in tax and/or exchange rates.

(iii) The differential impact of a change in tax and/or exchange rates on the rates of return of export-oriented and domestic industries is significant.

(iv) The differential impact of a change in tax and/or exchange rates upon the rates of return of import-competing and domestic industries is also significant.

Finally, the results of the analysis of variance reveals the presence of interaction between factor A and factor B. Tukey has also developed a

Table 6-7 - Contrasts Among A Means

Hypothesis	Statistic	Difference
$H_o : \frac{u_{1..} + u_{2..}}{2} = u_{3..}$	$\frac{\bar{x}_{1..} + \bar{x}_{2..}}{2} - \bar{x}_{3..}$	8.95 *
$H_o' : u_{1..} = u_{2..}$	$\bar{x}_{1..} - \bar{x}_{2..}$	1.87
$H_o'' : u_{1..} = u_{3..}$	$\bar{x}_{1..} - \bar{x}_{3..}$	8.02 *
$H_o''' : u_{2..} = u_{3..}$	$\bar{x}_{2..} - \bar{x}_{3..}$	9.89 *

Note:

* Indicates significance for a 5 per cent level test, the critical value being 4.66. Other linear combinations of the row means are of no interest.

test permitting to find out at which level the two factors do interact (that is, which cell means are significantly different). The results of such tests are assembled in Table 6-8.

The interpretation of these results is relatively simple. Treatment (3) consisting of a simultaneous change in tax rate and appreciation of the Canadian dollar is relatively detrimental to groups (1) and (2), that is to the export-oriented and import-competing industries, and relatively favourable to group (3) composed of domestic industries. Similarly, treatment (4) consisting of a large increase in tax rate accompanied by a negligible appreciation of the Canadian dollar is relatively favourable to the industries not significantly involved in international trade while it has a negative effect on the rate of return of both classes of industries significantly subject to international competition.

6.8. Economic Interpretation of the Results

The results of the analysis of variance for the experiment described earlier must be interpreted in relation to the implications of the consensus of opinion stated, the differential principle and the prediction of the elementary theory of international trade. (These are exposed respectively in Section 6.1., 6.2., and 6.4.) These results should also help to interpret the results of Chapter 4 of this study.

1. The first two items above are better treated together. The analysis reveals that the public contention stating that Canadian producers tend to be non-competitive in international markets as a result of heavy business taxes only holds water in so far as the predictions of the differential principle are consistent with the facts and, more important, in so far as

Table 6-8 - Contrasts Among Cell Means

Hypothesis	Statistic	Difference
$u_{13.} = u_{34.}$	$\bar{x}_{13.} - \bar{x}_{34.}$	15.58 *
$u_{23.} = u_{33.}$	$\bar{x}_{23.} - \bar{x}_{33.}$	14.07 *
$u_{23.} = u_{34.}$	$\bar{x}_{23.} - \bar{x}_{34.}$	17.98 *
$u_{24.} = u_{34.}$	$\bar{x}_{24.} - \bar{x}_{34.}$	15.73 *

Note:

* Indicates significance for a 5 per cent level test, the critical value being 13.32. Contrast among other cell means are not significant.

there is a de facto excess tax load placed on Canadian corporations. Both these conditions would be necessary, but neither would be sufficient by itself for the public allegation to be acceptable. The implications of the differential principle seem to be consistent with the facts in the sense that "treatments" involving a sizeable increase in tax rate are detrimental to the industries involved in international trade—whether export-oriented or import-competing—relative to domestic industries. This is a clear indication that the industries involved in international trade, be they exporting or import-competing, and thus subject to international competition, do not have the same success in shifting the tax through higher prices in the short-run than the industries not significantly involved in international trade. (See Table 6-5.) The second condition, however, should not be taken for granted as it often tends to. Indeed, the international comparison of Section 6.1. reveals that Canadian producers are not subject to a heavier tax load than most of their foreign competitors. (See Table 6-1.) The inference to be drawn is that although the differential principle appears to be consistent with the facts, the excess tax load, if any, affecting the Canadian corporate producers is not sufficient to put them at a significant disadvantage relative to their foreign competitors.

2. While the analysis reveals that there is equal treatment effects (that is, whether the change in tax rate is accompanied by a change in the exchange rate or not, it does not affect the average rate of return in a significant manner), there is indisputable evidence that the impact of any of these treatments is significantly different depending upon whether the industry to which it applies is involved in international trade or not. The size and direction of the impact provides us with an interesting empirical test of the classical theory of the exchange rate. The theory

may be summarized in the following passage by Kindleberger:

> But this change in the exchange rate, if it is enough to be significant, has more important effects. It changes the relationship between the prices of internationally traded goods—goods exported and imported, and goods produced domestically which are close competitors of imports—and the price of domestic goods which do not enter into international trade. An increase in the prices of internationally traded goods will expand the production of exports and of import-competing goods which are now more profitable, and will curtail expenditures on imports. A decrease in the price of internationally traded goods, relative to domestic goods, on the other hand, would increase imports and lead to a contraction of exports.
>
> Depreciation of a currency will increase the domestic price of internationally traded goods if we assume that world prices are unchanged....
>
> . . . . . .
>
> Even if we abandon the assumption that world price remains unchanged, the first effects of depreciation will be to encourage exports and discourage imports, while the converse will be true of appreciation. 5/

The analysis reveals that, during the years in which significant changes in tax rates took place, the industries producing internationally traded goods were affected differently (as far as their profitability is concerned) from the domestic industries. A look at the figures in Table 6-5 further reveals that the depreciation of the Canadian dollar occurring between 1949 and 1950 resulted in an increased profitability in industries involved in international trade relative to the domestic industries. On the other hand, the appreciation of the Canadian dollar taking place between 1950 and 1951 and between 1948 and 1952 resulted in decreases in profitability in the export-oriented and import-competing industries relative to the domestic industries. This is in every way consistent with the predictions of the theory.

3. The results obtained provide more than a test of the theory of the exchange rate; they permit an evaluation of earlier results regarding the

existence of shifting and the estimated degree of shifting which was not possible before this experiment was conducted. Indeed, the analysis suggests that the extent of shifting was overestimated at least in a number of industries during periods of declining exchange rate, and might have been underestimated in the same industries during periods of rising exchange rate. Part of the increase in prices and profitability of industries included in the sample and producing internationally traded commodities was wrongly attributed to shifting while it appears to be the result of successive changes in the exchange rate. On the other hand, the estimated degree of shifting may well be biased downward when periods of appreciation of the Canadian dollar are considered. The risk of a downward bias colouring our results is greater as the overall period considered is one of rising exchange rate.

To sum up, short-run increases in prices and profitability originally attributed to short-run forward shifting were in fact due to changes in the exchange rate occurring at the same time as the changes in tax rates. On the other hand, a failure to increase prices and gross rate of return in order to maintain the profitability of a number of corporate enterprises to its pre-tax level is largely the result of an increase in the external value of the Canadian dollar accompanying the increase in tax rates, while the analysis of Chapter 5 implied that it was the result of the inability of certain industries to pass the tax on to their consumers in the short run.

4. In view of the results of the latter analysis, it appears that the results of regression analysis contained in Chapter 5 suggesting an extensive degree of shifting in many manufacturing industries should be

treated with caution for some of these estimates may be biased. Indeed, these results hinge on the estimated coefficient of the concentration ratio, but the evidence suggests that, although this ratio is a good measure of the monopoly power characterizing domestic industries, it does not seem to adequately reflect the degree of competition facing industries producing internationally traded goods. Moreover, there is a strong possibility that the effects of the changes in corporate tax rates may be masked by the effects of simultaneous changes in the exchange rate.

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CHAPTER 7—SUMMARY OF THE RESULTS

On purely theoretical grounds, it was shown that when the tax is considered by the producer as being a part of his costs of production a change in the tax rate gives rise to a revision of the price-output policy by the producer maximizing his profits. It was also shown that, if the producer maximizes goals other than profits, a price-output reaction stands out as a definite possibility in the short run.

On empirical grounds, time series of rates of return, profit margins and turnover ratios were examined by many economists and the long-run trend points toward an extensive degree of shifting in many sectors of the economy. This way of looking at the problem of the incidence of income tax, however, calls for serious qualifications because of the ceteris paribus assumption inherent in this type of analysis adopted in many earlier studies of the problem of incidence. In view of this difficulty, time series analysis has been discarded in favour of a more appropriate technique of analysis.

It was hypothesized that the possibility of short-run shifting of the tax is dependent upon the degree of monopoly power, as the process of shifting is more likely to occur if the firms were not maximizing their profits before the imposition of the tax or before a change in tax rate. The hypothesis was tested through a multivariate regression analysis of a cross-section of 31 manufacturing industries, and was found consistent with the facts. More specifically, it was found that the rate of return before tax rose more in industries characterized by a high degree of

monopoly power as a result of an increase in tax rate than it did in industries where a higher degree of competition prevails. The hypothesis of the existence of a positive relationship between these two variables for reasons other than the shifting of the corporation tax was also tested by looking at a period of constant tax rate and it was rejected.

Having found unequivocal evidence of the existence of shifting, at least in the concentrated sectors of the economy, attempts were made to measure the extent of the phenomenon. Instead of relying upon a unique and somewhat questionable measure à la Krzyzaniak-Musgrave, a number of piecemeal measures were developed. These measures are based on both rates of return and factor shares of the national product, and they yield consistent and reasonably converging results. Regardless of the approach adopted the results converge toward 70 per cent shifting of the tax increases and a lower degree of shifting of the tax decreases. The margin of error is relatively wide, however, regardless of the formula used.

Although the evidence on the existence of shifting is unequivocal, the results as to the extent of shifting should be treated with caution and generalizations should be avoided. Indeed, the analysis was carried one step further and it reveals that all the industries, even the concentrated ones, did not have the same success in raising their rate of return before tax in order to maintain their after-tax return to the pre-tax level. It was found, for instance, that the large increase in tax rates taking place during the period 1948-52 was relatively detrimental to the industries involved in international trade, be they export-oriented or import-competing, compared to the domestic industries. The extent of shifting is probably lower in the industries subject to international competition than has been suggested by the previous analysis. This is

a result of the fact that, although the concentration ratio is a relevant measure of the degree of competition prevailing on the national market, it is much less so when the analysis extends to industries subject to international competition.

Moreover, because of the occurrence of changes in the exchange rate concurrently with the changes in tax rates during the period under examination it is quite likely that the estimated degree of shifting suffers a bias when applied to industries significantly involved in international trade and as such is affected by the change in the external value of the domestic currency.

APPENDIX A

A FORMAL EXPOSITION OF THE "TRADITIONAL VIEW"

It has been shown formally by many authors that a tax, proportional or progressive, imposed on the net income of a producer whether monopolist or perfect competitor has no effect on the profit maximizing equilibrium of the producer. 1/ This line of reasoning is correct if one accepts that the profit to which the tax applies is the economist's "pure profit", that is, an income over and above the "normal profit".

However, if one adopts the view that the tax is imposed on a profit which is composed of two elements: (a) "pure profit" as defined above, and (b) "normal profit", an element of long-run marginal cost, that is, if the tax is part of the producer's cost of production, the conclusion will be reversed. The object of this appendix is precisely to give a formal exposition of such a situation. For the sake of conciseness we shall consider the case of a monopolist, but the result may easily be extended to a situation of perfect competition. If the tax is part of the producer's cost of production, the monopolist's costs are now a function both of output and the height of the tax, we may write total cost as: $C(x,T)$. The monopolist's gross profits will then be

$$Y = R(x) - C(x,T)$$

where $R(x)$ is the monopolist's total revenue.

If we let P be the net profit after payment of the tax,

$$P = Y - T$$

$$P = R(x) - C(x,T) - T$$

His net profit is maximum if

$$\frac{dP}{dx} = o = \frac{dY}{dx} - \frac{dT}{dx}$$

$$= \frac{dY}{dx} - \frac{dT}{dY} \cdot \frac{dY}{dx} \quad \text{(if the tax is progressive)}$$

$$= \frac{dY}{dx}\left(1 - \frac{dT}{dY}\right)$$

that is, if either of the factors in the equation is zero. $\frac{dT}{dY} = 1$ only if the marginal rate of tax is 100 per cent. If we leave out this case of confiscatory tax we are left with:

$$\frac{dY}{dx} = o$$

which implies:

$$\frac{dR}{dx} = \frac{\delta C}{\delta x} + \frac{\delta C}{\delta T} \cdot \frac{\delta T}{\delta Y} \cdot \frac{\delta Y}{\delta x}$$

as a first order condition for profit maximization equilibrium.

The value of x, say x" satisfying the latter relation is less than the value of x, say x' satisfying the conditions for profit maximization in the absence of a tax (that is, $\frac{dR}{dx} = \frac{dC}{dx}$), because the curve $z = \frac{dR}{dx}$ has a negative slope and the two curves

$$z' = \frac{dC}{dx} \text{ and } z'' = \frac{dC}{dx} + \frac{\delta C}{\delta T} \cdot \frac{\delta T}{\delta Y} \cdot \frac{\delta Y}{\delta x}$$

have each got either a positive slope or else a negative slope greater than that of $z = \frac{dR}{dx}$; and for every value of x less than x', the curve

$$z'' = \frac{\delta C}{\delta x} + \frac{\delta C}{\delta T} \cdot \frac{\delta T}{\delta Y} \cdot \frac{\delta Y}{\delta x}$$

lies above the curve

$$z' = \frac{dC}{dx}$$

Consequently, a tax, when imposed on the producer's gross income as defined here, will induce a reduction of the profit maximizing output and, in the case of imperfect competition this will be accompanied by a price rise.

REFERENCE

1/ See for instance: L. Amoroso, Lezioni di Economia Matematica, Bologna: Nicolas Zanichelli, 1921, pp. 226-244. R. Bannink, "The Incidence of Taxes and Premium for Social Insurance of Family Budgets", Public Finance, Vol. IV, No. 1, pp. 72-93. D. Black, The Incidence of Income Taxes, London: Macmillan, 1939.

APPENDIX B

FIRST ORDER CONDITIONS FOR BAUMOL'S OLIGOPOLISTIC MODEL 1/

In addition to being consistent with a reasonable behaviour pattern for non-joint-profit-maximizing oligopolists, the rapid price response is also consistent with expected behaviour under sales maximization subject to a profit constraint. With this behavioural assumption (which Baumol believes characterizes the typical oligopolist's objectives—see Baumol, Business Behavior, Value and Growth, p. 49), it can be shown that the imposition of a profits tax, or an increase in its rate, will cause an increase in its price.

Consider a situation where an oligopolist's total revenue and total cost curves are such that the following conditions are satisfied:

$$R'(X) \geq 0;$$

$$R''(X) < 0;$$

$$C'(X) > 0;$$

and $C''(X) < 0$;

where: X is the output produced;

R' and R" the first and second derivative of total revenue with respect to X;

C' and C" the first and second derivative of total cost with respect to X.

Assume that the profit constraint is of the sort $P(X) = [R(X) - C(X)] \geq L$ where L is the minimum acceptable level of profit. As Baumol has shown (p. 61) it is almost certain that this constraint will be effective. This being the case, the equilibrium position for the firm can be obtained

from the Lagrangean expression

$$z = R(X) + \lambda\,[R(X) - C(X) - L]$$

where λ is some non-negative number. From this expression it is possible to obtain

$$\frac{\partial Z}{\partial X} = R'(X) + \lambda[R'(X) - C'(X)] = 0;$$

therefore

$$R'(X) = \frac{\lambda}{1 + \lambda}\, C'(X)$$

The equilibrium level of output is therefore that which satisfies the expression $MR = \frac{\lambda}{1 + \lambda}\, MC$

With the profits tax in effect, and assuming no alteration in the level of the profit constraint, the constraint becomes

$$(1-t)P(X) = (1-t)[R(X) - C(X)] \geq L$$

where t is the fraction of profits taken by the tax. The equilibrium condition obtained from this form of the constraint is

$$R'(X) = \frac{(1-t)\,\lambda}{[1+(1-t)\,\lambda]}\, C'(X).$$

As was the case in the absence of the tax, at equilibrium MR < MC.

To determine the impact of the tax (or tax change) on the equilibrium output, it is necessary only to differentiate the profit constraint with respect to the tax variable.

$$(1-t)P(X) = L$$

Therefore $$\frac{\partial L}{\partial T} = (1-t)\left(\frac{dP}{dX} \cdot \frac{dX}{dT}\right) - P(X) = 0$$

That is $\frac{dx}{dT} = \frac{P(X)}{\left[(1-t)\frac{dP}{dX}\right]}$. Since $P(X) > 0$, $0 < t < 1$, and $\frac{dP}{dX} < 0$

(marginal cost exceeds marginal revenue), it follows that $\frac{dX}{dT} < 0$.

The tax will therefore reduce the optimum level of output, and this, with $R''(X) < 0$, will result in a higher price.

REFERENCE

1/ A parallel derivation of these conditions will be found in J.R. Allan's The Income Tax Burden on Canadian Shareholders, Toronto: Canadian Tax Foundation, 1966, p. 41.

APPENDIX C

CONCENTRATION RATIOS

Most of the concentration ratios for the manufacturing industries considered in the cross-section regressions are those computed by G. Rosenbluth 1/ for the 3-digit level industries. 2/ Whenever concentration ratios were required for broader industrial classes, 2-digit industries, or some intermediate classes consisting of more than one 3-digit industry, the ratios were calculated using the basic information kindly provided to the author by Professor Rosenbluth.

Although a broad industrial class (for example, a 2-digit industry) is nothing but the sum of a group of smaller classes (for example, 3-digit industries), as a rule, the concentration ratio for the broader industrial class bears no simple relationship to the individual smaller class ratios. Consequently, a return to the basic data was necessary each time the concentration ratio of a class larger than a single 3-digit industry was required.

Table C-1, following, presents the ratios used in the computations. The industries whose names are preceded by an asterisk are those for which a concentration ratio had to be calculated because they represent broader industrial classes than those dealt with by Professor Rosenbluth. 3/

The index generally used is the percentage of employment accounted for by three leading firms, and may be expressed as follows:

$$C = \frac{\text{number of employees in the three leading firms}}{\text{number of employees in the industrial class}} \times 100$$

Table C-1 - Indexes of Firm Concentration, Selected Canadian Manufacturing Industries, 1948

Code Number	Industrial Class	Percentage of Employment Accounted for by Three Leading Firms
801--	Food, beverage, tobacco	
80101	Slaughtering and meat packing a/	55.3
80106 *	Dairy products a/	19.2
80111	Fruit and vegetable preparations	32.4
80116 *	Grain mill products a/	25.7
80117	Stock and poultry feeds (prepared) b/	15.5
80118	Milled cereal food (flour mills) a/	34.9
80121	Bakery products b/	20.9
80126 *	Sugar refineries	68.3
80131	Confectionery, cocoa, etc.	33.4
80132	Sugar and sugar products	29.4
80136	Soft drinks b/	30.9
80141 *	Alcoholic beverages a/	39.0
80151	Cigarettes, cigars and tobacco	84.5
80156	Fish curing and packing a/	14.9
802--	Textile, leather and rubber products	
80201	Cotton textile mills	59.8
80204	Cotton fabrics (yarn and cloth)	59.8
80206	Rayon and silk textile mills (synthetic textile and silk)	48.7
80211 *	Woollen and worsted textile mills c/	17.2
80215 *	Woollen yarn and cloth c/	19.0
80216	Hosiery and knit goods (knitting mills)	15.7
80226 *	Leather and leather products	5.4
80227	Boots and shoes (leather)	8.5
803--	Wood Products	
80301	Furniture	7.4
804--	Pulp and paper products	
80401	Pulp and paper mills a/	27.8
80402	Woodpulp	27.8
80403	Newsprint	27.8
80404	Wrapping paper (paper boxes and bags)	16.8

Table C-1 (Cont'd)

Code Number	Industrial Class	Percentage of Employment Accounted for by Three Leading Firms
806--	Chemical and allied products	
80601	Paints and varnishes	31.5
80606	Drugs and toilet preparations	19.7
80607	Soaps	74.6
80611	Industrial chemicals (acid, alkalies and salts)	81.4
80612	Compressed gases	81.4
80613	Vegetable oils a/	53.7
80614	Coal tar distillation c/	91.7
807--	Non-metallic mineral products	
80701	Petroleum refining c/	80.1
80706	Paving and miscellaneous petroleum products	80.1
80708	Asphalt	80.1
80709	Coke products c/	52.7
80721 *	Glass and glass products	91.7
80722 *	Window glass c/	91.7
80723	Plate, cut and ornamental glass c/	40.4
80726 *	Cement, gypsum and plaster	70.0
80727	Cement (products) b/	100.0
80728	(Plaster) gypsum products	91.7
80731 *	Other non-metallic mineral products c/	64.0
80732	Asbestos products c/	64.0
808--	Iron and steel products	
80801 *	Primary iron and steel	40.0
80802	Pig iron	91.9
80803	Iron casting (and forging) b/	19.8
80816	Agricultural machineries a/, c/	63.4
80826 *	Transportation equipment	79.2
80831	Automobiles (motor vehicles and parts)	87.5
809--	Non-ferrous metal	
80901	Non-ferrous metal (smelting and refining)	100.0

Notes: a/ Industries classified as having high exports.
b/ Industries classified as having regionally separated markets.
c/ Industries classified as having high imports.

REFERENCES

1/ Gideon Rosenbluth, Concentration in the Canadian Manufacturing Industries, N.B.E.R. Princeton: Princeton University Press, 1957.

2/ See the Standard Industrial Classification Manual, Dominion Bureau of Statistics, Ottawa, 1948.

3/ The ratios for the latter industries are computed using the figures provided by and the technique used by Professor Rosenbluth. Whenever this course of action was not possible, the concentration ratios for broad industrial classes were calculated in a different way. We used the techniques described and used by G.J. Stigler (op. cit., Appendix C, pp. 206-211).

APPENDIX D

LIST OF INDUSTRIES

Identification Code Number	Industry
801--	Food, beverages and tobacco products
80101	Meat packing
80106	Dairy products
80111	Canning and preserving fruits and vegetables
80116	Grain mill products
80117	Stock and poultry feeds
80118	Milled cereal food
80121	Bakery products
80126	Sugar refineries
80131	Confectionery
80132	Sugar and sugar products
80136	Non-alcoholic beverages
80141	Alcoholic beverages
80151	Tobacco products
80156	Fish canning and curing
802--	Textile, leather and rubber products
80201	Cotton textile mills
80204	Cotton fabrics (cloth)
80206	Rayon and silk textile mills
80211	Woollen and worsted textile mills
80215	Wool yarn and cloth
80216	Knitting mills
80226	Leather and leather products
80227	Boots and shoes
803--	Wood products
80301	Furnitures
804--	Pulp and paper products
80401	Pulp and paper mills
80402	Woodpulp
80403	Newsprint
80404	Wrapping paper

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List of Industries (Cont'd)

Identification Code Number	Industry
806--	Chemicals and allied products
80601	Paint and varnishes
80606	Drugs and toilet preparations
80611	Industrial chemicals (acids, alkalis and salts)
80612	Industrial gases (and compressed gases)
807--	Non-metallic mineral products
80701	Petroleum refining
80706	Paving and miscellaneous petroleum products
80708	Asphalt
80721	Glass and glass products
80722	Window glass
80723	Plate glass
80726	Cement, gypsum and plaster
80727	Cement
80728	Plaster (and gypsum products)
80731	Other non-metallic mineral products
80732	Asbestos
808--	Iron and steel products
80801	Primary iron and steel
80802	Pig iron
80803	Iron casting and forging
80816	Agricultural machineries
80826	Transportation equipment (total)
80831	Automobiles (motor vehicles and parts)
809--	Non-ferrous metal
80901	Non-ferrous metal (smelting and refining)

Note: The reader will notice that some industries are listed twice under a different identification code number. This is because the coverage is sometimes different depending on the approach taken, rate of return or prices. In these cases, one code number applies to the industry as considered in the rate of return approach, and the other to the industry when considered in the price approach.

APPENDIX E

BASIC DATA

KEY TO THE SYMBOLS

π_t : corporation profits (before taxes)

K_t : net worth (equity stock plus surplus less deficit)

C : concentration ratio (percentage of employment accounted for by three leading firms)

I/O : capital-output ratio (investment income resulting from ten dollars' worth of final output)

P_t : wholesale price index numbers (1935-39 = 100)

I_t : bond and mortgage interest paid

D_t : long-term indebtedness (funded and mortgage debt)

K_t : fixed assets (land, building and equipment)

S_t : gross sales or revenues

V_t : value added

E_t : labour earnings (total salaries and wages)

t : time subscript (t = 1 in 1948)

Note: The following tables of BASIC DATA contain only the raw data used in the analysis of Chapters 4, 5 and 6. These data were transformed internally by the computer (for example, in order to calculate ratios, etc.) and the transformed data were used in the computations. Unfortunately, the results of these transformations were not part of the output of the computer and consequently it is impossible to present the statistical material as used in its final form.

The various sources of these figures are given in the section entitled STATISTICAL SOURCES, p. 201.

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RATE OF RETURN APPROACH: BASIC DATA

(All money figures in thousands of dollars)

Code No.	π 1948	K 1948
80101	18680	67729
80106	4558	17670
80111	10414	60816
80116	20213	85565
80121	11498	57389
80126	10102	74429
80131	10288	40313
80136	11417	37482
80141	64907	186269
80151	14693	103902
80156	8275	31676
80201	22203	90815
80206	11521	42645
80211	10120	44148
80216	28649	82331
80226	11026	69677
80301	11835	44003
80401	213780	701649
80601	9186	46496
80606	16048	74357
80611	45241	163455
80701	52862	304064
80706	8800	19000
80721	7363	29111
80726	19108	60257
80731	11405	37238
80801	53758	229023
80816	31466	111395
80826	21449	125373
80831	49560	147225
80901	45811	111454

Code No.	Card No.	$\Pi_{1948-49}$	K_{48-49}	Π_{49}	K_{49}	Π_{50}	K_{50}
80101	1	31202	143392	12522	75663	17915	80144
80106	1	10307	37745	5749	20075	7928	23239
80111	1	19622	115431	9208	54615	9170	66351
80116	1	34332	173751	14119	88186	14775	90623
80121	1	23665	118646	12167	61257	12690	58309
80126	1	19773	149400	9671	74971	12074	50031
80131	1	18523	82362	8235	42049	9869	44169
80136	1	26810	75711	15393	38229	14118	41264
80141	1	132193	379937	67286	193668	73968	202150
80151	1	29080	210216	14387	106314	17077	106511
80156	1	13162	63852	4887	32176	7445	38973
80201	1	47307	198256	25104	107441	28139	123465
80206	1	23956	91308	12435	48663	9566	50160
80211	1	16486	88534	6366	44386	8808	47911
80216	1	55361	171379	26712	89048	27435	99867
80226	1	19574	137974	8548	68297	8643	70305
80301	1	23266	93044	11431	49041	12395	52347
80401	1	410189	1421196	196409	719547	268173	801386
80601	1	16148	91929	6962	45433	8989	48927
80606	1	32046	153378	15998	79021	23814	86272
80611	1	92302	331548	47061	168093	58446	167154
80701	1	116808	675861	63946	371797	83997	401632
80706	1	16499	40733	7699	21733	9873	24015
80721	1	15617	64033	8254	34922	9481	35179
80726	1	42734	128674	23626	68417	25871	73309
80731	1	24556	88895	13151	51657	23477	52918
80801	1	119179	481306	65421	252283	79308	277257
80816	1	75116	235198	43650	123803	44324	130605
80826	1	44762	259394	23313	134021	18540	142512
80831	1	123192	314158	73632	166933	101021	181322
80901	1	94521	229209	48710	117755	67406	128946

Code No.	Card No.	Π_{1951}	K_{51}	Π_{52}	K_{52}	C	I/O
80101	2	16906	79832	19905	96627	55.3	0.8313
80106	2	5729	20105	5189	21391	19.2	0.7299
80111	2	15291	67560	15725	71377	32.4	1.3092
80116	2	17856	92325	16146	94988	25.7	1.2647
80121	2	13064	66574	18171	68432	20.9	1.1213
80126	2	12934	82030	8226	72603	68.3	1.1632
80131	2	6954	44410	8773	45346	33.4	1.1632
80136	2	14698	40457	19606	43712	30.9	2.3451
80141	2	79557	210719	78887	202583	39.0	3.0491
80151	2	20975	111389	30701	121810	84.5	1.7634
80156	2	10782	39680	7739	42617	14.9	0.8364
80201	2	38761	134264	13216	125925	59.8	1.3196
80206	2	13179	52900	9039	53671	48.7	1.3196
80211	2	5506	45926	1389	42033	17.2	1.3196
80216	2	22625	98916	16933	99308	15.7	1.3196
80226	2	4869	70646	5233	68421	5.4	0.8410
80301	2	11422	57111	11209	58659	7.4	1.1036
80401	2	377236	927402	266926	945545	27.8	2.0934
80601	2	11211	52772	8216	56001	31.5	1.7050
80606	2	21726	89367	21650	96196	19.7	1.7050
80611	2	78925	187689	79215	205932	81.4	1.7050
80701	2	104250	505826	122826	559666	80.1	0.9180
80706	2	11244	26382	10870	28174	80.1	0.9180
80721	2	10539	37829	10259	44619	91.7	1.9489
80726	2	29518	79164	30573	84379	70.0	1.9489
80731	2	29186	69616	26375	89154	64.0	1.9489
80801	2	106732	306423	95578	335958	46.0	1.7345
80816	2	43366	134162	45374	147792	63.4	2.0046
80826	2	30503	156522	50898	189357	79.2	1.5461
80831	2	97516	186466	122944	220278	87.5	1.5461
80901	2	78625	212412	83531	167610	100.0	1.6778

Code No.	Card No.	I_{1948}	D_{48}	I_{49}	D_{49}	I_{50}	D_{50}
80101	4	264	8193	320	10234	377	7705
80106	4	20	1008	12	1665	46	1856
80111	4	111	3747	70	3715	85	10542
80116	4	193	5555	267	10487	282	11542
80121	4	220	6149	110	5571	264	8872
80126	4	164	7595	158	5582	152	5215
80131	4	49	2129	38	2846	65	3338
80136	4	101	2791	79	3471	95	3381
80141	4	201	15475	376	10665	358	11159
80151	4	433	15218	421	15299	671	25192
80156	4	83	3129	67	2455	62	2854
80201	4	403	12832	433	13787	456	12804
80206	4	105	3702	116	3760	97	4484
80211	4	152	5318	136	4848	132	3343
80216	4	577	17630	542	17339	538	16604
80226	4	151	6274	130	6079	224	10470
80301	4	111	4045	71	3593	46	3205
80401	4	8206	185505	6241	163154	8890	151889
80601	4	103	2539	93	2924	66	2722
80606	4	145	7343	203	5747	209	3602
80611	4	23	2645	21	4164	123	5185
80701	4	1165	51510	1886	89701	2701	100676
80706	4	289	8509	299	8118	284	8884
80721	4	32	1686	21	821	36	1305
80726	4	198	6088	186	5482	180	3227
80731	4	23	1182	206	7106	209	7768
80801	4	1130	43371	1332	45251	1459	54860
80816	4	546	24530	848	22319	918	29232
80826	4	342	5441	69	6816	66	6560
80831	4	40	1207	16	1281	45	1489
80901	4	1493	112404	148	109111	1476	153766

Code No.	Card No.	I_{1951}	D_{51}	I_{52}	D_{52}
80101	5	123	3559	302	7811
80106	5	49	2529	65	2419
80111	5	268	10808	292	9809
80116	5	531	10538	446	11233
80121	5	356	9824	499	10007
80126	5	144	4700	138	4185
80131	5	88	4069	109	3865
80136	5	100	2944	90	2849
80141	5	397	13016	503	14210
80151	5	734	25238	733	25270
80156	5	113	6855	126	7965
80201	5	494	15336	835	27842
80206	5	128	4579	125	4995
80211	5	143	5195	145	5159
80216	5	553	19153	685	20499
80226	5	352	12079	392	11097
80301	5	106	3275	161	3272
80401	5	9898	201779	10162	195897
80601	5	110	3060	388	2758
80606	5	218	8881	317	7020
80611	5	332	10083	423	9122
80701	5	3325	119313	4183	143417
80706	5	321	8565	304	7553
80721	5	57	1033	685	7390
80726	5	140	6211	299	11587
80731	5	228	6476	314	8544
80801	5	2252	74466	2688	40522
80816	5	1043	28270	1174	46741
80826	5	229	8812	443	10064
80831	5	44	1191	43	796
80901	5	1404	101082	4853	284881

Code No.	Card No.	K* 1948	S 48	K* 49	S 49	K* 50	S 50
80101	6	76916	674151	83387	757843	90312	788014
80106	6	20650	101194	24631	108773	28956	121498
80111	6	54364	131230	57081	132958	59346	145465
80116	6	70895	369620	74087	408770	78236	416529
80121	6	63693	168544	65937	174471	72173	185501
80126	6	37976	106636	41586	113839	48722	128440
80131	6	37520	91984	37326	91835	43148	100564
80136	6	28280	57644	34902	70018	39701	72918
80141	6	144728	351486	158418	346385	169703	371843
80151	6	20640	138044	21882	141796	23049	145785
80156	6	29094	86866	30047	82883	37050	95408
80201	6	127901	211981	137269	226704	147978	239888
80206	6	46701	64011	56164	77255	59619	77207
80211	6	41274	87840	42995	81283	43582	87543
80216	6	86767	163288	95452	165598	103525	175010
80226	6	44065	205480	43098	217748	47397	208030
80301	6	40669	115034	43640	125895	46794	138018
80401	6	1088915	890434	1122011	868156	1181482	1069133
80601	6	31836	90740	31349	83180	34379	96872
80606	6	47110	162305	55946	174442	59675	192612
80611	6	163988	270359	190631	286694	192357	319059
80701	6	310324	574763	402536	682448	474295	782692
80706	6	28305	55757	30092	57663	31789	66165
80721	6	23487	56950	25401	62505	29261	72734
80726	6	73461	78174	81014	102505	85757	103854
80731	6	49239	71540	72019	80174	71043	107946
80801	6	318763	432434	327974	497413	342517	515929
80816	6	65009	252700	69740	296800	75193	295832
80826	6	102346	285299	110928	278822	123847	226111
80831	6	112550	483607	118038	579168	138262	759441
80901	6	342260	252843	349157	253468	355505	285120

Code No.	Card No.	K* 1951	S 51	K* 52	S 52
80101	7	79658	792544	107055	970948
80106	7	27339	107600	28173	115844
80111	7	61215	179815	63689	188189
80116	7	82456	471234	86782	511375
80121	7	79947	205146	85404	228082
80126	7	52688	157832	54116	98921
80131	7	42919	101444	43534	111124
80136	7	42157	76255	43451	89719
80141	7	183270	435310	198699	457035
80151	7	24762	154411	26037	180437
80156	7	40983	117389	50807	124404
80201	7	156590	305591	169623	256349
80206	7	65320	92967	70778	87176
80211	7	49162	116672	49090	110436
80216	7	124912	192332	121208	190610
80226	7	49897	232975	49096	226799
80301	7	49823	153267	51295	161720
80401	7	1372781	1351876	1415848	1177192
80601	7	37637	112826	36743	106592
80606	7	65489	229507	72793	230851
80611	7	218488	395466	276567	428698
80701	7	558650	911001	612028	1041291
80706	7	36395	67667	37602	71401
80721	7	34175	84158	45351	92978
80726	7	101458	120096	125570	127037
80731	7	76138	137020	78346	123771
80801	7	405838	648651	453208	723482
80816	7	82426	346218	91119	381114
80826	7	147157	369840	169190	578296
80831	7	163176	916236	215057	978307
80901	7	462677	374283	629394	408493

Code No.	Card No.	V 1948	E 48	V 49	E 49	V 50	E 50
80101	8	95144	53445	108059	52136	107701	54532
80106	8	93766	44202	96276	48151	96839	48625
80111	8	64783	25451	57106	23864	64278	24561
80116	8	65065	24899	66943	27349	70583	27167
80121	8	112386	62349	125032	68161	132214	70966
80126	8	22726	7662	23703	8843	31940	9536
80131	8	45355	15227	47402	17108	49223	18451
80136	8	40716	12015	51716	14599	51957	15641
80141	8	140036	32190	153703	34770	166707	35942
80151	8	57667	19551	58529	21896	65176	22629
80156	8	39468	17041	41140	16970	46692	18722
80201	8	93423	53154	89113	52306	103790	58481
80206	8	62951	30739	75578	36122	87763	40112
80211	8	60916	34081	62090	35232	60555	36042
80216	8	77807	42807	76672	43949	75853	44142
80226	8	86948	55123	91158	59700	87419	57810
80301	8	76442	47667	85290	53591	90624	57112
80401	8	412770	151663	423376	157704	511143	169247
80601	8	36225	12341	39810	14138	42446	14569
80606	8	54879	18164	59894	19125	64280	20062
80611	8	40296	15348	39664	16505	48527	18039
80701	8	63137	22062	82971	26142	107371	30558
80706	8	63137	22062	82971	26142	107371	30558
80721	8	22166	12497	22932	13126	27255	15632
80726	8	24192	6333	28674	7026	32323	8122
80731	8	12024	5328	10989	6079	12841	7658
80801	8	125277	77358	136153	82958	154542	85412
80816	8	63368	45271	79193	44220	68356	43284
80826	8	421809	256940	426529	270852	552171	290436
80831	8	215999	109139	263250	122347	386302	150507
80901	8	146831	52277	181908	55133	202712	58748

Code No.	Card No.	V 1951	E 51	V 52	E 52
80101	9	120489	62109	158761	71378
80106	9	104355	54582	114423	57855
80111	9	82000	30108	88490	31993
80116	9	81321	31496	83700	34384
80121	9	152561	79037	169276	87263
80126	9	28728	10273	33045	11044
80131	9	40311	16867	44342	18703
80136	9	55132	16049	66936	18391
80141	9	186453	42105	203379	46094
80151	9	59033	24438	70777	25405
80156	9	58665	24744	45735	24426
80201	9	106481	62550	86844	57580
80206	9	96477	44694	90004	42709
80211	9	63183	38616	63082	37262
80216	9	83523	49000	80619	48963
80226	9	84885	59669	101511	66153
80301	9	98474	61429	106057	65890
80401	9	679258	213170	584101	225353
80601	9	48430	16129	53554	17220
80606	9	74327	22693	77145	24727
80611	9	67456	24579	65243	27208
80701	9	135903	37079	178524	46145
80706	9	135903	37079	178524	46145
80721	9	30819	17660	32695	19103
80726	9	36209	9609	42101	11629
80731	9	17618	8341	15249	7733
80801	9	209472	108562	233577	124387
80816	9	72719	52217	93778	62424
80826	9	657424	368106	778348	473118
80831	9	388135	166626	394322	186215
80901	9	262973	75475	266721	87964

PRICE APPROACH: BASIC DATA

(All money figures in thousands of dollars)

Code No.	π_{1948}	K_{1948}
80101	18680	67729
80106	4558	17670
80111	10414	60816
80117	20213	85565
80118	20213	85565
80121	11498	57389
80132	20390	114742
80156	8275	31676
80204	22203	90815
80206	11521	42645
80215	10120	44148
80216	28649	82331
80227	11026	69677
80402	213780	701649
80403	213780	701649
80404	213780	701649
80601	9186	46496
80612	45241	163455
80701	52862	304064
80708	8800	19000
80722	7363	29111
80723	7363	29111
80727	19108	60257
80728	19108	60257
80732	11405	37238
80802	53758	229023
80803	53758	229023
80816	31466	111395
80901	45811	111454

Code No.	Card No.	Π 1948-49	K 48-49	Π 49	K 49	Π 50	K 50
80101	1	31202	143392	12522	75663	17915	80144
80106	1	10307	37745	5749	20075	7928	23239
80111	1	19622	115431	9208	54615	9170	66351
80117	1	34332	173751	14119	88186	14775	90623
80118	1	34332	173751	14119	88186	14775	90623
80121	1	23665	118646	12167	61257	12690	58309
80132	1	38296	231762	17906	117020	21943	94200
80156	1	13162	63852	4887	32176	7445	38973
80204	1	47307	198256	25104	107441	28139	123465
80206	1	23956	91308	12435	48663	9566	50160
80215	1	16486	88534	6366	44386	8808	47911
80216	1	55361	171379	26712	89048	27435	99867
80227	1	19574	137974	8548	68297	8643	70305
80402	1	410189	1421196	196409	719547	268173	801386
80403	1	410189	1421196	196409	719547	268173	801386
80404	1	410189	1421196	196409	719547	268173	801386
80601	1	16148	91929	6962	45433	8989	48927
80612	1	92302	331548	47061	168093	58446	167154
80701	1	116808	675861	63946	371797	83997	401632
80708	1	16499	40733	7699	21733	9873	20415
80722	1	15617	64033	8254	34922	9481	35179
80723	1	15617	64033	8254	34922	9481	35179
80727	1	42734	128674	23626	68417	25871	73309
80728	1	42734	128674	23626	68417	25871	73309
80732	1	24556	88895	13151	51657	23477	52918
80802	1	119179	481306	65421	252283	79308	277257
80803	1	119179	481306	65421	252283	79308	277257
80816	1	75116	235198	43650	123803	44324	130605
80901	1	94521	229209	48710	117755	67406	128946

Code No.	Card No.	Π 1951	K 51	Π 52	K 52	C	$I/_0$
80101	2	16906	79832	19905	96627	55.3	0.8313
80106	2	5729	20105	5189	21391	19.2	0.7299
80111	2	15291	67560	15725	71377	32.4	1.3092
80117	2	17856	92325	16146	94988	25.7	1.2647
80118	2	17856	92325	16146	94988	25.7	1.2647
80121	2	13064	66574	18171	68432	20.9	1.1213
80132	2	19888	126440	16999	117949	29.4	1.1632
80156	2	10782	39680	7739	42617	14.9	0.8364
80204	2	38761	134264	13216	125925	59.8	1.3196
80206	2	13179	52900	9039	53671	48.7	1.3196
80215	2	5506	45926	1389	42033	17.2	1.3186
80216	2	22625	98916	16933	99308	15.7	1.3196
80227	2	4869	70646	5233	68421	5.4	0.8410
80402	2	377236	927402	266925	945546	27.8	2.0934
80403	2	377236	927402	266925	945546	27.8	2.0934
80404	2	377236	927402	266925	945546	27.8	2.0934
80601	2	11211	52772	8216	56001	31.5	1.7050
80612	2	78925	187689	79215	205932	81.4	1.7050
80701	2	104250	505826	122826	559666	80.1	0.9180
80708	2	11244	26382	10870	28174	80.1	0.9180
80722	2	10539	37829	10259	44619	91.7	1.9489
80723	2	10539	37829	10259	44619	91.7	1.9489
80727	2	29518	79164	30573	84379	70.0	1.9489
80728	2	29518	79164	30573	84379	70.0	1.9489
80732	2	29186	69616	26375	89154	64.0	1.9489
80802	2	106732	306423	95578	335958	46.0	1.7345
80803	2	106732	306423	95578	335958	46.0	1.7345
80816	2	43366	134162	45374	147792	63.4	2.0046
80901	2	78625	212412	83531	167610	100.0	1.6778

Code No.	Card No.	P_1	P_2	P_3	P_4	C	$I/_O$
80101	3	269.2	306.0	328.6	259.8	55.3	0.8313
80106	3	215.1	227.1	238.1	228.0	19.2	0.7299
80111	3	140.5	157.7	171.3	178.4	32.4	1.3092
80117	3	208.2	219.8	250.0	232.3	15.5	1.2647
80118	3	178.3	198.6	199.9	195.5	34.9	1.2647
80121	3	141.9	165.4	175.1	177.0	20.9	1.1213
80132	3	171.3	204.3	209.6	177.4	29.4	1.1632
80156	3	255.9	281.0	287.8	271.0	14.9	0.8364
80204	3	224.0	270.1	265.1	252.9	59.8	1.3196
80206	3	120.1	145.6	165.7	169.5	48.7	1.3196
80215	3	233.4	388.0	294.5	235.9	19.0	1.3196
80216	3	207.9	243.4	280.7	260.9	15.7	1.3196
80227	3	172.4	199.4	216.5	201.4	8.5	0.8410
80402	3	191.7	223.8	250.9	223.3	27.8	1.4447
80403	3	240.1	251.6	270.0	278.2	27.8	2.0934
80404	3	159.7	185.1	213.3	215.9	16.8	2.0934
80601	3	159.9	173.1	184.6	189.1	31.5	1.7050
80612	3	119.1	120.3	126.0	127.7	81.4	1.7050
80701	3	163.3	164.4	165.3	164.0	80.1	0.9180
80709	3	174.8	177.5	180.3	180.9	80.1	.9180
80722	3	180.0	177.7	199.4	199.0	91.7	1.9489
80723	3	131.8	149.2	166.7	170.7	40.4	1.9489
80727	3	123.9	135.1	146.3	155.1	100.0	1.9489
80728	3	108.9	119.7	125.3	126.7	91.7	1.9489
80732	3	200.8	223.2	244.3	267.1	64.0	1.9489
80802	3	211.8	230.0	251.0	257.1	91.9	1.7345
80803	3	159.7	172.8	180.9	179.4	19.8	1.7345
80816	3	161.7	179.2	191.9	195.3	63.4	2.0046
80901	3	148.5	173.3	181.3	170.7	100.0	1.6778

Code No.	Card No.	I_{1948}	D_{48}	I_{49}	D_{49}	I_{50}	D_{50}
80101	4	264	8193	320	10234	377	7705
80106	4	20	1008	12	1665	46	1856
80111	4	111	3747	70	3715	85	10542
80117	4	193	5555	267	10487	282	11542
80118	4	193	5555	267	10487	282	11542
80121	4	220	6149	110	5571	264	8872
80132	4	213	9724	196	8428	217	8553
80156	4	83	3129	67	2455	62	2854
80204	4	403	12832	433	13787	456	12804
80206	4	105	3702	116	3760	97	4484
80215	4	152	5318	136	4848	132	3343
80216	4	577	17630	542	17339	538	16604
80227	4	151	6274	130	6079	224	10470
80402	4	8206	185505	6241	163154	8890	151889
80403	4	8206	185505	6241	163154	8890	151889
80404	4	8206	185505	6241	163154	8890	151889
80601	4	103	2539	93	2924	66	2722
80612	4	23	2645	21	4164	123	5185
80701	4	1165	51510	1886	89701	2701	100676
80708	4	289	8509	299	8118	284	8884
80722	4	32	1686	21	821	36	1305
80723	4	32	1686	21	821	36	1305
80727	4	198	6088	186	5482	180	3227
80728	4	198	6088	186	5482	180	3227
80732	4	23	1182	206	7106	209	7768
80802	4	1130	43371	1332	45251	1459	54860
80803	4	1130	43371	1332	45251	1459	54860
80816	4	546	24530	848	22319	918	29232
80901	4	1493	112404	148	109111	1476	153766

Code No.	Card No.	I 1951	D 51	I 52	D 52
80101	5	123	3559	302	7811
80106	5	49	2529	65	2419
80111	5	268	10808	292	9809
80117	5	531	10538	446	11233
80118	5	531	10538	446	11233
80121	5	356	9824	499	10007
80131	5	232	8769	247	8050
80156	5	113	6855	126	7965
80204	5	494	15336	835	27842
80206	5	128	4579	125	4995
80215	5	143	5195	145	5159
80216	5	553	19153	685	20499
80227	5	352	12079	392	11097
80402	5	9898	201779	10162	195897
80403	5	9898	201779	10162	195897
80404	5	9898	201779	10162	195897
80601	5	110	3060	388	2758
80612	5	332	10083	423	9122
80701	5	3325	119313	4183	143417
80708	5	321	8565	304	7553
80722	5	57	1033	685	7390
80723	5	57	1033	685	7390
80727	5	140	6211	299	11587
80728	5	140	6211	299	11587
80732	5	228	6476	314	8544
80802	5	2252	74466	2688	40522
80803	5	2252	74466	2688	40522
80816	5	1043	28270	1174	46741
80901	5	1404	101082	4853	284881

Code No.	Card No.	K* 1948	S 48	K* 49	S 49	K* 50	S 50
80101	6	76916	674151	83387	757843	90312	788014
80106	6	20650	101194	24631	108773	28956	121498
80111	6	54364	131230	57081	132958	59346	145465
80117	6	70895	369620	74087	408770	78236	416529
80118	6	70895	369620	74087	408770	78236	416529
80121	6	63693	168544	65937	174471	72173	185501
80132	6	75496	198620	78912	205674	91870	229004
80156	6	29094	86866	30047	82883	37050	95408
80204	6	127901	211981	137269	226704	147978	239888
80206	6	46701	64011	56164	77255	59619	77207
80215	6	41274	87840	42995	81283	43582	87543
80216	6	86767	163288	95452	165598	103525	175010
80227	6	44065	205480	43098	217748	47397	208030
80402	6	1088915	890434	1122011	868156	1181482	1069133
80403	6	1088915	890434	1122011	868156	1181482	1069133
80404	6	1088915	890434	1122011	868156	1181482	1069133
80601	6	31836	90740	31349	83180	34379	96872
80612	6	163988	270359	190631	286694	192357	319059
80701	6	310324	574763	402536	682448	474295	782692
80708	6	28305	55757	30092	57663	31789	66165
80722	6	23487	56950	25401	62505	29261	72734
80723	6	23487	56950	25401	62505	29261	72734
80727	6	73461	78174	81014	102505	85757	103854
80728	6	73461	78174	81014	102505	85757	103854
80732	6	49239	71540	72019	80174	71043	107946
80802	6	318763	432434	327974	497413	342517	515929
80803	6	318763	432434	327974	497413	342517	515929
80816	6	65009	252700	69740	296800	75193	295832
80901	6	342260	252843	349157	253468	355505	285120

Code No.	Card No.	K* 1951	S 51	K* 52	S 52
80101	7	79658	792544	107055	970948
80106	7	27339	107600	28173	115844
80111	7	61215	179815	63689	188189
80117	7	82456	471234	86782	511375
80118	7	82456	471234	86782	511375
80121	7	79947	205146	85404	228082
80132	7	95607	259276	97650	210045
80156	7	40983	117389	50807	124404
80204	7	156590	305591	169623	256349
80206	7	65320	92967	70778	87176
80215	7	49162	116672	49090	110436
80216	7	124912	192332	121208	190610
80227	7	49897	232975	49096	226799
80402	7	1372781	1351876	1415848	1177192
80403	7	1372781	1351876	1415848	1177192
80404	7	1372781	1351876	1415848	1177192
80601	7	37637	112826	36743	106592
80612	7	218488	395466	276567	428698
80701	7	558650	911001	612028	1041291
80708	7	36395	67667	37602	71401
80722	7	34175	84158	45351	92978
80723	7	34175	84158	45351	92978
80727	7	101458	120096	125570	127037
80728	7	101458	120096	125570	127037
80732	7	76138	137020	78346	123771
80802	7	405838	648651	453208	723482
80803	7	405838	648651	453208	723482
80816	7	82426	346218	91119	381114
80901	7	462677	374283	629394	408493

Code No.	Card No.	V_{1948}	E_{48}	V_{49}	E_{49}	V_{50}	E_{50}
80101	8	95144	53445	108059	52136	107701	54532
80103	8	93766	44202	96276	48151	96839	48625
80111	8	64783	25451	57106	23864	64278	24561
80113	8	18869	8472	24361	10890	25090	10645
80118	8	6903	2371	9418	2555	9931	2712
80121	8	112386	62349	125032	68161	132214	70966
80132	8	68081	22889	71105	25951	81163	27987
80156	8	39468	17041	41140	16970	46692	18722
80204	8	80069	45956	83073	49364	95310	55220
80206	8	62951	30739	75578	36122	87763	40112
80215	8	44545	25970	43418	26283	41085	26543
80216	8	77807	42807	76672	43949	75853	44142
80227	8	48732	32513	54956	36733	50718	34710
80402	8	412770	151663	423376	157704	511143	169247
80403	8	412770	151663	423376	157704	511143	169247
80404	8	41510	22566	47334	25513	55813	28552
80601	8	36225	12341	39810	14138	42446	14569
80612	8	8729	2613	9680	3231	10370	3240
80701	8	63137	22062	82971	26142	107371	30558
80708	8	63137	22062	82971	26142	107371	30558
80722	8	22166	12497	22932	13126	27255	15632
80723	8	22166	12497	22932	13126	27255	15632
80727	8	17705	4356	21077	4804	23091	5297
80728	8	6487	1977	7597	2222	9232	2825
80732	8	3445	2214	5088	3638	6396	3890
80802	8	125277	77358	136153	82958	154542	85412
80803	8	71415	46388	74881	46165	78528	47718
80816	8	63368	45271	79193	44220	68356	43284
80901	8	146831	52277	181908	55133	202712	58748

Code No.	Card No.	V_{1951}	E_{51}	V_{52}	E_{52}
80101	9	120489	62109	158761	71378
80106	9	104355	54582	114423	57855
80111	9	82000	30108	88490	31993
80117	9	27953	12180	29967	13392
80118	9	12179	3587	13465	3991
80121	9	152561	79037	169276	87263
80132	9	69039	27140	47387	29747
80154	9	58665	24744	45735	24426
80204	9	97158	58735	78955	53706
80206	9	96477	44694	90004	42709
80215	9	42771	28868	44324	27328
80216	9	83523	49000	80619	48963
80227	9	52010	35847	62281	41092
80402	9	679258	213170	584101	225353
80403	9	679258	213170	584101	225353
80404	9	68940	32235	68379	34441
80601	9	48430	16129	53554	17220
80612	9	12388	3681	13307	3890
80701	9	135903	37079	178524	46145
80708	9	135903	37079	178524	46145
80722	9	30819	17660	32695	19103
80723	9	30819	17660	32695	19103
80727	9	26632	6305	32664	7921
80728	9	9577	3304	9437	3708
80732	9	9900	5387	9796	5449
80802	9	209472	108562	233577	124387
80803	9	86683	52128	89182	51142
80816	9	72719	52217	93778	62424
80901	9	262973	75475	266721	87964

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